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Potential for the Incorporation of Economic Development Benefits in the Evaluation of Transit Investments

POTENTIAL FOR THE INCORPORATION OF ECONOMIC DEVELOPMENT BENEFITS IN THE EVALUATION OF TRANSIT INVESTMENTS

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1. INTRODUCTION

This paper examines the causes and measurement of economic development impacts that occur when localities invest in transit improvements. In the past, though many studies have proven that economic development impacts do occur, the evaluation of such impacts has largely been excluded from the criteria used to allocate funding for such investments. This paper investigates the magnitude of economic development impacts attributable to transit investment, assesses the extent to which such development is incremental, examines whether or not incrementality is genuinely required in order to justify the inclusion of such benefits in evaluation frameworks, and assesses the current state of measurement practice. Based on this foundation, this paper then evaluates several methodologies used to estimate economic development benefits subsequent to transit investment, and reviews several predictive methodologies that could be used to estimate such benefits prior to investment. These methodologies rely on four features of economic development effects suggested by existing research: economic development benefits appear to be incremental to other benefits, they are measurable, they benefit from agglomeration economies, and they are predictable. Because economic development is incremental, measurable, and predictable, any number of methodologies could be developed to estimate future impacts resulting from transit investments.

The paper reviews four classes of methods that practitioners and academics might choose to further develop. Regardless of the approach eventually utilized, the fact that economic development potential can be *predictively* estimated suggests that funding criteria need to be revised in order to better allocate funding to investments that have the greatest over-all impact on their communities. Further, if economic development impacts were measured and factored into funding criteria, planners and communities would have further incentive to maximize economic development potential, through zoned density, pedestrian-friendly access design, and transit-oriented development planning.

This paper reviews prior experience with the estimation of economic development benefits and then assesses the current state of economic development evaluation and transit investment criteria. Next, some of the common objections regarding the predictive estimation of benefits are reviewed and finally, potential methodologies for predictive estimation are assessed.

The literature reviewed covers both the conventional measures of economic development – employment, tax revenues, regional production, and property values – and finding from previous studies. Several studies are examined which have found evidence of economic development impacts, both positive and negative, resulting from transit investments. These are all post-hoc studies, but they provide both a basis for understanding how development impacts can be measured, and suggest the incremental nature of benefit. Most studies rely on the hedonic method of comparing properties near to and further from transit stations and using regression analysis to estimate the impact of that proximity on housing and/or lease prices. The hedonic method is closely examined in Section 2.

Following the literature review, this paper assesses the current state of transit investment evaluation. The evaluation criteria established under the new starts program are reviewed along with changes implemented under SAFETEA-LU.

Next, this paper addresses several common concerns with incorporating economic development benefits in transit investment evaluation. These include common misperceptions about the inability to separate out incremental economic development impacts from the capitalization of productivity improvements into property values, the existence of agglomeration economies, which create additional economic activity by co-locating economic activities within a dense geographic space, and the predictability of economic development impacts prior to investment and construction.

Following this review of policy objections, three predictive economic development estimation models are assessed. These are based on survey approaches, hedonic approaches and the input-output approach. The first, based on surveys of residents, businesses, and system users attempts to estimate potential future property values by asking property owners and users how much they would be willing to pay for properties with bundles of locational attributes or by using expert opinion in a survey of development potential. The second methodology relies on post-hoc hedonic studies of existing investments to create a database of economic development impacts and locational, property, and neighborhood attributes. Future investments could then be compared to the collected data and ranges of possible outcomes be estimated on a parcel by parcel basis, based on similarity to characteristics and outcomes in prior study areas. The input-output approach uses commercial software to estimate multiplier impacts from an initial investment.

Finally, next steps are discussed, including the need for a national forum for review and refinement of predictive economic development impact estimations approaches and suggestions for specific next steps recommended to the FTA. Transit investment can clearly have a significant impact on improving economic activity, output, and property values in areas where stations are installed. It would be to the benefit of planners, policy makers, and residents to have the ability to estimate and predict where such investments will have the most significant positive impact on economic development. Funding organizations should be able to consider the impact funding dollars will bring above and beyond ridership level and travel time savings which are the major staples of investment evaluation today.

1.1 Defining Economic Development

In order to accurately understand and assess the economic development benefits of transit investment, a satisfactory definition of economic development is necessary. In a broad sense, transit-related economic impacts occur as either a *generative, redistributive, or transfer impact*.[1] Generative impacts account for economic growth, as measured by income, employment, job accessibility, and travel time savings, which occur as a consequence of transit and result in a net economic gain for society as a whole. Redistributive impacts involve a shift in regional

[1] *Economic Impact Analysis of Transit Investments: Guidebook for Practitioners*, TCRP Report 35, Transportation Research Board, National Research Council, 1998.

economic activity, resulting in a concentration around transit, rather than an even distribution across the region. While these impacts are redistributive in nature, the concentration of economic activity can result in economic development benefit of agglomeration. Therefore, both generative and redistributive impacts can be seen as measures of regional economic development. Conversely, transfer impacts are a result of monetary transfers between entities which result in a net economic gain of zero.

Confusion can arise around the ambiguity of the term economic development. A systematic review of 25 transit operators' websites by the Center for Transit-Oriented Development revealed several different definitions of economic development. Economic development is defined as having an impact on real estate development or property values for slightly over half of the agencies surveyed. Another popular definition referenced job creation as a result of transit. Along the same line, increased accessibility is commonly mentioned as a definition of economic development, specifically regarding greater job accessibility. The following table summarizes the various definitions of economic development used by transit agencies and their frequency. It should be noted that several agencies provided definitions that fell into more than one category.

Defintion Category	**Frequency**
Real Estate/Property Values	36%
Employment	14%
Accessibility	14%
Local Spending	8%
Tax Revenues	6%
Social Justice	3%
None/Undefined	19%

Source: Center for Transit-Oriented Development, 2006.

While this survey provides no clear, consensus definition, it illustrates that transit operators have several proxy definitions of economic development, which often encompass several categories.

In development economics, the term economic development denotes sustainable increases the standard of living as indicated by income, health statistics and education opportunities. Broadly defined, economic development is an increase in a region's welfare, due to labor or capital improvements brought about by a structural or technological change. In order for economic development to take place, there must be a driving force that causes a permanent shift in labor or capital, such as a change that leads to increased labor productivity.

While development economics focuses on the developing world, this definition can be applied to developed areas to assess the continuation of economic development. In the case of transportation economics, economic development is the change in a region's welfare specifically brought about by transportation infrastructure spending. This is very similar to the developmental economics definition; however it focuses on a specific source of change, transit. While regions considered in transportation economics are typically "developed", the addition of transit brings about incremental gains in productivity which would not exist otherwise. The change to a regions transportation infrastructure can have a number of economic impacts, such as

access to a larger labor pool, a higher concentration of consumers in close proximity, and other factors that foster sustainable increases in total regional production. Economic development is typically measured by production, employment, income or property values in the region. Examining these statistics provides a more complete picture of transit's impact to a region. Often times in assessing transit investments, the focus is on ridership, however to ensure the best return on investment, economic development must also be considered.

1.2 Changes in Urban Planning and Transit Investment

In the next 25 years, the demand within the United States for living within a half-mile of a fixed-guideway transit station is conservatively estimated to double from 6.2 million households to almost 16 million by 2030.[2] As urban planning becomes more transit-oriented and advocates of transit-oriented development (TOD) get their voices heard in urban and suburban areas alike, development planning has become more and more focused on the aggregation of complementary activities within neighborhood and even sub-neighborhood areas. With mixed-use developments in urban and suburban villages attracting premium rents, many are seeing a nexus of retail, residential, and other commercial activities with linked transit access as a desirable, marketable, and profitable concept. Though the majority of new development in the United States continues to be in outer suburbs with no transit access of any kind, awareness is growing of the need to re-focus growth into greater densities with improved access in order to sustain both environmental and economic well being.

1.3 Nature of Economic Development Benefits Attributable to Transit Investments

Benefits stemming from transit investments are typically categorized into user and non-user benefits. User benefits typically refer to benefits accrued to system users through the reduction of travel time and travel costs. In addition to user benefits, the prevailing evaluation framework also recognizes non-user benefits – benefits that accrue to non-riders, such as reduction of road congestion, environmental benefits, employment impacts, etc. The non-user benefit category is reflective of the belief that transit improvements generate external economies – public benefit accruing broadly in addition to the benefit accruing to the direct users of the investment. Economic development benefits can accrue to local resident and businesses (and other landowners), but may also accrue to the greater metropolitan area through increasing tax revenues, improved landuse, and increasing economic welfare.

