Bus Transit in Small Cities: Economic Development Strategy and/or Social Service?

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ABSTRACT: This research investigates the relationship between public transit and economic development (as measured by labor market and income variables) in counties with small to medium-sized cities. Our objectives are to answer: Do counties with transit experience higher income growth, employment growth, and population growth? And do counties with transit have lower levels of transfer payments such as food stamps, Temporary Aid to Needy Families (TANF), and unemployment compensation? Public transit is commonly viewed as a social service; this analysis explores the economic development impact of this public investment. We find that the presence of transit has no effect on traditional economic development outcomes such as population and employment growth. However, relative to counties without transit, counties with transit systems have significantly lower unemployment rates, lower growth in family assistance, food stamp payments, and unemployment compensation. Yet, access to transit has a negative effect on income growth, and the poverty rate is higher in counties with transit systems. The positive impact on job access which reduces payments for family assistance, food stamps and unemployment compensation is tempered by negative effects on income likely driven by supply side effects in the labor market.

Introduction

For individuals, particularly low income individuals, access to transportation may determine the number and types of available jobs and ultimately income levels. The spatial mismatch hypothesis suggests that geographic racial (and income) segregation is a primary determinant of unemployment and poverty, particularly for minorities. The residential location of available workers is often far from the location of available jobs which results in relatively high commuting costs associated with moving low-income workers between residential areas and job opportunities (Kain 1968).

Much of the research related to the spatial mismatch hypothesis has focused on large metropolitan areas. While smaller cities exhibit patterns of racial and/or income segregation in residential areas, the smaller size of these cities may mean that jobs are more accessible. Ihlanfeldt and Sjoquist (1990) show that spatial mismatch is more pronounced in larger metro areas and that this theory explains 14 percent of the employment gap for youths in medium-sized cities versus 25 percent in large cities. This finding suggests that access to transportation will have a differential impact in cities of different sizes. Despite the longstanding interest in this issue, little research has explicitly examined the relationship between transit and economic outcomes in small and medium-sized cities.

This paper uses a carefully constructed dataset of 79 counties with small to medium-sized cities in the upper Midwest (Illinois, Indiana, Michigan, Ohio, Pennsylvania, and Wisconsin) to examine the relationship between transportation, particularly public transit, and various measures of economic development.[1] Of the 79 counties in the dataset, 38 had no public transportation

[1] Since a limited number of variables are available for cities, the county in which the city is located is the focus of analysis in this study. The dataset was constructed using two criteria: (1) counties with population between 75,000

system in 2006. The presence and absence of public transit in counties of this size provides a natural experiment to examine the impact of public transit. In the counties included in this study, transit is primarily bus and demand response. Demand response (commonly called Dial-a-ride or DR) is transit that does not operate on a fixed route like the most common type of bus service. DR consists of passenger cars, vans, or small buses responding to calls to agencies that for the most part are publicly funded and may or may not provide other types of public transportation.

Since the early 1970s, federal, state and local governments have invested in public transit systems.[2] In 2006 federal, state and local governments provided just over $27 billion in capital and operating funds to public transit systems in the U.S. (33.9 percent was from local government).[3] Public transit systems are highly subsidized (although to a lesser degree than federal highways). The federal government generally funds 80 percent of capital expenditures with a 20 percent local match, and only a small portion of capital and operating funds is generated by the transit system primarily through fares, advertising fees, and taxes imposed by the transit authority or revenue from a municipality's general fund.[4]

More generally, the literature on infrastructure investment has shown that at the national level, investment in infrastructure capital is positively related to productivity growth. See Gramlich (1994) for a review essay. Hicks (2006) provides a recent study. Public transit infrastructure is one component of infrastructure capital.

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and 125,000 inhabitants in 1950 in the aforementioned states and (2) counties with cities with boundaries primarily in one county.

[2] Mass transportation systems in the early part of the 20th century were owned and operated by the private sector. With the advent of the automobile, many of these firms went out of business. See Kyvig, David E. and Marty, Myron A. Getting Around Exploring Transportation History Malabar, FL: Krieger Publishing Co. 2003.

[3] American Public Transportation Association. 2008 Public Transportation Fact Book Washington, D.C. 2008 (Tables 40 and 47).

[4] Ibid.

The contribution of the current research is to determine if and how public transit is related to key labor market variables, measures of socio-economic wellbeing, and economic development in counties with small cities. The remainder of the paper is organized as follows. The next section provides a review of the literature related to the economic development impact of public transit systems. The third section provides a brief description of transit funding and usage in the cities considered in this analysis. The fourth section provides an overview of the data used in the analysis. The fifth section describes our modeling strategy. The penultimate section discusses results. The final section offers a summary and conclusions.

The Literature

Much of the literature examining the relationship between transit and economic development has focused on highways or rail transit. We know of no studies that have examined the effects of the availability of bus transit on economic development or various socioeconomic indicators related to labor markets or antipoverty expenditures. In his review of public transportation policies from 1960 to 2000, Sanchez (2008) concludes that we know little about the effect that public transportation policies have on "creating opportunity or improving the well-being of families in the grip of poverty" (840). We provide a review of the more general literature on mass transit and economic development and the literature addressing the impact of transit for the low income population. These two themes should be related in that if transit has a positive impact on traditional economic development indicators, the low income population should receive some benefit.

Transit and Economic Development

The studies examining the relationship between transit and economic development have focused primarily on fixed rail transit systems in large cities. Bollinger and Ihlanfeldt (1997) find that while the presence of a MARTA station had no impact of employment or earnings in the area around the station, it did alter the composition of employment increasing government employment proximate to stations.

There are a variety of studies looking at the relationship between rail stations and property values. One of the most rigorous is Bowes and Ihlanfeldt (2001) which examines the effect of proximity to rail stations on residential property values in Atlanta and find that residential properties within a quarter mile of a station sell for 19 percent less than properties three miles from a station indicating that there are negative externalities associated with proximity to the station. Properties between one and three miles have a higher value than those further away indicating a positive benefit from being close but not too close to rail transit. This is the traditional inverted U-shaped proximity relationship observed in hedonic pricing models which account for proximity effects.

