Link Between Transit Spending and Personal Income

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ABSTRACT

One of the biggest challenges in getting public acceptance of transit enhancements is making the case that it will benefit the entire public, not just the users. In the era of economic challenges, it is even more important to make the economic case for transit. Construction of transit systems are very large regional investments that have significant economic impact. This study confirms that the some projects are large enough so that they have an observable impact on personal income in a region. Transit spending and changes in personal income were compared in the top two dozen U.S. Combined Statistical Areas. During and after the projects there was a trend for income to rise.

INTRODUCTION

It is well known that investment in transportation systems produces economic impact. However, those impacts are usually measured at the microeconomic level. For example, the potential impacts are first enumerated. Then, the impact from each is found and summed. However, microeconomic methods have some shortcomings. First, only impacts that are known can be estimated. Secondly, impact analysis is often based on conservative assumptions.

Economic impact can be confirmed by using macroeconomic methods. When a new transit system is built, the region's increase in economic activity can be measured. The economic activity in an area is measured as its production function. Production is the total effect of use of capital, labor, resources, and technology: Q = (K, L, R, T). A city has economic growth only if one of K, L, R, or T changes. Conversely, the total production of an area can be measured as income, which is wages and salaries, rents, interest, and profits. Income and production are both equal measures of development.

Measuring the regional economy as a whole can provide a larger picture of economic impact. However, infrastructure investment is only one cause of economic development. Looking at the change in income in one region immediately after a large transit project would not clearly distinguish what portion of the change in income is due to the investment. By aggregating the effect several regions over several years and several infrastructure projects, other effects in the economy become filtered out.

IMPACT OF TRANSIT ON INCOME

Recognizing the effects of transportation on income, the Federal Highway Administration has stated that mobility is money (Federal Highway Administration 1999). There statement shows that there is a link between transportation and income:

> *Household income appears to be the single most significant determinant of mobility. All aspects of travel are related to income—the amount of travel, the area in which a person travels, and vehicle ownership. People in low-income households have fewer travel options and a much smaller radius of access to*

> *goods and services than those in higher income households. The high cost of acquiring, registering, insuring, and maintaining a vehicle places vehicle ownership out of range for many low-income households.*

Microeconomic methods usually find that the impact from transit is at least $3 per $1 spent on transit (Shapiro and Hassett 2005; TRB 1998). Their analysis included evaluation of the impact on construction capital expense and reduced congestion. Nonetheless, it acknowledges:

> *the estimate relies on a conservative rate of return for public infrastructure and does not include the value of surface transportation in facilitating people's access to schools, medical facilities and other non-work-related destinations. The estimate also may not capture all of the ways in which highways and public transit support economic growth and help U.S. workers and companies compete in global markets.*

Not all residents in a region benefit equally from transit improvements. Among the beneficiaries are those employed in the construction and operation of the system, the riders gain through the service, the people who commute on parallel roads gain through reduced congestion, and everyone else in the region has some benefit such as in higher economic activity as seen through the multiplier process. There are many more potential microeconomics impacts that are not easily measured and therefore have been neglected in previous studies.

The macroeconomic method used in this work to evaluate economic impact does not rely on identifying all of the possible impacts of the project since the economy as a whole is measured. However, it is beneficial to list overlooked economic impacts of transit.

First, transit spurs economic growth by increasing the labor supply. By providing lower cost transportation for the rider and overall for the region, it is easier to attract employees. The labor supply curve has a flattened elasticity. Therefore, employers who had pent up potential to grow, but were limited by labor supply, can then grow. Employment growth is generally thought to occur mostly through relocations from other regions (Bartik 1991). This is true without transit; however, by adding transit the labor supply increases by including the previously unemployable. A statistic is generated here comparing poverty in metro areas. Poverty is 15.2 percent for half of the areas with the lowest transit spending versus 11.9 percent for the highest areas (see Figure 1; U.S. Bureau of Economic Analysis 2004). Poverty goes down because employment increases. Consequently federal, state, and local government support for people in poverty also reduces. From an economic development standpoint, regional support for people in poverty is only an added tax that harms the business climate.

