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A "Before and After" Test

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and
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I. Introduction and Background

A. Induced travel

Background

Several recent studies have demonstrated an association between increases in highway capacity and increases in vehicle miles of travel (VMT). That phenomenon, called induced travel, has increasingly been cited as a basis for rethinking travel demand modeling, land-use/transportation interactions, and the environmental impacts of highway projects. Yet before the policy community can firmly conclude that induced travel is an important phenomenon, one lingering doubt must be addressed. Do new highways really induce additional travel, or are the associations between lane miles and VMT driven by a reverse causal link – namely that new highways are built in anticipation of expected increases in travel demand? The debate remains contentious, in part because the empirical evidence on induced travel is mostly from aggregate data that are better suited to establishing correlations than causality. As Noland and Lem (2000) note, the studies to date, while often supportive of the hypothesis, do little to illuminate the behavioral underpinnings of the phenomenon. Determining causality with data that are aggregated over broad geographic areas, such as counties or states is difficult, and focusing on individual projects can help clarify matters. In this light, we examine three highways in a rapidly growing urban area to pose the following question: Do new highways influence urban development in ways that suggest that they induce new automobile traffic, or are urban growth patterns somewhat impervious to the completion of new highways?

Behavioral impacts of new highways

If increases in highway capacity cause increases in VMT, the behavioral underpinnings can be divided into two broad classes. First, an increase in capacity that reduces congestion and lowers travel times reduces the full cost of travel. This lower price of travel can induce more travel. This is part of the underpinning of Downs' (1962) "law of peak hour expressway congestion".[1] Second, increases in highway capacity that lower travel times can facilitate changes in urban development that are associated with longer trips and thus more VMT (see, e.g., Noland and Lem (2000); Downs (1996); Hills (1996)). The focus of this report is on the second class of behavioral changes of induced travel, caused by increased highway capacity, i.e. the link between highways and urban development. Specifically, this paper is a "before and after" study of the impact on house prices of the construction of toll roads in Orange County, California.

[1] Downs (1962, 1992) also discusses how increases in highway capacity can induce shifts in travel from different times of day, routes, and modes. With the exception of changes in mode, it is not clear that changes in trip scheduling or route will increase VMT, even if those shifts contribute to increases in peak period congestion. For that reason, we follow Noland and Lem (2000), who note that the effect of highway capacity on inducing new or longer trips should be a key focus for research on the link between VMT and highway capacity.

B. Empirical study using the Orange County Toll Roads

Since 1993, fifty-one new centerline miles of toll road have opened in Orange County. Collectively, those roads extend the County's relatively dense highway network into the rapidly growing southern part of the County. (See Figure 1 for a depiction of the highway and toll road network in the County.) The San Joaquin Hills, Eastern, and Foothill corridors (California State Routes 73, 241, 261, and portion of 133) have all been in Orange County's Master Plan of Arterial Highways since the 1970s, but planning for the toll roads began in earnest when the Transportation Corridor Agencies (TCAs) were created in 1986.[2] In 1987, the TCAs determined that state and federal funds would not be sufficient to finance the roads and state legislation passed in that year allowed the roads to be built as toll facilities.

The TCA toll roads were chosen because they provide a rare opportunity to examine a significant expansion of highway capicity in a rapidly growing suburban area, and to test, using readily available data, growth pattern before and after the highways were built. The fact that the TCA highways are toll facilities has some impact on both induced travel and the link between the roads and urban growth. The argument for induced travel in many ways hinges on the fact that virtually all highway construction in the United States for the past several decades has been for roads that do not charge tolls. Highway travel is thus unpriced in the sense that drivers do not pay for the additional congestion that they cause during peak period. Induced demand, as originally popularized by Downs (1962, 1992) is intimately linked to the theoretical proposition that persons will increase their driving on free highways in response to increases in capacity that reduce congestion. A commonly proposed policy solution to the problem of induced demand is to charge for highway travel during peak times – i.e. to impose toll that vary with congestion levels (e.g. Vickrey, 1963; Small, Winston, and Evans, 1989). While the TCA toll roads do not vary the toll with either the time of day or congestion levels, one could argue that the existence of even a flat toll should attenuate the induced demand effect which has been documented in studies (e.g. Hansen and Huang, 1997; Noland, 1998) of free highway capacity.

That argument is well taken, and our response is threefold. First, while the ideal case study for this research would be highways built in growing suburban areas, such cases are rare, and the Orange County case study brings countervailing advantages in data availability and model calibration. The data for much of the empirical work needed for the Orange County case were readily available. Also the population and employment growth model had been tested on Orange County data, such that much work on model validity had been completed in Orange County. Second, there are few suburban areas

[2] A detailed case study of the toll roads, conducted as separate research, revealed that few persons in the County regarded the roads as likely to be built before the creation of the TCAs (Boarnet, DiMento, and Macey, 2002). It is unlikely that land development would have anticipated the roads before the formation of the TCAs in 1986, and more generally the early 1990s, when construction began on the toll road network, is the earliest time that development would likely have anticipated the roads. For a discussion of the history of the toll roads, drawn from archival documents and expert interviews, see Boarnet, DiMento, and Macey (2002).

with current highway investment program's that are comparable in size to Orange County's.

Third, recent theoretical research (Arnott, 1998) suggests that even congestion tolled highway capacity is likely to influence urban growth patterns, although the influence might not be as strong as if the new capacity were unpriced. The implication for this research is that links between highways and urban growth are likely to persist even if the capacity is congestion tolled, and would likely be even more apparent in the case of the flat tolls used by the TCAs.

In the first part of this report, we employ both hedonic regression analysis and multiple sales techniques to examine how the opening of the toll road network alters house prices in nearby corridors. In the second part, we use a census tract population and employment growth model to examine impact of the toll roads on urban development patterns.

Urban economic theory posits that the influence of highway improvements on urban growth patterns acts through land prices. If highways improve accessibility, that accessibility premium will be reflected in higher land prices (and *ceteris paribus*, higher house prices), and higher priced land will be developed more densely. As a first step in better understanding the link between highways and urban development, we examine how the construction of the Orange County toll road network altered house prices in nearby corridors. Understanding the link between house prices, development patterns, and induced travel requires first understanding those related literatures, which we summarize below.

II. Literature Review

A. Induced Travel

Downs (1962) offered one of the earliest theoretical justifications for induced travel, stating the improvements in highway capacity lower the cost of peak hour travel, and thus can create additional peak hour traffic. More recent research has focused on the link between VMT and highway capacity, rather than peak hour traffic. The empirical literature, especially works that have been influential in policy circles, is quite new. Important recent empirical research on induced travel includes the research of Goodwin (1996), Hansen and Huang (1997), and the report of the Special Advisory Commission on Truck Road Assessment (1994). The SACTRA (1994) report examined traffic growth in corridors that had increases in capacity, and also compared actual and forecast travel along new and improved corridors. Both pieces of evidence led SACTRA (1994) to conclude that induced travel is a real phenomenon, concluding that, on average, traffic increased by 77% due to capacity expansion.

Hansen and Huang (1997) used panel data for California counties to examine statistically how VMT is influenced by state highway lane miles, controlling for other factors such as county population and per capita income. They concluded that the elasticity of VMT with respect to lane miles ranged from 0.3 to 0.7 for counties and 0.5 to 0.9 for metropolitan areas. Virtually all elasticity point estimates were significant at conventional (5% or better) levels. Noland (forthcoming) found similar results using the same methodology with data for U.S. states, and Noland and Cowart (forthcoming) also found similar results with data on metropolitan areas from the mid-Atlantic region of the United States. The results have provided support for the idea that induced travel is an important transportation phenomenon, but the issue of causality remains a point of some controversy. As Noland and Lem (2000) note, the research to date provides little information on the underlying behavioral foundations of whether and how increases in highway capacity cause increases in VMT. To increase our understanding of the behavioral links between highway construction and induced travel, this paper focuses on the link between highways and urban growth patterns.

B. Highways and Urban Development

The literature on highways and urban development has focused largely on the question of whether highways contribute to the decentralization of metropolitan areas. The evidence, reviewed by Boarnet and Haughwout (2000), suggests that transportation infrastructure is only one of several factors that influence metropolitan decentralization, although there is debate about the relative importance of transportation versus other

[3] Downs (1962, 1992) also discusses how increases in highway capacity can induce shifts in travel from different times of day, routes, and modes. With the exception of changes in mode, it is not clear that changes in trip scheduling or route will increase VMT, even if those shifts contribute to increases in peak period congestion. For that reason, we follow Noland and Lem (2000), who note that the effect of highway capacity on inducing new or longer trips should be a key focus for research on the link between VMT and highway capacity.

factors (see, e.g., the exchange between Cervero and Landis (1995) and Giuliano, (1995)). The empirical literature initially focused on how highways influence the relative growth of central cities and suburban rings. An often-cited example of this work is the study by Payne-Maxie (1980) that examined the influence of suburban beltways on the growth of suburbs and central cities in fifty-four United States metropolitan areas. The authors conclude that beltways have little impact on overall growth of the metropolitan area, and they also conclude that the intra-metropolitan economic and land use effects that do exist are likely to be transfers from one place to another within the metropolitan area (Payne-Maxie (1980), pp. 114-116). Yet the work by Payne-Maxie (1980), and similar articles on the determinants of decentralization such as Bradford and Kelejian (1973), Mills and Price (1984), and Palumbo, Sacks, and Wasylenko (1990), divided metropolitan areas into two components – central cities and the remaining suburban ring. This geographic focus is relatively crude and allows little analysis of finer scale impacts of highways on metropolitan growth patterns. Partly for that reason, we use data on house sales prices that are matched, via a geographic information system (GIS), to street addresses. This allows a more detailed geographic study of the effect of highways on urban development.

C. Hedonic Price Studies of Highway Access

In the United States, studies of the impact of highways on nearby land and house values date to the beginnings of the Interstate Highway program (e.g. Adkins (1959); Mohring (1961)). The technique of hedonic price analysis was later formalized by Rosen (1974), and there have since been several studies of the impact of highways on house prices. Huang (1994) reviewed the literature on hedonic price studies of the influence of highway access on house prices. He concludes that the early studies, from the 1950s and 1960s, usually showed large land price increases near major highway projects. The later studies, from the 1970s and (less often) the 1980s, typically showed smaller and often statistically insignificant land price effects from highway projects. Giuliano (1989), in reviewing the literature on the effect of transportation infrastructure on urban development, comes to the same conclusion – namely that later studies show a smaller impact of highway access on home values. Both Giuliano (1989) and Huang (1994) argue that, as the highway system was developed in many urban areas, the value of access to any particular highway was reduced because accessibility is now generally good throughout the network in most United States cities. Huang also notes that, for residential properties, noise and other disamenities will reduce the value of locating close to a highway. Langley (1976, 1981), in a study of homes near the Washington Beltway, concluded that house prices increase with distance from the highway out to a distance of 1,125 feet, and then decrease with distance beyond 1,125 feet. Langley interprets this as evidence that the disamenities of highways dominate the value of access for distances of less than 1,125 feet.

The literature on highways and house prices echoes the broader literature on highways and urban growth. Giuliano (1989, 1995), in reviewing both literatures, concluded that the influence of transportation on urban development patterns is growing less important. Yet most of the evidence that led Giuliano to that conclusion is based on data that are aggregated to broad geographic distinctions such as central cities and suburban rings. A more recent hedonic price study, by Voith (1993), found that highway access (measured by travel time by highway to the downtown) influenced house prices in the Philadelphia area, and that the magnitude of that effect increased during the 1980s. Overall, the literature on house prices and highway access, like the literature on highways and urban development, has often used data that are aggregated to a geographic scale that can obscure fine-grained links between highways and growth patterns. Thus, the link between highways and metropolitan growth, and any ensuing link to induced travel, remains incompletely understood.

D. Population-employment growth model

Population and employment growth models have a long history in regional science and urban economics (Steinnes and Fisher, 1974; Bradford and Kelejian, 1973; Mills and Price, 1984; Carlino and Mills 1987). More recently, the two equation population and employment growth model has been reformulated in an explicitly spatial econometric framework (Boarnet, 1994). The motivation for the spatial treatment is that, within urban areas, the link between population and employment growth extends beyond geographic boundaries. Population changes in a geographic unit depend not only on employment changes within the same jurisdiction, but also on employment changes in a labor market area that typically extends beyond that jurisdiction. Similarly, employment changes depend on population changes in surrounding labor markets. This leads to a spatial structure in the econometric model, and the problem of spatial dependence across observations is more severe for a smaller observations of the sort that are inherent in intra-metropolitan as opposed to inter-metropolitan models.

Boarnet (1994) applied spatial econometrics to a Carlino and Mills (1987) lagged adjustment model of population and employment growth to handle this problem of spatial dependence across observations. The theoretical rationale was that interactions across observations (New Jersey municipalities in the case of Boarnet's 1994 study) are mediated by a commuting relationship. Thus, the link between population and employment is best modeled as a dependence within labor-market areas or commutersheds which, given the small size of New Jersey municipalities, almost certainly were larger than any one municipal observation.

Since then, the model in Boarnet (1994) has been adapted by other authors to study problems that include the employment impacts of urban rail transit (Bollinger and Ihlanfeldt, 1997), the link between urban and rural development (Henry, Barkley, and Bao, 1998), and the influence of highway location on urban growth (Boarnet, 1996). This research is yet another effort to apply the growth model to illuminate another ongoing policy debate – in this case, the chicken and egg problem of highway construction and and urban development. The model is applied to the fast-growing south Orange County, before and after it received a major highway investment in the last decade.

III. Research Strategy

A. House Sales Price Analysis

If the toll roads changed that pattern of accessibility in Orange County, that should be capitalized into house prices. We have data on every home sale in Orange County from 1988 through the early part of 2000. Because these data span a period that ranges from the early planning stages of the toll roads through the opening of most of the network, we expect to see house prices decrease with distance from the toll road in the later years of our data set, but not in the earlier years.

The toll roads are built and operated by the Transportation Corridor Agencies (TCAs), a special purpose government agency formed in 1986 with the sole purpose of building the roads. Portions of the toll road network exist in County planning documents that date to the 1970s. Yet it was not until the TCAs developed a plan to raise money primarily through tolls, first proposed in 1988, that the prospect of the roads became a serious possibility. Even then, construction started on a small, 7.3-mile portion, in 1990, and the rest of the network was built in stages beginning in 1993. The first part of the toll roads, the Foothill Corridor Backbone, was opened in 1993; the San Joaquin Hills Transportation Corridor opened in 1996, and later portions of the Foothill and Eastern Transportation corridors opened in 1999. Figure 1 shows the toll road network. Figure 1 also shows population density (as of 1990) for census block groups in Orange County, so that the toll road and highway networks can be viewed alongside existing development patterns. Table 1 lists each segment with the date that construction started and the date the construction was completed.

Even with some foresight on the part of home buyers, we expect that the market assessment of the likelihood that the roads would be built will rise over the early years of our data, implying that the full value of the toll roads would not be capitalized into house prices in 1988. For example, the San Joaquin Hills corridor was the subject of litigation until 1993. In all, the TCAs have opened fifty-one new centerline miles of toll highway in Orange County. Of those toll roads, the two segments the opened the earliest – the Foothill Corridor Backbone and the San Joaquin Hills Corridor – are the focus of this study, as they were built and opened in essentially the middle of the span of our data, providing a good comparison of accessibility values before and after the segments opened. For those roads, we expect to see no effect of distance to the toll road before some threshold year, but declining house prices with increasing distance from the road after the threshold.[4] Threshold years are chosen to reflect when the housing market most likely viewed the road as being likely to be built. Different threshold years were tested, as is discussed below.

[4] Based on Langley's results (1976, 1981) we exclude homes that are within a 1,125 of the toll road, to avoid confounding the value of access with noise and other disamenities that are experienced close to highways.

B. Population and Employment Growth Model

The second part of the empirical study in this report involves the use of a two-equation population and employment growth regression model to examine the link between highway access and urban growth in south Orange County. The model is briefly reviewed here. (See Boarnet, 1994 for a detailed description.)

The model follows a long tradition of intraurban population and employment location models (e.g. Bradford and Kelejian, 1973; Carlino and Mills, 1987; Mills and Price, 1984; Steinnes and Fisher, 1974). The observations, in the case of the Orange County research are census tracts in the county. The dependent variables are the change in population and employment in each tract.

