Transportation and the Housing Crisis: Are They Related?

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ABSTRACT

The role of transportation in shaping urban form has been extensively studied. The conventional wisdom is that transportation systems, especially expressways, are contributors to sprawl. However, there is not universal agreement on this point. The issue centers around the level of importance, not whether transportation has any affect. Still transportation is commonly associated with increased housing on the periphery of metropolitan areas and high homeownership rates. There is little doubt that sprawl is closely associated with home ownership. Metropolitan areas that can and have recently sprawled have very high homeownership rates such as Indianapolis, Cleveland and Detroit. There is also credible evidence that sprawl is more a function of prosperity and household formation than the development of the transportation system, such a radial expressways.

After more than a decade of increases, in recent years the national homeownership rates have declined and the association between transportation and housing has become of greater interest. Nationally homeownership rates hit a peak in early 2004 and are now at the same levels as the first half of 2001. During this period, the homeownership rates have changed considerably among the major metropolitan areas, as have transportation statistics. These measures have increased in some metropolitan areas and decreased in others.

This study investigates to what extent there is an association between transportation (portrayed by a number of highway-related measures) and the housing crisis measured by foreclosure rates for the 47 largest metropolitan areas. For many of these variables we also examine the growth (change) in these variables since 2000. While it is well known that the economy plays a major role in foreclosure rates (measured by unemployment rates) what is the role of total metropolitan vehicles miles traveled (VMT), per capita VMT, number of roadway miles, population density, and homeownership rates?

Using metropolitan-level data from 2000 to 2007 this study finds an association between the use of the transportation system and the magnitude of the housing foreclosure problem in metropolitan areas. As expected we find that foreclosure is *positively* related to high homeownership and unemployment rates – both 2006 data. Equally important is the association with transportation variables. There are *negative* relationships with roadway miles; both the per capita number of roadway miles in 2000 and the increase in roadway miles from 2002 to 2006. This suggests that the addition of roads has not been detrimental to home ownership.

At the same time there is a *positive* relationship between foreclosure rates and number of miles driven (VMT) – as VMT increases from 2002 to 2006 so does foreclosure. This may suggest that (1) transportation costs divert resources from being applied to housing or (2) possibly high VMT is related to overextension of the suburban growth that attracted first-time buyers that over reached their resources. Clearly these are not direct interpretations and require more research.

All of the variables cited have relationships that are statistically significant with foreclosure rates. In sum they suggest that standard non-transportation variables are important but the

empirical evidence here also points to an association with highway use (VMT) but the existence of highways and their expansion are not positively associated with foreclosure.

INTRODUCTION

The role of transportation in shaping urban growth has been extensively studied. The conventional wisdom is that transportation systems, especially expressways, are contributors to sprawl. However, there is not universal agreement on this point. The issue centers around the level of importance, not whether transportation has any effect on. Prosperity has been shown to be a stronger contributor to urban sprawl than highways (Sen et al., 1999). We can expect that the rapid growth in peripherally located subdivisions is now declining during this period of economic turmoil. We can build expressways but it is unlikely that, at least currently, it would stimulate urban sprawl. Conversely urban sprawl has grown in many places without the existence of expressways. McHenry County in suburban Chicago is a good example. For several decades it was the fastest growing county in the eight-county metro region. It is also the only one of the eight counties (Cook, DeKalb, DuPage, Grundy, Kane, Kendall, McHenry and Will counties) without a freeway interchange. In the Phoenix area much of the suburbanization occurred without expressway including the Scottsdale and Paradise Valley areas.

Still transportation is commonly associated with increased housing on the periphery of metropolitan areas and high homeownership rates. There is little doubt that sprawl is closely associated with home ownership. Metropolitan areas that can and have recently sprawled have very high homeownership rates such as Indianapolis, Cleveland and Detroit, all with rates over 75 percent. Places that cannot easily sprawl, principally due to topographic constraints, such as Los Angles, San Francisco and San Jose have low homeownership rates, all under 60 percent.