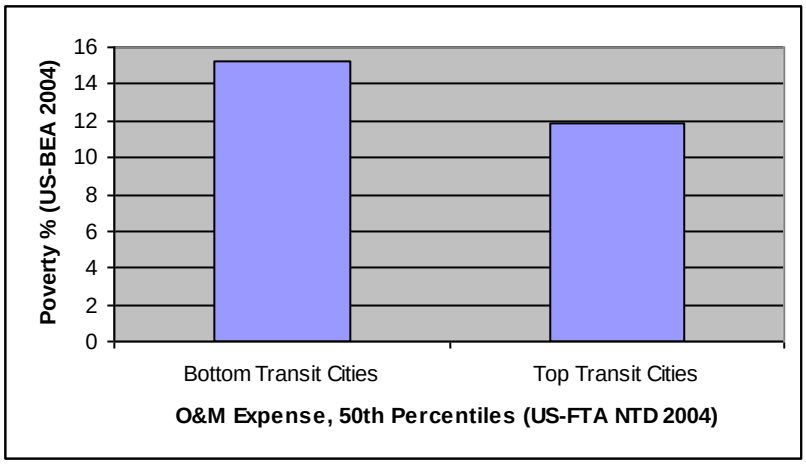

Figure 1 Poverty Rates in Cities

A second impact is that retail becomes less monopolistic. Older people who can not drive and poorer people without vehicles are locked into monopolistic market areas for services because of their limited ability to travel to find better deals. Transit increases the market area for retailers because it reduces the customer travel costs. Monopolistic profits on captive audiences do not encourage business growth, but instead cause customers to cut back. Purchasing goods and services is important for the regional economy because it causes the money to turn over from hand to hand.

A third impact comes from the nature of large cities. Modern large cities are held together by two things: seldom needed services with economies of scale such as brain surgery, and a research and development climate. Services were addressed above. The research climate feeds off the atmosphere of interaction. Large cities have unintended free exchange of ideas between competitors. This promotes growth of technology, which was the production function variable T in the production function above. Transit encourages interaction between people and therefore further promotes exchange of ideas and causes technology growth.

INCOME SURGES POST-TRANSIT INVESTMENT

Regions with higher income are generally more willing to use that income to support transit. Transit also increases regional income. Therefore, it is important to determine which comes first, and thus causes the other. A pattern of increase in regional income was found during and after investment in transit. A surge in income growth occurring after the investment could have arisen from the infrastructure investment.

Income data was collected for the years 1969 to 2004 for all U.S. Combined Statistical Areas (CSA or CMSA; U.S. Bureau of Economic Analysis 2004). Transit spending data was also collected for 1981 to 2004 for all transit agencies that existed in the United States during that period (Urban Mass Transit Administration 1981–1992; U.S. Federal Transit Administration 1993–2004). Transit agency spending was assigned to the region in which they operated. Multiple agencies exist in each of the regions studied. For agencies that serve multiple CMSAs, the spending was split equally between the areas served.

All surges in transit expenditure (capital plus operating) of $50 per capita (2005 $s) from one year to the next were identified as expenditures to investigate. It was decided that the impact from smaller investments would not be measurable due to the smaller effect on incomes. Then the New York CMSA would have been thrown out post-September 11, 2001, because of fluctuating income and transit repairs. However, the expense for repairs after September 11 did not cause the very extensive New York transit system to meet the $50 threshold, so it was irrelevant whether to include it. See Table 1 for the list of CMSAs and years of transit spending surges. Although the large investments in transit are clustered around several years, the income growth in those areas was indexed to how the country was fairing at the same time.

When an agency's investments surged for two consecutive years, even though it could be due to two separate improvements, they were combined into one equivalent investment. This was because the effects on income would be overlapping. Also, if after a few years a second investment was made, the analysis of the impact from the first was discontinued at that year.