The impact of rail stations on commercial development has been investigated for San Francisco's BART (Cervero and Landis 1997), Atlanta's MARTA (Bollinger and Ihlanfeldt 1997, Bowes and Ihlanfeldt 2001), and Washington, D.C.'s METRO (Green and James 1993). The BART and METRO studies compare commercial activity in station and nonstation areas before and after station openings and do not control for other influences. The BART study finds a small effect of rail on commercial activities and the METRO study finds large effects. Bollinger and Ihlanfeldt (1997) include extensive controls and find that rail stations have no effect on commercial activity. Bowes and Ihlanfeldt (2001) focus exclusively on retail activity

and find that rail stations further from the CBD have a positive effect on retail activity with the largest effects occurring within a quarter and half mile from the station.

A variety of studies have also looked at infrastructure, particularly roads and economic development. Wasylenko (1997) provides a key review of findings, as does Fox and Porca (2001), with the latter focusing on rural growth and the former reviewing the broad literature. A variety of empirical studies have addressed this issue. Bollinger and Ihlanfeldt (2003) examine a variety of tax incentive programs and investment in transportation infrastructure and find that highway improvements increase the employment share at the census tract level while investment in rail stations did not. Dalenburg, Partridge and Rickman (1998) found that investment in public highways and other public capital has a positive impact on state employment growth. Other empirical studies include Holtz-Eakin (1994), Eberts (1991) and Fox and Murray (1990).

The one study that we are aware of that examines buses and economic development focuses on property values. Rodriquez and Targa (2004) examine the effect of Bus Rapid Transit (BRT) on property value in Bogota Columbia and find that property rental prices decrease by 6.8 to 9.3 percent for each 5 minute increase in walking time to the BRT corridor which suggests that BRT positively influences property values.

Transit and Employment Outcomes

There are a variety of studies examining the relationship between individual's access to transportation and employment outcomes. Car ownership has been shown to positively influence employment (Ong 2002, Raphael and Rice 2002) although the later study also showed that car ownership has a negative effect on wages within the same sample. The studies examining employment outcomes and other types of transit have focused on job accessibility. These studies

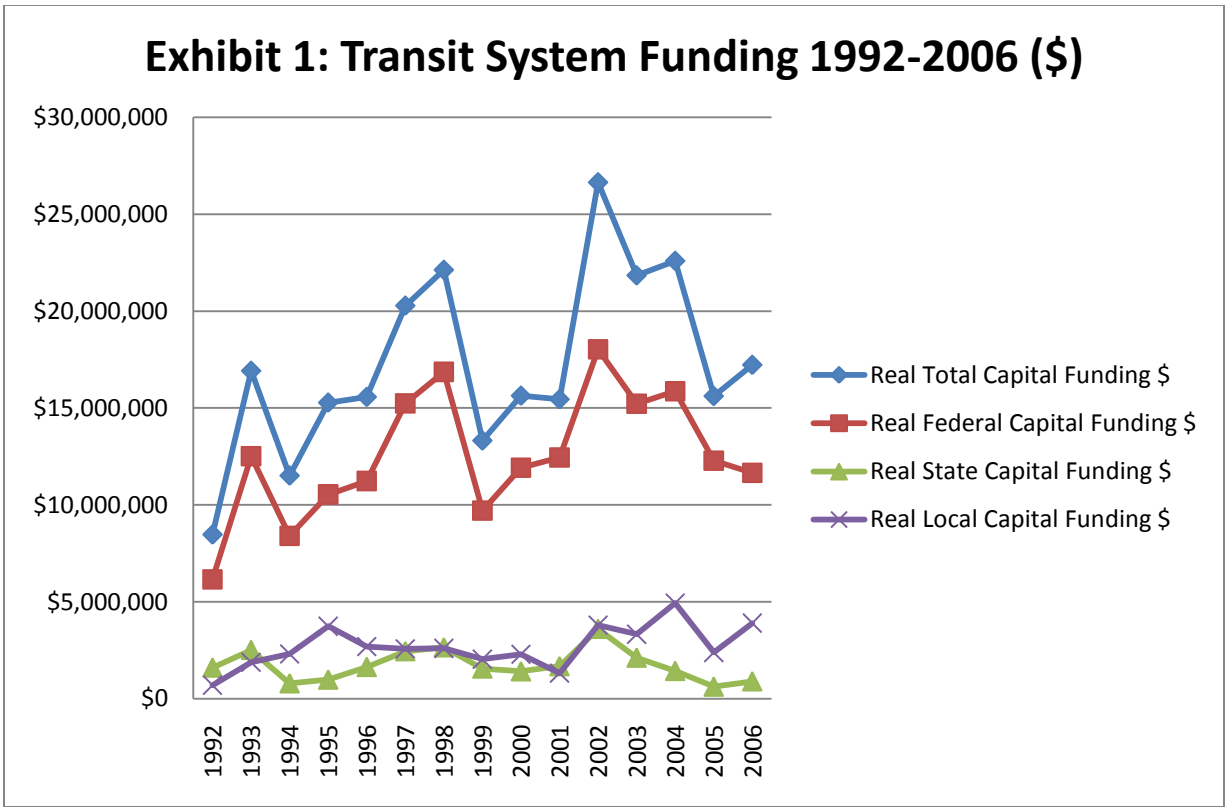
use different geographic areas, different statistical methods, and focus on different groups of employees and find differing effects. Sanchez, Shen and Peng (2004) and Bania, Leete and Coulton (2008) show that access to transit, including bus transit in the later study, has no affect on employment outcomes. In contrast, Sanchez (1999) finds that access to public transit leads to higher labor force participation in Portland, OR and Atlanta, GA. Allard and Danziger (2003) and Ong and Blumenberg (1998) do not use specific transit measures but find that proximity to jobs positively affect employment outcomes.