These benefits, where they occur, result from agglomeration economies: increasing economic activity that results from the concentrated location of activities. Some scholars have pointed to the benefits of intellectual concentration and improved likelihood of both chance and arranged exchanges of ideas, while others have pointed to the efficiencies of shared labor pools which can

[2] Center for Transit-Oriented Development, *Hidden In Plain Sight: Capturing the Demand for Housing Near Transit.* Reconnecting America: April 2005; 2030 update forthcoming.

move more easily from firm to firm.[3] As the review of economic development impacts from transit investment indicates, both residents and employers value the existence of transit and are willing to pay a premium to locate near it, in excess of the estimated travel time savings incurred. In fact, evidence indicates that a significant proportion of residents within walking distance of transit do not use it to regularly commute to work, recreation, or school. None the less, these residents continue to value proximity to transit and are willing to pay a premium for that proximity. This strongly suggests an incremental economic development benefit above and beyond the capitalization of travel time savings.

This paper reviews the evidence for economic development benefits resulting from transit investments and concludes the following regarding such benefits:

- Economic development associated with transit appears to be incremental
- Economic development is measurable
- Economic development benefits from agglomeration effects
- Economic development can be predicted given sufficient data

[3] See, Sassen, Saskia, The Global City: New York, London, Tokyo, Princeton University Press (1991) and Storper, Michael, Regional World: Territorial Development in a Global Economy, Guilford Press (1997) for example.

2. EVIDENCE FROM PAST EXPERIENCE

If it is desirable to encourage more sustainable development, and such development benefits significantly from transit, then it seems appropriate that the full impacts of transit investments be understood. To that end, this section provides a review of evidence of economic development benefits from past experience. The evaluation criteria and potential for adding more detailed evaluation of economic development for new starts proposals are discussed in the section that follows. Finally, several potential alternatives for predictively assessing such benefits are discussed and next steps proposed.

2.1 Conventional Measures of Economic Development

Economic development can be a key benefit of transit investments. Beyond simply providing transportation options to local residents, transit systems, when properly planned, can stimulate economic development in the surrounding area. Transit systems can result in agglomeration of development and provide area businesses with access to a larger labor pool. In the absence of transit, development can occur sporadically around the area. While development may still occur in the absence of transit, a transit system in the area can foster a greater level of economic development with larger benefits. The agglomeration of a metropolitan area's development provides companies with a larger labor pool, which results in a greater number of workers overall and the potential for more qualified candidates as a result of a more competitive labor market. Agglomeration helps markets to run more efficiently. Firms are provided with a larger, more concentrated market for their goods and services. This results in lower transaction costs and greater sales potential. Additionally, economies of scale arise as related firms concentrate in the area. Through their proximity to each other, these firms are able to reduce their production costs. In general, the agglomeration of regional development can lead to greater economic development benefits than a similar level of development that is less concentrated.

There are various measures employed to assess the benefits of economic development in a region, such as employment statistics, tax revenues, regional production and real estate prices.

Employment statistics are commonly used as a measure of economic development in a region. Due to its widespread implications, employment rates in a region are of keen interest to policy makers. Economic development can result in job creation and job improvement, factors that can cause employment rates to rise. In areas with considerable unemployment, a greater number of available jobs in a region can lower unemployment rates. Additionally, higher quality jobs can attract those who would otherwise remain unemployed or underemployed. Examining changes in employment statistics can provide policymakers with an indication of economic development activity in the region.

Similar to employment statistics, *Tax Revenues* are commonly used as a measure of economic development as they are relatively easy to measure and of interest to the regional and federal government. An increase in overall employment in the region will lead to an increase in the tax

base and in tax revenues, all else equal. Additionally, economic development that causes a shift in regional employment, bringing about higher quality, higher paying jobs, will provide an additional increase in the tax base, as those currently employed will now earning higher salaries.

Regional production, similar to Gross Domestic Product (GDP) at the national level, can also be used as an indicator of economic development; however this can prove more challenging, as data is not always available at smaller, regional levels. Indicators such as local retail sales can be used as a proxy for regional production.

One of the more popular and widely used methods of measuring regional economic development is *Real Estate prices*, either in the form of property value or rent. Real estate prices are easily quantifiable and represent an individual's willingness to pay for specific amenities of an area. The same holds true for businesses. An examination of real estate prices reveals individuals' preferences, where a survey of opinions might fail to capture true consumer preferences. Real increases in prices for real estate can be seen as an increase in the market's willingness to pay for a specific location due to the availability of more desirable amenities. Additionally, the onset of development in an area can drive up real estate values, as there is an increased demand to be located in a specific area.

As we will see in the following section, measuring property values and rents is a commonly used approach to quantify economic development.

2.2 Findings from Past Experiences

In recent years there has been considerable investigation into the relationship between transit and economic development. There are two common approaches used in assessing the economic impact of transit: stated preference and revealed preference. A stated preference survey proposes hypothetical travel choices and asks the respondent what his choice would be. On the other hand, revealed preference studies make use of available data to reveal underlying preferences. A common application of the revealed preference approach is hedonic pricing methodology. When assessing the impact of transit using the hedonic pricing methodology, researchers use property values or rents as a proxy for economic development.

2.2.1 The Hedonic Approach

The hedonic pricing method uses regression analysis to examine the impact of transit on property values while controlling for other variables that may influence property value, such as location attributes and property characteristics. Distance from transit (either walking or linear) is often the key variable used in determining transit's effect on property values. Both methods have their merit, however the hedonic approach may provide a more fundamentally sound approach, as it can accurately estimate the incremental effects of transit systems.

Hedonic pricing models allow researchers the ability to isolate the effects of transit on property values. These models must accurately account for factors that provide a statistically significant

variation in property values. Once these factors are isolated, the impact of transit on the property value can be accurately assessed. If a model fails to account for these key factors, it will be biased and the impact of transit can not be accurately measured. In the case of residential properties values, factors commonly considered in hedonic pricing studies are property characteristics, such as age, total square footage, number of bedrooms, and lot size; proximity to highways; and neighborhood zoning. Not all of these factors can be included in the regression model as they can be highly correlated. A model which includes several highly correlated factors will fail to accurately explain the effect of any of the factors on property value. Therefore, in order to accurately capture the effects of key property characteristics, the model must be specified in such a manner which avoids high levels of correlation between the chosen variables. The following equation comes from a 1997 study of San Francisco's BART.[4]

$$HomeValue = \alpha + \beta_1 Dist\_to\_Bart + \beta_2 Dist\_to\_Hwy + \beta_3 HomeAge + \beta_4 HomeSize + error$$

Where *Dist_to_Bart* represents the walking distance, in feet, to the BART station;
Dist_to_Hwy represents the distances to the highway interchange in feet;
HomeAge represents the age of the home in years; and
HomeSize represents the home's square footage.

After testing several regression specifications this equation was chosen, as it was found that home size and age account for most of the variation in property values. In this equation, the primary coefficient of interest is β_1, which represents the change in a home's value given a 1 foot change in walking distance to the BART station. In this regression, the desirable outcome is that the coefficient will be negative and statistically significant. A negative coefficient represents an inverse relationship between distance to transit and property value. That is, we expect as the walking distance to transit decreases, property values will increase. In this study, the coefficient has a value of $15.78 and is statistically significant. The interpretation of this coefficient is that for each foot closer to the BART station a home is, the home's property value will increase by approximately $16, all else equal.

2.2.2 Findings from the Application of Hedonic Models

Current literature offers promising results in attempts to quantify economic development benefits of transit using the hedonic method described above. Studies examining the impact of transit on property values have been conducted at various stages of transit development, from project announcement, to planning, to already well-established systems, with most of them finding statistically significant impacts on property values, many of them positive. The following studies analyze the effects of transit on property values and rents using the hedonic pricing methodology. These studies control for and accurately measure the direct impacts of transit systems on property values.

[4] Workman, Steven Lewis and Daniel Brod, Measuring Neighborhood Benefits of Rail Transit Accessibility, Prepared for Transportation Research Board 1997 Annual Meeting, January 1997.