Table 1. Transit and Income for Largest Areas

CMSA	***2000 Transit per Capita***	***2000 Income per Capita***
Atlanta	154.5041	32445
Boston	303.7059	39550
Chicago	291.1184	34680
Cincinnati	76.37588	30386
Cleveland	167.1236	30823
Dallas-Fort Worth	129.9032	33550
Denver	173.6227	38146
Detroit	96.9546	33388
Houston	146.2121	33717
Los Angeles	154.9494	29516
Miami	177.2685	31224
Minneapolis	126.2427	35784
New York City	597.0836	40043
Philadelphia	395.4541	33791
Phoenix	74.9227	28364
Pittsburgh	207.3945	30313
Portland, OR	215.6411	32123
Sacramento	93.68749	30219
San Diego	146.9446	32803
San Francisco	326.4451	47139
Seattle	356.7839	36298
St. Louis	100.9142	30943
Tampa	29.52029	28653
Washington DC-Baltimore	301.7894	37787

Figure 2 shows the changes in income which were normalized to the U.S. average growth rate. Therefore, when a CMSA region's growth is less than the U.S. growth, the region would appear to drop. The preliminary results shown in Figure 2 are confusing. A large number of CMSAs had large increases or decreases in per capita income after the investment in transit. Non-transit related economic factors had a more significant impact than transit. For example, the CMSA including San Francisco and San Jose had an income surge of 14 percent in one year during the 2000 dotcom boom. Then during the bust the following year, there was much less growth. Inversely, incomes in Houston had a long decline in the late 1980s due to its reliance on oil, which dropped in price over that time. Scientists are accustomed to quantifying all effects and writing the perfect modeling equation. Yet, there are many factors in the booms and busts of regional economic development.

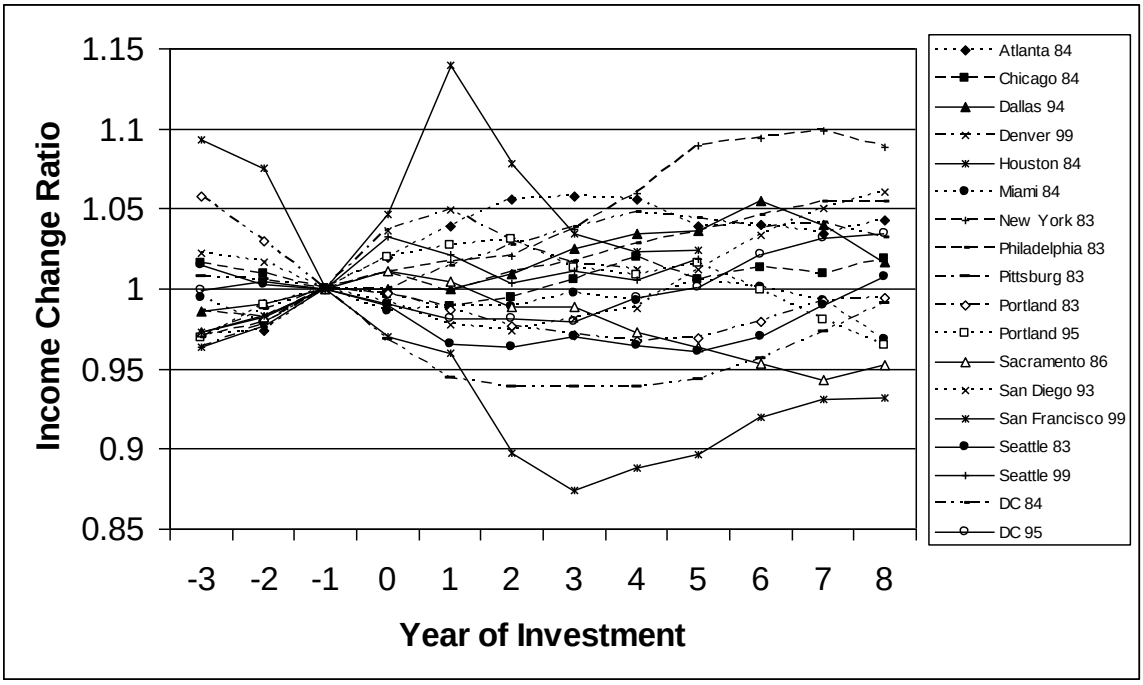

Figure 2 Changes Post-Transit

Scatter in data such as in Figure 2 is expected, especially in social phenomena. Averaging is preferred for looking at trends because it evens out effects of other variables on income. Looking at a single region it is possible to find a reduction in income after investing in transit because it may have already been losing income. It is not possible to prove the effect on a single region. However, by averaging the change in incomes over all regions, the total net effect is shown.