In sum, studies examining the economic development effects of transit and studies examining the impact of transit on employment outcomes have focused on large cities and have found limited effects. There are likely to be differences in results for cities of different sizes. In their analysis of metropolitan areas of different sizes, Partridge and Rickman (2008) find a differential impact of job growth on poverty -- in smaller metropolitan areas job growth has a larger effect on reducing poverty than in larger metro areas. Jobs are likely to be more accessible in smaller cities and the economic development impact of bus transit is likely to be more diffuse than that of fixed-route rail.

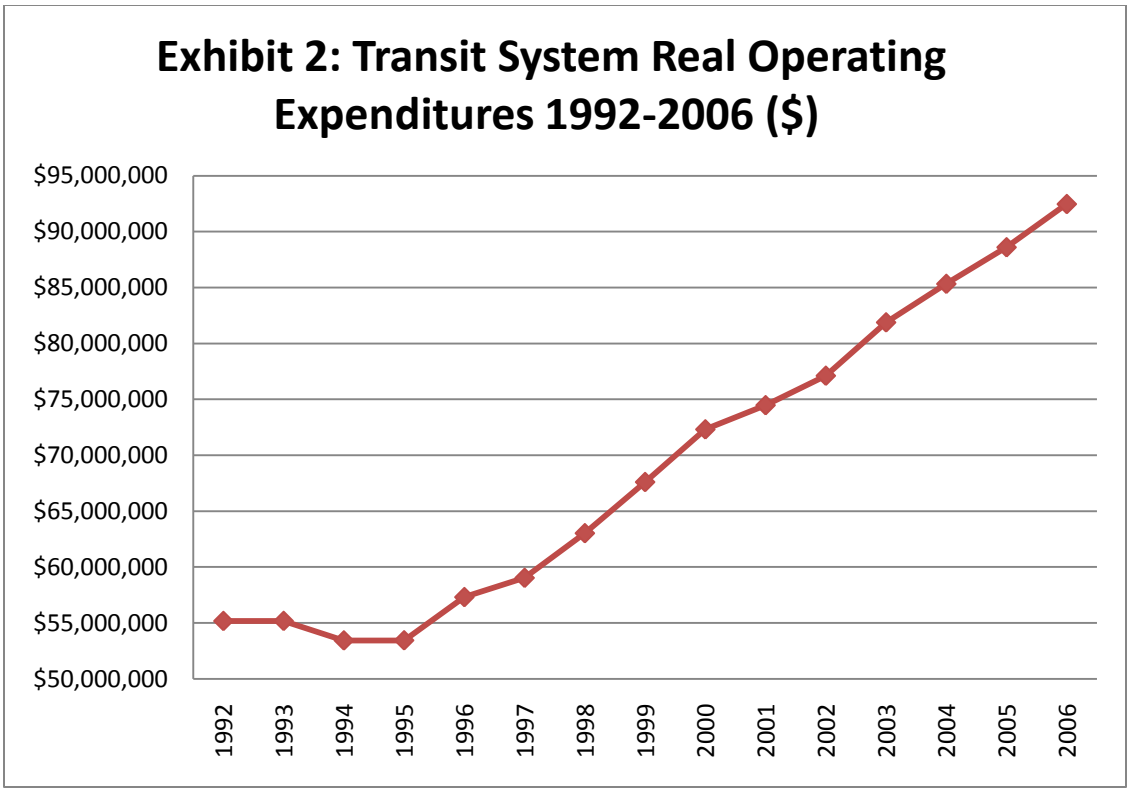
Brief Overview of Transit in 79 Small Midwestern Cities

Exhibits 1-4 show various characteristics of the transit systems for the counties with public transit systems in our sample. Exhibit 1 shows that the level of real total capital funding (in 1982-84 constant dollars) was somewhat variable although the overall trend was an increase from $8.47 million in 1992 to over $17 million in 2006 with a peak of $26.6 million in 2002. The federal government provided the largest share of capital funding. As shown in Exhibit 2,

real operating expenditures increased from $55.2 million in 1992 to $92.5 million (67.6 percent) in 2006.



*All dollar values in 1982-84 constant dollars.



*All dollar values in 1982-84 constant dollars.

Exhibits 3 and 4 focus on capacity and usage of transit systems in the 41 counties with transit included in the study. Since the mid 1990s the number of buses and vans both directly operated and contracted and through demand response systems and traditional fixed route bus systems have increased steadily from 1,123 in 1992 to 1,843 (64 percent) in 2006. The largest increase occurred in the number of demand response vehicles in these counties -- from 318 to 813 (156 percent). The number of buses increased from 805 to 1,030 (28 percent) from 1992 to 2006. The general trend in transit usage has been positive although there is a visible variability. Over this period unlinked passenger trips increased from 38.9 million to 52.8 million (35.7 percent), and passenger miles traveled increased from 120.9 million to 173.7 million (43.7 percent).