The independent variables can be grouped into three classes - variables that measure transportation access, variables that measure non-transportation local amenities, and variables that represent the simultaneity between population and employment growth within an urban area. This latter point warrants some further discussion. Population changes within a census tract depend, in part, on employment changes in a surrounding labor market area. Employment changes within a census tract similarly depend on population changes within a surrounding labor market area. Those labor market areas are likely to be larger than census tracts, so that the simultaneity between tract population and employment links tract variables to variables measured over a larger area. The labor market variables are formed by taking weighted sums of values from surrounding census tracts. The formal implementation benefits from the ideas of spatial econometrics pioneered in, e.g., the work of Anselin (1980, 1988).

The motivation for the census tract population and employment growth model has its roots in bid rent theory, as developed, for example, in the well known urban location models of Alonso (1964), Mills (1972), and Muth (1969). For an excellent description, see Fujita (1989). Bid-rent models theorize that persons and firms will choose locations within urban areas based in part on the transportation access and other amenities found at those locations. Population and employment changes are inherently disequilibrium phenomena, as the equilibrium condition in bid-rent models is that persons and firms cannot improve their position by moving. Following Carlino and Mills (1987), the model census tract population and employment growth model links the disequilibrium phenomenon of differential census tract growth to equilibrium bid-rent theory through a lagged adjustment model. The lagged adjustment model assumes that census tracts adjust to equilibrium population and employment levels slowly, and that changes in tract population and employment are adjustments toward equilibrium. See Boarnet (1994) for a full discussion of the development of the model.

The model explains tract population and employment growth as a function of various tract characteristics, including socioeconomic and demographic variables and local amenities. In this research, a major extension from an earlier Orange County case study (Boarnet, 1999) is the inclusion of highway and toll road dummy variables in the transportation access class, which enter both population and employment growth equations as independent variables in the simultaneous system of equations. The "before/after" test of the impact of toll roads can be constructed by fitting this population and employment growth model on data from two time periods, before and after the opening of the toll roads. The "before" period is defined as the decade from 1980 to 1990, before the toll roads were open and before virtually all of the construction for those toll road began. The "after" period is the years from 1990 to 1997, which saw the development and opening of much of the toll road network. For the "before" period, the toll road dummy variable will measure access to a "phantom" road – a line on a map that represents where each toll road will be built. If the toll roads were built strictly to serve future growth, the toll road dummy variable should behave much the same way in the model in both "before" and "after" period. If, on the other hand, the toll roads alter urban growth patterns, the impact of the toll road should be reflected by changes in toll road dummy variables across the two time periods.

IV. House Sales Price Analysis

A. Data

Dataquick, Inc. provided information about physical characteristics of houses, such as dwelling size, lot size, number of bedrooms, number of bathrooms, and street address, and information on house sales, such as year of sale, price, and loan amount. Geographic Data Technology, Inc. and the California Department of Transportation provided GIS maps of Orange County's street network, which include the center lines of freeways, toll roads, and local roads, as well as the entrance and exit ramps of all grade-separated highways. Two major neighborhood characteristics are used in this study, namely crime rate and school quality. School quality was proxied by average SAT score. Crime rates were calculated based on data from California Department of Justice's Justice Statistics Center (1999) and the California State Department of Finance Demographic Research Unit (1999). SAT scores for Orange County were obtained from the Los Angeles Times (1999).

There are 367,841 records of single-family detached dwelling unit sales in Orange County from 1988 to the first quarter of 2000. We used Arcview-GIS to geocode the home addresses based on the street network map mentioned earlier, and selected only those that were perfectly matched, i.e. the street number is found on a street segment with the exact same name as in the address, and the house is matched to the correct block, side of street, and approximate location within the block. We tested several address matches by comparing the GIS match to published street maps to develop the methods and criteria for an exact GIS address match. See Table 2 for the distribution by year of the number of house transactions and those that were geocoded with a perfect address match. We also used Arcview-GIS to link the locational characteristics to each house. A school district and police department jurisdiction is assigned to each house by joining the house location from the address match to the both the school district and police department jurisdiction base maps. Then, an SAT score and crime rate were assigned to each house transaction based on the year of sale and the school district or police department jurisdiction associated with the house's location.

After the GIS processing of raw data, the data set was filtered for missing data, apparent data entry errors, and non-arms length transactions. We dropped all observations with missing key variables, such as size, lot size, and number of bedrooms and bathrooms. We also dropped observations with inconsistent data, such as a four-bedroom house with floor area less than 500 square feet or houses with more than 10,000 square feet and fewer than 4 bedrooms. As for non-arms length transactions, we dropped all observations with sales price less than $25,000 and observations with loan amounts greater than 125% of the sale price. See Table 2 for the distribution of number of observations by year after the inappropriate data were filtered out. After address matching and filtering inappropriate data, we were left with 275,185 sales in Orange County from 1988 to the first quarter of 2000.

B. Hedonic Price Regressions

We analyzed access to toll roads using a hedonic price analysis for corridors surrounding the two oldest segments of the toll road network – the Foothill Transportation Corridor Backbone (FTCBB) and the San Joaquin Hills Transportation Corridor (SJHTC).[5] The regression specification is shown below.

$$P = \alpha_0 + \alpha_1 SQFT + \alpha_2 Bedroom + \alpha_3 Bath + \alpha_4 Lotsize + \alpha_5 Age + \alpha_6 SATscore + \alpha_7 CrimeRate + a_8 DtrBefore + \alpha_9 DtrAfter \sum_{i=1}^{12} \beta_i YEAR_i + \varepsilon \quad (1)$$

Where P = home sales price
SQFT = size of dwelling, in square feet
Bedroom = number of bedrooms
Bath = number of bathrooms
Lotsize = size of lot, in square feet
Age = number of years since residence was constructed
SATscore = average SAT scores for the school district that contains the home
CrimeRate = total violent and property crimes per 1,000 residents in the municipality where home is located
$YEAR_i$ = Dummy variable for year of sale, ranging from 1988 (index "i" = 1) to 1999 (index "i" = 12); 2000 is the omitted year

We measured the effect of distance from the toll road with two variables, *DtrBefore* and *DtrAfter*. Both variables measure the straight-line distance from each house to the nearest toll road on-ramp.[6] *DtrBefore* measures distance to the nearest toll road on-ramp before a threshold year that was chosen to mark when the toll roads became a serious possibility. *DtrAfter* measures distance to the nearest toll road on-ramp in all years during and after the threshold year. Thus, *DtrBefore* and *DtrAfter* are defined as shown below.

DtrBefore = Dtr*(1 – ThresholdDummy)
DtrAfter = Dtr*ThresholdDummy
Where Dtr = straight-line distance from each house to the nearest toll road on-ramp

[5] The corridors now carry the names of routes of the state highway network. The San Joaquin Hills corridor is the southern extension of State Highway 73, the Foothill corridor is State Highway 241, and the Eastern corridor is a combination of an extension of State Highway 133 and portions of State Highways 241 and 261. To avoid confusion with pre-existing portions of the state highway network, we refer to the corridors by name rather than number, and so will use FTCBB and SJHTC to refer to those two corridors, respectively.

[6] Visual examination of GIS maps confirmed that straight-line distance is strongly correlated with street network distance. This is due in part to the relatively dense network of surface streets in the corridors that we studied. Because we are testing the hypothesis that distance from the toll road is reflected in house values, a good proxy for driving distance will suffice if the hypothesis test is accepted. For that reason, and due to the additional computational difficulty of calculating road network distance, straight-line distance was used for this analysis.

ThresholdDummy = 0 for all home sales that occur before the threshold year; 1 for sales in the threshold year and in subsequent years.

Threshold years are defined both on an *a priori* basis and by analyzing which definitions of threshold years yielded regressions with a maximum log-likelihood value.

The variables in the hedonic regression include structure-specific characteristics (*SQFT*, *Bedroom*, *Bath*, *Lotsize*, and *Age*), neighborhood characteristics (*SATscore*, *CrimeRate*), year dummy variables to control for the real estate cycle, and the toll road distance variables that are the focus of this analysis. The structure-specific and neighborhood characteristics are similar to those used in other hedonic studies (e.g. Dipasquale and Wheaton (1996); Haurin and Brasington (1996); Li and Brown (1980)). The structure-specific variables include all variables in the Dataquick data set that were reported with a frequency and reliability that allowed them to be used in this study.[7] The neighborhood variables, *SATscore* and *CrimeRate*, were included to control for two local characteristics that can affect house prices. Homes were address matched to school districts and municipalities, and then the *SATscore* and *CrimeRate* data for the appropriate year was matched to each sale.

We analyzed sales prices in corridors around the FTCBB and SJHTC both to isolate property markets that were internally homogenous and to focus on areas that would be most likely to experience improvements in accessibility from the toll roads. Initial analyses on the full Orange County data set suggested that the hedonics for different sub-markets behave differently. For example, the price of properties within several miles of the coast is strongly affected by distance from the coast. Also, the markets in the northern and southern half of the county behave differently both in relation to the time-series properties and in relation to specific hedonic characteristics. Lastly, we expected accessibility from the toll road to be reflected primarily in prices of homes along the toll road corridors.

The corridor around the FTCBB was chosen to include all homes that were closer to a FTCBB on-ramp than to any other toll road or highway on-ramp. There were only 123 home sales within 1,125 feet of the FTCBB, out of 29,197 sales in the FTCBB corridor, and so whereas for other corridors we explicitly excluded homes with 1,125 feet of an on-ramp we did not exclude those few homes for the FTCBB. Unlike other corridors, we did not impose a maximum distance cutoff for the FTCBB. The FTCBB corridor is somewhat more isolated from the rest of the highway network. Of the sales within the FTCBB corridor, approximately 95% of were within three miles of an on-ramp. The corridor for the SJHTC included all homes more than 1,125 feet from a SJHTC on-ramp and less than two miles from a SJHTC on-ramp. The two mile limit was imposed to isolate areas near the SJHTC and to avoid places that might be close enough to the parallel Interstate 5 that improvements on that highway would confound the

[7] For example, the variables that denote swimming pools, view properties, and garages were missing in well over half of the observations.

analysis.[8] Also, homes that were closer to an on-ramp on Interstate 5 than to a SJHTC on-ramp were excluded from the analysis, to reduce the potentially confounding influence of the parallel Interstate 5 corridor.

C. Structural Tests

The literature on hedonic price analyses includes both linear and log-linear specifications. Huang (1994) concludes that there is no single dominant hedonic price specification, and we followed common practice by using a Box-Cox test to examine the relative performance of linear and log-linear specifications of the regression in Equation (1). In the log-linear specification, the log of all variables was used in the regression. Because the year dummy variables take on a value of zero, the Box-Cox regressions were run separately for each year. Homes with *Age* equal to zero were dropped from the log-linear specifications and thus from the Box-Cox tests.

To compare the performance of linear and log-linear specifications, we normalized the original data by their geometric means. Pindyck and Rubinfeld (1991) showed that MLE and OLS yield the same results with normalized data. The OLS results of the normalized data for linear and log linear forms can therefore be compared directly, and the best-fitting model with the highest adjusted R^2 is chosen as the preferred specification. For the FTCBB, the linear specification is preferred in all years other than 1989. For the SJHTC, the linear specification is preferred in seven of thirteen years – 1991 through 1996 and 1998. Based on these results, we used linear specifications for both the FTCBB and the SJHTC. Because the log-linear specification requires excluding new homes (which have *Age* equal to zero) – and because new homes are approximately one-fifth of all sales in the SJHTC corridor – we felt that the linear specification should be preferred even in the case of the SJHTC, for which the Box-Cox test gave more ambiguous results about the appropriate specification.

We first chose threshold years to reflect the time when the housing market was most likely to view the completion of the two segments of toll road as a certainty. The results are shown in Table 3. For the FTCBB, we chose two thresholds – one year before construction began (1989) and the year construction began (1990). The SJHTC was the subject of litigation until early 1993, and so we chose 1993 as the threshold for that corridor.

D. Regression Results and Discussion

Looking first at the structure-specific variables variables, Table 3 shows that larger homes sold for a higher price, homes with more bedrooms sold for less in both the FTCBB and SJHTC corridors, more bathrooms increased sales price, older homes sold

[8] The Interstate 5 corridor parallel to the SJHTC was improved substantially in the mid-1990s, and thus we wish to attempt to isolate areas where the effect of the SJHTC is likely to dominate the effect of improved accessibility on Interstate 5.

for less near the FTCBB and for more near the SJHTC.[9] Homes in school districts with higher SAT scores sold for more in the SJHTC corridor but for less near the FTCBB. Higher crime rates had no significant impact on sales prices near the FTCBB but were associated with higher sales prices near the SJHTC. Both the SJHTC and the FTCBB corridors are in low-crime, upper income areas with good schools. The "wrong signs" on the *SATscore* and *CrimeRate* variables likely reflect the small variation in those variables in the corridors that we examined and the fact that variations in those variables are correlated with other, unmeasured aspects of geographic desirability. Lastly, distance from the coast (in feet) was included for homes in the SJHTC corridor, and as expected the effect is negative – homes sold for more than $60,000 less with each mile from the coast.

The year dummy variables show the time pattern of home prices in southern California. Home prices appreciate rapidly in the late 1980s, lost value in the recession years of the early 1990s, and began to appreciate again in 1995 for the FTCBB corridor and 1997 for the SJHTC corridor.

The distance variables show the expected pattern – a negative gradient appears after the threshold year for both the FTCBB and the SJHTC. Specifically, the coefficients on *DtrBefore* are insignificant and the coefficients on *DtrAfter* are significantly negative in all three regressions. After the threshold year, home prices decrease, *ceteris paribus*, by approximately $1.30 per foot (almost $7,000 per mile) from the FTCBB, and by approximately $4.50 per foot (or almost $24,000 per mile) from the SJHTC.

E. Selection of Threshold Year

While the results in Table 3 suggest that the toll roads created an accessibility premium, and by inference could have contributed to changing development patterns, we prefer to also analyze different threshold years. We defined threshold years for both the FTCBB and SJHTC that ranged from 1989 to 1998. This allows us to examine every possible threshold year without choosing the endpoints of our data.[10] We ran the regression in equation (1), allowing the threshold year to take on values from 1989 through 1998, and then chose the threshold year that yielded the largest log-likelihood

[9] The negative coefficient on *Bedroom* is indicative of a higher-priced, luxury home market, with larger homes that have relatively few bedrooms. Local real estate experts and persons familiar with the Dataquick data agreed that house prices in south Orange County are more influenced by dwelling size than by the number of bedrooms, and that the negative coefficient on *Bedroom* was not surprising. The positive effect of *Age* near the SJHTC was likely due to the generally young age of homes in the area. For example, real estate experts suggested that new homes, when sold in a resale market, often show price increases due to improvements such as landscaping that are not reflected in the price of the new home.

[10] Choosing endpoint years would create a considerably unbalanced test, as the number of observations in the endpoint year would be substantially smaller than the number of observations in all other years, creating some concern that statistical results could be driven by those differences in the number of observations. Also note that, given the span of the data, it is unlikely that the effect of the toll roads would be first felt at either endpoint year. Lastly, note that given that the data for 2000 include only the first couple of months, we regard 1999 as the endpoint year for the data for purposes of this analysis.

value. This allows the data to suggest which threshold year gives the best explanatory power. Log-likelihood values for threshold years for the corridors are shown in Table 4.

The log-likelihood surface is quite flat, suggesting that the choice of threshold year has little impact on the overall explanatory power of the hedonic regression. Of course, the choice of threshold year can matter somewhat more for hypothesis tests on the *DtrBefore* and *DtrAfter* variables, and so it is reassuring that the maximum likelihood technique gives results that are generally consistent with the results in Table 3.

For the FTCBB, the maximum log-likelihood value is attained when the threshold year is 1993. Table 5 shows the coefficients and t-statistics for the *DtrBefore* and *DtrAfter* variables for each threshold year, so that one can see how the hypothesis tests are affected by the choice of threshold year. For a threshold year of 1993, the coefficient on *DtrBefore* is insignificant and the coefficient on *DtrAfter* is significantly negative – consistent with the FTCBB creating a negative house price gradient with distance from the toll road. Note that the magnitude of the accessibility affect is larger for a threshold year of 1993 than for threshold years of 1989 or 1990. Also note that, from Table 5, the hypothesis of an insignificant *DtrBefore* coefficient and a negative *DtrAfter* coefficient is confirmed for any threshold year on or before 1993. Construction on the FTCBB began in 1990, and the first segment of that portion of toll road opened in 1993, so the significantly negative coefficient on *DtrBefore* for later threshold years likely reflects that the accessibility of the FTCBB is captured in both the *DtrBefore* and *DtrAfter* variables for years after 1993. Overall, the results in Table 5 strongly support the hypothesis that the FTCBB created an accessibility premium that previously did not exist in that corridor.