AGGREGATED INCOME CHANGES

Figure 2 was averaged for all the CMSAs and was plotted in Figure 3 as a single line. The cities with the highest average income growth and lowest average— New York and Houston, respectively, both in the 1980s—were thrown out of the data. It is common procedure to throw out the high and low values when dealing with a small data set (The

Olympic Scoring Method; Renze 2004). Otherwise, the extremes dominate the behavior. Each CMSA was thrown out in sequence. The shape of the plot was roughly the same in each.

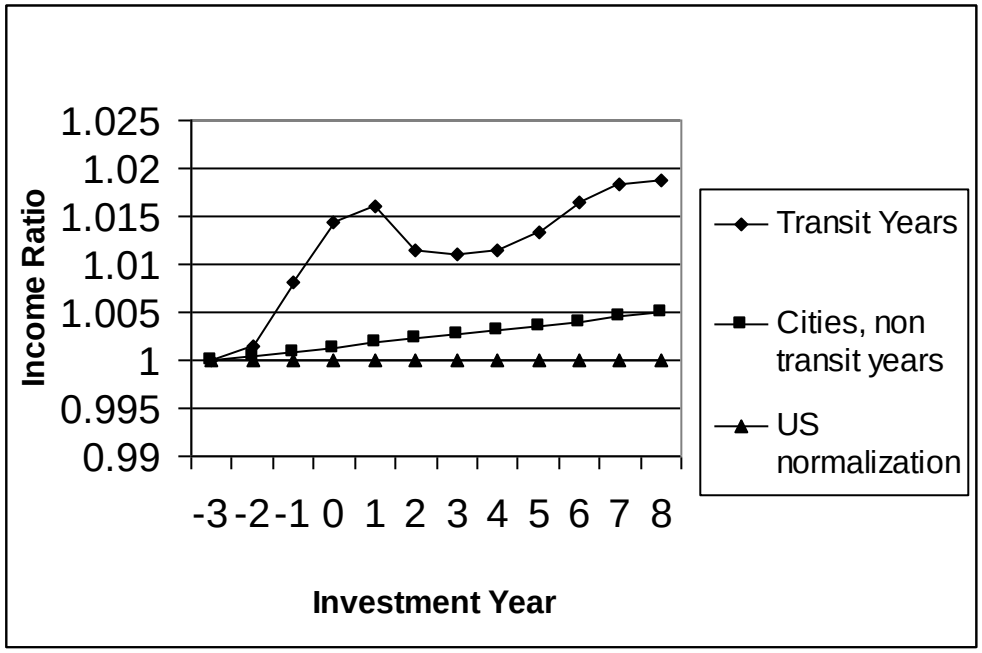

Figure 3 Average Income Growth

Again, the changes in incomes were normalized to the U.S. change in income. A value above one means the growth that year was above the U.S. average growth rate. The normalization is more appropriately done by comparing cities with significant investments in transit in large cities because when comparing the whole United States over the period studied, large cities grew at a faster rate than the U.S. average. Normalizing to "Cities Non-transit Years" is appropriate because if a city did not invest in transit, it should grow at that rate. However, the fact that cities grow faster could have been the effect of smaller investments in transit that did not meet the minimum $50 surge in investment.