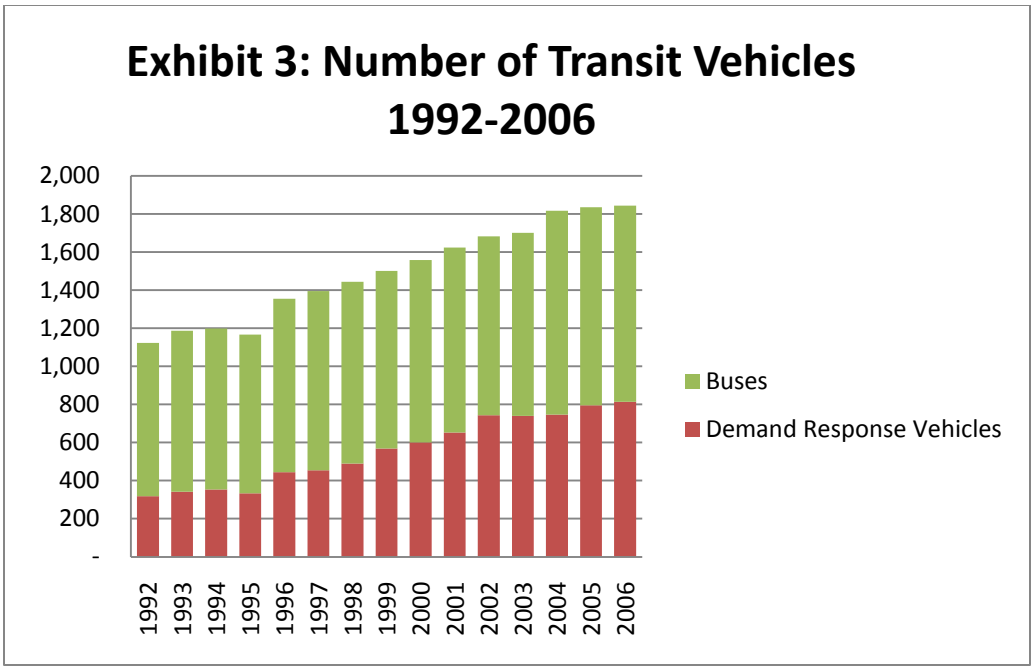
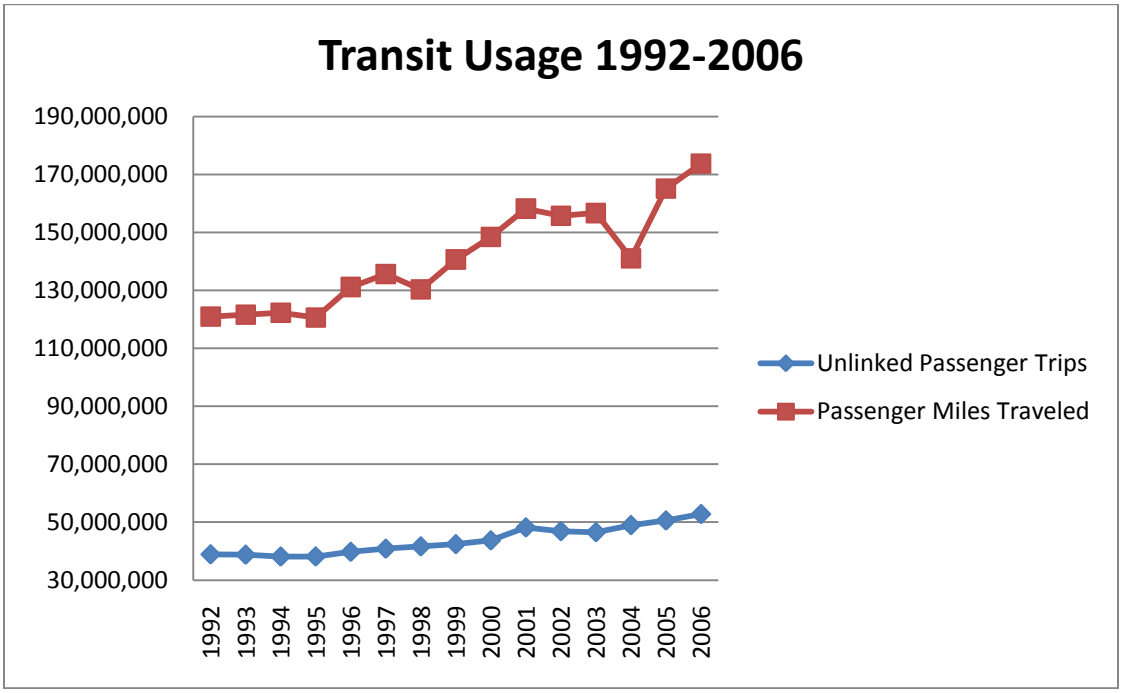


Exhibit 3: Number of Transit Vehicles 1992-2006
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
-
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
Buses
Demand Response Vehicles


Transit Usage 1992-2006
190,000,000
170,000,000
150,000,000
130,000,000
110,000,000
90,000,000
70,000,000
50,000,000
30,000,000
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
Unlinked Passenger Trips
Passenger Miles Traveled

Data

We investigate the role public transit in small cities plays in improving worker outcomes and changes to patterns of transfer payments. Panel data analysis from 1992-2006 is used to analyze the proposed research questions. We examine the economic impact of transit in terms of traditional and nontraditional variables. Variables traditionally used to measure economic development include population, employment and income growth. Nontraditional variables include poverty rates, unemployment rates, and federal transfer payments. We use these latter variables to draw conclusions about the effects of transit investment on low-income populations.

Table 1 shows the definitions and sources of the variables that we use in the model. Descriptive statistics are shown in table 2. Of the 79 counties over the 1992-2006 time period included in the sample, 48 percent have transit systems during this period.[5] Average real personal income growth was $27.1 million over this time period. Average employment growth was 492 workers and average population growth was 549 people. Average growth in manufacturing and retail were negative at -101 and -167, respectively. The average unemployment rate was 5.5 percent and ranged from 1.9 to 12.6 percent over this period. The average poverty rate was 10.7 percent and ranged from 2.9 to 25.3 percent. Over this time period average growth in family assistance was negative at -$74,236, average growth in food stamps was $5,693, and average growth in unemployment compensation was -$292,879.

Table 3 shows the descriptive statistics for counties with and without transit systems. Many of the variables that we consider are more favorable in the counties with transit. For example, average real income growth, per capita income growth, employment growth, and

[5] Some cities opened transit systems during the 1992-2006 period. In 1992, 36 counties had transit systems. In 2006, 41 counties had transit systems. Some counties have more than one transit system (there were a total of 49 transit systems in the counties with transit.

population growth are greater in these counties, but the variation is also greater compared to counties without transit. The average labor force participation rate, unemployment rate and poverty rate are lower in counties with transit. The average decline in manufacturing and retail employment was higher in counties with transit during the sample period. The average decline in manufacturing and retail employment were higher in counties with transit. Growth in average real food stamps was higher, and the decline in average real family assistance was larger. The decline in unemployment compensation was smaller in cities with transit.