For the SJHTC, the results in Table 4 show that 1997 is the threshold year that maximizes the regression log-likelihood value. The SJHTC opened in November of 1996. Looking at the results in Table 5, the coefficients on *DtrBefore* and *DtrAfter* are the opposite of our hypothesis for a 1997 threshold – *DtrBefore* is significantly negative in that year and *DtrAfter* is not significant. Looking at how the coefficients and hypothesis tests vary with different threshold years, the coefficient on *DtrBefore* is generally insignificant for thresholds before 1994, while *DtrAfter* is generally significantly negative. The exception is a significantly negative *DtrBefore* for a 1990 threshold. For 1994 and later threshold years, the pattern is reversed, with *DtrBefore* being significantly negative while *DtrAfter* is not significant. We believe these results reflect, at least in part, the effect of substantial improvements that were completed in the nearby Interstate 5 corridor in the mid-1990s.

The interchange between Interstates 5 and 405 – a major peak hour traffic bottleneck in this region – was substantially improved and capacity in the interchange was increased during the mid-1990s. The Interstate 5 corridor is an alternative commute route for many residents in the SJHTC corridor. To the north and east of the SJHTC corridor, homes further from the SJHTC are closer to Interstate 5. Thus one explanation for the insignificant coefficient on *DtrAfter* for later threshold years is that the expected negative price gradient with distance from the SJHTC is confounded with the negative price gradient, in the opposite direction, from the improved Interstate 5 corridor. Overall, the approximately contemporaneous improvements in the parallel Interstate 5 corridor make it more difficult to isolate an accessibility premium associated with the SJHTC than with the FTCBB. Also, the improvements in the Interstate 5 corridor suggest that earlier threshold years, before the Interstate 5 improvements were completed, might better isolate the premium from the SJHTC. Lastly, if home buyers anticipated the completion of the SJHTC, a threshold as late as 1997 could include some portion of the accessibility premium in the *DtrBefore* coefficient. For all these reasons, we believe earlier threshold years give more reliable information on the effect of the SJHTC, and for threshold years before 1994 the results are generally consistent with what was found for the FTCBB.

F. State Route 22: The Controlled Corridor

Lastly, to verify our method, we use our technique to examine a corridor that had no substantial capacity improvements during this time period. We chose the State Route (SR) 22 corridor in northern Orange County. According to Caltrans, the SR-22 had no important increases in capacity during the study period. We ran the regression in equation (1) on sales farther than 1,125 feet from the SR-22, but less than two miles from SR-22, defining *DtrBefore* and *DtrAfter* based on threshold years as was done for the FTCBB and SJHTC. Of course the threshold years do not reflect real changes in capacity, and so we expect there to be no meaningful difference in the coefficients on *DtrBefore* and *DtrAfter*. We examined the SR-22 to verify that the "before and after" test does not generate differences in price gradients for corridors where no difference should exist.

In Table 3, we chose 1993 as a threshold year for the SR-22, as that year is approximately in the middle of the data. The coefficients on *DtrBefore* and *DtrAfter* are both insignificant, implying no difference in the effect of distance from the highway before and after the admittedly arbitrarily chosen threshold year. In Table 5, we show the coefficients and t-statistics for *DtrBefore* and *DtrAfter* for threshold years that range from 1989 through 1998. The coefficients on both distance variables are insignificant for all threshold years, providing robust evidence that the "before and after" test gives no evidence of a change in price gradient for an unimproved corridor. This provides some reassurance that the changes in price gradient for the FTCBB and the SJHTC are associated with the construction of those toll road segments, and not with any statistical artifact of the analytical technique.

G. Multiple Sales Price Analysis

An alternative method of analyzing house price changes is to develop indices based on multiple sales of the same property (e.g. Bailey, Muth, and Nourse (1963); Case, Pollakowski, and Wachter (1991)). The advantage of this technique is that it controls for any time-invariant characteristics of the property or location, including characteristics that cannot be measured in the data set. When applied to an event study such as the construction of the toll roads, it is typical to develop multiple sales price indices for two areas – an area near the toll road (a treatment group, borrowing terminology from standard research design literatures) and an area more distant from the toll road (a control group). For an example of this technique applied to the Miami rail transit system, see Gatzlaff and Smith (1993).

The treatment and control groups must be chosen by the researcher, and should be as similar as possible for all characteristics other than the event being examined. For our purposes, this implies choosing areas near the toll road corridor and more distant from the corridor that are otherwise similar. Choosing areas near and very distant from the toll road, while that clearly creates a stark difference in toll road accessibility across the two groups, also risks comparing areas that are not otherwise similar. In particular, the toll road corridors generally run through middle and upper income areas in the rapidly growing suburban fringe of south Orange County. Past research has demonstrated that prices indices in different locales appreciate differently, in ways that appear to be linked to characteristics of the neighborhood (Case and Mayer (1996); Case and Shiller (1994); Mayer (1993); Smith and Tesarek (1991)). For example, preliminary analysis of our data suggested that south Orange County emerged earlier and more strongly from the depressed real estate market of the early and mid-1990s. For those and other reasons, we chose control and treatment groups that are relatively close to each other, so that the two groups would likely differ only in access to the toll roads.

For both the FTCBB and the SJHTC, the treatment group is homes between 1,125 feet and one mile from the nearest toll road on-ramp. The control group is homes between two and three miles from the nearest toll road on-ramp. More dramatic variation in distance from the toll road, and thus toll road access, would have allowed a more stark comparison, but given the development patterns in Orange County we felt that choosing homes further than three miles from the toll road risked comparing control and treatment groups that were not sufficiently similar.

For both the FTCBB and SJHTC, we developed multiple sales price indices for homes in the nearby (1,125 feet to one mile) and more distant (two to three miles) corridors. Given that the FTCBB and SJHTC were constructed and opened during the span of our data, we expect nearby homes to get a larger accessibility premium and thus appreciate faster than homes in the more distant corridor.

Following Gatzlaff and Smith (*33*), the regression for developing the sales price index is shown below.

$$\ln(P2_i/P1_i) = ß_1(Y88_i) + ß_2(Y89_i) + \ldots + ß_3(Y00_i) + e \qquad (2)$$

where P1 = first sale for the same property
- P2 = second sale for the same property
- Y88 = dummy variable equal to –1 if first sales was in 1988, 1 if second sale was in 1988, 0 otherwise
- dummy variables for Y89 through Y00 correspond to the years 1989 through 2000, and are defined similarly to Y88
- e = regression error term

Sales price indices for the nearby (1,125 feet to one mile) and more distant (two to three miles) corridors around the FTCBB are shown in Table 6. The indices for the FTCBB are graphed in Figure 2. Note that the nearby index appreciates more rapidly during the last few years of our study period. This is consistent with the toll road creating an accessibility premium that caused nearby houses to appreciate more rapidly during the study period.

The price indices in Table 6 are derived from the regression coefficients, shown in Appendix 1. Because the coefficients are point estimates, the price indices and similarly the change in price indices for the nearby and more distant corridors are also estimated from the data. We examined whether the change in the regression coefficients from 1988 through 2000 was significantly different across the two corridors. In Table 7, we show the change in the regression coefficient from 1988 to 2000 (the coefficient on the 2000 dummy variable minus the coefficient on the 1988 dummy variable) and the standard error of that change. We also show the 90 percent and 95 percent confidence intervals for the change in coefficients from 1988 to 2000 for both the nearby and the more distant corridors. Note that the 90% confidence intervals for the change in year coefficients do not overlap, implying that the changes in the year coefficients, and hence house price appreciation, is significantly different for the nearby and more distant FTCBB corridors at the 90 percent confidence level.

Also in Table 6, we show the price indices for the nearby (1,125 feet to one mile) and more distant (two to three miles) corridors around the SJHTC toll road. A graph of those price indices is shown in Figure 3, and the coefficients from the estimating equation for the nearby and more distant SJHTC corridors are shown in Appendix 2. Note from Table 6 and Figure 3 that the index for the nearby corridor is higher than the index for the more distant corridor until 1996. In 1996 and later years, the more distant corridor has a higher price index. In Table 7, we show the change in the regression coefficient from 1988 to 2000 for both the nearby and more distant corridors, the standard error of that change, and the 90 and 95 percent confidence intervals for the change in year coefficients over the study period. The 90 percent confidence intervals for the nearby and more distant corridors for the SJHTC overlap, implying that there is no statistically significant difference in appreciation of homes across the nearby (1,125 feet to one mile) and more distant (two to three miles) corridors around the SJHTC from 1988 to 2000.

Overall, the results from the multiple sales price method show evidence that the FTCBB positively influenced the appreciation of nearby homes, but give no similar evidence for an effect of the SJHTC on home price appreciation. It is important to note that the multiple sales price method is especially limited when applied to the SJHTC corridor. The multiple sales price technique requires that the two corridors (nearby and more distant) be identical on all characteristics other than access to the toll road. For the SJHTC that assumption is problematic. The SJHTC is approximately four to five miles from the Coast, such that homes south of the SJHTC are almost certainly influenced by the desirability of Coastal locations. Similarly, homes in the "more distant" corridor to the north of the SJHTC are within a few miles of the I-5 corridor, and could have benefited from the improvements in capacity on that corridor that occurred at roughly the same time that the SJHTC opened. Overall, we find it very difficult to believe that the nearby and more distant corridors around the SJHTC provide a good "controlled experiment" that holds factors other than toll road access constant. In that regard, the FTCBB provides a more clean experiment, and we also prefer to give more weight to the hedonic regressions for both the FTCBB and the SJHTC, since the hedonic analysis allows some ability to control for potentially confounding factors. We conclude that the multiple sales price technique for the SJHTC illustrates the difficulty of finding good "control" and "experimental" corridors around that toll road, and we are persuaded by the evidence from the cross-sectional regressions and the multiple sales price technique for the FTCBB that the toll roads created an accessibility premium that is reflected in home sales prices beginning approximately in the mid-1990s.[11]

[11] As in the cross-sectional regression analysis, we also used the multiple sales price technique to examine price indices in nearby (1,125 feet to one mile) and more distant (two to three mile) corridors around the SR-22. As we expected, the price indices for the nearby and more distant corridor for the SR-22 tracked each other very closely and the change in the year dummy variables for the nearby and more distant corridors were not statistically significantly different from each other. The SR-22 does not have the confounding influences of coastal access and proximity to other parallel and improved corridors, and so the results of the multiple sales price technique applied to the SR-22 suggest that there is no change in accessibility premium associated with that road during the study period, as expected since that corridor had no important capacity improvements from 1988 to 2000.

V. Population and Employment Growth Model

The second component of the empirical study in this report involves the simultaneous population and employment growth regression model that was developed by the principal investigator (Boarnet, 1994 and 1999). The model and the empirical study based upon it have been extended to examine the link between highway access and urban growth in south Orange County by expanding the period of study to cover the period after the toll roads were opened and including highway access variables as explanatory variables for growth. We also improved the performance of the original model by testing various alternative specifications as well as by improving the definitions of the variables. The results of this case study can provide additional evidence to buttress our conclusion about induced travel demand that we have drawn in the previous sections.

We review the original model in the next section. Then, we describe extensions and changes that we made to the model in section B. Data sources are discussed in section C, and econometric results in section D. Finally, we conclude with a discussion of the results in section E.

A. Overview of Population and Employment Growth Model

The derivation of the two-equation population and employment growth model can be found in Boarnet (1994 and 1999). The original system of population and employment growth equations is given by.

$$\Delta\mathbf{POP}_t = \mathbf{X}_{t-1}\mathbf{ß}_1 + \alpha_1(\mathbf{I}+\mathbf{W})\mathbf{EMP}_{t-1} + \frac{\alpha_1}{\lambda_e}(\mathbf{I}+\mathbf{W})\Delta\mathbf{EMP}_t - \lambda_p\mathbf{POP}_{t-1} + \mathbf{u} \quad (3)$$

$$\Delta\mathbf{EMP}_t = \mathbf{Y}_{t-1}\mathbf{ß}_2 + \alpha_2(\mathbf{I}+\mathbf{W})\mathbf{POP}_{t-1} + \frac{\alpha_2}{\lambda_p}(\mathbf{I}+\mathbf{W})\Delta\mathbf{POP}_t - \lambda_e\mathbf{EMP}_{t-1} + \mathbf{v} \quad (4)$$

where
? $\mathbf{POP}_t$ = population growth from time period *t-1* to *t*
? $\mathbf{EMP}_t$ = employment growth from time period *t-1* to *t*
$\mathbf{POP}_t$ = population in time period *t*
$\mathbf{EMP}_t$ = employment in time period *t*
X = a matrix of location characteristics that affect population growth
Y = a matrix of location characteristics that affect employment growth
I = (n x n) identity matrix
W = (n x n) weight matrix
u and **v** = a vector of i.i.d. normal disturbances

In both equations, the subscripts *i*, referring to a census tract on which a labor market is centered, are suppressed. The matrices **X** and **Y** capture various characteristics of census tracts at the beginning of the period of study. These include variables that may affect population and employment growth, such as demographic characteristics, housing stock, location-specific amenities, etc. In addition, the land use variables, such as amount of residential land, commercial and office, etc., were included to reflect such location characteristics as constraints imposed by local government's zoning regulations. Lastly, places dummy variables were used to control unobserved characteristics of municipalities and census defined places. Together, these variables determine how persons and firms locate within a metropolitan area. The lists of variables are given in Tables 8 to 10.

The weight matrix **W** reflects the relationship between a census tract on which the labor market is centered and neighboring census tracts, determined to be within the same labor market. The five specifications of **W** are described briefly here. See Boarnet, Chalermpong, and Geho (2002) for more detailed discussion.

(0, 1) neighbor matrix
Element w_{ij} equals one if tracts i and j border each other and zero otherwise.

(0, 1) neighbor matrix (normalized)
Similar to (0, 1) neighbor matrix but the elements are row normalized

(0, 1) distance-based matrix
Element w_{ij} equals one if the distance between the centroid of tracts i and j is less than 10 miles and zero otherwise

Weighted inverse distance-based matrix
Element w_{ij} equals $(d_{ij})^{-\alpha}$, where d_{ij} is the distance between tracts i and j, and α is set equal to 0.67 as was used in Boarnet (1992).

Tract-to-tract flow matrix.
Element w_{ij} equals the commute (journey-to-work) flows between tracts i and j. The tract-to-tract flows data were obtained from the STP154 from the Bureau of Census.

Given the definition of **W**, population (employment) growth can be explained, partly, by the initial level of population (employment) in the labor market, defined by **W**.

B. Specification Issues

Periods of analysis

To examine the growth impact of toll roads, we applied the population and employment growth model reviewed in the previous section to the periods "before" and "after" the toll roads were opened. The years between 1980 and 1990 are the "before" period, and the years from 1990 to 1997 are the "after" period for purposes of fitting the population-employment growth model. Note that there is little reason to suspect that land markets anticipated the construction of the toll roads much before 1990, since the TCAs had no viable funding mechanism until 1988, and the house price analysis in the previous section shows no evidence of the roads producing an accessibility premium that is reflected in house prices until, at the earliest, 1990. In the house price analysis, the evidence for an accessibility premium is not consistent until 1994.

Highway access dummy variables

To explicitly account for the impact of highway accessibility on population and employment growth, we included a dummy variable that reflects the presence of highways as an additional independent variable in the matrices of location characteristics (**X** and **Y**) in both equations. More importantly, we also included a similar dummy variable for toll roads. These dummy variables take a value of one if a census tract contains (at least) one centerline of highway (or toll road), and zero otherwise. As mentioned earlier, the toll road dummy variable, which is the key to the empirical test, is included in both "before" and "after" growth model even though the toll roads exist only in the "after" period. The statistical significance of the toll road dummy variable in each period from these estimations reflects the impact of the new highways on development patterns in southern Orange County. If, for example, the coefficient of the toll road dummy variable is statistically and positively significant in both periods, we may interpret this result as evidence that the toll roads were constructed in anticipation of the growth. On the other hand, if the coefficient is not significant in the "before" period, but becomes significant in the "after" period, we may conclude that the toll roads trigger the growth. The empirical results will be discussed more fully in section D.

Land use variables

We used measures of land use as independent variables in the regression, in part to proxy for local attitudes toward development. These variables are based on the 1990 land use classification developed by Aerial Information Systems, Inc. Ideally, the land use variables should reflect the initial development condition of census tracts. Therefore, the 1990 data may not be suitable for the "before" period of study, which began in 1980. However, we used these variables in some of our specifications in the "before" period as the proxy for the land use variables in the desirable year that we lack.