In *San Francisco*, Gatzlaff and Smith (1993) found a measurable, but small impact on property values, with greater effects occurring in the urban CBD than the near suburban commuting stations.[5] Landis et al (1995)[6] looked at properties in three counties with access to BART. The study found premiums of $1.96 to $2.26 for each meter closer to the rail transit station. Additionally, the found a negative effect on values for properties near freeway interchanges. These negative values were found to have a 30% greater impact on property values than transit station proximity. This study shows that, in general, property values are positively impacted by transit station proximity, with negative impacts explained by other transit station characteristics, such as proximity to highways.

In a 1997 paper, Workman and Brod examine user and non-user benefits of rail transit accessibility.[7] They conduct a hedonic price study for properties in the San Francisco area in close proximity to the Pleasant Hill BART (Bay Area Rapid Transit) station. Their study examines the effect on home values based on walking distance to the BART station, controlling for factors such as the proximity to the highway and the size and age of the home. They find, in San Francisco that proximity to rail transit has a positive effect on property values. As mentioned above, they find, on average, that access to the BART station is worth $15.78 more for every foot closer to the station.

Additionally in this study, Workman and Brod examine property values near three stations along the East Burnside corridor of Portland's MAX light rail transit system. Again using the hedonic pricing methodology, they examined the effect of walking distance to the stations on property values for homes within a 1 mile radius of the station, controlling for other factors such as home size, age, lot size and zoning. The results in this study were not as strong, with the authors citing the MAX stations' proximity to heavy traffic areas as a problem. The MAX rail stations examined in this study are in close proximity to heavy traffic areas, which in other studies, such as Gatzlaff and Smith (1993) above, has negatively impacted property values. The findings of this paper show positive impacts on property values as a result of transit; however they also illustrate the importance of proper planning and placement of transit systems to achieve these benefits.

Several studies in the *Washington, DC* metro area have concluded that proximity to the Metrorail results in higher property values. Gatzlaff and Smith (1993) foundthe average price for a townhouse within 1,000 feet of the Metrorail station was $12,300 higher than comparable townhouses further away from the station.[8] Lerman et al. (1978) found that a 10 percent change in distance to a station results in a 1.3 percent change in property value for a single family home and a 6.8 percent change in retail property values.[9] This study shows a higher sensitivity of retail property values to transit, relative to residential properties.

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[5] Gatzlaff, Dean H. and Mark Smith. "The Impact of Miami Metrorail on the Value of Residences Near Station Locations," Land Economics, vol. 69 no. 1, February 1993.
[6] Landis, John et al, "Rail Transit Investments, Real Estate Values, and Land Use Change: A Comparative Analysis of Five California Rail Transit Systems". Prepared for Institute of Urban and Regional Development, University of California at Berkley, July 1995.
[7] op. cit. Workman and Brod.
[8] op. cit. Gatzlaff and Smith.
[9] Lerman, Steve R., David Damm, Eva Lerner-Lamm, and Jeffrey Young, The effect of Washington Metro on Urban Property Values, Prepared for Urban Mass Transportation Administration, (July 1978).

In a 1999 report prepared for the Federal Transit Administration, HLB, Inc. analyze commercial property benefits of Washington, DC's Metrorail transit system.[10] In this study they take into account actual walking distances to the station, rather than straight line distances. Overall their findings suggest that proximity to a Metro station has a positive impact on commercial property values. Using the hedonic pricing method, they find, on average that, holding all else equal, a 1,000 foot decrease in walking distance to a Metrorail station increases commercial property values by $2.30 per square foot. Given an average property size of 30,630 square feet in their sample, a 1,000 foot reduction in walking distance increases the commercial property value by $70,139.

In *Philadelphia*, along the Lindenwold rail line, studies have illustrated similar results. Studies by the Rice Center[11] and Voith (1993)[12] show a 6 to 7 percent premium for houses located near commuter rail service. Voith also concluded that the station areas contained 29 percent more Central Business District (CBD) employees than non-station areas and that the "productivity of the CBD and the transportation system are not independent, as one of the major attributes of the CBD is its accessibility to a wide labor pool."

Armstrong (1994) examines single family residential property values along the Fitchburg Line in *Boston*.[13] In this, he examined 117,602 single family residences and found a 6.7% property value premium for proximity to existing rail stations. He also noted that travel times to and from the CBD have an effect on property values, founding that for every 10 percent increase in commuter rail travel time, property values decreased by 13.7 percent.

Fejarang (1994) examines the impact of an announcement to build a transit station on property values in *Los Angeles*.[14] The study analyzed 152 commercial properties before and after the announcement, finding that prior to announcement, the difference between property values in the expected station areas and non-station areas was signification. A following a realization period, property values in the expected station areas had grown 78 percent, compared to only 38 percent in the expected non-station areas. This study illustrates the expected economic development benefits of transit; with property value premiums occurring before transit station is in place.

Anas (1993) examines the effect of rail transit on property values in the *New York Metropolitan Area*.[15] In additional to looking at proximity to rail transit stations, Anas considered the effects of transit quality. He found a property value premium for properties near stations with greater a

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[10] HLB, Inc., Commercial Property Benefits of Transit, Prepared for the Federal Transit Administration, (February 1999).
[11] Rice Center, Joint Center for Urban Mobility Research, 1987, "Assessment of Changes in Property Values in Transit Areas". Prepared for the Urban Mass Transit Administration.
[12] Voith, Richard, "Transportation, Sorting, and House Values", AREUEA Journal, vol. 19 no. 2 (1991).
[13] Armstrong, R.J., Jr. "Impacts of Commuter Rail Service as Reflected in Single-Family Residential Property Values". Paper presented at the 73rd Annual Meeting of the Transportation Research Board, (Washington, D.C., 1994).
[14] Fejarang, R.A., Impact on Property Values: A Study of the Los Angeles Metro Rail, Prepared for Transportation Research Board 73rd Annual Meeting, (January 1994).
[15] Anas, Alex, Transit Access and Land Value-Modeling the Relationship in New York Metropolitan Area, United States Department of Transportation, Federal Transit Administration, (September 1993).

frequency of service. Specifically, a change in the service frequency from five minutes to two minutes provides a residential property value premium of $24 per year and a commercial property value of $0.06 per square foot per year.

2.2.3 Implications of the Results of Hedonic Studies

The studies highlighted above focus on per property economic development impacts. To gain a more accurate understanding of the magnitude of these effects, it is beneficial to look at aggregate impacts for the entire region. The 1999 report prepared by HLB, Inc. for the FTA found a 1,000 foot decrease in walking distance to a Metrorail station increases commercial property values by $2.30 per square foot. In the report, it was estimated that there were approximately 11,000 commercial properties in Washington, D.C. Given this information, if the average walking distance to a Metrorail station were to fall by 100 feet, all else equal, the aggregate effect would total approximately $71 million in real estate premiums. Additionally, attempts to estimate the economic development impact of a transit project on yielding community economic development benefits ranges from approximately $100 million to over $300 million.[16]

There is considerable evidence, in various cities for several types of transit, that transit has a positive effect on economic development as evidenced by commercial and residential property values. The following section examines whether these property value increases are indeed incremental, above and beyond user benefits.

[16] HLB Decision Economics, *Light Rail Transit in the Austin Urbanized Area: A Cost Benefit Analysis,* prepared for Austin Transit Authority, March, 2000 estimated community economic development benefits of $94.6 million for the Orange Line light rail in Austin Texas and $293.5 for the Green Line. *Economic and Community Benefits of Transportation Options for Greater Cincinnati*, February, 2001, prepared for Ohio-Kentucky-Indiana Metropolitan Planning Organization estimated region wide economic development benefits of $353.9 million.

3. TRANSIT INVESTMENT EVALUATION AND POLICY IMPLICATIONS

3.1 Transit Investment Evaluation

It has been shown that transit systems can have a significant, positive, and measurable economic impact on the surrounding region, however, current New Starts criteria do not specifically require an analysis of the economic benefits associated with potential new transit investments. The criteria existent under TEA-21 and ISTEA did not specifically account for economic development impacts. The Safe, Accountable, Flexible, Efficient, Transportation Equity Act: A Legacy for Users (SAFETEA-LU) was signed into law in 2005, bringing about changes to the current New Starts criteria. Among the changes to be implemented under SAFETEA-LU, is a re-evaluation of economic development as a separate criterion when assessing the worthiness of a proposed transit project. For Fiscal Year 2007, only two changes resulting from SAFETEA-LU have been incorporated into the New Starts criteria, neither of which deals with the evaluation of economic development.