Table 1 -- Variable Description and Sources

Variable	**Definition**	**Source**
Transit Dummy	=1 if there is a transit system in the county =0 otherwise	National Transit Database
Real Personal Income Growth ($ thousands)	Annual change in income	Regional Economic Information System (REIS)
Real Per Capital Income Growth ($)	Annual change in per capita income	Regional Economic Information System (REIS)
Employment Growth	Annual change in employment	Bureau of Labor Statistics
Population Growth	Annual change in population	Regional Economic Information System (REIS)
Growth in Manufacturing Employment	Annual change in manufacturing employment	Regional Economic Information System (REIS)
Growth in Retail Employment	Annual change in retail employment	Regional Economic Information System (REIS)
Real Growth in Family Assistance ($)	Annual growth in state-administered benefit payments to low-income families (AFDC or TANF)	Regional Economic Information System (REIS)
Real Growth in Food Stamps ($)	Annual growth in food stamps issued to low-income individuals	Regional Economic Information System (REIS)
Real Growth in Unemployment Compensation ($)	Annual growth unemployment insurance compensation	Regional Economic Information System (REIS)
Labor Force Participation Rate	The percentage of the population that is in the labor force	Bureau of Labor Statistics and REIS
Unemployment Rate	The percentage of the labor force that is not employed	Bureau of Labor Statistics
Poverty Rate	The percentage of people with incomes below the poverty threshold	Small Area Income and Poverty Statistics, U.S. Census Bureau

Table 2 -- Descriptive Statistics – TOTAL Sample

Variable	Mean	Standard Deviation	Minimum	Maximum	Number of Obs.
Transit Dummy	0.48	0.50	0	1	1,185
Real Personal Income Growth ($ thousands)	27,105	52,887	-273,426	530,570	1,106
Real Per Capita Income Growth ($)	144	296	-1,538	2,166	1,106
Employment Growth	492	1,503	-9,590	7,623	1,106
Population Growth	549	1,126	-3,575	6,868	1,106
Growth in Manufacturing Employment	-101	762	-7,841	4,750	1,106
Growth in Retail Employment	-167	1,289	-12,171	2,100	1,106
Growth in Real Family Assistance ($)	-74,236	697,541	-3,897,173	3,911,447	790
Growth in Real Food Stamps ($)	5,693	606,367	-2,529,174	2,984,754	1,106
Growth in Real Unemployment Comp ($)	-292,879	2,680,552	-11,724,741	13,103,228	1,106
Labor Force Participation Rate (%)	0.51	0.04	0.39	0.65	1,185
Unemployment Rate (%)	5.46	1.81	1.9	12.6	1,185
Poverty Rate (%)	10.74	3.21	2.9	25.3	869

Table 3 – Descriptive Statistics for counties with and without transit systems

Counties WITHOUT transit systems					
Variable	Mean	Standard Deviation	Minimum	Maximum	Number of Obs.
Transit Dummy	0.0	0	0	0	612
Real Personal Income Growth ($ thousands)	19,626	35,745	-91,664	200,940	569
Real Per Capita Income Growth ($)	135	268	-967	1,020	569
Employment Growth	458	1,303	-9,590	6,928	569
Population Growth	381	985	-956	5,799	569
Growth in Manufacturing Employment	-86	592	-2,950	3,682	569
Growth in Retail Employment	-119	966	-8,851	1,594	569
Growth in Real Family Assistance ($)	-70,569	502,288	-2,258,607	1,309,974	402
Growth in Real Food Stamps ($)	-23,019	552,130	-1,713,545	2,984,754	569
Growth in Real Unemployment Compensation ($)	-404,443	2,426,955	-10,798,286	10,201,253	569
Labor Force Participation Rate (%)	0.50	0.04	0.39	0.60	612
Unemployment Rate (%)	5.83	1.83	2.4	11.5	612
Poverty Rate (%)	10.78	3.37	4.8	25.3	448
Counties WITH transit systems					
Variable	Mean	Standard Deviation	Minimum	Maximum	Number of Obs.
Transit Dummy	1.0	0	1	1	573
Real Personal Income Growth ($ thousands)	35,030	65,499	-273,426	530,570	537
Real Per Capita Income Growth ($)	153	322	-1,538	2,166	537
Employment Growth	528	1,690	-9,105	7,623	537
Population Growth	726	1,235	-3,575	6,868	537
Growth in Manufacturing Employment	-118	908	-7,841	4,750	537
Growth in Retail Employment	-217	1,560	-12,171	2,100	537
Growth in Real Family Assistance ($)	-78,036	854,714	-3,897,173	3,911,447	388
Growth in Real Food Stamps ($)	36,116	658,142	-2,529,174	2,120,341	537
Growth in Real Unemployment Compensation ($)	-174,666	2,923,034	-11,724,741	13,103,228	537
Labor Force Participation Rate (%)	0.52	0.04	0.40	0.65	573
Unemployment Rate (%)	5.06	1.71	1.9	12.6	573
Poverty Rate (%)	10.69	3.03	2.9	22.2	421

Modeling Strategy

Assessing transportation infrastructure's impact on regional economic activity imposes significant modeling concerns related to the endogeneity of the investment. More rapidly growing cities, and those with greater fiscal resources may be more likely to pursue infrastructure investment. This raises the specter of endogeneity bias in subsequent econometric estimates. This problem is not limited to transportation infrastructure, and indeed may be more of a concern in areas such as firm entrance and expansion, for example.

There is the potential for endogeneity bias with the provision of public transit. As mentioned above most of the capital funding for public transit is from the federal government, but there must be a local match to qualify for federal funding, and operating funds (staff salaries) must come from local sources. There may be differences among cities that cause some cities to be more likely to apply for federal transit funding than others or that cause some cities to be more willing to fund the local match and a portion of operating funds. The likelihood of applying for federal transit funding may be related to differences in human capital, local government efficiency, or political enthusiasm for these types of intergovernmental transfer. This suggests that a systematic and careful examination of potential endogeneity is warranted.