In the original specification, we use the amount of land devoted to certain uses as explanatory variables. For example, an amount of agricultural and vacant land may reflect the potential for development and population and employment growth. A large amount of land occupied by single-family detached housing units may signify residential zoning, and therefore may indicate an openness to further population growth. Reasoning that the *amount* of land devoted to certain activities may not fully capture development potential, we explored another specification of these variables, i.e., the ratio of the amount of land devoted to certain uses relative to the total land area in a given census tract. In this way, a census tract with a large fraction of vacant land may be more likely to experience faster growth. A census with high fraction of commercial or retail land use may have strong agglomeration economies and may therefore experience higher employment growth.

In the other strand of specifications, we omitted the land use variables altogether. This specification is used to test the explanatory power of the land use variables.

Additional explanatory variables

We attempt to explain the impact of agglomeration benefits on employment growth with the proportion of employment by industrial sector in each tract. However, the data on employment at such a disaggregate level is quite limited, and we could only acquire the retail employment data by census tract. Yet, we feel that it is important to include some proxy for agglomeration in the growth equations. Therefore, the ratio of retail employment to total employment in the initial year of each period (1980 in the "before" and 1990 in the "after" periods) was included as an exogenous variable in the employment equation's location characteristics matrix, **Y**.

Alternative definitions of dependent and explanatory variables

We also estimated a version of the model using population and employment densities. Reasoning that the growth relationship may be in the form of density, we hypothesized that the change of population (employment) density in a given tract depends on the initial population (employment) density of the labor market, and so on. However, the results obtained when using this definition of dependent and explanatory variables yielded poor results, prompting us to abandon this specification.

Improving the performance of the model

Following earlier studies (Boarnet, 1994, 1999), we employed several demographic, socioeconomic, and housing variables, to construct the location characteristics matrices, **X** and **Y**. These include proportion Hispanic and Black persons, percentage of housing stock built prior to 1940 and 1960, and several land use variables, defined as total tract area in a given use. We also included dummy variables for census places to control unobserved characteristics within places, such as crime, property tax rates, and school quality. See Tables 8 through 10 for the list of variables. In addition to these variables, we made several changes to the specification of the model to improve its performance. These are discussed below.

In the original specification, we attempt to explain the growth of dependent variables (population and employment) by the level of those variables at the beginning of the study period. This is according to the theoretical model discussed earlier. In this case, the dependent variable is an absolute growth over the period, i.e., population (employment) growth between 1980 and 1990 for the "before" period and 1990 and 1997 for the "after" period. The independent variables are the initial level of the dependent variables for each period, i.e., population (employment) in 1980 for the "before" period and 1990 for the "after" period.

To control for the impact of regional economy, we also examined an alternative definition of dependent variables that we call "growth fraction". Growth fraction is defined as the share of total growth in the county and is therefore a relative measure of growth that isolates the county-wide trend. For example, the population growth fraction is defined as population change in a census tract divided by total population change in the county over a study period. If the toll road has no impact on population and employment growth, we should not be able to explain the variation of growth fraction by the presence of the toll road.

C. Data

The data that we used to estimate the population-employment growth equations include employment and population, housing stock age, demographic and land use data, as well as the five specifications of weight matrices. The entire analysis is based on 1980 census tracts; for the "after" period (1990 to 1997), the 1990 tract definitions were converted to 1980 tract definitions, to allow consistency in the model specification across time periods. Since we used the same geographic unit of observation, i.e., the 1980 census tract, the weight matrices that reflect spatial relationship between census tracts are the same in both "before" and "after" periods.

We obtained additional data that were used to estimate the population-employment growth equations for both periods from two different sources. First, the Southern California Association of Governments (SCAG) provided employment and population data for 1997 as well as 1980 and 1990 retail employment. Since the data are available by 1990 census tract, similar procedures as those in the original case study were used to convert the data into 1980 census tract for consistency and comparability between the 1980-1990 and 1990-1997 analyses. Second, GDT, Inc. provided GIS maps (similar to the one used in previous sections) for ArcView spatial analysis. The procedure yielded highway and toll road dummy variables. Of the 415 census tracts in Orange County, 162 tracts contain at least one highway centerline and 16 tracts, mostly in the southern part of the County, contain at least one toll road centerline.

D. Regression Results and Discussions

The estimation results of population-employment growth equations are presented in Tables 11 through 26. There are four tables for each specification. The first two tables are a system of population-employment growth equations for the "before" period (1980-1990) and the second two are for the "after" period (1990-1997). In each table, there are five columns, each one for a specification of the neighbor weight matrix, **W**.

Without Land Use Variables Specification

Tables 11 through 14 show the regression results of the specification, in which land use variables were not used. We used the original definition of the variables, i.e., the level of population and employment. Due to the poor performance of this specification (without land use variables), especially in the employment equations, we decided to use land use variables in the rest of our specifications.

Level I Specification

In the regression results reported in Tables 15 through 18, population and employment variables are in levels or absolute changes. This specification is called

"Level I". Land use variables are in the absolute amount of land devoted to certain activities. The major differences are the inclusions of percentage of retail employment, toll road and highway dummy variables. These are the key difference from the original work that will be present in the rest of the specifications. Another difference is the exclusion of residential land use variables (lu1110, lu1120, and lu1140) from the population equation. We reasoned that since the land use data is from 1990 (the last year of the "before" period), the amount of residential land at the end year may not be a good explanatory variable over the ten year period prior to that year.

In general, the performance of this family of specifications is good. Note the substantial improvement over the "without land use" specification in employment equations. In both systems of equations (before and after), land use variables are generally highly significant in all equations. In the 1980's system, the coefficient of 1980 population has the wrong sign, as the lagged adjustment model requires a negative coefficient on that variable for the system to be dynamically stable. The issue of stability in lagged adjustment models has received considerable attention, much of which is beyond the scope of this research. Various studies have found coefficients that do not imply dynamic stability, but the robust results reported in this study for coefficients on the toll road variable provide reason to believe that issues of model specification will not influence the conclusions of this research. For a further discussion of stability in population and employment growth models, see Boarnet, Chalermpong, and Geho (2002).

The coefficient on the toll road dummy variable in the population equation is positively significant at a 95% significance level for all specifications of **W**. This coefficient, however, is negatively significant in the family of employment equations. The coefficients on the highway dummy variable are not statistically significant in both the population and employment equations for any specifications of **W**. Turning to the 1990's system, we found the general pattern of coefficients similar to the 1980's period. An important difference is that the coefficient on the toll road dummy variable switched sign in all employment equations except for the flow matrix specification for **W**. The statistical significance of this variable, however, decreased. On the other hand, the coefficients on the toll road dummy variable are still positive and statistically significant in all specifications of **W**. The significance level of this variable also increased in all population equations.

Level II and Level III Specifications

We report the estimation results of two alternative specifications, closely related to the previous one, in Tables 19 through 26. In the first alternative specification – Level II, reported in Tables 19 through 22, the only difference is that we left out all land use variables but the ones that reflect the amount of developable land – agriculture and vacant land. In the other specification – Level III, reported in Tables 23 through 26, we included commercial and industrial land use variables (lu1210 through lu1340) as a ratio of land devoted to those uses divided by total land in the census tract. The estimation of both of these specifications, Level II in particular, produced poor fit in the employment equations.

E. Interpretation of the Regression Results

We originally intended to choose a preferred specification from the four different specifications in Tables 11-26. A decision about which specification should be preferred can be based on various regression diagnostics, including the R-squared, the signs of the coefficients on the lagged values of population and employment (which relate to the structure of a lagged adjustment model that forms the basis for equations 3 and 4, as discussed in Boarnet, 1994 and Boarnet, Chalermpong, and Geho, 2002), the performance of the different W matrices, and other diagnostics that can be applied to the regressions. Preliminary analyses suggested that determining a preferred specification would be complicated, and more detailed analysis was beyond the scope of this research. Thus, the interpretations offered here are based on all the regression results.[12]

The coefficients on the toll road variables display a remarkably stable pattern across all four specifications. Hence, a decision about preferred specification is unlikely to affect the interpretation offered here. Summarized briefly, the coefficient on the toll road dummy variable in the population change regression is typically positive and significant in both the "before" (1980-1990) and "after" (1990-1997) time periods. The coefficient on the toll road dummy variable in the employment change equation is typically negative and significant in the "before" (1980-1990) time period, but that same coefficient is typically insignificant in the "after" (1990-1997) time period. The toll road corridors were, *ceteris paribus*, areas of high population growth both before and after the toll roads were built. Yet the corridors were areas of low employment growth before the toll roads were built, while those same corridors showed employment growth that, controlling for other factors, did not differ from the county average after the toll roads were built.

This provides evidence that the toll roads changed the pattern of employment growth in Orange County. Note that the model in equations (3) and (4) is a simultaneous model, such that employment growth is estimated based on, among other things, population growth in a surrounding labor market area. Thus the finding that the toll roads influenced employment growth holds while controlling for the pattern of population growth. The influence of the toll roads on employment growth which can be inferred from the regression results is not simply due to the fact that employment followed population to the growing corridor areas. The influence inferred from the changing sign and significance on the toll road dummy variable in the employment equation can be credited to the toll roads even after controlling for contemporaneous population growth.

Interpreting further, one might conclude that the toll roads were located in areas of pre-existing high population growth, which suggests that the roads were placed where growth would occur in the future. Yet once the roads were built, there is evidence that

[12] In later work, we have examined in more detail various specification issues related to the model in equations (3) and (4). See Boarnet, Chalermpong, and Geho (2002).

the existence of the toll roads exerted an independent effect on employment growth in the census tracts that contained the toll highways. Thus even if, as the regressions suggest, the toll roads were built in areas that were growing rapidly for other reasons, the construction of the roads appears to have altered the growth pattern, and in particular the employment growth pattern, in the toll road corridors.

VI. Conclusion

The empirical analysis of house sale prices provides evidence that the construction of the first two portions of the Orange County toll road network created accessibility premia that are reflected in home sales prices analyses. The evidence is especially strong in that regard for the FTCBB, and the evidence suggests that the accessibility premium for that road shows up with increasingly large magnitudes up until the time that the first portion of the FTCBB opened. This is consistent with what standard urban and land use theory would predict. While the evidence of an accessibility premium is less strong for the SJHTC, we conclude that much of the ambiguity in the statistical results for that corridor is caused by other confounding factors that are correlated with distance from the SJHTC toll road. It is encouraging that the hedonic regressions, which allow some ability to control for confounding influences, give evidence of the appearance of an accessibility premium after the litigation over the SJHTC had concluded.

The population-employment growth regressions provide evidence that the toll roads altered the pattern of employment growth nearby. The toll road corridors were, controlling for other factors, low employment growth areas before the roads were built, while employment growth in the corridors typically did not differ from other areas in the county (again controlling for other factors) after the toll roads were built. Coupled with the evidence from the house price analysis, this is strong support for the hypothesis that the toll roads altered urban growth patterns in Orange County.

The implication for induced travel is that the evidence from Orange County suggests rather strongly that new highways change the geographic pattern of accessibility. Overall, our results are consistent with recent research that has suggested that induced travel is a real phenomenon, and our results are consistent with the hypothesis that changes in development patterns are one cause of induced travel.

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TABLE 1 Date of Toll Road Construction and Completion

Toll Road Segments	Construction Began	Construction Complete
Eastern Transportation Corridor (SR-133)	June 1995	February 1999
Eastern Transportation Corridor (SR-241)	June 1995	February 1999
Eastern Transportation Corridor (SR-261)	June 1995	February 1999
Foothill Transportation Corridor Backbone Segment (FTCBB)	1990	1993 and 1995
Foothill Transportation Corridor Other Segments (SR-241)	Mid 1995	January 1999
San Jaoquin Hills Transportation Corridor (SJHTC)	September 1993	November 1996

Source: http://www.tcagencies.com/

TABLE 2 Number of Single-Family Detached Dwelling Unit Sales in Orange County, by Year

Year	All observations	Observations with perfectly-matched address	Observations after filtering out inappropriate data
1988	43733	38200	36716
1989	34430	29959	28836
1990	26042	22605	21481
1991	25157	22129	19894
1992	22902	20096	17251
1993	24388	21356	18014
1994	29272	25536	20791
1995	23822	20833	16821
1996	29040	25468	20345
1997	32763	27595	21590
1998	37396	29821	24244
1999	33237	28580	24900
2000	5659	4954	4302
Total	367841	317132	275185

TABLE 3 Hedonic Regressions for Toll Roads and Freeway Corridors in Orange County

Corridor	FTCBB				SJHTC		SR-22	
Threshold year	1989		1990		1993		1993	
Variables	Coefficient	t-stat.	Coefficient	t-stat.	Coefficient	t-stat.	Coefficient	t-stat.
SQFT	122.67	48.19	122.66	48.17	165.82	29.34	73.22	35.57
Bedroom	-14070.26	-7.28	-14068.06	-7.28	-12372.67	-2.91	12688.88	12.29
Bath	11118.79	3.17	11138.74	3.17	24448.70	3.42	-4163.51	-2.41
Lotsize	0.47	11.00	0.47	11.00	1.25	4.62	2.56	14.40
Age	-1043.73	-3.72	-1039.95	-3.70	2338.20	4.15	593.72	4.47
SATscore	-967.09	-6.39	-965.64	-6.38	859.48	7.51	118.67	8.40
CrimeRate	-101.98	-1.79	-101.37	-1.77	510.40	11.34	-260.95	-23.17
DtrBefore	-0.81	-1.11	-1.02	-1.79	-3.31	-1.69	0.14	0.42
DtrAfter	-1.32	-3.78	-1.32	-3.63	-4.53	-2.47	0.23	0.78
Coast	-	-	-	-	-12.80	-26.59	-	-
Year88	-268752.70	-8.82	-266480.20	-8.86	-129849.50	-3.88	14719.43	2.27
Year89	-182782.70	-6.87	-185631.20	-6.85	-33244.10	-1.00	51633.07	7.93
Year90	-199708.50	-7.40	-199495.50	-7.39	-29834.67	-0.91	55550.17	8.41
Year91	-200329.30	-7.41	-200120.50	-7.40	-68924.24	-2.11	47166.38	7.15
Year92	-201497.50	-8.07	-201302.80	-8.06	-108805.50	-3.36	43638.77	6.66
Year93	-212713.10	-8.55	-212526.60	-8.54	-106896.90	-3.80	23596.69	3.87
Year94	-214119.00	-9.27	-213949.70	-9.26	-105496.30	-3.78	5466.12	0.91
Year95	-192638.10	-9.51	-192491.10	-9.50	-131949.30	-4.86	-5584.48	-0.95
Year96	-108785.00	-9.88	-108757.10	-9.88	-203992.80	-7.99	-28271.62	-4.99
Year97	-91689.36	-8.58	-91670.11	-8.58	-163779.10	-6.55	-32868.49	-5.81
Year98	-48203.56	-4.58	-48179.41	-4.57	-87745.68	-3.52	-20496.63	-3.70
Year99	-14238.57	-1.36	-14235.68	-1.36	-57875.85	-2.32	-5039.04	-0.92
Constant	1207062.00	7.13	1205333.00	7.12	-606506.90	-4.84	-46378.24	-2.66
Number of Obs.	10218		10218		5329		4141	
R-Squared	0.4167		0.4166		0.5738		0.6085	
Adj. R-Squared	0.4155		0.4154		0.5720		0.6065	
ML	-133224.6		-133224.7		-72292.269		-49748.252	

TABLE 4 Log-likelihood values for threshold years

Threshold Year	Log-likelihood values for threshold years: FTCBB	SJHTC
1989	-133224.56	-72292.25
1990	-133224.67	-72292.03
1991	-133224.19	-72292.36
1992	-133223.21	-72292.37
1993	**-133223.06**	-72292.27
1994	-133224.79	-72292.08
1995	-133224.69	-72290.59
1996	-133224.74	-72287.27
1997	-133224.77	**-72285.57**
1998	-133224.72	-72285.76

TABLE 5 Coefficients and t-statistics for DtrBefore and DtrAfter

Threshold	FTCBB		SJHTC		SR-22	
Year	Coefficient	t-statistics	Coefficient	t-statistics	Coefficient	t-statistics
1989						
DtrBefore	-0.8087	-1.111	-5.3990	-1.761	-0.2562	-0.420
DtrAfter	**-1.3177**	**-3.775**	**-3.6822**	**-2.383**	0.2553	1.054
1990						
DtrBefore	-1.0201	-1.786	**-5.7407**	**-2.271**	-0.3460	-0.785
DtrAfter	**-1.3230**	**-3.632**	**-3.3551**	**-2.077**	0.3666	1.413
1991						
DtrBefore	-0.8346	-1.642	-4.4374	-1.952	-0.0367	-0.096
DtrAfter	**-1.4444**	**-3.811**	**-3.7431**	**-2.228**	0.2995	1.098
1992						
DtrBefore	-0.6892	-1.493	-3.6863	-1.781	0.0683	0.195
DtrAfter	**-1.6306**	**-4.101**	**-4.1642**	**-2.364**	0.2663	0.937
1993						
DtrBefore	-0.7365	-1.692	-3.3127	-1.688	0.1377	0.422
DtrAfter	**-1.6972**	**-4.116**	**-4.5307**	**-2.470**	0.2318	0.777
1994						
DtrBefore	**-1.2778**	**-3.104**	**-4.9003**	**-2.625**	0.2464	0.802
DtrAfter	**-1.2220**	**-2.815**	-2.9703	-1.543	0.1289	0.409
1995						
DtrBefore	**-1.3475**	**-3.421**	**-5.9079**	**-3.338**	0.2400	0.838
DtrAfter	**-1.1050**	**-2.393**	-1.1725	-0.567	0.1142	0.332
1996						
DtrBefore	**-1.3094**	**-3.428**	**-6.9359**	**-4.041**	0.3533	1.292
DtrAfter	**-1.1393**	**-2.324**	1.4222	0.640	-0.1303	-0.349
1997						
DtrBefore	**-1.2162**	**-3.303**	**-6.8933**	**-4.187**	0.4066	1.561
DtrAfter	**-1.3524**	**-2.492**	3.4418	1.391	-0.4132	-0.984
1998						
DtrBefore	**-1.2982**	**-3.625**	**-6.2316**	**-3.965**	0.3966	1.583
DtrAfter	-1.0558	-1.686	5.3831	1.825	-0.6428	-1.336

Note: Siginificant coefficients (95% two-tailed test) are shown in bold.