New Starts project development flows through three main stages: Alternatives Analysis, Preliminary Engineering, and Final Design. Projects in the Preliminary Engineering and Final Design stages are analyzed annually against the New Starts criteria. These criteria are separated into three categories: Project Justification, Local Financing, and Overall Evaluation. Project justification examines the key impacts and improvements brought about by the transit system. Local financing analyzes stability and reliability of the non-New Starts funding for the project, as well as the localities ability to fund operations and maintenance for the system. All the project justification and local financing criteria are then considered and the project is given an overall rating.

The focus here will be on the project justification criteria; as they are intended to evaluate the key benefits and impacts of the proposed investment. Local financing criteria, while an important consideration, are likely to remain unchanged as a result of analyzing economic development benefits. The key criteria of the project justification area are categorized as follows:

- Mobility Improvements;
- Environmental Benefits;
- Cost Effectiveness;
- Operating Efficiencies;
- Transit Support Land Use and Future Patterns; and
- Other.

Table 1 summarizes the key measures used in analyzing each of the project justification criteria.

Table 1: New Starts Project Justification Criteria and Measures

Criteria	Measure(s)
Mobility Improvements	• Hours of Transportation System User Benefits • Low-Income Households Served • Employment Near Stations
Environmental Benefits	• Change in Regional Pollutant Emissions • Change in Regional Energy Consumption • EPA Air Quality Designation
Operating Efficiencies	• Operating Cost per Passenger Mile
Cost Effectiveness	• Incremental Cost per Hour of Transportation System User Benefit
Transit Supportive Land Use and Future Patterns	• Existing Land Use • Transit Supportive Plans and Policies • Performance and Impacts of Policies • Other Land Use Considerations
Other Factors	• Project benefits not reflected by other New Starts criteria

Table Source: "An Introduction to New Starts," FTA Website, http://www.fta.dot.gov/planning/newstarts/planning_environment_2608.html

Currently economic development is included as an optional component under the "other" category. As noted, SAFETEA-LU calls for a reevaluation of economic development as a standalone criterion, however, this remains to be implemented. For FY 2007 only two changes to the evaluation criteria stemming from SAFETEA-LU have been implemented: new rating designations and a clause regarding non-Federal funding requirements. The overall project rating designations have been updated to *high, medium-high, medium, medium-low,* and *low*. Prior to SAFETEA-LU, project rating designations fell into three categories: *highly recommended, recommended,* and *not recommended*. The project justification criteria, along with the local financial commitment criteria, are assessed in determining the overall project rating.

3.2 Beyond User Benefits: Past Experience Implications

Traditionally, the key economic factor considered when assessing the worth of a transit system is user benefits. These are benefits linked directly to the use of the transit system, which boils down to travel time and cost savings of transit users. User benefits only account for a portion of the total economic benefits of a transit system. As such, it is important to look beyond the user benefits when assessing the value of an investment in transit.

It is clear that there are economic benefits of transit systems to transit users. Current New Starts criteria attempt to capture and account for these benefits, such as travel time savings. In addition, the criteria attempt to capture non-user benefits. The following table categorizes transit benefits by users and non-users.

Table 2: User and Non-User Benefits of Transit Systems

User Benefits	Non-User Benefits
• Travel time savings • Transportation cost savings	• Environmental Impacts • Congestion Relief • Property Values • Employment Impacts • Economic Development

Economic development benefits are more than just the capitalization of user travel time savings. These are benefits that stretch beyond the benefits accrued directly by transit users. As shown in the previous section, past studies illustrate the incremental nature of the economic development benefit. Studies have indicated that there is an additional premium people are willing to pay to be near transit systems, without having any intention of using the system. Workman and Brod (1997), in their analysis of San Francisco's BART, find many individuals who are willing to pay housing price premiums in excess of $20,000 to live near transit without ever using the system. Additionally, they point out that the value of premium they discover is far too large to simply account for user benefits.

These non-user benefits can be attributed to a demand for higher density, walking-oriented neighborhoods with less dependency on automobile transportation. It is important to realize that these additional benefits exist and to capture these positive externalities of the transit investment in order to gain a full understanding of the true economic impact to the region. Likewise, it is important to note that neighborhood attributes other than transit access can impact the economic development benefit accrued through transit availability. As we will discuss below, the extent to which planning controls do or do not focus development into livable, transit-oriented forms can significantly impact the level of positive economic development benefit realized through transit investment.

3.3 Incrementality of Economic Development Benefits

For some, the issue of including economic development benefits in transit investment assessment hinges on whether or not such benefits are incremental. Incrementality of economic development benefits means that the value of economic activity stimulated or caused through investment is additional to, and separable from the improved productivity delivered through improved transit times for users and for employers of users. There is good indication that this incrementality exists. Studies of land value nearer and further from station areas indicate a difference driven by the presence of transit. Sometimes transit has been linked to a decline in land values, indicating that, given improved travel times, the existence of a station has a clear impact incremental from productivity improvements. Elsewhere it has been suggested that increased land values are in excess of the calculated travel time savings. Again this is indicative of incrementality. Incrementality is deemed important because, if it does exist, it suggests that measurement of economic development would avoid a double counting flaw that has been cited as one reason for not including these benefits. An important question when assessing

incrementality, however, is the policy context within which development is being assessed. Different kinds of evidence for incrementality are germane to different objectives.

Evidence of value creation around transit hubs/stations

This evidence is relevant to the objective of encouraging a particular type of **land use**. If evidence shows that development value does arise, and that it would otherwise have occurred in less dense parts of the region, the objective of higher density development can be said to have been promoted by transit. Where the FTA is seeking to encourage improved land use as a policy objective, this evidence would be sufficient for demonstrating incrementality.

Evidence that value creation around stations would not have occurred elsewhere in the region

This evidence is relevant to the objective of regional **economic growth**. If the evidence indicates that development is more than densification, but truly additive to the expected regional net development, then the objective of economic growth can be said to have been caused through the investment. This would be true regardless of whether or not such growth was caused through the capitalization of user benefits into property values. If the FTA is primarily interested in net economic growth, then this is the standard of incrementality that needs to be met.

Evidence that value creation around stations would not have occurred elsewhere in the region and is not the capitalization of user benefits

This evidence is relevant to the objective of net **economic welfare**. If the development is incremental to the region and incremental to user benefits, it represents a net gain in economic welfare. Clearly, this is the most challenging standard of incrementality to empirically prove, regardless of the fact that such incrementality is intuitive to analysts who are interested in agglomeration economies. In this context, however, it is not at all self-evident that FTA is interested in economic growth or economic welfare, but rather land use. New starts criteria are already heavily land use focused. If this is true, the burden of proof that value creation is incremental to the region and incremental to user benefits is limited to the well-established evidence that transit investments do have an impact on property values. Additionally, the evidence is suggestive of an incremental benefit above and beyond user benefits and net of expected regional economic activity.

Although a portion of observed increased land values reflects the capitalization of transit time savings, and is thus captured in the measurement of congestion benefits, transit gives rise to urbanization and amenity affects that are valued as well by people who do not use transit. Where increased land values associated with transit represent, in part, the transfer of development from other parts of the region, the character of development, namely urban as distinct from suburban development, is unique and thus additive to diversity value of the region.

When hedonic studies are used to examine the impact of transit on regional property values and rents, they indicate that premiums appear to be more than the result of transit user travel time savings. There are additional economic benefits of transit that are not directly captured by its

users. The hedonic method's ability to isolate the impacts of transit on property values makes it a preferred tool. Through proper estimations techniques and accurate data, researchers can ensure the impacts they are measure are actually due to access to transit.

In their examination of the Pleasant Hill neighborhood, which has access to San Francisco's BART system, Workman and Brod provide the following example. They examine two properties, inhabited by regular users of BART who walk to the station. One property is three quarters of a mile from the Pleasant Hill station while the other is one half mile away. Their regression results indicate that properties one quarter mile closer to the station yield a premium of $18,000. In their example, the $18,000 premium results in approximately $130 per month of additional mortgage costs at 8 percent interest for 30 years. Therefore according to their study, an individual is willing to pay an additional $130 per month to live ¼ mile closer to the transit station. Assuming it takes 5 minutes to walk ¼ mile, with two trips made daily and 20 days in a month, the total travel time savings in one month would be about 3.3 hours. An upper bound estimate for value of time of $20/hour, results in a willingness to pay of only $66/month due to the travel time savings. In this example, travel time savings only accounts for approximately ½ of the total willingness to pay to live closer to the transit station. Based on this example, the authors conclude there are likely some non-user benefits associated with proximity to transit and that these benefits likely account for at least 50% of the total property value premium. The Workman and Brod study indicates that it is possible to estimate the incremental value of economic development benefits and separate them from productivity improvements within the hedonic framework. This evidence is suggestive of an incrementality even beyond that required within a landuse policy context.