Within the literature there are two methods for dealing with the endogeneity concern. The more common and earlier method is a simultaneous equation approach employing elements of a production function. This technique is attractive since it imposes some theoretical basis for the interpretation of the relationships and the resulting estimates. This method has three significant limitations beyond the appropriate structuring of the production function relationship. First, these models are necessarily data intensive. The need for data on local capital stock, with some frequency of observation (annually in the current application), data on human capital, and

data on production output are examples of data requirements that make these types of models inappropriate for some settings. We will revisit this matter shortly. Second, the relationship between the basic production function and some identifying relationship must be structured. An example is Cadot, Rollet and Stephan (2006) who model transportation and political effort for 'pork barrel' spending in a simultaneous equations approach. These authors structure an equation that measures political lobbying intensity to in effect identify the endogenous variable in the production function. This approach is attractive in settings where the identifying relationship can be plausibly structured. Finally, adding additional structure to the model imposes the potential for additional endogeneity problems beyond those existing with the transportation infrastructure.

The first two of these limitations present a particular nuisance to the issue we address. Our research explores the effects of bus transit systems in small cities over a period of less than two decades. While we have data on annual capital expenditures on transit, data on the capital stock for a regional production function is nearly non-existent. Further, use of human capital estimates over the 1992-2006 period would necessitate the interpolation of no more than two census periods onto local population estimates. For these reasons we have chosen to use a simpler empirical method and the standard treatment for addressing the potential for endogeneity bias.

A pure treatment model offers an alternative to a structured production function. This approach has been used in a number of settings to model potentially endogenous firm entrance into regions (see Basker 2006; Hicks 2008). This is a far more appropriate choice for our research question. First, we believe that the question we seek to answer offers a fairly controlled examination of the data, which would serve to minimize endogeneity bias. We have limited our

sample to 79 fairly homogenous communities in the Great Lakes region. This provides a quasi-experimental element to the empirical approach, though it is not a formal quasi-experimental technique. The choice of these locations was made specifically to establish a heterogeneous sample. Second, the questions we are asking appear to have less endogeneity concern than other related questions in the literature. For example, the papers noted above focus on either aggregate infrastructure expenditures in a region (which clearly suffer danger of endogeneity), and location decisions by retail firms (another obvious candidate for locating due to regional growth). In contrast our list of growth and social service measures do not, on their face, present a robust concern regarding endogeneity of a bus transit system. Indeed, none of these variables would appear to present the bias inducing risk of a measure of public capital stock for example. Since the largest component of funding for these bus systems is primarily federal, it is in our judgment a fairly benign endogeneity concern here. While there are formal mechanisms for testing for endogeneity, the introduction of a production function or simultaneous equation model in this setting offers some significant drawbacks beyond the data limitations. Were we to have data on public and private capital stock, we would need a convincing identification strategy for the presence of a city bus system. We view this as a fairly elusive task. As a consequence we will test for, rather than attempt to pre-emptively correct for, the presence of endogeneity.

Our approach is to employ a pure treatment model to examine the effects of transit on economic development outcomes. In the model we control for the presence of a transit system and fixed effects which take into account differences in the counties that do not vary over time. The model takes the following form:

$$Y_{it} = \propto + \beta_{it}(Transit) + t + \gamma_i D_i + \varepsilon_{it}$$

where Y_{it} represents the various economic development measures considered in this analysis: growth in real personal income, growth in real per capita personal income, employment growth, population growth, growth in manufacturing employment, growth in retail employment, the unemployment rate, the poverty rate, growth in real family assistance, growth in food stamps, growth in unemployment compensation. Economic development is a function of an intercept, a binary variable for counties that have transit systems, a time trend, fixed effects dummies, and a white noise error term. The model is estimated using generalized least squares. We correct for heteroscedasticity using White's (1980) method. We include autoregressive terms to account for autocorrelation observed in the basic model. We also conduct Hausman's endogeneity test to test for endogeneity bias in each regression where transit is statistically significant. In each case we were able to exclude the presence of endogeneity between transit and the dependent variable for each model.

Given both the results of the Hausman test and the practical difficulty in formulating a clear identification strategy for the presence of a primarily federally funded transportation grant and underlying economic conditions in our already homogenous sample of Midwestern cities we proceed to estimation results.

Results

The results of the regression analysis are shown in Tables 4 and 5. Table 4 focuses on traditional measures of economic growth – income, employment, and population. Table 5 focuses on transfer payments and labor market variables.

The presence of a transit system is negatively related to income growth and does not appear to influence overall employment growth or population growth. Annual growth in real

personal income is lower (by $17,000) in counties with transit systems. Annual growth in real per capita income is lower (by 150 dollars) in counties with transit systems. The poverty rate is higher (by 0.61 percentage point). Annual employment growth, population growth and growth in manufacturing employment are positive but not at commonly accepted levels of statistical significance. Growth in retail employment is positive and significant, but the model fit is not acceptable as measured by the adjusted R-squared statistic and the F-value.

The presence of transit in a county has benefits for the low-income population. Annual real growth in family assistance is lower (by an average of $163,000) in counties with transit systems for the period after the 1996 Welfare Reform. Annual real growth in food stamp payments is lower (by an average of $252,000 per year over the study period) in counties with transit systems. This finding is consistent using data before and after the 1996 Welfare Reform. The population captured by these socioeconomic variables is low-income, single mothers. Previous research suggests that a large percentage of this demographic does not have access to a reliable automobile for personal transportation and that alternatives are necessary to meet their transportation needs. While previous studies focusing on larger cities (Sanchez, Shen, Peng 2004; Bania, Leete, Coulton 2008) showed that access to public transportation had no impact on labor market outcomes for low income population in large cities (Atlanta, Baltimore, Dallas, Denver, Milwaukee, Portland, Cleveland), the findings discussed above indicate that public transportation may have a positive impact on job access in small cities.

The presence of transit also has general benefits for the unemployed population. Annual real growth in unemployment compensation is lower (by an average of $1,302,000 per year over the study period) in counties with transit systems. The unemployment rates is significantly lower (by 0.29 percentage point) in counties with transit systems. This suggests that counties with

transit may experience lower levels of unemployment and /or shorter unemployment spells.

These findings suggest that transit systems increase the access of low income individuals to jobs. However, despite increased access to jobs, earnings are not high enough to positively affect earnings growth and the associated poverty rate. There are a variety of effects at work here. Transit increases access to jobs which increases labor supply. In particular, the low skill, low wage segment of the labor market is affected. More workers willing and able to supply labor in this submarket put downward pressure on wages which dampens earnings growth.