TABLE 6 House Price Indices in Toll Road Corridors by Year

Year	FTCBB 1125 ft. to 1 mi.	FTCBB 2 to 3 mi.	SJHTC 1125 ft. to 1 mi.	SJHTC 2 to 3 mi.
1988	100.00	100.00	100.00	100.00
1989	127.23	121.37	125.86	115.75
1990	119.90	118.40	127.00	120.83
1991	117.30	113.84	120.00	117.92
1992	114.82	110.04	115.69	113.18
1993	104.55	104.03	107.33	103.71
1994	104.81	100.81	105.84	103.84
1995	**103.04**	98.75	**104.47**	103.23
1996	101.28	**100.32**	103.10	110.35
1997	105.81	101.89	112.32	116.79
1998	124.84	120.06	129.17	133.05
1999	138.78	133.43	142.38	145.91
2000	146.56	135.75	-	-

Note: Interpolated indices are shown in bold.

TABLE 7 Changes in Coefficients for Determining Home Price Indices in Toll Road Corridors

Toll Road Corridors	Treatment/Control Corridors	Changes in Coeff.	Standard Errors	90% C.I. Lower	90% C.I. Upper	95% C.I. Lower	95% C.I. Upper
FTCBB	1125 ft. to 1 mi.	0.3823	0.0186	0.3517	0.4129	0.3451	0.4195
	2 to 3 mi.	0.3057	0.0230	0.2679	0.3434	0.2597	0.3516
SJHTC	1125 ft. to 1 mi.	0.3533	0.0173	0.3249	0.3817	0.3188	0.3879
	2 to 3 mi.	0.3778	0.0574	0.2835	0.4721	0.2631	0.4925

Note: Changes in coefficients are from 1988 to 2000 for FTCBB and from 1988 to 1999 for SJHTC.

TABLE 8 General Variables

Variable Name	Description
Population	
pop80	1980 population
pop90	1990 population
phisp	Proportion of Hispanic population (initial year, i.e. 1980 or 1990)
pblack	Proportion of Black population (initial year, i.e. 1980 or 1990)
totpop80	**W** x pop80
totpop90	**W** x pop90
pop9080	Absolute difference between 1990 and 1980 population
pop9790	Absolute difference between 1997 and 1990 population
totpopdl	**W** x pop9080 or W x pop9790
pre40per	Percentage of housing stock built before 1940
pre60per	Percentage of housing stock built before 1960
Employment	
emp80	1980 employment
emp90	1990 employment
totemp80	**W** x emp80
totemp90	**W** x emp90
emp9080	Absolute difference between 1990 and 1980 employment
emp9790	Absolute difference between 1997 and 1990 employment
totempdl	**W** x emp9080 or **W** x emp9790
pretemp	Percentage of retail employment (initial year, i.e. 1980 or 1990)
Dummy variables	
hwydummy	Highway dummy variable
trdummy	Toll road dummy variable

TABLE 9 Land Use Variables

Variable Name	Description
lu1110	Single-family residential
lu1120	Multi-family residential
lu1140	Mixed residential
lu1210	General office use
lu1220	Retail stores and commercial services
lu1230	Other commercial
lu1240	Public facilities
lu1310	Light industrial
lu1320	Heavy industrial
lu1340	Wholesaling and warehousing
lu2000	Agriculture
lu3000	Vacant

Note: Each variable in Table 9 gives the amount of land, in acres, in the land use category for each census tract.

TABLE 10 Place Dummy Variables

Variable Name	Place in Orange County
pl0070	Anaheim
pl0325	Brea
pl0335	Buena Park
pl0625	Costa Mesa
pl0685	Cypress
pl0705	Dana Point
pl0903	El Toro
pl0904	El Toro Station
pl1110	Garden Grove
pl1300	Huntington Beach
pl1347	Irvine
pl1420	Laguna Beach
pl1423	Laguna Hills
pl1424	Laguna Niguel
pl1428	La Habra
pl1477	La Palma
pl1615	Los Alamitos
pl1786	Mission Viejo
pl1915	Newport Beach
pl2015	Orange
pl2195	Placentia
pl2411	Rossmoor
pl2470	San Clamente
pl2519	San Juan Capistrano
pl2570	Santa Ana
pl2650	Seal Beach
pl2735	South Laguna
pl2800	Stanton
pl2965	Tustin
pl2967	Tustin Foothills
pl3009	Villa Park
pl3085	Westminster
pl3169	Yorba Linda
pl9999	Unincorporated

TABLE 11 ABSOLUTE POPULATION CHANGE WITHOUT LAND USE VARIABLES 1990-1980

Population change 1990-1980	Inverse Distance Weight matrix		10 mile labor market area		Contiguity matrix row normalized		Contiguity matrix Row non-normalized		Tract-to-tract commute flows	
	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
1980 Population	**0.2399**	**3.60**	**0.2515**	**3.80**	**0.2303**	**3.08**	**0.2719**	**3.99**	0.0944	0.63
Proportion Hispanic	**2021.44**	**2.13**	**1956.02**	**2.06**	1547.84	1.47	**1908.73**	**2.00**	-319.85	-0.15
Proportion Black	-9524.57	-1.60	-10104.55	-1.70	-7688.83	-1.14	-10886.59	-1.80	4248.53	0.31
totemp80	0.0181	1.86	-0.0045	-1.18	-0.0321	-0.70	0.0049	0.50	-0.0949	-1.33
totempdl	-0.0385	-1.40	0.0196	1.79	0.4958	1.51	0.0460	1.03	**1.9648**	**2.76**
% pre-1960 Housing	-1212.33	-1.71	-638.20	-0.97	-113.55	-0.14	-537.63	-0.82	62.95	0.05
% pre-1940 Housing	3351.44	1.87	2800.27	1.57	1267.21	0.60	2650.63	1.49	-2252.87	-0.56
trdummy	**4505.21**	**6.05**	**4704.61**	**6.33**	**5750.75**	**5.70**	**4869.81**	**6.48**	**8408.31**	**4.14**
Highway dummy	-303.09	-1.18	-278.14	-1.08	-583.42	-1.81	-486.59	-1.75	-952.91	-1.62
pl0070	-160.83	-0.39	185.98	0.49	332.15	0.84	209.97	0.58	168.58	0.23
pl0325	-199.75	-0.28	138.36	0.19	-1035.41	-1.15	-478.79	-0.64	-2337.73	-1.43
pl0335	-374.86	-0.61	262.95	0.44	462.60	0.62	76.85	0.12	1302.37	1.01
pl0398	-1052.90	-0.55	-684.26	-0.36	86.80	0.04	-559.87	-0.29	1264.93	0.32
pl0625	445.25	0.83	151.52	0.29	-265.25	-0.42	72.42	0.14	-1946.27	-1.42
pl0685	-868.64	-1.26	-396.54	-0.55	-1136.85	-1.51	-999.06	-1.42	-1073.23	-0.76
pl0705	**6634.51**	**4.02**	**6295.15**	**3.79**	**5145.76**	**3.01**	**5713.95**	**3.66**	3471.58	1.05
pl0903	1335.69	1.30	412.33	0.42	-1339.74	-0.90	-163.10	-0.15	-4556.35	-1.78
pl0904	1306.27	0.81	1768.43	1.10	1623.93	0.94	1832.33	1.12	3669.35	1.07
pl1065	-740.00	-1.16	-984.21	-1.49	-1028.46	-1.50	-841.22	-1.32	-2331.01	-1.65
pl1095	-556.41	-1.04	167.55	0.35	308.96	0.54	-9.56	-0.02	275.49	0.29
pl1110	-6.95	-0.02	-244.53	-0.56	69.30	0.16	75.66	0.18	65.07	0.08
pl1300	-512.70	-1.07	-526.14	-1.10	-688.53	-1.33	-619.81	-1.28	-1487.21	-1.42
pl1347	1175.28	1.92	284.48	0.42	-39.75	-0.05	464.78	0.75	-2399.76	-1.42
pl1420	-1995.07	-1.86	**-2107.36**	**-1.96**	**-2594.16**	**-2.34**	**-2433.31**	**-2.34**	-2893.96	-1.36
pl1423	959.62	0.92	-24.16	-0.02	-1699.85	-1.11	-407.97	-0.38	-5347.51	-1.94
pl1424	**8329.48**	**5.49**	**7636.99**	**5.00**	**5204.64**	**2.36**	**7234.48**	**4.74**	-960.38	-0.22
pl1428	15.58	0.02	885.76	1.13	-396.52	-0.53	-160.92	-0.24	-2412.49	-1.49
pl1477	-454.89	-0.44	-6.70	-0.01	-301.40	-0.27	-310.09	-0.30	-342.36	-0.16
pl1615	-4.67	0.00	330.52	0.30	-489.95	-0.41	-137.72	-0.13	-1652.20	-0.71
pl1786	1022.72	0.97	56.77	0.05	-247.16	-0.23	186.97	0.19	-966.30	-0.47
pl1915	-765.53	-1.20	-173.35	-0.30	629.78	0.64	-230.33	-0.34	1938.19	1.28
pl2015	2.45	0.00	-343.38	-0.64	-545.90	-0.85	-229.10	-0.42	-1623.99	-1.33
pl2195	-893.57	-1.36	-282.65	-0.42	-485.46	-0.68	-568.28	-0.85	-1885.21	-1.35
pl2411	-46.20	-0.03	15.16	0.01	211.75	0.13	104.33	0.07	1446.97	0.45
pl2470	**3922.37**	**3.25**	**3891.82**	**3.34**	2297.95	1.74	**3257.85**	**2.99**	663.30	0.28
pl2519	**2728.14**	**2.54**	2075.35	1.84	1942.12	1.77	**2042.18**	**1.97**	1375.87	0.65
pl2570	858.75	1.60	488.22	1.03	418.88	0.83	529.19	1.16	-951.30	-0.85
pl2650	-76.19	-0.09	203.71	0.23	-389.24	-0.44	-279.70	-0.34	-735.80	-0.43
pl2735	-1631.55	-1.17	-1664.19	-1.20	-1732.01	-1.17	-2028.62	-1.45	-651.39	-0.23
pl2800	61.77	0.09	135.47	0.20	-436.01	-0.56	-126.43	-0.18	-1532.31	-1.03
pl2965	1059.56	1.57	684.63	0.99	109.34	0.12	657.89	0.93	-2692.33	-1.39
pl2967	-874.05	-0.90	-1306.68	-1.35	-341.74	-0.31	-713.62	-0.72	1077.09	0.50
pl3009	166.61	0.17	231.59	0.23	804.99	0.68	288.32	0.28	1822.72	0.84
pl3085	135.26	0.27	43.77	0.09	173.01	0.32	136.34	0.27	-74.56	-0.07
pl3169	**2156.01**	**2.74**	**2271.42**	**2.90**	**1659.81**	**1.96**	**1729.19**	**2.15**	1675.15	1.05

pl9999	-50.19	-0.19	-30.26	-0.11	-372.71	-1.10	-132.91	-0.49	-1182.30	-1.75
constant	-923.67	-0.58	**-1788.03**	**-2.08**	-816.03	-1.43	-769.69	-1.44	-2387.58	-1.93

TABLE 11 (cont.)

Number of obs		415		415		415		415		415
F(46, 368)		6.43		6.49		5.58		6.30		1.65
Prob > F		0		0		0		0		0.0067
R-squared		0.4436		0.4463		0.3578		0.4305		.
Adj R-squared		0.3741		0.3771		0.2775		0.3593		.
Root MSE		2114.3		2109.2		2271.5		2139.1		4375.4

TABLE 12 Absolute employment change without land use variables 1990-1980

Employment change 1990-1980	Inverse Distance W matrix		10 mile labor market area		Contiguity matrix row normalized		Contiguity matrix Row non-normalized		Tract-to-tract commute flows	
	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
totpopdl	0.0227	1.39	0.0034	0.58	0.1485	1.58	0.0305	1.35	0.0031	0.04
totpop80	**-0.0072**	**-1.97**	-0.0013	-1.19	0.0546	0.93	0.0150	1.01	0.0297	0.97
emp80	0.04580	1.63	0.04291	1.52	0.03861	1.41	0.03090	1.10	0.01553	0.52
% retail employment	**-1557.29**	**-2.39**	**-1618.34**	**-2.46**	-1203.28	-1.83	**-1436.60**	**-2.20**	**-1552.73**	**-2.31**
Toll road dummy	**-1875.73**	**-2.47**	**-1881.92**	**-2.46**	**-2976.39**	**-3.24**	**-2710.97**	**-3.22**	**-2800.20**	**-3.15**
Highway dummy	380.34	1.43	360.03	1.34	410.71	1.55	392.46	1.47	390.86	1.47
pl0070	239.07	0.63	244.28	0.62	-3.05	-0.01	31.03	0.09	11.41	0.03
pl0325	861.65	1.18	808.07	1.09	886.22	1.24	880.00	1.21	772.82	1.07
pl0335	-108.96	-0.18	-274.85	-0.43	-434.14	-0.74	-394.30	-0.67	-502.70	-0.87
pl0398	-536.08	-0.28	-651.13	-0.34	-272.37	-0.14	-262.31	-0.13	-776.41	-0.40
pl0625	750.43	1.43	614.85	1.15	745.78	1.43	799.12	1.50	636.19	1.21
pl0685	812.50	1.09	489.95	0.68	550.49	0.79	568.97	0.81	306.25	0.44
pl0705	-21.39	-0.01	401.03	0.24	-219.72	-0.13	667.91	0.41	1029.78	0.62
pl0903	**2123.87**	**2.28**	**2017.40**	**2.01**	**2107.60**	**2.30**	**2145.00**	**2.32**	**2585.23**	**2.91**
pl0904	-761.86	-0.47	-879.43	-0.54	-1440.78	-0.89	-1270.89	-0.78	-1750.01	-1.07
pl1065	1079.96	1.69	919.49	1.45	888.28	1.39	823.94	1.26	592.71	0.95
pl1095	-86.79	-0.18	-192.56	-0.41	-288.58	-0.62	-293.59	-0.61	-378.86	-0.82
pl1110	484.48	1.10	468.55	0.99	142.35	0.35	145.20	0.35	63.56	0.16
pl1300	**1241.35**	**2.26**	850.17	1.75	765.78	1.56	800.21	1.58	608.90	1.29
pl1347	610.13	0.88	957.21	1.41	**1196.72**	**1.99**	**1203.54**	**1.96**	**1287.51**	**2.17**
pl1420	373.07	0.35	387.24	0.36	1287.39	1.22	1261.52	1.20	695.26	0.68
pl1423	1854.03	1.89	1819.51	1.70	**2253.70**	**2.42**	**2341.52**	**2.48**	**2628.56**	**2.80**
pl1424	**3307.75**	**2.13**	**3618.55**	**2.33**	2710.06	1.56	**3583.96**	**2.27**	**4604.60**	**2.80**
pl1428	761.24	1.04	654.16	0.87	687.71	1.02	860.09	1.25	671.61	0.99
pl1477	405.82	0.38	309.82	0.29	149.35	0.14	260.44	0.25	116.22	0.11
pl1615	951.14	0.85	909.42	0.80	909.08	0.82	966.70	0.86	691.81	0.62
pl1786	-68.04	-0.07	62.75	0.06	162.94	0.17	249.92	0.24	711.32	0.74
pl1915	-851.23	-1.42	-976.50	-1.61	-647.45	-1.11	-598.71	-1.01	-853.98	-1.48
pl2015	844.91	1.60	733.94	1.18	888.44	1.69	918.67	1.70	841.23	1.60
pl2195	402.22	0.62	290.49	0.45	660.98	1.02	582.93	0.89	452.15	0.71
pl2411	-72.61	-0.05	-242.10	-0.15	-209.51	-0.13	-205.17	-0.13	-231.86	-0.15
pl2470	534.16	0.44	671.36	0.56	333.79	0.29	944.01	0.84	977.75	0.85
pl2519	-436.44	-0.39	-74.51	-0.07	-677.60	-0.58	-486.12	-0.41	296.08	0.28
pl2570	381.34	0.67	725.59	1.48	292.08	0.71	415.44	1.03	535.76	1.36
pl2650	547.12	0.61	521.08	0.53	523.36	0.62	607.24	0.72	279.26	0.34
pl2735	-1087.02	-0.76	-897.66	-0.63	-888.05	-0.64	-1136.94	-0.79	-925.72	-0.66
pl2800	1110.08	1.58	872.73	1.27	822.76	1.22	810.64	1.18	796.91	1.17
pl2965	**1687.36**	**2.43**	**1785.50**	**2.56**	**1589.39**	**2.32**	**1691.56**	**2.44**	**1785.76**	**2.61**
pl2967	-1447.29	-1.48	-1624.55	-1.61	-1084.04	-1.11	-1331.14	-1.36	-1396.05	-1.43
pl3009	-991.41	-0.98	-1045.26	-1.02	-1196.71	-1.18	-1125.73	-1.10	-1077.38	-1.06
pl3085	541.15	0.98	327.40	0.61	144.03	0.28	134.05	0.26	98.70	0.19
pl3169	-214.87	-0.27	-108.55	-0.13	-529.45	-0.66	-227.39	-0.29	-203.23	-0.26
pl9999	482.86	1.78	497.90	1.82	**545.84**	**2.05**	**528.96**	**1.96**	455.33	1.68
constant	1380.32	0.83	951.91	1.05	-429.09	-0.80	-364.58	-0.68	271.97	0.76
Number of obs		415		415		415		415		415
F(43, 371)		1.93		1.87		2.03		1.92		1.98