3.4 The Need to Account for Economic Development

There is constant scrutiny around the allocation and use of government funding. Given limited resources, critics wish to ensure that funding is allocated in an efficient manner. Public investments are commonly assessed using conventional quantitative economic criteria; however, transit projects are subjected to a different set of criteria. The commercial failure of transit in the 1940s and 50s has lead people to believe that transit investments cannot stand up to the rigor of economic analysis. As a result transit investments are assessed against a different set of evaluation standards. Using different criteria to evaluate transit investments may lead critics to believe that transit spending is not an efficient use of government resources. By accounting for economic development benefits of transit, proponents can make the case that transit investments can be an efficient use of government funds.

From an economic perspective, current New Starts criteria focuses on user benefits, but ignores the more widespread, regional benefits of economic development. Focusing on user benefits only makes a case for transit from the user's perspective, which can be troublesome in regions where a bulk of the population will not be transit users. Opponents can oppose the notion of a new transit investment if they feel they will not receive any benefits, while they may potentially bear some of the costs. As demonstrated in the previous section, evidence in past studies has shown that economic development can account for a sizable portion of total transit benefits. In

order to truly measure the benefits of transit, and make a case for the importance of transit to the region as a whole, both user and non-user benefits must be assessed.

Additionally there are a far greater number of proposed transit projects than there is funding to support them. When deciding which projects to approve for federal funding, it is important to have a full picture of the potential regional benefits. By ignoring benefits associated with economic development, decision makers are only seeing a portion of the total picture. In order to fully account for the worthiness of a proposed transit investment, all costs and benefits, including the benefits of economic development, must be properly assessed and measured. Failure to do so may result in a less than optimal allocation of funding.

Finally, where the policy objective is to improve development patterns, reduce sprawl, encourage transit-oriented development, and create value through transit investments, the inclusion of economic development benefits in investment evaluation will encourage the types of land use policies that lead to transit-based economic development: zoning overlays that allow for mix-use development, higher densities, and investment in areas free from existing stagnation.[17]

[17] See Chapter 2 of the Urban Land Institute's Developing Around Transit: Strategies and Solutions that Work (2005) by Robert Cervero and Chapter 4 of The Center for Transit-Oriented Development's New Transit Town (2004) by Ellen Greenberg for discussions of the specific transit-land use policies that tend to encourage positive economic growth. As Cervero points out, investment has been most successful in generating economic development when it is made in areas that are not considered blighted.

4. APPROACHES TO INCORPORATE ECONOMIC DEVELOPMENT BENEFITS INTO TRANSIT INVESTMENT EVALUATION

Our review of the evidence for the existence of measurable economic development impacts resulting from transit investment, and incremental to productivity improvements already explored in the evaluation of such improvements indicates that there is a need for an applicable predictive analysis method acceptable to the FTA and planners and practitioners. This section assesses the challenges of developing such a predictive method and proposes several frameworks from which such a method might emerge. Our intent in this section is not to suggest that there is a perfect method, or that all questions relating to predictive analysis of economic development have been answered, but to point to several promising approaches that could be refined, combined, or even replaced in order to develop a method that would be widely accepted.

4.1 Evaluation Challenges

Previous efforts to incorporate quantified economic development benefits into transit cost-benefit analyses, particularly for new starts, have been met with skepticism. This reaction may largely be due to a set of misperceptions about the ability of quantitative approaches to extract the incremental economic development benefit of transit investments and separate such benefit from other traditional user benefits which might also be observed through measurement of property values. Though concerns with the attempts to include economic development benefits into the transit evaluation framework have been described in a variety of thoughtful ways, they can generally be categorized into the following six issues:

- It is not possible to distinguish economic development from other, already measured, land use change criteria
- Economic development benefits are the same as capitalized travel time savings and including such benefits amounts to double counting
- There is no rigorous methodology for quantitatively measuring economic development benefits
- Economic development benefits can not be predictively estimated, but can only be assessed post-hoc
- Economic development may be assisted through transit investments, but can not be directly attributed to specific investments
- Economic development around transit hubs is really a transfer of activity from other geographic points within the same region and is not additive development

While critics of the inclusion of economic benefits into the evaluation criteria for new starts have serious concerns, the review of previous experience discussed above indicate that economic development benefits associated with transit investments do have the following attributes:

- Economic development associated with transit appears to be incremental
- Economic development is measurable
- Economic development benefits from agglomeration effects

- Economic development can be predicted given sufficient data

Because economic development is apparently incremental, and is measurable, additive, and predictable each of the concerns described above can be addressed, given a rigorous approach and a supply of sufficient previous evidence. Several approaches can meet these criteria and two are described later in this paper. Each concern is addressed below.

It is too difficult to distinguish economic development from land use

New starts evaluation criteria already assess how land use planning supports the use of the transit system. Plans that encourage ridership through access and density are more likely to receive a positive rating. Critics of the incorporation of economic development benefits suggest that economic development is caused not by the transit improvement, per se, but by the land use policies that accompany the investment. As these policies are already accounted for in the evaluation criteria, additional evaluation of economic development benefits is unnecessary and duplicative.

The current land use criteria do not focus on monetized economic benefits, but rather assesses various qualitative factors and assigns a rating. Effective land use policies in areas served by transit are amiable to economic development; however evaluating land use is not synonymous to measuring the benefits of economic development. It is important to distinguish economic development benefits from land use policies, recognizing that the latter may play an important role in shaping regional economic development.

While it is true that conducive land use policies (density, mixed use zoning, appropriate commercial zoning, etc.) facilitate economic development, the purpose and focus of the New Starts evaluation of supportive land use policy is focused on encouraging ridership, not economic development. While policies that encourage ridership, may also help to facilitate development it is the interaction of improved access and density of economic activities which cause the economic growth assessed in the hedonic studies reviewed above. Further, the new starts criteria assess subjective assessments of good land use policy. The study of economic development can be quantitative and predictive of outcomes – values that lead to better decision making about funding allocation.

Economic development improvements are already accounted for in productivity measures

Some have expressed concern that rising property values, be they commercial or residential, are in reality the capitalization of travel time savings, already accounted for in the new starts evaluation criteria. If this were true, and economic development benefits were factored into funding decisions, a double counting of the travel time savings would occur.

While it is true that some of the value of travel time savings is capitalized into property values, particularly for residential properties, two pieces of evidence indicate that economic development benefits reflect an incremental value additive to improved productivity.[18] The first

[18] It is noted here that travel time savings tend to be better reflected in residential property values as opposed to commercial properties. This is because, while employers using commercial properties may value improved access

indication that economic development is incremental and additive to productivity improvements, is the fact that several studies have indicated negative development impacts from transit investments. This suggests that even where users experience improved travel times, property values may decline, either due to negative perceptions of transit station areas, or due to poor implementation. As such, economic development can be seen as both incremental and separable from productivity improvements. Second, studies have indicated that the positive economic development benefits experienced are greater than the sum total of travel time savings.[19] This indicates that while travel times savings may be capitalized into property values, the improvement in the use-value, in terms of escalating economic activity, is incremental and calculable.

Quantitative analysis of economic development benefits is impossible and qualitative measurement is too subjective

Qualitative methods are often criticized for being too subjective. These measures can be used to assess economic development benefits; however, a sound quantitative method is preferable. In the case of assessing the economic development benefits of transit in the New Starts program, qualitative measurement is unnecessary if an acceptable quantitative method is available. There may be a desire to use qualitative measures for the newly created Small Starts program which is defined as having a simplified and expedited evaluation process for projects seeking less than $75 million in federal capital investment funds.

Assuming that economic development benefits will be capitalized in property values, hedonic pricing models can be utilized to accurately measure economic development impacts to real estate that are directly attributable to transit. Past experiences, as discussed in Section II, have shown that it is possible to quantitatively measure the benefits of economic development using a sound and widely accepted methodology. The hedonic pricing models allow researchers to isolate the impact of transit on property values by controlling for other property characteristics that influence value, such as age, size and zoning.