On the other hand, high homeownership rates have also been attributed to the dramatic expansion of housing credit in recent years. Indeed until the recent housing market collapse, it was relatively easy for moderate-income families to assume mortgage debt, raising the chances of further housing cost miscalculations (Courchane et al., 2004). Recent increases in mortgage foreclosures may provide some evidence of these kinds of miscalculations by consumers (Goldstein, 2004).

While the association between transportation and urban sprawl has been extensively studies, the relationship between transportation and foreclosure has not. It is the purpose of this study to better understand if transportation plays a role in the variation in foreclosure rates among the major metropolitan areas. This is a worthy topic since transportation and sprawl are not necessarily associated with foreclosure and because foreclosure is now of prime national interest.

BACKGROUND

In order to better assess the nature of the problem examined here it is useful to discuss a few background points. First, the trend in homeownership rates in the last decade. And second

the changes in the roadway miles and their use. In the latter case, metropolitan trends and national trends are not the same.

National Trends in Homeownership

While there are substantial differences in homeownerhsip rates – the percentage ratio of owner-occupied dwelling units to total occupied dwelling units in an area (U.S. Bureau of the Census, 2000) – among the major metropolitan areas, over the last several decades there have been increases in most if not all metropolitan areas. In recent years, however, the national homeownership rates have declined and the association between transportation and housing has become of greater interest. Nationally homeownership rates hit a peak in the second quarter of 2004 and are now at the same levels as the first half of 2001 (Figure 1). In essence the national homeownership rate has been declining for four years. This counters the commonly held belief that it has only been a problem in the last year or two.

Figure 1.
**National Quarterly Homeownership Rates, 2000 to 2008**
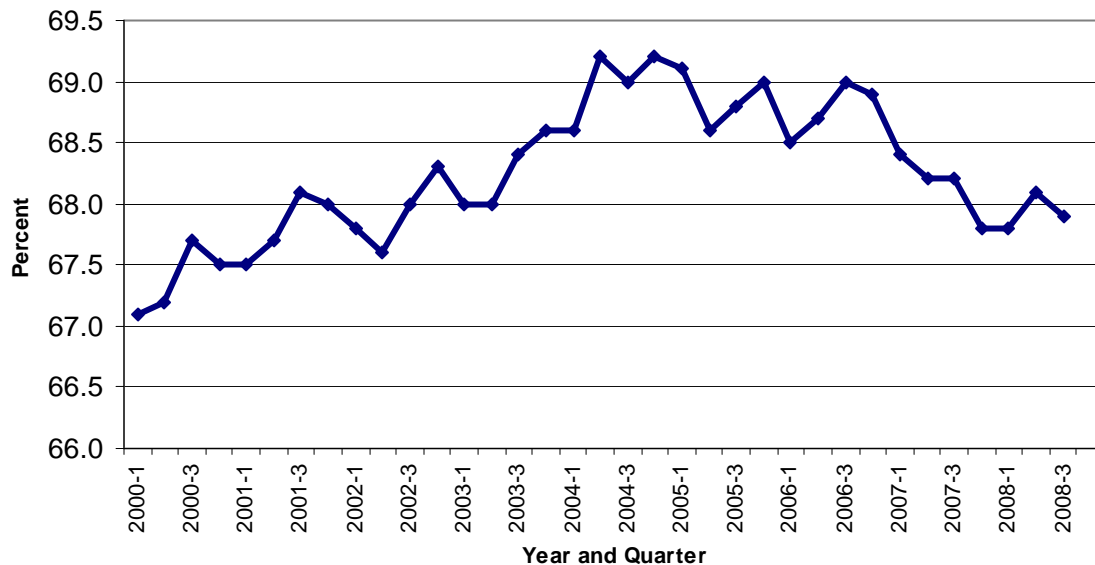
During this period, the homeownership rates have changed considerably among the major metropolitan areas. In the last twenty-one years (1986 to 2007) homeownership rates have increased in the Chicago and Indianapolis metropolitan areas by more than 14 percentage points. During the same time the Census data for Portland and Seattle show declines (U.S. Bureau of the Census, 2008). At least there are substantial differences among the metropolitan areas and it is these differences among metropolitan areas that this is of importance in this study.