Another mechanism that explains the negative relationship between increased access to jobs and income growth is related to the distance between residential and work locations. Increased distance between the residential and work location may lead to longer travel times and more complex and unreliable transit trips or lower access to information about job opportunities (Bania, Leete and Coulton 2008, 2181). Problems with the reliability of transit and/or higher commuting costs may affect the employment level, duration of employment spells increased absenteeism, or tardiness for workers commuting via transit. These issues will in turn affect earnings and/or hours worked due to lower job performance because of poor job matches or slower accumulation of experience which ultimately leads to lower earnings and/or slower earnings growth.

The findings that the presence of bus transit in small cities has a positive impact on labor market variables in small cities (in contrast to the limited economic development impact of rail transit in larger cities) may result from the flexibility of bus transit relative to rail. Unlike fixed route rail, bus transit routes can be adjusted to serve new or growing retail centers or industrial parks, for example. In addition, the negative labor market effects associated with spatial mismatch are likely to be less pronounced in smaller cities relative to larger cities.

Table 4. The effects of transit on traditional measures of economic development [p-values]

Variables	Real Personal Income Growth	Real Per Capita Income Growth	Employment Growth	Population Growth	Growth in Manufacturing Employment	Growth in Retail Employment
Constant	46,444.78 [0.000]	358.93 [0.000]	433.83 [0.000]	709.40 [0.000]	-59.81 [0.416]	-231.91 [0.044]
Transit Dummy	-17,198.52 [0.017]	-147.84 [0.057]	279.35 [0.175]	151.67 [0.121]	203.85 [0.138]	620.16 [0.009]
Time Trend	-1,464.741 [0.000]	-17.55 [0.000]	-28.38 [0.000]	-33.30 [0.000]	-24.23 [0.000]	-37.98 [0.000]
AR(1)	..	-0.010 [0.739]	0.17 [0.000]	0.37 [0.000]	0.33 [0.000]	-0.05 [0.003]
AR(2)	..	-0.076 [0.009]	-0.09 [0.004]	..	-0.12 [0.000]	-0.14 [0.000]
Adj. R-sq	0.25	0.05	0.12	0.86	0.19	-0.03
F-stat	5.7 [0.000]	1.59 [0.001]	2.61 [0.000]	78.76 [0.000]	3.83 [0.000]	0.61 [0.997]
Durbin-Watson stat	2.02	2.02	2.10	2.00	2.14	2.18
Obs.	1,106	948	948	1,027	948	948

Significance: *0.10 level, **0.05 level, ***0.01 level

Table 5. The effects of transit on nontraditional measures of economic development [p-values]

Variable	Growth in Family Assistance	Growth in Food Stamps	Growth in Unemployment Compensation	Labor Force Participation Rate	Unemployment Rate	Poverty Rate
Constant	-387,881.1 [0.000]	-654,425.1 [0.000]	399,545.8 [0.194]	50.89 [0.000]	4.52 [0.000]	8.31 [0.000]
Transit Dummy	-162,908.4 [0.055]	-252,040.4 [0.005]	-1,302,163.0 [0.026]	0.12 [0.765]	-0.29 [0.010]	0.61 [0.013]
Time Trend	40,935.73 [0.000]	92,503.83 [0.000]	19,841.32 [0.298]	0.06 [0.021]	0.09 [0.000]	0.19 [0.000]
AR(1)	-0.197529 [0.000]	0.50 [0.000]	0.39 [0.000]	0.96 [0.000]	1.09 [0.000]	-0.17 [0.000]
AR(2)	0.092642 [0.005]	..	..	-0.20 [0.000]	-0.39 [0.000]	-0.08 [0.000]
Adj. R-sq	0.09	0.63	0.66	0.97	0.89	0.95
F-stat	2.05 [0.000]	22.72 [0.000]	22.72 [0.000]	370.33 [0.000]	104.86 [0.000]	185.72 [0.000]
Durbin-Watson stat	1.75	1.99	1.99	2.06	2.03	1.09
Obs.	786 Yr>1996	1,027	1,027	1,027	1,027	788 Yr =1993, 1995, 1997-2005

Significance: *0.10 level, **0.05 level, ***0.01 level

Summary and Extensions

Previous analysis suggests a limited but positive relationship between public transportation, particularly rail systems, and economic growth. The focus of the current analysis is to examine the impact of bus transit on traditional and nontraditional measures of economic development using a sample of 79 counties with small cities in the upper Midwest. We find that transit has no effect on traditional economic development outcomes such as population and employment growth. However, relative to counties without transit, counties with transit systems have significantly lower unemployment rates, lower growth in family assistance, food stamp payments, and unemployment compensation. Yet, access to transit has a negative effect on income growth, and the poverty rate is higher in counties with transit systems. The positive impact on job access which reduces payments for family assistance, food stamps and unemployment compensation is tempered by negative effects on income likely driven by supply side effects in the labor market.

Nevertheless, this analysis suggests that there are previously unquantified benefits to transit in small cities. Transit has a positive effect on getting people to work suggesting the transit has positive effects on the distribution of employment. However this increased capacity to work appears to have negative consequences for aggregate income growth and potentially an associated negative effect on the distribution of income. This research offers only tentative direction to understanding this effect. One hypothesis that deserves comment is that the growth in low wage workers (as a consequence of the increased transit availability) has dampened overall income growth in regions. This hypothesis is ripe for further research.

Future research should examine this issue more closely, with an eye towards better understanding the effect on individual workers of transit access. Previous studies examining the

relationship between job access and transit have used micro data on individual workers or potential workers in a variety of large cities. This work should be extended to employment outcomes and transportation usage for workers in smaller cities that have and do not have transit systems.