TABLE 12 (cont.)

Prob > F		0.0007		0.0012		0.0003		0.0007		0.0004
R-squared		0.1833		0.1779		0.1982		0.1723		0.187
Adj R-squared		0.0886		0.0826		0.1053		0.0763		0.0927
Root MSE		2162.4		2169.6		2142.6		2177		2157.6

TABLE 13 ABSOLUTE POPULATION CHANGE WITHOUT LAND USE VARIABLES 1997-1990

Population change 1997-1990	Inverse Distance W matrix		10 mile labor market area		Contiguity matrix row normalized		Contiguity matrix row non-normalized		Tract-to-tract commute flows	
	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
1990 Population	0.2676	10.47	0.2661	10.50	0.2676	10.47	0.2706	10.79	0.2673	9.94
Proportion Hispanic	-707.46	-1.21	-827.07	-1.52	-707.46	-1.21	-642.41	-1.19	-1187.85	**-2.00**
Proportion Black	**-3173.68**	-0.70	**-3432.07**	-0.78	**-3173.68**	-0.70	**-5592.81**	-1.26	**-17237.67**	**-2.84**
totemp90	0.0113	**3.24**	0.0013	1.50	0.0113	**3.24**	0.0111	**2.79**	0.0502	**2.60**
totempdl	-0.0468	-1.22	0.0082	0.96	-0.0468	-1.22	-0.0016	-0.09	**0.3953**	**3.34**
% pre-1960 Housing	-377.68	-0.71	-172.96	-0.33	-377.68	-0.71	139.45	0.27	-176.45	-0.32
% pre-1940 Housing	119.67	0.08	136.93	0.09	119.67	0.08	-598.92	-0.41	300.79	0.19
Toll road dummy	**3748.48**	**7.05**	**3644.11**	**6.99**	**3748.48**	**7.05**	**3860.53**	**7.23**	**3150.55**	**5.21**
Highway dummy	-161.65	-0.89	-119.62	-0.66	-161.65	-0.89	-283.39	-1.51	-159.50	-0.83
pl0070	252.07	0.96	329.78	1.22	252.07	0.96	356.32	1.44	**591.15**	**2.19**
pl0325	147.95	0.29	64.39	0.12	147.95	0.29	82.24	0.17	-315.20	-0.59
pl0335	343.44	0.83	159.92	0.40	343.44	0.83	67.77	0.17	37.55	0.09
pl0398	**-8787.63**	**-6.62**	**-8575.02**	**-6.55**	**-8787.63**	**-6.62**	**-8194.42**	**-6.34**	**-7094.68**	**-4.97**
pl0625	158.96	0.43	487.47	1.19	158.96	0.43	182.14	0.50	-56.11	-0.14
pl0685	307.02	0.60	629.67	1.30	307.02	0.60	418.45	0.88	301.83	0.59
pl0705	1747.20	1.49	1463.28	1.27	1747.20	1.49	562.16	0.52	78.25	0.07
pl0903	331.64	0.50	-168.64	-0.24	331.64	0.50	-420.16	-0.68	**-1641.78**	**-2.17**
pl0904	-1175.64	-1.05	-1315.59	-1.19	-1175.64	-1.05	-1080.28	-0.93	-2360.79	-1.91
pl1065	-533.66	-1.04	-179.00	-0.36	-533.66	-1.04	0.18	0.00	241.72	0.50
pl1095	311.05	0.96	292.99	0.93	311.05	0.96	209.19	0.67	417.12	1.23
pl1110	-360.30	-1.02	-116.68	-0.37	-360.30	-1.02	60.73	0.21	426.50	1.32
pl1300	-443.93	-0.97	137.96	0.35	-443.93	-0.97	-82.91	-0.24	409.87	1.05
pl1347	-226.75	-0.49	-608.40	-1.43	-226.75	-0.49	-719.05	-1.73	**-1101.73**	**-2.31**
pl1420	1235.35	1.66	1063.63	1.44	1235.35	1.66	601.74	0.85	538.53	0.71
pl1423	393.90	0.58	-44.91	-0.06	393.90	0.58	-256.72	-0.40	-1236.32	-1.64
pl1424	**-4369.08**	**-4.11**	**-4613.65**	**-4.34**	**-4369.08**	**-4.11**	**-5114.04**	**-4.98**	**-5411.42**	**-4.89**
pl1428	257.58	0.48	324.33	0.65	257.58	0.48	-42.38	-0.09	1155.20	1.93
pl1477	-35.09	-0.05	153.56	0.21	-35.09	-0.05	-22.41	-0.03	889.92	1.10
pl1615	199.26	0.26	354.48	0.46	199.26	0.26	29.95	0.04	-70.32	-0.09
pl1786	1009.34	1.36	436.58	0.57	1009.34	1.36	42.71	0.06	-1529.57	-1.78
pl1915	210.22	0.44	527.29	1.32	210.22	0.44	259.25	0.64	444.56	1.02
pl2015	10.31	0.03	-123.59	-0.29	10.31	0.03	196.67	0.55	113.71	0.30
pl2195	457.00	1.02	493.39	1.11	457.00	1.02	430.99	0.97	652.27	1.35
pl2411	110.05	0.10	102.73	0.10	110.05	0.10	105.06	0.10	100.22	0.09
pl2470	**5379.52**	**6.29**	**4916.19**	**5.98**	**5379.52**	**6.29**	**4325.86**	**5.75**	**2858.56**	**3.15**
pl2519	**2884.62**	**3.85**	**2708.92**	**3.66**	**2884.62**	**3.85**	**2166.68**	**3.11**	**1654.31**	**2.17**
pl2570	-520.44	-1.52	-359.38	-1.09	-520.44	-1.52	-221.89	-0.72	-458.48	-1.31
pl2650	332.14	0.51	757.99	1.20	332.14	0.51	189.02	0.34	704.48	1.13
pl2735	**8396.98**	**8.60**	**8275.23**	**8.57**	**8396.98**	**8.60**	**7805.43**	**8.24**	**6792.39**	**6.34**
pl2800	-244.71	-0.47	96.07	0.20	-244.71	-0.47	-51.45	-0.11	463.79	0.90
pl2965	-545.50	-1.09	-328.85	-0.69	-545.50	-1.09	-402.78	-0.83	116.70	0.22
pl2967	1092.32	1.60	841.47	1.21	1092.32	1.60	1167.72	1.73	610.82	0.84
pl3009	264.78	0.38	18.51	0.03	264.78	0.38	119.15	0.17	187.41	0.26
pl3085	-163.29	-0.41	33.87	0.10	-163.29	-0.41	182.03	0.53	528.86	1.37
pl3169	83.59	0.15	-86.93	-0.16	83.59	0.15	-366.20	-0.68	-626.94	-1.08
pl9999	166.54	0.84	21.81	0.12	166.54	0.84	5.20	0.03	-367.67	-1.63

constant	**-4028.55**	-3.94	**-1938.51**	**-3.51**	**-4028.55**	**-3.94**	**-1143.37**	**-3.58**	**-1611.59**	**-4.26**
Number of obs	415		415		415		415		415	
F(46, 368)	11.17		11.34		11.17		11.52		10.12	
Prob > F	0		0		0		0		0	
R-squared	0.5749		0.5855		0.5749		0.5901		0.5272	
Adj R-squared	0.5217		0.5337		0.5217		0.5389		0.468	
Root MSE	1477.3		1458.6		1477.3		1450.5		1558	

TABLE 14 Absolute employment change without land use variables 1997-1990

Employment change 1997-1990	Inverse Distance W matrix		10 mile labor market area		Contiguity matrix row normalized		Contiguity matrix row non-normalized		Tract-to-tract commute flows	
	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
totpopdl	-0.0107	-0.10	-0.0306	-1.90	-0.0107	-0.10	-0.0485	-1.41	0.1531	1.51
totpop90	0.0057	1.17	**0.0029**	**2.56**	0.0057	1.17	0.0245	1.89	0.0144	0.71
emp90	-0.0258	-1.01	-0.0307	-1.22	-0.0258	-1.01	-0.0337	-1.31	**-0.0577**	**-2.17**
% Retail employment	1043.07	1.25	1040.43	1.27	1043.07	1.25	1124.78	1.36	1311.53	1.63
Toll road dummy	**2404.12**	**2.92**	**2214.83**	**2.68**	**2404.12**	**2.92**	**2315.36**	**2.64**	423.99	0.44
Highway dummy	-40.64	-0.14	41.97	0.14	-40.64	-0.14	-144.02	-0.50	-73.58	-0.26
pl0070	4.17	0.01	-95.50	-0.23	4.17	0.01	233.11	0.60	147.28	0.39
pl0325	920.28	1.08	931.49	1.18	920.28	1.08	720.24	0.92	653.56	0.86
pl0335	721.57	1.01	336.32	0.51	721.57	1.01	574.39	0.92	539.34	0.89
pl0398	-1215.50	-0.56	-1510.12	-0.72	-1215.50	-0.56	-881.15	-0.41	1348.36	0.60
pl0625	-188.44	-0.33	-446.63	-0.76	-188.44	-0.33	-59.83	-0.10	-253.02	-0.46
pl0685	721.68	0.95	331.81	0.43	721.68	0.95	773.67	1.04	468.60	0.65
pl0705	665.42	0.36	1567.36	0.83	665.42	0.36	-693.46	-0.41	-1290.74	-0.78
pl0903	754.90	0.72	2129.31	1.73	754.90	0.72	-102.04	-0.10	162.82	0.17
pl0904	**6105.39**	**3.33**	**5264.93**	**2.93**	**6105.39**	**3.33**	**6431.32**	**3.65**	**5683.64**	**3.21**
pl1065	-969.58	-1.33	-1122.70	-1.65	-969.58	-1.33	-788.27	-1.18	-843.66	-1.31
pl1095	45.12	0.09	-61.86	-0.12	45.12	0.09	17.35	0.04	-61.88	-0.13
pl1110	-676.70	-1.39	-836.40	-1.73	-676.70	-1.39	-425.94	-0.97	-476.83	-1.12
pl1300	-545.56	-0.78	-941.48	-1.67	-545.56	-0.78	-568.83	-1.11	-597.88	-1.22
pl1347	256.94	0.29	812.65	1.10	256.94	0.29	8.00	0.01	60.70	0.10
pl1420	-414.83	-0.29	439.02	0.34	-414.83	-0.29	-146.64	-0.12	-1534.04	-1.43
pl1423	13.76	0.01	1430.10	1.11	13.76	0.01	-527.02	-0.52	-268.83	-0.27
pl1424	-1271.09	-0.71	-374.29	-0.22	-1271.09	-0.71	-1491.71	-0.87	-943.25	-0.59
pl1428	-1109.86	-1.13	-1340.26	-1.72	-1109.86	-1.13	**-1481.04**	**-2.01**	**-1601.85**	**-2.25**
pl1477	-1194.81	-1.00	-1535.84	-1.34	-1194.81	-1.00	-1276.29	-1.12	-1297.72	-1.17
pl1615	808.84	0.63	565.61	0.47	808.84	0.63	678.86	0.56	521.27	0.44
pl1786	1234.23	0.99	2131.07	1.71	1234.23	0.99	478.87	0.45	315.23	0.31
pl1915	-703.12	-1.08	-650.79	-1.01	-703.12	-1.08	-992.32	-1.59	**-1342.49**	**-2.21**
pl2015	-294.40	-0.50	20.70	0.03	-294.40	-0.50	-178.93	-0.31	-280.09	-0.50
pl2195	-298.63	-0.43	-280.77	-0.41	-298.63	-0.43	-308.23	-0.44	-316.53	-0.47
pl2411	-162.64	-0.10	-278.58	-0.17	-162.64	-0.10	-21.42	-0.01	-89.06	-0.05
pl2470	1499.13	1.14	1636.43	1.27	1499.13	1.14	1111.59	0.83	-1154.72	-0.88
pl2519	394.85	0.30	1310.84	1.02	394.85	0.30	-565.08	-0.49	-1153.54	-1.02
pl2570	226.75	0.45	644.35	1.28	226.75	0.45	372.46	0.81	592.59	1.45
pl2650	-267.09	-0.22	-1011.72	-1.03	-267.09	-0.22	-648.98	-0.72	-855.66	-0.99
pl2735	**3147.55**	**1.96**	**3446.98**	**2.22**	**3147.55**	**1.96**	2873.94	1.82	894.89	0.52
pl2800	-963.16	-1.30	-1287.73	-1.69	-963.16	-1.30	-924.70	-1.25	-816.13	-1.14
pl2965	-1348.60	-1.61	-1327.60	-1.78	-1348.60	-1.61	-1375.81	-1.82	**-1502.11**	**-2.06**
pl2967	541.11	0.50	811.50	0.76	541.11	0.50	636.84	0.60	278.19	0.27
pl3009	-454.01	-0.41	-380.05	-0.35	-454.01	-0.41	-830.94	-0.75	-1114.79	-1.04
pl3085	-570.03	-0.96	-756.86	-1.29	-570.03	-0.96	-365.73	-0.65	-356.32	-0.66
pl3169	671.75	0.77	872.14	1.00	671.75	0.77	161.30	0.19	-176.26	-0.21
pl9999	**810.59**	**2.75**	**821.35**	**2.80**	**810.59**	**2.75**	**737.81**	**2.53**	**625.76**	**2.20**
_cons	-3035.16	-0.69	-619.19	-0.61	-3035.16	-0.69	-910.52	-1.64	-241.31	-0.64
Number of obs		415		415		415		415		415
F(43, 371)		2.07		2.15		2.07		2.05		2.52
Prob > F		0.00		0.00		0.00		0.00		0.00

R-squared		0.1917		0.1987		0.1917		0.1861		0.2363
Adj R-squared		0.098		0.1058		0.098		0.0918		0.1478
Root MSE		2337		2326.9		2337		2345.1		2271.6