Vehicle Miles Traveled

Nationally the vehicle miles traveled (VMT) reflect the declines in rural miles together with the increases in urban miles driven (FHWA 1997, 2008). In this analysis we only consider

the 47 largest metropolitan areas. Figure 2 shows that there has been an increase in the total miles driven collectively among these metropolitan areas.

Figure 2.
Increases in Roadway Miles and Daily VMT (DVMT) in Study Area Metropolitan Areas, 2002-2006
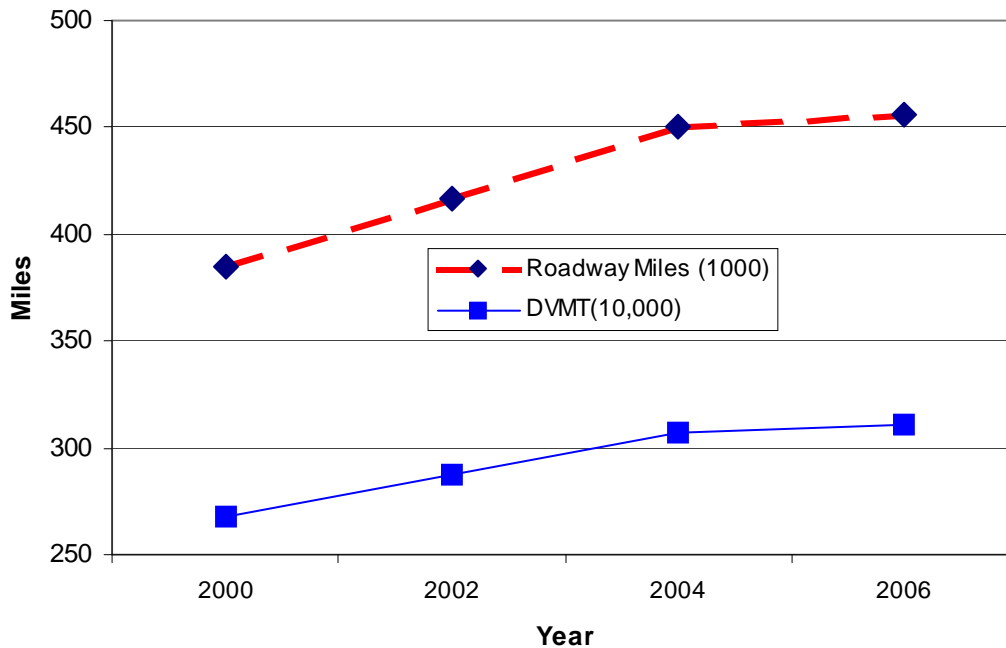
Roadway Miles

Figure 2 also shows that there has been an increase in the number of roadway miles in the 47 largest metropolitan areas. Like the VMT data the increases in the beginning of the decade were greater than in the last two years (2004 to 2006).

STUDY PURPOSE

This study investigates to what extent there is an association between transportation (portrayed by a number of highway-related measures) and the housing crisis measured by foreclosure rates for the 47 largest metropolitan areas. For many of these variables we also examine the growth (change) in these variables since 2000. While it is well known that the economy (measured by unemployment rates) plays a major role in foreclosure rates what is the role of total metropolitan VMT, changes in per capita VMT, number of roadway miles, population density, and homeownership rates?

DATA AND STUDY AREA

Data and Data Sources

This analysis used data from a variety of data sources including:

- FHWA Highway Statistics,
- Case-Shiller Index (home sale prices), and
- U.S. Bureau of the Census (homeownership).