Economic development benefits can't be predicted, but only assessed post-hoc

The question of quantitative measurability and predictive analysis go hand-in-hand. Though we believe concern over the measurability of economic development benefits has declined as the body of evidence from various studies mounts, some may still be concerned a movement toward the incorporation of economic development evaluation criteria will result in difficulty in standardizing practice and evaluation technique.

Later in this paper, several methodologies for quantitatively assessing prospective economic development benefits are proposed. The review of prior experience above already indicates that useable retrospective approaches exist. Economic development impacts can be assessed

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for their employees, they are not directly paying for the cost of lengthened commutes, nor are they directly benefiting from shortened travel times. Residential property owners, on the other hand, tend to directly benefit from either improved access or reduced road congestion.

[19] See, for example, Workman and Brod's study of the Pleasant Hill BART station neighborhood.

quantitatively. We believe that the hedonic approach also provides an opportunity for predictive analysis.

Benefit estimation should account only for benefits directly attributable to transit investments

This concern seems to express the idea that mutually advantageous agglomeration economies resulting from grouping of economic activities around transit hubs should not be credited to the transit investment, but should rather be seen as a secondary impact resulting from a variety of factors.

The economic development value assessments in the hedonic studies reviewed include controls to ensure a level assessment. Typically, the measurement approach will include regression techniques that control for a variety of factors, including density, tax rates, and other costs. Further, the incremental nature of such benefits allows the analyst to separate economic development value due to transit investments from other causal factors.

Economic development around transit hubs is really just a geographic transfer of economic activity from other, non-transit served areas in the region

This concern suggests that transit does not create activity; it merely causes relocation and redistribution from a dispersed geographic plane to specific hub points. If this were correct, then the incorporation of economic development benefits would "credit" projects for development that wasn't new, just refocused.

The focusing, or channeling of economic activity into denser geographic locations, generates additive economic value through agglomeration economies. Agglomeration economies refer to the decline in production costs due to the concentration of economic activity in a specified geographic area. This concept helps explain, in particular, why firms and industries located in urban areas tend to be more efficient than firms and industries located in rural areas. By extension, this concept also helps explain why larger cities tend to operate more efficiently than smaller ones. In this context, the presence of a well-functioning transit system is thought to strengthen the impact of agglomeration economies, and thereby, to help cities function even *better*.

In congested areas, mass transit is often the fastest and most reliable way for people to move from one point to another. As such, transit facilitates meetings and other face-to-face communications between members of different firms and industries. In other words, transit promotes the exchange of information, ideas and concepts between firms and industries located within large metropolitan areas. By reducing transportation costs and congestion, mass transit also lowers search costs for would-be employees and recruitment costs for employers. It facilitates the transfer of workers across firms and industries and promotes the efficiency of urban labor markets. Improved public services in general and mass transit, in particular, also attract more workers to a city. This increase in the number of workers will, through the realization of economies of massed reserves ("economies from selecting workers from a larger

pool"), benefit the firms located in a city. Finally, because transit reduces congestion costs, it facilitates the concentration of economic activity. Other things equal, transit enables a higher degree of agglomeration which in turn results in higher productivity and stimulates economic growth.

If the concentration of economic activities around transit stations does in fact create agglomeration economies, then the incremental economic development value could be said to be more than a redistribution of activity that would have occurred within the region without the investment. This is even true of stations within primarily residential areas, as they enable the labor force to more easily access dense employment areas elsewhere within the metropolitan area. As such, the investment can be said to support policies of economic growth and economic welfare improvements.

4.2 Review of Estimation Approaches

Several potential methodological frameworks exist for isolating the predicted incremental economic development benefits to be derived from a transit investment. Of these, four have stood out as having potential as the basis for a widely accepted predictive analysis methodology. This section reviews a stated preference framework, a revealed preference framework, an input/output framework, and an alternative econometric approach. The stated preference framework, which relies on surveys of existing residents and system users, has the advantage of applying specifically to the unique characteristics of the investment geography. On the other hand, the revealed preference framework, which uses evidence from past experiences to generalize to the proposed investment, has the advantage of overcoming the typically difficulty of assessing public goods based on public perception. The input/output framework, which is widely used in transportation analysis benefits from methodological soundness, but may fail to account for agglomeration economies. The alternative econometric approach relies on historically data to predict an average development trend using regression analysis. This section explores the concept of the survey based framework and examines various ways it might be applied to generating a prospective estimate of the incremental value of economic development benefits to be achieved through a transit investment. The next section examines two hedonic approaches which rely on the aggregation of data from our collective national experience with transit investment in-order to develop a comparative data base to be used in prospective estimation. The subsequent sections look at input/output approaches and the alternative econometric framework.

4.2.1 Survey Approaches

Survey Approach: Primary Data

One approach used to isolate the incremental benefit associated with economic development from travel time savings and other user benefits is the survey-based approach. Stated preference models use surveys of residents to measure the impact of a range of location specific neighborhood attributes in study areas. For example, a 1994 study of the value of proximity to light rail in Calgary measured the impact of, among other things, distance to work, distance to

retail, size of housing, cost of housing, and proximity to a light rail station[20]. A survey was conducted by presenting hypothetical collections of attributes, particularly locational attributes, and asked respondents to select their preferred location. By observing willingness to pay for preferred locations, the study was able to estimate the value of transit proximity.

When the level of planning for a new investment is sufficient enough to develop the ridership estimates required for federal funding requests, enough details would be known to create a survey specific to the study area. The survey would bundle neighborhood and locational attributes and ask respondents to estimate how much they would be willing to pay to reside at such properties. Similarly, businesses could be asked about their willingness to pay for office or production space with a range of location options. This data could then be used to structure a proximity-value estimate. Once the additional value, if any, created through improved access is estimated, travel time savings would be deducted out and incremental economic development benefits could then be estimated over a program lifecycle.

Survey Approach: Secondary Evidence

Another survey-based approach would be to rely on data collected nationally in the Census Transportation Planning Package to estimate the average incremental proportion of economic development benefits from total property value improvements. The Census Transportation Planning Package (CTPP) provides a robust data source for such an estimation.

In estimating residential and commercial development benefits, planners should ideally use a set of success factors to determine the potential level of economic development at each station location. Transit areas (within a one-mile radius around the transit station) can be evaluated against key factors for Transit Oriented Development (TOD) opportunities such as:

- **Strong market** – properties in the transit station area are selling well, have high absorption rates, and healthy lease rates;
- **Economic opportunity –** land proximate to the transit station area is attractive;
- **System Plans** – the transit station will be platform, station, and/or a park and ride lot;
- **Type of development –** the investment program in the transit station area is characterized as either greenfield, downtown, suburban, big box retail, campus, redevelopment, or medical center that reflects existing available development assets and potential investment restrictions;
- **Accessibility** (Pedestrian, Auto, Transit) – the transit station is convenient and easy to travel to for a variety of modes, including pedestrians, bicycles, automobiles and other transit;
- **TOD supportive zoning** – the transit station area has transit oriented zoning, which encourages increased development densities supporting compact development, endorses mixed use development, reduces parking requirements and is pedestrian friendly;
- **Available Land for TOD development –** the transit station area has property available for development or redevelopment;

[20] Hunt, J.D. et al, op. cit.

- **Major Attractions –** the transit station area is proximate to major attractors that create a destination for riders;
- **Public Sector Investment/Support –** the transit station area has public sector support and ongoing or proposed public sector investment in place to support operations (such as infrastructure); and
- **Private Sector Investment Support –** the transit station area has private sector support and ongoing or proposed private development projects in place, which will support TOD development.

The secondary approach might combine data collected from real estate transactions, socio-economic data, and Geographical Information System (G.I.S.) data for residential and commercial properties located within the area of study. Again, the hypothesis of this approach is that transit improves the livability of transit-oriented neighborhoods, producing benefits across the neighborhood, *whether or not a particular resident uses transit*. Finding a property value benefit with transit access, regardless of use, helps to confirm the notion of an economic development benefit apart from transit use.

Evidence for benefits accruing to non-users can be found in the CTPP data prepared by the Census Bureau, under a contract with the American Association of State Highway and Transportation Officials. The CTPP tabulations are grouped in three parts:

- Part 1 presents results aggregated by place of residence. Over 100 tables describe the characteristics of persons, workers and housing units living in each TAZ. Tables present variable totals (e.g. number of persons living in the zone), distributions (e.g. number of households by income) as well as cross-tabulations involving two variables (e.g. household vehicles available by income) or three variables (e.g. travel time to work by means of transportation and by time leaving home). Continuous variables such as income or travel time are discretized into standard categories (ranges) that are used consistently throughout the tabulations.