TABLE 15 SPECIFICATION LEVEL I ABSOLUTE POPULATION CHANGE WITH LAND USE VARIABLES 1990-1980

Population change 1990-1980	Inverse Distance W matrix		10 mile labor market area		Contiguity matrix row normalized		Contiguity matrix row non-normalized		Tract-to-tract commute flows	
	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
totempdl	-0.0007	-0.04	0.0047	0.60	-0.1174	-1.18	-0.0334	-1.71	**0.1324**	**2.45**
1980 Population	**0.2074**	**3.82**	**0.2075**	**3.83**	**0.2245**	**3.94**	**0.2167**	**3.99**	**0.2003**	**3.74**
Proportion Hispanic	**1524.65**	**2.00**	**1517.41**	**1.99**	**1642.47**	**2.09**	**1561.26**	**2.08**	1412.61	1.91
Proportion Black	1693.80	0.35	1537.08	0.32	290.44	0.06	1305.01	0.27	2436.94	0.51
totemp80	0.0032	0.46	-0.0007	-0.24	0.0357	1.59	**0.0159**	**2.56**	0.0021	0.09
% pre 1960 housing	-287.96	-0.52	-239.54	-0.45	-368.38	-0.67	-242.36	-0.47	-179.62	-0.35
% pre 1940 housing	**2798.46**	**1.96**	**2791.01**	**1.95**	**2966.95**	**2.01**	2650.30	1.90	2319.54	1.68
Toll road dummy	**1443.04**	**2.19**	**1471.90**	**2.23**	**1378.41**	**1.96**	**1521.45**	**2.33**	**1751.39**	**2.67**
Highway dummy	-106.22	-0.51	-97.41	-0.47	-115.33	-0.51	-181.34	-0.84	-160.27	-0.78
lu2000	**2.4550**	**7.45**	**2.4368**	**7.40**	**2.4549**	**7.24**	**2.5149**	**7.72**	**2.4789**	**7.74**
lu3000	**1.4837**	**8.81**	**1.4834**	**8.88**	**1.4773**	**8.56**	**1.4629**	**8.82**	**1.4621**	**8.94**
pl0070	-1.4054	0.00	25.8728	0.09	-14.9914	-0.05	-55.6383	-0.20	61.8666	0.23
pl0325	-1075.68	-1.86	-988.20	-1.66	-943.88	-1.55	-918.13	-1.59	**-1249.10**	**-2.22**
pl0335	-232.06	-0.48	-144.94	-0.30	-450.11	-0.92	-483.26	-1.04	-173.88	-0.39
pl0398	-749.75	-0.47	-689.00	-0.43	-795.71	-0.49	-668.17	-0.43	-421.62	-0.27
pl0625	182.4611	0.43	147.5266	0.36	202.2219	0.46	87.7169	0.21	-20.2570	-0.05
pl0685	-697.34	-1.27	-590.16	-1.04	-693.37	-1.22	-662.41	-1.21	-742.25	-1.38
pl0705	**5718.64**	**4.32**	**5681.73**	**4.27**	**5506.96**	**4.30**	**5511.80**	**4.51**	**5233.43**	**4.34**
pl0903	782.0476	0.98	717.7106	0.93	996.4708	1.23	1047.746	1.40	269.5851	0.38
pl0904	**-4270.56**	**-3.09**	**-4194.42**	**-3.05**	**-4093.24**	**-2.88**	**-4152.32**	**-3.04**	**-4090.97**	**-3.03**
pl1065	-807.82	-1.58	-881.25	-1.66	-748.9199	-1.44	-728.7288	-1.46	-899.27	-1.81
pl1095	-263.37	-0.64	-166.80	-0.44	-376.9252	-0.98	-410.1836	-1.12	-211.65	-0.60
pl1110	-68.5988	-0.21	-143.41	-0.41	-44.4771	-0.13	-37.2371	-0.11	-28.9477	-0.09
pl1300	-500.25	-1.31	-500.02	-1.31	-544.5501	-1.37	-530.93	-1.40	-591.08	-1.56
pl1347	815.4826	1.68	663.1250	1.26	814.4541	1.59	733.0267	1.55	505.2696	1.04
pl1420	**-2008.95**	**-2.32**	**-2011.51**	**-2.32**	**-2200.56**	**-2.56**	**-2242.96**	**-2.72**	**-2204.55**	**-2.71**
pl1423	216.8138	0.26	120.4539	0.15	438.2176	0.51	496.6608	0.63	-313.39	-0.42
pl1424	**9297.47**	**7.51**	**9209.53**	**7.39**	**9588.87**	**7.25**	**9436.66**	**7.84**	**8523.46**	**7.12**
pl1428	218.8827	0.39	402.8044	0.66	114.2136	0.21	55.7328	0.11	-54.5310	-0.10
pl1477	-534.52	-0.64	-454.15	-0.54	-602.9351	-0.70	-613.6506	-0.75	-563.63	-0.70
pl1615	-194.73	-0.22	-124.86	-0.14	-212.74	-0.24	-240.99	-0.28	-376.84	-0.44
pl1786	841.4339	1.00	702.6899	0.76	684.2146	0.85	703.1705	0.92	528.7522	0.70
pl1915	-705.068	-1.43	-625.051	-1.36	**-1121.233**	**-2.11**	**-1147.197**	**-2.40**	-609.287	-1.30
pl2015	-215.986	-0.50	-272.22	-0.63	-93.9249	-0.21	-101.4772	-0.24	-278.86	-0.68
pl2195	-752.42	-1.44	-642.75	-1.20	-853.0618	-1.60	-919.7709	-1.79	-839.40	-1.67
pl2411	-45.2222	-0.04	-19.0951	-0.02	-99.2879	-0.08	-91.6486	-0.08	60.8292	0.05
pl2470	1305.49	1.32	1310.13	1.36	1244.71	1.34	1153.39	1.32	832.32	0.97
pl2519	1038.09	1.19	936.93	1.03	875.64	1.03	950.15	1.17	780.38	0.97
pl2570	453.4255	1.09	431.7974	1.14	541.5171	1.46	459.5307	1.29	400.8706	1.12
pl2650	-545.41	-0.80	-463.11	-0.66	-651.8752	-0.96	-634.7528	-0.98	-706.78	-1.11
pl2735	**-4648.02**	**-4.03**	**-4671.37**	**-4.06**	**-4809.25**	**-4.08**	**-4702.11**	**-4.15**	**-4653.02**	**-4.17**
pl2800	36.1810	0.07	54.5580	0.10	126.3319	0.23	87.5624	0.16	-74.7985	-0.14
pl2965	84.5576	0.16	29.8853	0.05	178.6094	0.30	21.9937	0.04	-167.14	-0.31
pl2967	-431.60	-0.56	-506.92	-0.65	-506.3986	-0.62	-379.1331	-0.49	-298.48	-0.39
pl3009	-722.05	-0.89	-715.87	-0.89	-938.6029	-1.11	-825.9537	-1.03	-662.94	-0.84
pl3085	-109.25	-0.27	-120.35	-0.30	-112.5263	-0.27	-118.1886	-0.30	-101.27	-0.26

pl3169	407.6776	0.63	443.1928	0.68	379.4400	0.57	482.2292	0.76	322.7218	0.52
pl9999	-119.73	-0.56	-120.69	-0.57	-84.0090	-0.37	-119.8979	-0.57	-218.84	-1.05
constant	-1042.21	-0.85	-880.99	-1.29	-316.44	-0.76	-345.73	-0.85	-522.18	-1.32
Number of obs	415		415		415		415		415	
F(46, 368)	13.89		13.93		13.08		14.26		14.67	
Prob > F	0		0		0		0		0	
R-squared	0.6456		0.6462		0.6222		0.6517		0.6616	
Adj R-squared	0.5991		0.5998		0.5727		0.606		0.6172	
Root MSE	1692		1690.5		1747		1677.5		1653.3	

TABLE 16 SPECIFICATION LEVEL I ABSOLUTE EMPLOYMENT CHANGE WITH LAND USE VARIABLES 1990-1980

Employment change 1990-1980	Inverse Distance Weight matrix		10 mile labor market area		Contiguity matrix row normalized		Contiguity matrix row non-normalized		Tract-to-tract commute flows	
	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
totpopdl	0.0023	0.20	-0.0019	-0.44	-0.0477	-0.60	-0.0018	-0.12	**-0.2377**	**-2.68**
totpop80	-0.0042	-1.66	-0.0005	-0.67	0.0672	1.61	-0.0064	-0.60	**0.0664**	**2.62**
emp80	**-0.6201**	**-14.20**	**-0.6198**	**-14.20**	**-0.6223**	**-14.04**	**-0.6201**	**-14.15**	**-0.6571**	**-13.45**
% Retail emp	-516.80	-1.04	-502.51	-1.00	-373.34	-0.74	-413.26	-0.83	-673.02	-1.24
Toll road dummy	**-2438.68**	**-4.16**	**-2490.87**	**-4.23**	**-2454.58**	**-4.00**	**-2476.49**	**-4.11**	**-2156.94**	**-3.13**
Highway dummy	-99.4042	-0.52	-72.4691	-0.38	-80.3482	-0.42	-59.6104	-0.31	-121.25	-0.59
lu1210	**21.2895**	**9.23**	**21.0285**	**9.05**	**21.6837**	**9.25**	**21.2515**	**9.19**	**21.8646**	**8.58**
lu1220	**13.0391**	**4.39**	**12.7047**	**4.28**	**11.6709**	**3.74**	**12.9352**	**4.26**	**14.0015**	**4.32**
lu1230	**15.1802**	**5.70**	**15.3053**	**5.75**	**14.8529**	**5.55**	**14.9320**	**5.62**	**15.0196**	**5.27**
lu1240	**43.2955**	**5.43**	**44.1253**	**5.55**	**44.2866**	**5.44**	**45.0095**	**5.63**	**49.9279**	**5.70**
lu1310	**18.6031**	**12.47**	**18.6926**	**12.49**	**19.0203**	**12.35**	**18.7701**	**12.60**	**20.1818**	**11.61**
lu1320	**33.3183**	**2.34**	**33.9688**	**2.38**	**32.4990**	**2.24**	**33.5045**	**2.34**	20.8605	1.29
lu1340	-7.2723	-1.63	-7.5600	-1.69	-8.6773	-1.90	-7.4825	-1.66	-7.6038	-1.59
lu2000	0.0362	0.13	0.0414	0.14	0.1461	0.40	0.0400	0.13	0.8915	1.90
lu3000	-0.2658	-1.73	-0.2658	-1.72	-0.2402	-1.19	-0.2458	-1.55	-0.0007	0.00
pl0070	-0.9606	0.00	-25.6368	-0.09	-194.88	-0.76	-165.93	-0.64	-147.33	-0.54
pl0325	-305.52	-0.58	-339.86	-0.64	-245.99	-0.46	-202.08	-0.39	-495.56	-0.87
pl0335	-420.17	-0.97	-562.05	-1.24	-554.89	-1.31	-412.24	-0.99	-630.66	-1.41
pl0398	950.93	0.66	778.92	0.55	566.46	0.39	461.24	0.32	242.47	0.16
pl0625	517.35	1.37	510.10	1.33	469.44	1.23	469.49	1.23	479.95	1.18
pl0685	-123.12	-0.23	-263.88	-0.52	-315.11	-0.62	-170.91	-0.35	-457.59	-0.87
pl0705	-244.03	-0.20	78.21	0.07	884.51	0.71	666.48	0.59	2084.72	1.60
pl0903	698.82	1.03	778.80	1.07	862.84	1.28	1187.05	1.78	1110.05	1.60
pl0904	-1498.08	-1.22	-1574.90	-1.28	-1735.44	-1.38	-1656.32	-1.35	**-2801.40**	**-2.02**
pl1065	402.06	0.89	340.21	0.76	19.86	0.04	234.23	0.51	-143.83	-0.30
pl1095	67.8757	0.21	10.4843	0.03	-106.130	-0.32	25.3462	0.08	-129.06	-0.37
pl1110	87.2042	0.28	17.7380	0.05	-223.53	-0.77	-138.39	-0.48	-229.67	-0.75
pl1300	482.41	1.25	323.21	0.95	141.51	0.39	369.76	1.05	81.80	0.23
pl1347	491.63	0.98	718.70	1.45	860.13	1.93	747.36	1.69	**955.56**	**2.05**
pl1420	606.27	0.80	763.22	1.00	901.13	1.17	1009.44	1.37	901.64	1.16
pl1423	954.98	1.36	1094.38	1.43	1222.24	1.80	**1367.20**	**2.03**	1385.60	1.90
pl1424	1025.34	0.90	1212.71	1.06	2152.14	1.55	1526.74	1.31	**3577.54**	**2.55**
pl1428	-69.2185	-0.13	-138.20	-0.26	61.1016	0.13	147.37	0.31	73.0262	0.14
pl1477	418.54	0.56	332.77	0.44	208.09	0.28	425.29	0.57	237.55	0.30
pl1615	-19.3443	-0.02	-80.6952	-0.10	-38.5961	-0.05	71.6478	0.09	-314.43	-0.37
pl1786	127.40	0.17	320.73	0.42	603.87	0.84	720.52	1.01	826.29	1.12
pl1915	-274.68	-0.65	-250.85	-0.58	-186.62	-0.43	-81.42	-0.19	-240.76	-0.54
pl2015	577.01	1.53	701.71	1.59	460.47	1.19	536.57	1.39	501.77	1.24
pl2195	-836.04	-1.80	-828.88	-1.79	-831.84	-1.73	-809.56	-1.72	-927.70	-1.85
pl2411	2.9380	0.00	-79.6687	-0.07	-29.8650	-0.03	-125.25	-0.11	84.2475	0.07
pl2470	-548.14	-0.62	-297.04	-0.35	132.60	0.16	176.99	0.22	642.58	0.75
pl2519	-654.68	-0.83	-437.17	-0.56	27.16	0.03	-46.21	-0.06	389.18	0.48
pl2570	591.08	1.47	671.47	1.92	386.62	1.27	427.13	1.51	**652.21**	**2.08**
pl2650	303.57	0.48	217.10	0.32	334.70	0.55	527.17	0.90	235.13	0.37
pl2735	-969.80	-0.93	-862.49	-0.83	-798.30	-0.75	-626.97	-0.60	-1351.69	-1.19
pl2800	119.78	0.24	18.44	0.04	-3.92	-0.01	8.69	0.02	-17.42	-0.03

pl2965	**2060.68**	**4.19**	**2123.11**	**4.30**	**2047.61**	**4.16**	**2123.65**	**4.35**	**2082.37**	**3.98**
pl2967	**-1629.01**	**-2.36**	**-1557.81**	**-2.17**	**-1607.64**	**-2.29**	**-1579.86**	**-2.28**	**-1725.13**	**-2.32**
pl3009	-398.15	-0.55	-340.72	-0.46	-449.26	-0.61	-172.01	-0.24	-517.35	-0.66
pl3085	302.41	0.78	160.66	0.43	18.91	0.05	96.08	0.26	-26.51	-0.07
pl3169	-245.05	-0.42	-234.52	-0.40	-28.20	-0.05	25.36	0.04	11.64	0.02
pl9999	71.5857	0.37	82.3754	0.42	108.093	0.55	132.40	0.69	50.2886	0.24
constant	2161.23	1.85	1164.71	1.81	-141.11	-0.35	446.82	1.14	200.64	0.68
Number of obs	415		415		415		415		415	
F(43, 371)	10.91		10.85		10.63		10.74		9.47	
Prob > F	0		0		0		0		0	
R-squared	0.6106		0.6091		0.601		0.6068		0.5476	
Adj R-squared	0.5547		0.5529		0.5437		0.5503		0.4826	
Root MSE	1511.6		1514.5		1530.1		1519		1629.3	