The Case-Shiller index (see Case and Shiller 1987, 1989), in particular, is a repeat sales price estimator that provides estimates that are essentially equally weighted geometric averages of individual house prices. As an aside, the geometric average of any set of positive numbers not all equal is less than the arithmetic average of them.

These sources provided a solid basis for our analysis. There are at least three caveats to the veracity of the data obtained be merging these data into one set. First, some of the data pertain to urbanized areas while others cover the metropolitan area. Generally there are proportionally few residents beyond the urbanized area within the metropolitan limits so the difference is not great. Second, in at least two cases the metropolitan area includes two large urbanized areas. San Francisco and Oakland are in one metropolitan area as are Miami and Ft. Lauderdale. In these cases we combined the data into one data observation.

Third, the dates (years) do not always match. The most recent highway statistics are for 2006 while the most recent data for foreclosure are for 2007. In many cases, however, this was not a serious problem because some variables have a lag effect and only a minimal immediate impact. In these cases it is prudent to use data from different years. For example, construction of new roads may affect foreclosure rates only after several years. As a consequence, for several variables we collected data from 2000 to 2006.

Variables

The objective here was to collect numerous economic variables that are related to foreclosure rates. Also a variety of transportation-related variables were used to assess the relationship between foreclosure and transportation. Both types of variables that describe the extent and growth of the transportation network (roadway miles) as well as the use of the transportation systems (VMT) were used.

The list of variables is shown in Table 1. Note that this is a list of initial variables that increased substantially as simple transformations were conducted. Since we have transportation data for four different years, 2000 to 2006, increases could be computed both as totals and as per capita variables. We could have used highway data for each year but felt that year-to-year changes were too short.

Hypothesized Relationships

We anticipate that foreclosure rates are related to local economic conditions. The unemployment rate relates well with the economic stress felt in some places (Foster and Van Order 1984; Case and Shiller, 1996; Capozza et al., 1997; NAR, 2003 and 2004). Figure 3 shows however, that there is no immediately obvious relationship between the two. The

implication is that the foreclosure problem is not a simple matter of unemployment but rather a complex problem with other factors at play.

Table 1.
List of Input Variables for 47 Metropolitan Areas

Year	Variable
2000, 2002, 2004, 2006	Total roadway miles
2000, 2002, 2004, 2006	Total daily vehicle miles traveled (VMT)
2000, 2002, 2004, 2006	Population estimates*
2000, 2002, 2004, 2006	Land area*
2007	Foreclosure rate
2006	Unemployment rate
2006	Homeownership rate
2006	Median home price

* Density was computed by diving population by land area, and likewise several other variables were also produced, e.g., per capita daily VMT.

Figure 3.
Unemployment and Foreclosure Rates
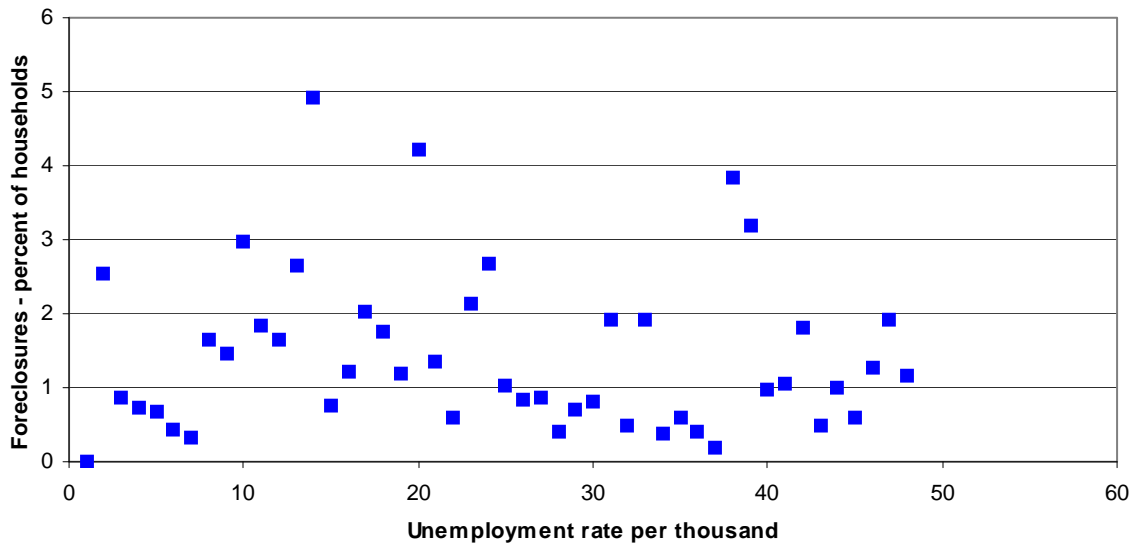
Of equal interest to us is the association between foreclosure and transportation characteristics. We anticipate that road miles may enhance mobility in a metropolitan area and does not contribute to foreclosures. Indeed Figure 4 suggests that there may be a negative relationship between the two. We will see below the importance of roadway miles in our regression analysis.