Notice that the income was normalized to 1.0 at the third year before the surge in transit investments. One year of this setback was because a change in income must be normalized to the year before the change is expected. The additional two years of setback was chosen because looking at the transit expenditure data showed that the expense usually ramped up over a one- or two-year period before the large surge. Therefore, to get to the preexisting economic conditions, the normalization needed to be set back two or three years. The plot also indicates that only a miniscule difference exists between using the second or third year before the surge. This means that before an investment the CMSAs were growing at the same rate as other areas.

The result of Figure 2 is that an increased growth rate of about 1 percent can be seen in the years after a large investment in transit. Cause and effect are shown by their relationship in time. The investments in transit precede changes in regional income.

Since changes in income vary widely from city to city before and after an investment in transit, this does not mean that a region will have income growth after an investment in transit. It means that growth was likely higher than it would have been otherwise. Disaggregating the data for each city would simply produce Figure 2 again. Looking at a specific city and trying to determine from the plot which portion of the income growth came from transit is not recommended because transit investment will only cause a net effect, not necessarily a growth to overall income.

Figure 3 shows two spurts of income growth after an investment in transit. The first is years zero to two. The second is years five through eight. Figure 4 shows the net growth above while norming with cities non-transit years rather than all the United States and gives a possible explanation for the two distinct spurts of growth.

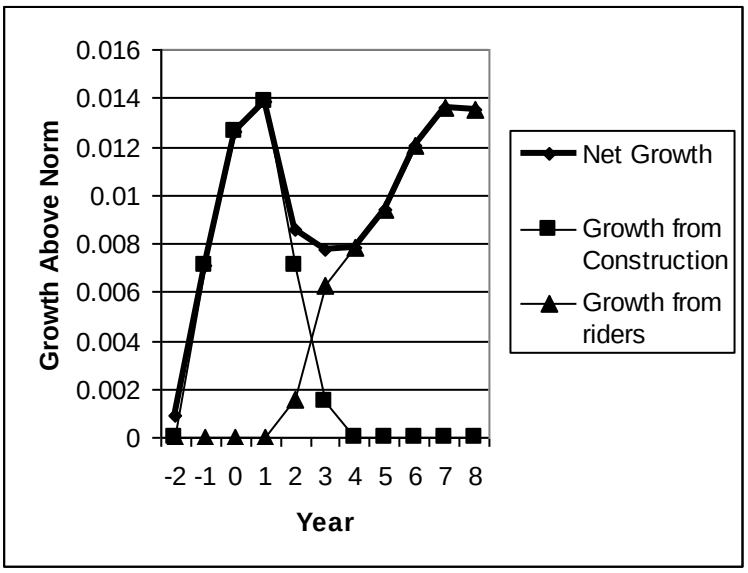

Figure 4 Net Income Growth

The first income spurt could be due to the economic impact from spending money on construction, which peaks in the first years after the money is spent and then fades (Transit Research Board 1998). The second spurt could be due to the increasing number of riders using a new system and therefore the impact of riders increases with time. It is not possible to get the actual ridership related to the transit improvements. This is because some of the transit investments were multiple new extensions and new lines all in the same year. It would be merely an argument as to what portion of unlinked trips from a line or service extension would have happened even without the extension. Yet, some generalizations can be made. Usually, the new line or extension is opened to riders a couple years after the capital is spent, but for larger projects this could take a few more years. Also, in the first year, the unlinked trip counts are for only the portion of the year that the new service was open. Both of these effects suggest that it takes four to five years after the surge in capital investment for the number of riders to reach a maximum. Therefore, the proposal that the second surge in economic impact found in Figure 4 is due to impact on riders is plausible.

PAYBACK RATIOS

The results above are used to very roughly find the payback ratio from investment in transit. If the transit investment and the income change can both be found then a payback ratio is the income change divided by the investment. However, neither the transit investment nor the income change can be precisely found with the methods of this paper.

The personal income change due to transit improvements is difficult to determine. Regions sometimes simultaneously launch multiple economic development initiatives. For example, a convention center with hotels might be planned to open on a new transit route at the same time that the transit route opens. Although, transit enables or enhances the other simultaneous economic development initiatives, it is difficult break out the portion of income change due just to transit. The problem with macroeconomic analyses is that it is not possible to assign specific causes to the results.