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Appendix A: List of Counties

FIPS	County	State	1950 County Population
17001	Adams	IL	64,690
17019	Champaign	IL	106,100
17091	Kankakee	IL	73,524
17095	Knox	IL	54,366
17115	Macon	IL	98,853
17113	McLean	IL	76,577
17143	Peoria	IL	76,165
17183	Vermilion	IL	87,079
18035	Delaware	IN	90,252
18039	Elkhart	IN	84,512
18053	Grant	IN	62,156
18067	Howard	IN	54,498
18091	La Porte	IN	76,808
18095	Madison	IN	103,911
18105	Monroe	IN	50,080
18157	Tippecanoe	IN	74,473
18167	Vigo	IN	105,160
18177	Wayne	IN	68,566
26017	Bay	MI	88,461
26021	Berrien	MI	115,702
26025	Calhoun	MI	120,813
26075	Jackson	MI	107,925
26091	Lenawee	MI	64,629
26115	Monroe	MI	75,666
26121	Muskegon	MI	121,545
26139	Ottawa	MI	73,751
26147	St. Claire	MI	91,599
39003	Allen	OH	88,183
39007	Ashtabula	OH	78,695
39013	Belmont	OH	87,740
39023	Clark	OH	111,661
39029	Columbiana	OH	98,920
39043	Erie	OH	52,565
39045	Fairfield	OH	52,130
39081	Jefferson	OH	96,495
39085	Lake	OH	75979
39089	Licking	OH	70,645
39119	Muskingum	OH	74,535

39133	Portage	OH	63,954
39139	Richland	OH	91,305
39141	Ross	OH	54424
39145	Scioto	OH	82,910
39147	Seneca	OH	52,978
39157	Tuscarawas	OH	70,320
39169	Wayne	OH	58,716
39173	Wood	OH	59,605
42005	Armstrong	PA	80,842
42015	Bradford	PA	51722
42019	Butler	PA	97,320
42025	Carbon	PA	57,558
42027	Centre	PA	65,922
42033	Clearfield	PA	85,957
42037	Columbia	PA	53,460
42039	Crawford	PA	78,948
42041	Cumberland	PA	94,457
42055	Franklin	PA	75,927
42063	Indiana	PA	77,106
42073	Lawrence	PA	105,120
42075	Lebanon	PA	81,683
42081	Lycoming	PA	101,249
42085	Mercer	PA	111,954
42097	Northumberland	PA	117,115
42111	Somerset	PA	81,813
42121	Venango	PA	65,328
55009	Brown	WI	98,314
55027	Dodge	WI	57,611
55035	Eau Claire	WI	54,187
55039	Fond du Lac	WI	67,829
55059	Kenosha	WI	75,238
55063	La Crosse	WI	67,587
55071	Manitowoc	WI	67,159
55073	Marathon	WI	80,337
55087	Outagamie	WI	81,722
55101	Racine	WI	109,585
55105	Rock	WI	92,778
55117	Sheboygan	WI	80,631
55133	Waukesha	WI	85,901
55139	Winnebago	WI	91,103
55141	Wood	WI	50,500

Appendix B: Transit Systems included in the analysis

Transit System Name	City	County	State
Bloomington-Normal Public Transit System	Bloomington	McLean	IL
City of Danville/Danville Mass Transit	Danville	Vermilion	IL
Decatur Public Transit System	Decatur	Macon	IL
City of Kankakee TaxiVan Program	Kankakee	Kankakee	IL
River Valley Metro Mass Transit District	Kankakee	Kankakee	IL
Greater Peoria Mass Transit District	Peoria	Peoria	IL
Champaign-Urbana Mass Transit District	Urbana	Champaign	IL
City of Anderson Transportation System	Anderson	Madison	IN
Bloomington Public Transportation Corporation	Bloomington	Monroe	IN
City of Kokomo	Kokomo	Howard	IN
Greater Lafayette Public Transportation Corporation	Lafayette	Tippecanoe	IN
Muncie Indiana Transit System	Muncie	Delaware	IN
Goshen Transit System	South Bend	Elkhart	IN
Heart City Rider Program	South Bend	Elkhart	IN
Michiana Area Council of Governments	South Bend	Elkhart	IN
Terre Haute Transit Utility	Terre Haute	Vigo	IN
Battle Creek Transit	Battle Creek	Calhoun	MI
Bay Metropolitan Transit Authority	Bay City	Bay	MI
Twin Cities Area Transportation Authority	Benton Harbor	Berrien	MI
City of Jackson Transportation Authority	Jackson	Jackson	MI
Muskegon Area Transit System	Muskegon Heights	Muskegon	MI
Niles Dial-A-Ride	Niles	Berrien	MI
Blue Water Area Transportation Commission	Port Huron	St. Clair	MI
Portage Area Regional Transportation Authority	Kent	Portage	OH
Campus Bus Service	Kent	Portage	OH
Allen County Regional Transit Authority	Lima	Allen	OH
Richland County Transit	Mansfield	Richland	OH
City of Newark Transit Operations	Newark	Licking	OH
Licking County Transit Board	Newark	Licking	OH
Sandusky Transit System	Sandusky	Erie	OH
Springfield City Area Transit	Springfield	Clark	OH
Steel Valley Regional Transit Authority	Steubenville	Jefferson	OH
County of Lebanon Transit Authority	Lebanon	Lebanon	PA
Centre Area Transportation Authority	State College	Centre	PA
Williamsport Bureau of Transportation	Williamsport	Lycoming	PA
City of Appleton - Valley Transit	Appleton	Outagamie	WI
City of Beloit Transit System	Beloit	Rock	WI
Eau Claire Transit	Eau Claire	Eau Claire	WI

Fond du Lac Area Transit	Fond du Lac	Fond du Lac	WI
Green Bay Metro	Green Bay	Brown	WI
Janesville Transit System	Janesville	Rock	WI
Kenosha Transit	Kenosha	Kenosha	WI
LaCrosse Municipal Transit Utility	LaCrosse	La Crosse	WI
Oshkosh Transit System	Oshkosh	Winnebago	WI
Belle Urban System - Racine	Racine	Racine	WI
Sheboygan Transit System	Sheboygan	Sheboygan	WI
Waukesha County Transit System	Waukesha	Waukesha	WI
City of Waukesha Transit Commission	Waukesha	Waukesha	WI
Wausau Area Transit System	Wausau	Marathon	WI