Figure 4.
Road Miles and Foreclosure Rates
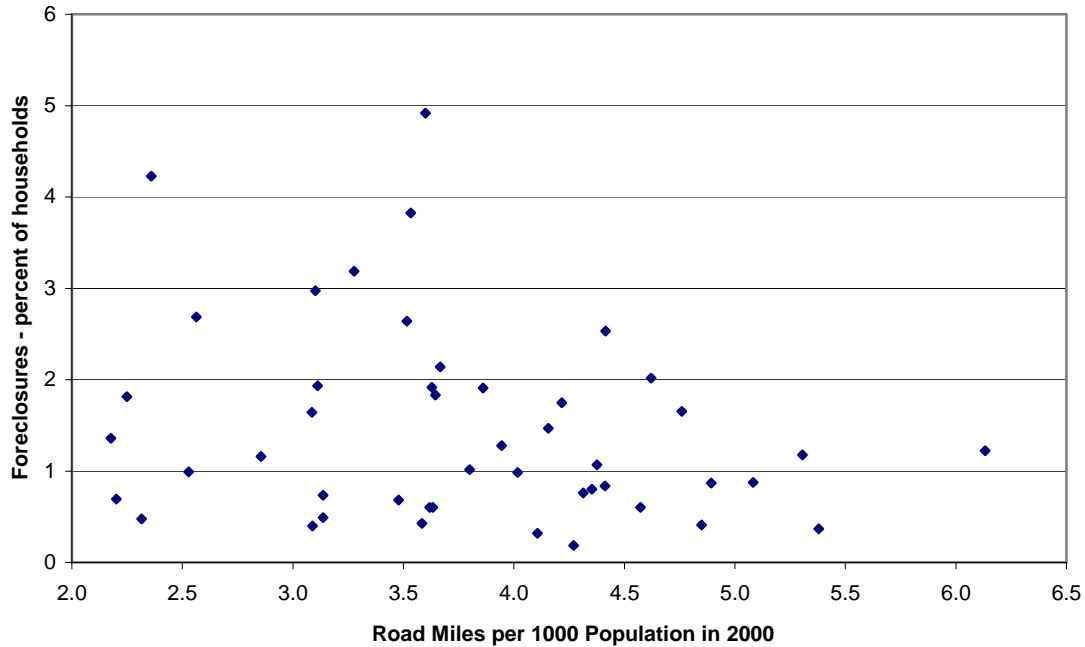
Study Scope

The analysis focuses on the largest metropolitan areas in the country. There was no effort to limit the number of metropolitan areas included, this was done for us by the data sources used. In the least our objective was to include all of the metropolitan areas with urbanized area populations in excess of one million. This was achieved with a half dozen places with population less than one million, such as Salt Lake City, Charlotte, Austin and Indianapolis.