From Figure 3, it is seen that income rises to a new plateau and stays there. The plot of incomes is stopped in the eighth year after a transit project. Many cities begin a second moderate or large project within that time and so the data for them is stopped at that time. By the eighth year fewer cities have not made another moderate or large investment, so the analysis stop there because of lack of data. However, there appears to be no return of income to the previous level. As long as a region maintains a system, the benefits continue to be returned. This would imply no limit to payback from transit, however, a limit of eight years is taken. Calculating the net income growth each year for transit-investing CMSAs and multiplying by $30,000, which is the approximate average income in 2005 dollars for the time period, the impact is found to be $3215 per capita for the studied enhancements.

Transit investment is also difficult to determine precisely. Transit agencies are required to submit their financial information to the government. However, there is no easy way to correlate a surge in transit spending to one specific transit improvement. For example, adding a new rail line often causes connecting bus routes to be improved simultaneously to serve the rail line. Published data for a new rail system might only include the cost of the rail system, and not the cost of the enhancements. Therefore, only estimates of changes in transit funding year to year can be used to approximate a net change in transit funding in a region.

Looking at patterns of change from year to year, the rough cost related to the enhancements was estimated at $400 per capita over several years of construction then operation. Therefore, the payback ratio is very roughly estimated as $3215 / $400 = 8. Although this can not be done precisely, it suggests that the payback from transit investment is much higher than the usual quoted $3 per $1 spent on transit.

REGION VERSUS NATION

Through the Federal New Starts program, the U.S. government pays around half the cost of constructing new transit systems. It also pays an average of about 6 percent of operating costs. As a whole, the U.S. government pays about 28 percent of the cost. The region pays the rest of the transit system cost through state or local taxes and rider fees. The federal portion of the money is funded by taxes that are somewhat uniform across the country. Therefore, the public perception is that the whole country is merely transferring money for construction of a system to benefit a select few people.

On the other hand, the average marginal income tax rate is 35 percent including Social Security. This means each additional dollar of income is taxed at about $0.35. Therefore an $1 growth from transit will cause an increase in income tax from the region of $0.35. If $1 in government support generates $3 in income, it generates $1.05 in income taxes and it pays for itself without increasing the federal tax rate. A hypothetical increase in income of $8 produces $2.80 of tax. The federal government also gains from reduced numbers of people in poverty in higher transit regions. Lower poverty means lower expense for social spending.

Additionally, when a regional economy grows, the whole country is lifted up by exports to the region. People have a marginal propensity to consume local goods and services 60 percent of the time and imports 40 percent of the time. This means that economic growth in one area of $1 causes a $0.67 growth in the rest of the economy. Therefore, a $3.00 growth from transit will cause a $2.01 growth in the rest of the economy. A hypothetical $8.00 growth would cause $5.36 in the rest of the economy. Some of this will be in the nation and some will be due to foreign imports. Even if a large share of this comes from overseas, the economies of the other regions are still lifted up to some extent. Further study is needed to evaluate exactly how much the country is lifted up by one region investing in transit.

CONCLUSIONS

Investments in large-scale transit projects have a significant impact on local economies such that the effect is observable using macroeconomics. Regional income growth is one method of measuring the production function. Change in regional income due to new transit was not distinguishable when looking individually at each region because the net regional impact can not be evaluated with macroeconomic methods. However, by looking at an aggregation of all systems unrelated effects in the economy were filtered out and a solid trend in net income increase after transit investment was shown. Regional income rose during construction of transit projects and remained high for the extent of the analysis after the project.

Traditional economic impact analysis attempts to measure each component of impact. A macroeconomic analysis suggests that the economic impact from transit is much higher than can be measured through enumeration and evaluation. However, the exact level of the economic impact can not be stated with certainty.

Since transit investment raises region income and regional income predisposes regions to invest more in transit, a virtuous cycle is created. Both regional income and transit investment will reinforce each other and rise together.

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Endnotes

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