- Part 2 consists of over 60 tabulations of Census responses aggregated by place of work. To obtain these tabulations, the individual long form responses are aggregated by TAZ of work rather than TAZ of residence. (The long form asks respondents to identify their work location, and this is matched to particular TAZs.) The Part II tabulations include some of the same data items as do those of Part 1, but are aggregated by TAZ of work. This aggregation is very useful to analyze trip attraction relationships, and is not otherwise available from the Census. Example tabulations include: household income of workers in a zone; number of workers by industry and by means of transportation to work; mean travel time by means of transportation to work and by time of arrival at work.

- Part 3 consists of over 10 tabulations of Census responses, aggregated by both place of residence and place of work. In other words, these are tabulations of data about journey to work flows between particular origins and destinations. Tabulations include data items such as: total workers; mean travel time by means of transportation to work and by time leaving home. Again, this origin-destination data is extremely useful for transportation planning, and is not otherwise available from the Census.

CTPP data from 1999 indicate that approximately 55% of residents within the station area radii do not regularly use transit to commute, however, they still demonstrate transit preference as indicated by their willingness to pay additional property costs in exchange for the proximity benefit. An updated analysis of the CTPP could generate an improved estimate of the proportion of residents not using transit regularly within proximity rings. These could then be used to estimate the incremental economic development benefit by matching those ratios to the distance-value relationships estimated using hedonic modeling (described below).

Survey Approach: Land Use Survey

A final survey approach also involves data collection, but relies on evaluation of development potential done by planners. Land use survey approaches rely on planner opinion in a qualitative review, property by property, or development opportunity. Surveyors assess each property within the study area along several criteria, including:

- Proximity to proposed investment
- Neighboring activities
- Age of structures
- Existing demand
- Projected future demand

As the survey is completed, a matrix of high to low redevelopment probability is filled out. The matrix is then used to estimate the likelihood of redevelopment on a property by property basis. This approach can only be qualitative in nature, and it is unlikely that a dollar figure could be attached to the analysis. However, it does offer the benefit of providing a pretty comprehensive picture of development potential in the study area and is fairly reflective of the process developers would use in evaluating neighborhood potential.

The survey approaches reviewed offer the potential for examining the incremental economic development benefit potential that would be engendered by a transit investment both quantitatively and qualitatively.

While the survey approach does offer a way of assessing preferences and economic development value it does have some drawbacks. First and foremost, any stated preference approach is going to suffer from problems of matching expectations to outcomes. Stated preference studies related to public goods will typically risk under-valuing goods. Secondly, and more practically, generating sufficient survey responses in order to assess a proposed transit investment may prove to be a greater administrative challenge than necessary or reasonable for planners to undertake. The survey approach offers a way to assess investments in areas or regions (or types of investments) that are atypical to previous investments (for example a wholly suburban system or a significantly new technology).

4.2.2 Hedonic Modeling- Based Approaches

The hedonic approach offers the potential of generating predictive estimates of the incremental economic development benefits based on historically experience. While the revealed preference approach achieves improved likelihood of approximating the actual outcome, it does require the aggregation of a large amount of historical data – an activity that would likely need a national sponsor.

Hedonic-Based Approach: National Average

One approach to estimating economic development impacts is to collect data on existing projects and estimate an average impact based on system scope, transit technology, investment size, and geographic region. Once collected, such data could by analyzed to suggest a set of typical impacts. The benefit of such an approach would be that little investment in analysis would be required on a project-by-project basis. Once the data from post-hoc studies were collected and assessed (much in the manner described in the review of the hedonic studies above) and an analysis of regional impacts were completed, analysts could calculate regional averages, controlling for investment size and system type.

This approach has the advantage of requiring minimal investment on a project-by-project basis, while providing some guidance in terms of economic development expectations as policy makers consider an investment. Clearly, the national average approach lacks the power to finely discern differences in geography, local economies, and neighborhood characteristics that more detailed approaches offer. One such approach, the comparative approach is described below.

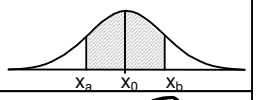
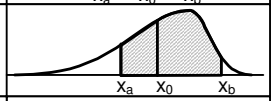
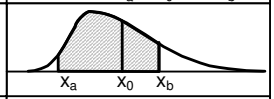
Hedonic-Based Approach: Comparative

The hedonic-based approach reviewed here is based on the comparison of parcels in a study area for a transit investment to a data base of parcels from studies of already implemented transit investments. By categorizing properties in a study area and comparing them to the characteristics of properties around prior investments, several variables that might effect economic development potential can be controlled for. These include:

- Distance to closest station
- Size
- Structure age
- Zoning
- Density
- System type
- Neighborhood demographics

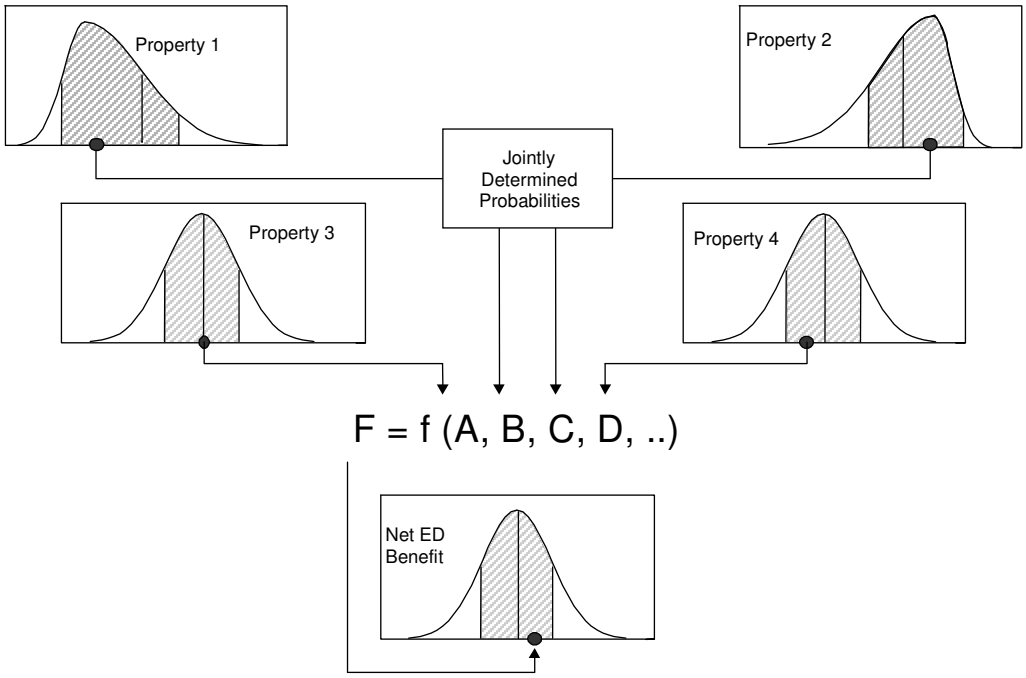
As these data are collected for the study area, the examined parcels can be compared to the database and assigned an index value. The index value would be based upon the distance-property value relationship observed for similar parcels. Then, based on that index value, an economic development value range could be assigned based on observed transit-related property value increases, less transit time savings, for use in a cost-benefit analysis framework. The database comparison envisioned could look something like Figure 1.

Figure 1: Sample Hedonic-Based Economic Development Benefit Estimation Tool

Property Name	Property Characteristics				Index Value	ED Benefit Range
	Square Footage	AGE	Property Type	Distance to Transit		
15 Hickory Ct	1,500 sqft	27 years	Residential	1520 ft	97	
245 5th Ave	8,050 sqft	15 years	Commercial	720 ft	105	
1501 M St	700 sqft	44 years	Commercial	5,208 ft	91	

By comparing the parcels in the area surrounding the proposed investment to the parcels in the database, estimates of the likely incremental economic development impact in the study area can be made. These estimates, based as they are on comparison to similar properties in neighborhoods with similar characteristics with similar investments, are unlikely to be so certain that they can be made as a single point. Rather, a high-to-low range of possible outcomes would be estimated by parcel, along with an estimated distribution of outcomes. These probabilities could then be combined in a randomized, iterative simulation, such as Monte Carlo, to develop a risk-adjusted estimate of the economic development impact of the proposed investment, as described in Figure X, below.