Sample Data Issues

In order to better understand the information analyzed in this study it may be useful to review some of the data. For example, the highest foreclosure rates are in Detroit followed by Las Vegas (Table 2). Detroit also has the highest unemployment level of the 48 places studied, but Las Vegas has among the lowest unemployment rates.

At the low end of the foreclosure rates are Richmond and Pittsburgh. Both of these places have particularly high number of road miles per capita suggesting a negative relationship.

Table 2.
2007 Foreclosure Rates by Metropolitan Area

Metropolitan Area	Rate
Detroit/Livonia/Dearborn, MI	4.918
Las Vegas/Paradise, NY	4.228
Riverside/San Bernardino, CA	3.826
Sacramento, CA	3.189
Cleveland/Lorain/Elyria/Mentor, OH	2.972
Miami, FL	2.685
Denver/Aurora, CO	2.641
Atlanta/Sandy Springs/Marietta, GA	2.531
Memphis, TN	2.141
Indianapolis, IN	2.019
Orlando, FL	1.932
Phoenix/Mesa, AZ	1.915
Tampa/St Petersburg/Clearwater, FL	1.908
Columbus, OH	1.832
San Diego, CA	1.816
Jacksonville, FL	1.748
Dallas, TX	1.653
Chicago, IL	1.641
Cincinnati, OH	1.469
Los Angeles/Long Beach, CA	1.36
St Louis, MO-IL	1.279
Houston/Baytown/Sugar Land, TX	1.221
Kansas City, MO-KS	1.177
Washington/Arlington/Alexandria, DC-VA-MD	1.16
San Antonio, TX	1.067
Milwaukee/Waukesha/West Allis, WI	1.017
San Jose/Sunnyvale/Santa Clara, CA	0.991
Salt Lake City, UT	0.984
Austin/Round Rock, TX	0.874
Nashville/Davidson, TN	0.869
Minneapolis/St Paul/Bloomington, MN-WI	0.836
Oklahoma City, OK	0.801
Hartford, CT	0.761
Baltimore/Towson, MD	0.734
New York/Wayne/White Plains, NY-NJ	0.695
Boston/Quincy, MA	0.683
Portland/Vancouver/Beaverton, OR-WA	0.602
Seattle/Bellevue/Everett, WA	0.602
Louisville, KY	0.601
Philadelphia, PA	0.492
San Francisco, CA	0.478
Buffalo/Cheektowaga/Tonawanda, NY	0.426
Providence/New Bedford, RI	0.411
New Orleans, LA	0.399
Pittsburgh, PA	0.367
Charleston, SC	0.318
Richmond, VA	0.184

RESULTS

As stated above we produced a relatively large number of variables for a regression analysis. These may be divided into two general categories, economic and transportation variables. Each category has several variables that were statistically related to foreclosure and the discussion below is divided into these two categories.

Economic variables

Perhaps the most expected economic variable related to home foreclosure is the unemployment rate. Joblessness too frequently is an indication of financial stress and may directly contribute to foreclosure. In the terminology of Capozza et al. (1997) and Foster and Van Order (1984), this is called a 'trigger event variable'. It is then not surprising that the unemployment rate in a metropolitan area is statistically related to foreclosure (Table 3). As unemployment rates increase so do foreclosure rates.

Table 3.
Regression Results

Variable	Parameter Estimate	Significance
Intercept	-3.12	0.110
2006 Unemployment rate	0.579	0.003
2006 Homeownership rate	0.0541	0.046
2002-2006 VMT increase (000's)	0.101	0.003
2002-2006 increase in road miles (000's)	-0.516	0.006
2000 per capita road miles	-0.464	0.006

R^2=0.35; s=0.91

The other 'economic' variable in our model is the 2006 homeownership rates. Where rates are high so are foreclosure rates. This is significant at 0.05. In places where homeownership rates are high they apparently are more vulnerable to foreclosures. This is certainly true for the Detroit area, which has the highest foreclosure rate and the third highest homeownership rate.

A likely reason why homeownership is statistically significant is that high rates of ownership imply that many who are not already owners may not be good candidates for ownership. Conversely, high homeownership rates are thought to contribute to foreclosures because the marginal borrowers in areas with high levels of homeownership are more fragile and may be more prone to economic dislocations (Turner and Smith, 2009).

In the Detroit metropolitan area, with 76 percent homeownership, only 24 percent of the households are not owners. Conversely in the Los Angeles area where homeownership is at

54 percent the non-owner household account for 46 percent of all households. The difference in the proportion of the population not owning is nearly two fold. In the Los Angeles area it may be more likely that the new owners are able to afford the pending mortgage payments while in the Detroit area with less than a quarter of the households not owning, the new buyers may have been more likely to be attracted to homeownership with what appeared to be affordable mortgages rather than possessing solid financial footing. This may account for the low foreclosure rates in Los Angeles and the San Jose. Both metropolitan areas have low homeownership rates.

Transportation Variables

Less obvious may be the relationship with transportation variables. The transportation variables are divided into two categories, those that describe transportation use and those that describe the extent (size) of the transportation network.

Transportation Use Variables

There is one transportation-use variable in our model – the increase in VMT from 2002 to 2006 (others were tested but were not found to be significant). With a positive and statistically significant relationship the foreclosure rate increases with increases in VMT. Since this a change in the magnitude it has several potential interpretations. First, it is a measure of overall growth in the region and perhaps larger growth in the peripheral areas. Second, it may imply that as the VMT increases, the cost of transportation is increasing and there are fewer household resources for other expenditures such as housing. This requires further research.

Transportation (Road Miles) Variables

There are two variable in our model that describe the extent of the transportation network, the per capita road miles in 2000 and the increase in road miles from 2002 to 2006. Both are significant and have negative relationships.

We anticipated a lag effect with roadway mile so we used 2000 data. Specifically, the per capita road miles describe the transportation network at the beginning of the decade and it was included in the model to assess how this may have affected the foreclosure problem. Since the sign is a negative it suggests the extent of the underlying transportation network does not contribute to the (foreclosure) problem. As a per capita variable it suggests that if there were a high number of road miles per person, then there was not a need to expand the road network. Since road construction revenues come from the public, in metropolitan areas where the per capita road miles are high, there may not be the need to build more roads and add to the financial stress of households.

The other road network measure in the model is the increase in the number of road miles from 2002 to 2006. Again there is a negative relationship. In metropolitan areas where road miles were added the foreclosure rates were low.

Summary Results of Transportation Variables

The data analyzed in this study indicates that there is a relationship between transportation variables and the foreclosure rate. The extent and the growth of the transportation network are negatively related but the increase in VMT is positively associated with foreclosure. In essence high increases in VMT may contribute to foreclosures but not the existence of an extensive highway network. Such an extensive network may enhance mobility and is consistent with the argument that advancements in infrastructure stimulate the economy.

CONCLUSION

As the national attention focuses on a variety of urban concerns, the role of the transportation system is frequently questioned as a possible contributing factor. This has been true with urban sprawl and pubic health, both of which have tenuous and disputed relationships with transportation, specifically expressways. Today the foreclosure crisis has caught the attention of many and deserves similar scrutiny.

Furthermore we are beginning to pay particular attention to rebuilding and expanding our transportation infrastructure. There is widespread interest in using investment in infrastructure as a means to improve the national economy. It is then particularly important that we better understand whether there is relationship between the transportation system and housing foreclosure. For example if building road miles is associated with foreclosure then the nature of this relationship needs to be better understood.

The study finds a positive relationship between foreclosure and economic characteristics, namely unemployment and homeownership. Transportation, however, plays both a positive and negative role. Transportation use (VMT growth) is positively related while the extent of the highway network is negatively related. Most importantly these are findings at the metropolitan level and we encourage much more detailed analysis of the role of transportation in foreclosure rates.

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