Figure 2: Combining Economic Development Risk Profiles to Assess Net Benefit



Because the hedonic-based approach utilizes post-hoc data from previous investments, and because that data would be collected nationally, the estimated, risk adjusted economic development impact could be expected to be broadly representative of any particular proposed investment. Obviously, the richer the database, the more reliable the estimates could be expected to be. Given that the database could be expected to be populated with cases where both economic development and economic decline occurred, the range of possible outcomes could be expected to also provide prior indication of potential negative economic consequences. Rather then complicate an investment evaluation with complicated calculations of potential input and output and agglomeration effects, the hedonic-based solution uses comparison to experienced impacts to factor in the range of possible effects. Finally, because in the collection and population of the database, estimated travel time savings per capita would be captured and factored in, the proposed hedonic-based solution could ensure that only the incremental value specific to economic development would be factored in. The proposed hedonic solution, then, takes advantage of the predictability of economic development impacts, the incremental nature of economic development benefits, and accounts for the potential for escalating economic activity that occurs when economic activities are co-located in a dense environment.

4.2.3 Input-Output Approaches

Finally, input-output approaches, common in the evaluation of transportation investments, offer potential for the evaluation of economic development impacts of transit investments. Input-output models seek to model the impact of investment by breaking down expenditures in one industry into the demands such expenditures create in other industries. For example, construction of a building may require $1 million of labor expenditures for skilled and semi-skilled crafts. That labor expenditures would then create demand for products and services consumed by the labor pool. That consumption would, in turn, create demand for additional consumption and expenditure. In this way secondary and induced effects of the transportation investment are captured. The analytical machines used rely on multipliers which are typically specific to CMAs at their finest level of analysis. Sub-CMA analysis is typically not available in commercial data sets. Commercially available packages include IMPLAN, REMI, and RIMS II.[21]

Among the advantages of the input-output approach are:

- Availability of commercial analysis software
- Coverage of greater metropolitan area in analysis
- A quantitatively methodology that is already accepted in transportation economics
- Ability to combine multiple counties into a single analysis

[21] For a discussion of the available analytic packages and the assessment of the economic impact of transportation investments see Lynch, Tim, *Analyzing the Economic Impact of Transportation Projects using RIMS II, IMPLAN and REMI*, Center for Economic Forecasting and Analysis for the Office of Research and Special Programs, USDOT (2000).

Disadvantages of the Input-Output approach in this context include:

- Inability to achieve greater than MSA specificity
- Inability to account for agglomeration economies created through dense clustering of activities
- Inability to distinguish between residential and commercial locations

Along with survey and hedonic-based approaches, the input-output approach offers potential for the assessment of economic development impacts created through transit investments. Further work is needed to evaluate and refine the existing approaches. A national forum for the discussion, refinement, and testing of these approaches could help to establish both legitimacy and best practice.

4.2.4 Econometric Analysis

Another potential approach would be to utilize econometric methods to develop an estimate of the typical economic development value created through transit investment. The econometric approach is based on assessing data from multiple cities simultaneously to develop an estimate of "typical" transit investment relationship to economic development so that when a new system is proposed, the analyst can use the same relationship to calculate estimated future impact.

Given a panel data set of sufficient size (encompassing perhaps 25 cities over 10 to 20 years), analysts could use regression analysis to estimate for the typical effect of transit controlling for a range of contributing factors including local system types and sizes, population sizes, density, employment, investment, education, industrial composition and more. Significant work would need to be done to clarify several uncertainties, including: the appropriate measure for economic development (tax revenue, property values, economic activity), appropriate measures for the level of transit (system type dummies, revenue miles, revenue passengers), and appropriate measures for each of the control variables. However, the econometric approach does offer the possibility of a statistically valid, standardized approach that would require communities to invest in fewer assessment resources than some of the other proposed approaches.

One could test the relationship between transit and economic growth utilizing a form such as the following:

$$Y_i = a + b_1 X_{1i} + b_2 X_{2i} + b_2 X_{3i} + \ldots + b_n X_{ni} \qquad \textit{Equation 1}$$

Where:

Y_i is a measure of economic growth in region i between two given years;

X_{1i} is a measure of productivity in region i in the initial year (e.g. output per employee, per capita income);

X_{2i} is a measure of agglomeration in region i in the initial year (e.g. population, density);

X_{3i} is a measure of transit presence in region i in the initial year, expressed in either a dichotomous form based on a threshold of service, or expressed in terms of normalized continuous output measure, such as transit employees per capita, revenue miles of service per capita, etc.;

X_{ji}, j = 4…k are other control variables (e.g. region size, location dummies, industrial composition, capital endowment, labor force quality, etc.)

Such an approach can avoid the issue of double counting through the capitalization of travel time savings by using economic development measures that are separate from property values. Further, if enough data could be collected it offers the potential for developing regionally specific estimates and even of developing an investment specific tool that accounts for local factors.

4.2.5 Summary

Having reviewed several frameworks that hold potential for providing the basis for a widely accepted methodology, it should be noted that this is by no means a comprehensive list of applicable frameworks. Nor should it be assumed that these frameworks are mutually exclusive. Clearly there is potential for combining elements of different approaches in order to address deficiencies evidenced within each. A hybrid framework might combine land use analysis, econometric assessment of property values, planning elements, and urban policy criteria among many other potential areas of assessment. Regardless of the final selection, it is clear that evaluation of economic development impacts engendered through transit investment should be anticipated, estimated and factored into decision making. The next section suggests several concrete next steps toward this goal.

5. NEXT STEPS

This paper suggests that incremental economic development benefits resulting from transit investment are measurable and that the incorporation of these benefits into the routine evaluation of investment proposals is desirable. These conclusions are based on a review of the available evidence and an assessment of the current state of economic development evaluation. However, any review of published research can not replace the value of a national dialogue on this question. We suggest that there is a need for a national forum to address the following questions:

- Should economic development join other primary evaluation criteria for new starts funding?
- What is acceptable evidence for economic development?
- What is the best practice for predictively evaluating economic development benefits?
- How should analysts interpret evidence for negative economic development impacts?
- Are similar approaches advisable for both the New Starts and Small Starts programs given the different size of investment and requirements for each?

Participants in this national forum should include, at the least, planners, developers, Departments of Transportation, Municipal Planning Authorities, the FTA, and consulting professionals. We hope such a forum could be organized and chartered to develop a set of recommendations leading to guidance and a reformulation of funding application requirements. Recognizing that each of the frameworks reviewed within this paper has some shortcoming, a similar approach to that used in developing the SUMMIT model should be applied to the selection an appropriate approach.

In addition to the need for a national dialogue on this topic, further research is required. Needed research includes development of case studies specifically addressing the ability to predict economic development outcomes. This paper has suggested a wide range of possible predictive approaches. These approaches need to be further developed, improved, and tested. While some of the proposed approaches seem intuitively stronger than others, statistically valid testing of each is required in order to establish a best practice.

In the short term the FTA should require New Starts applicants to collect data on regional property characteristics, property values and tax income on an annual basis, as part of the ongoing evaluation procedure. This data will be extremely useful in assessing the performance of predictive models and could be utilized to create a predictive database model, along the lines of the one proposed in Section 4, which can be used to assess potential economic benefits of future projects. Requiring the collection of this data, as part of the New Starts evaluation criteria provides a necessary incentive for applicants to collect accurate data. Additionally, it is critical that data collection encompass periods prior to approval. There may be several speculative increases to property values during the New Starts application process, from the initial

announcement, to the analysis of alternatives to the final design. Given these speculative impacts, the frequency of data collection, specifically with respect to property values, is critical in order to fully capture the entire impact of transit. The initial period of database construction should be the focus for the next two to five years, in order to ensure sufficient data collection before utilizing it in as a predictive tool.

In the intermediate time period the FTA should appoint a commission to oversee the investigation of approaches to predictive evaluation and to oversee the collection and aggregation of data from New Starts applicants. FTA should commission the construction of a predictive model. The selected model will need to ensure its predictive power across diverse localities, with differing demographics, industries and economies. The success of the model will hinge on the availability of diverse data, as well as recognizing the data limitations when assessing different regions. Once sufficient data is collected and a well specified model is developed, communities will have a standard with which to measure the potential economic development benefits of their proposed transit project.