TABLE 17 SPECIFICATION LEVEL I ABSOLUTE POPULATION CHANGE WITH LAND USE VARIABLES 1997-1990

Population change 1997-1990	Inverse Distance W matrix		10 mile labor market area		Contiguity matrix row normalized		Contiguity matrix row non-normalized		Tract-to-tract commute flows	
	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
totempdl	0.00850	0.40	0.00001	0.00	-0.06048	-1.19	-0.01279	-1.08	0.07601	1.70
1990 Population	**0.21440**	**8.43**	**0.21350**	**8.29**	**0.21462**	**8.17**	**0.21963**	**8.59**	**0.21818**	**8.58**
Proportion Hispanic	-746.50	-1.44	-565.43	-1.11	-330.93	-0.64	-387.83	-0.78	-539.52	-1.09
Proportion Black	1193.46	0.29	1634.25	0.39	2483.62	0.53	350.62	0.08	-1705.83	-0.38
totemp90 (W x emp90)	**0.00719**	**2.45**	0.00118	1.56	0.01964	1.52	**0.00999**	**2.72**	0.02433	1.57
% pre 1960 housing	-159.59	-0.33	-116.14	-0.24	134.41	0.27	174.99	0.36	12.62	0.03
% pre 1940 housing	267.82	0.20	206.19	0.15	-542.76	-0.39	-574.82	-0.42	-228.63	-0.17
Toll road dummy	**2272.43**	**4.34**	**2253.89**	**4.27**	**2559.73**	**4.60**	**2465.34**	**4.66**	**2331.92**	**4.38**
Highway dummy	-57.2631	-0.35	-36.8012	-0.22	-137.4344	-0.78	-207.6807	-1.19	-88.8001	-0.53
lu2000	**1.5489**	**5.94**	**1.5907**	**6.10**	**1.6800**	**6.24**	**1.6532**	**6.32**	**1.5608**	**6.03**
lu3000	**0.3450**	**2.44**	**0.3354**	**2.36**	**0.3487**	**2.38**	**0.3229**	**2.28**	**0.2973**	**2.09**
pl0070	124.31	0.52	183.03	0.74	241.37	1.01	239.79	1.04	326.98	1.42
pl0325	4.88	0.01	-42.24	-0.09	-117.36	-0.25	-122.05	-0.27	-212.87	-0.47
pl0335	145.5134	0.39	61.1797	0.16	11.1097	0.03	39.6899	0.11	-27.4106	-0.08
pl0398	**-7797.63**	**-6.10**	**-7535.61**	**-5.87**	**-7199.75**	**-5.54**	**-7172.02**	**-5.67**	**-7026.85**	**-5.56**
pl0625	258.20	0.77	261.34	0.71	166.00	0.48	133.90	0.40	109.48	0.31
pl0685	564.73	1.25	544.96	1.21	449.66	0.99	406.12	0.92	430.20	0.98
pl0705	1943.12	1.82	1522.42	1.42	704.05	0.68	745.72	0.75	745.05	0.75
pl0903	302.86	0.51	287.61	0.44	-42.43	-0.07	-52.84	-0.09	-348.22	-0.59
pl0904	**-4202.39**	**-3.83**	**-4315.32**	**-3.90**	**-3872.19**	**-3.30**	**-3919.50**	**-3.51**	**-4323.69**	**-3.93**
pl1065	-129.59	-0.30	-243.47	-0.53	-69.42	-0.16	-28.53	-0.07	11.57	0.03
pl1095	179.60	0.62	217.82	0.74	185.77	0.62	180.80	0.62	233.43	0.81
pl1110	-69.47	-0.24	-145.27	-0.50	-32.06	-0.12	2.91	0.01	99.36	0.38
pl1300	43.30	0.12	-18.72	-0.05	-99.61	-0.31	-88.52	-0.28	45.27	0.14
pl1347	-541.62	-1.37	-497.80	-1.27	-656.93	-1.64	-693.82	-1.80	-730.68	-1.83
pl1420	**1401.26**	**2.04**	1227.77	1.77	895.18	1.31	918.15	1.38	877.08	1.32
pl1423	429.57	0.69	409.08	0.61	-13.70	-0.02	36.65	0.06	-147.91	-0.24
pl1424	**-3055.11**	**-3.08**	**-3162.07**	**-3.13**	**-3674.12**	**-3.64**	**-3530.08**	**-3.60**	**-3744.78**	**-3.82**
pl1428	565.95	1.22	405.45	0.87	-103.22	-0.22	-59.21	-0.14	302.01	0.68
pl1477	53.19	0.08	-37.49	-0.06	-241.83	-0.35	-119.65	-0.18	78.39	0.12
pl1615	187.07	0.27	97.13	0.14	-95.09	-0.13	-78.04	-0.11	-95.87	-0.14
pl1786	1036.04	1.55	918.31	1.30	489.10	0.76	472.99	0.76	131.69	0.20
pl1915	535.91	1.37	507.63	1.36	184.21	0.48	185.93	0.50	301.04	0.80
pl2015	-2.50	-0.01	92.99	0.25	172.32	0.50	181.12	0.55	182.70	0.55
pl2195	284.09	0.69	302.45	0.73	161.78	0.38	233.41	0.56	284.59	0.69
pl2411	93.54	0.10	72.61	0.07	98.10	0.10	153.59	0.16	73.48	0.08
pl2470	**4490.68**	**5.64**	**4018.61**	**5.16**	**3454.90**	**4.74**	**3562.72**	**5.02**	**3254.77**	**4.53**
pl2519	**2127.21**	**3.05**	**1877.43**	**2.68**	**1377.05**	**2.03**	**1395.30**	**2.12**	**1399.02**	**2.14**
pl2570	-470.59	-1.50	-291.00	-0.95	-193.46	-0.66	-262.55	-0.91	-259.04	-0.88
pl2650	532.53	0.95	364.85	0.63	-33.34	-0.06	44.62	0.09	167.90	0.32
pl2735	**7418.60**	**7.98**	**7228.70**	**7.71**	**7154.57**	**7.51**	**6981.54**	**7.58**	**6908.76**	**7.51**
pl2800	49.06	0.11	-14.60	-0.03	-149.99	-0.33	-148.14	-0.34	64.81	0.15

pl2965	-801.56	-1.78	-726.67	-1.62	**-1004.13**	**-2.06**	**-985.99**	**-2.16**	-683.37	-1.53
pl2967	**1452.83**	**2.32**	**1428.21**	**2.22**	**1608.71**	**2.46**	**1626.17**	**2.57**	**1355.97**	**2.16**
pl3009	102.36	0.16	-25.43	-0.04	-139.62	-0.21	-49.70	-0.08	-47.25	-0.07
pl3085	31.51	0.09	18.86	0.06	43.06	0.13	68.11	0.21	155.84	0.48
pl3169	-264.22	-0.51	-342.96	-0.66	-463.73	-0.88	-511.29	-1.00	-517.18	-1.01
pl9999	63.66	0.36	37.87	0.22	72.75	0.39	41.48	0.24	-72.46	-0.41
constant	**-3272.44**	**-3.49**	**-1572.33**	**-3.04**	**-901.03**	**-2.94**	**-978.13**	**-3.24**	**-1046.30**	**-3.39**
Number of obs	415		415		415		415		415	
F(46, 368)	13.98		13.69		13.12		13.94		14.01	
Prob > F	0		0		0		0		0	
R-squared	0.6472		0.6423		0.6262		0.646		0.6497	
Adj R-squared	0.6009		0.5953		0.5771		0.5996		0.6038	
Root MSE	1349.4		1358.8		1389.1		1351.7		1344.6	

TABLE 18 SPECIFICATION LEVEL I ABSOLUTE EMPLOYMENT CHANGE WITH LAND USE VARIABLES 1997-1990

Employment change 1997-1990	Inverse Distance W matrix		10 mile labor market area		Contiguity matrix row normalized		Contiguity matrix row non-normalized		Tract-to-tract commute flows	
	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
totpopdl	0.11579	1.71	-0.00956	-0.79	-0.21887	-0.71	0.01130	0.45	**0.23018**	**2.59**
totpop90	-0.00189	-0.59	0.00116	1.40	0.07963	1.18	-0.00519	-0.53	-0.01554	-0.99
emp90	**-0.81942**	**-15.09**	**-0.83290**	**-15.32**	**-0.85679**	**-14.58**	**-0.84171**	**-15.43**	**-0.81610**	**-15.03**
% Retail emp	602.81	0.91	535.03	0.80	640.84	0.91	482.92	0.71	528.34	0.80
Toll road dummy	715.47	1.06	397.29	0.58	934.76	0.91	552.74	0.81	-437.53	-0.59
Highway dummy	**-421.23**	**-1.96**	-324.99	-1.49	-406.90	-1.82	-376.80	-1.77	-364.78	-1.74
lu1210	**32.31**	**12.17**	**32.27**	**12.00**	**33.48**	**11.42**	**32.48**	**12.05**	**31.02**	**11.50**
lu1220	**12.85**	**3.65**	**12.23**	**3.44**	**10.22**	**2.38**	**13.07**	**3.56**	**13.50**	**3.85**
lu1230	**10.98**	**3.56**	**11.53**	**3.69**	**11.67**	**3.58**	**11.94**	**3.83**	**11.83**	**3.87**
lu1240	12.96	1.42	16.33	1.78	19.25	1.66	15.79	1.73	8.44	0.89
lu1310	**18.86**	**9.58**	**19.46**	**9.94**	**20.46**	**9.05**	**19.66**	**10.05**	**18.34**	**9.30**
lu1320	**45.70**	**2.94**	**42.58**	**2.72**	36.89	1.93	**44.18**	**2.79**	**53.43**	**3.38**
lu1340	**25.06**	**5.03**	**24.37**	**4.83**	**24.67**	**4.69**	**24.88**	**4.92**	**23.68**	**4.74**
lu2000	0.52584	1.56	**0.74121**	**2.27**	0.95303	1.71	**0.75312**	**2.23**	0.06632	0.17
lu3000	0.04391	0.26	0.02370	0.14	0.04855	0.19	0.03169	0.18	-0.17353	-0.91
pl0070	50.28	0.17	47.36	0.15	277.40	0.89	229.82	0.80	128.98	0.45
pl0325	-24.74	-0.04	-342.29	-0.58	-459.55	-0.75	-478.85	-0.82	-394.96	-0.69
pl0335	297.82	0.58	-203.83	-0.41	-214.27	-0.44	-120.42	-0.26	-143.29	-0.32
pl0398	1165.99	0.73	710.16	0.44	-650.27	-0.20	1196.81	0.73	3224.40	1.85
pl0625	32.21	0.08	17.40	0.04	236.30	0.51	105.34	0.25	3.12	0.01
pl0685	440.92	0.80	127.79	0.23	346.87	0.58	176.44	0.32	81.52	0.15
pl0705	-76.67	-0.06	661.46	0.48	-272.98	-0.20	-251.54	-0.20	-865.70	-0.70
pl0903	-147.44	-0.19	728.82	0.79	-139.41	-0.18	22.52	0.03	-173.86	-0.25
pl0904	2570.82	1.77	1381.68	0.98	750.87	0.37	1635.82	1.18	**3217.77**	**2.17**
pl1065	-559.05	-1.07	-965.12	-1.93	-798.00	-1.57	-755.79	-1.55	-780.34	-1.63
pl1095	230.72	0.64	96.43	0.26	145.09	0.38	191.04	0.52	101.33	0.28
pl1110	-614.55	-1.77	**-849.48**	**-2.39**	-639.30	-1.92	-594.76	-1.85	**-661.34**	**-2.10**
pl1300	70.32	0.15	-590.53	-1.42	-511.45	-1.30	-392.43	-1.05	-474.87	-1.30
pl1347	-996.17	-1.59	-117.44	-0.21	-526.83	-1.01	-425.32	-0.87	-259.01	-0.54
pl1420	-980.93	-0.98	279.47	0.29	270.70	0.24	-610.69	-0.66	-755.81	-0.93
pl1423	-203.12	-0.25	823.10	0.85	65.81	0.08	79.55	0.11	71.52	0.10
pl1424	-726.50	-0.54	485.88	0.37	-724.61	-0.53	-309.22	-0.24	608.33	0.49
pl1428	-555.94	-0.81	**-1306.50**	**-2.27**	**-1488.59**	**-2.66**	**-1463.78**	**-2.72**	**-1538.04**	**-2.91**
pl1477	-505.42	-0.59	-1045.52	-1.24	-1097.87	-1.26	-956.36	-1.15	-979.35	-1.20
pl1615	1111.66	1.20	518.78	0.58	461.19	0.50	491.96	0.56	514.67	0.59
pl1786	434.35	0.49	1407.54	1.53	816.21	0.87	683.47	0.86	470.12	0.61
pl1915	-732.93	-1.55	-608.45	-1.27	-705.92	-1.44	-811.70	-1.76	**-954.41**	**-2.09**
pl2015	165.43	0.38	402.59	0.88	492.58	1.07	368.81	0.86	275.00	0.65
pl2195	**-1331.99**	**-2.57**	**-1416.96**	**-2.71**	**-1379.45**	**-2.51**	**-1500.54**	**-2.86**	**-1470.47**	**-2.85**
pl2411	-362.93	-0.30	-544.82	-0.44	-418.41	-0.33	-519.24	-0.42	-482.57	-0.40
pl2470	663.84	0.67	445.40	0.46	963.08	0.48	-337.47	-0.35	-1317.19	-1.36

pl2519	-1551.37	-1.66	-589.06	-0.62	-1113.65	-1.09	-1234.37	-1.45	**-1801.15**	**-2.15**
pl2570	575.90	1.56	**831.07**	**2.21**	675.92	1.63	**1037.42**	**3.06**	**909.45**	**2.97**
pl2650	876.85	1.03	-262.84	-0.36	-299.33	-0.44	-245.20	-0.37	-310.56	-0.48
pl2735	828.06	0.70	1383.42	1.17	2510.93	1.08	950.32	0.81	-573.62	-0.43
pl2800	**-1468.40**	**-2.74**	**-1609.24**	**-2.88**	**-1500.29**	**-2.65**	**-1455.60**	**-2.69**	**-1443.57**	**-2.71**
pl2965	-265.84	-0.44	143.01	0.25	96.46	0.16	134.73	0.24	231.96	0.42
pl2967	-966.23	-1.24	-659.71	-0.83	-465.20	-0.51	-836.45	-1.06	-1077.22	-1.38
pl3009	-1143.06	-1.41	-908.37	-1.11	-1240.72	-1.45	-1045.31	-1.28	-1071.13	-1.34
pl3085	-142.62	-0.33	-385.04	-0.89	-200.48	-0.47	-166.72	-0.41	-220.48	-0.55
pl3169	-12.26	-0.02	251.24	0.38	-203.58	-0.30	-8.14	-0.01	23.12	0.04
pl9999	405.26	1.88	398.15	1.83	345.21	1.54	338.75	1.57	324.90	1.53
constant	-5418.90	-1.85	172.09	0.23	50.41	0.09	767.71	1.79	**688.04**	**2.25**
Number of obs	415		415		415		415		415	
F(43, 371)	9.96		9.67		8.89		9.6		10.09	
Prob > F	0		0		0		0		0	
R-squared	0.5915		0.5811		0.5443		0.5796		0.5928	
Adj R-squared	0.5329		0.5209		0.4789		0.5192		0.5343	
Root MSE	1681.8		1703.3		1776.4		1706.2		1679.2	

TABLE 19 SPECIFICATION LEVEL II ABSOLUTE POPULATION CHANGE WITH LAND USE VARIABLES 1990-1980

Population change 1990-1980	Inverse Distance W matrix		10 mile labor market area		Contiguity matrix row normalized		Contiguity matrix row non-normalized		Tract-to-tract commute flows	
	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
totempdl	-0.00657	-0.30	0.00674	0.77	0.31370	1.25	0.01942	0.54	0.52543	1.82
1980 Population	**0.20635**	**3.80**	**0.20783**	**3.84**	**0.19945**	**3.44**	**0.22443**	**4.07**	**0.17202**	**2.76**
Proportion Hispanic	**1539.45**	**2.02**	**1526.10**	**2.00**	1239.42	1.54	**1485.85**	**1.96**	943.43	1.07
Proportion Black	1771.05	0.36	1535.70	0.32	3213.14	0.61	961.81	0.20	5321.18	0.93
totemp80	0.00493	0.63	-0.00132	-0.43	-0.01518	-0.43	0.00745	0.94	-0.02045	-0.70
% pre 1960 housing	-345.49	-0.61	-221.45	-0.42	151.99	0.25	-134.22	-0.26	-24.99	-0.04
% pre 1940 housing	**2856.54**	**1.99**	2762.88	1.93	1759.52	1.10	2643.85	1.87	1328.39	0.79
Toll road dummy	**1424.42**	**2.16**	**1489.60**	**2.26**	**2106.84**	**2.64**	**1613.65**	**2.43**	**2495.11**	**2.78**
Highway dummy	-108.09	-0.52	-99.55	-0.48	-303.65	-1.24	-251.80	-1.13	-289.12	-1.18
lu2000	**2.46061**	**7.47**	**2.43122**	**7.37**	**2.52844**	**7.49**	**2.45593**	**7.41**	**2.50466**	**7.09**
lu3000	**1.47687**	**8.73**	**1.48238**	**8.88**	**1.48225**	**8.69**	**1.47934**	**8.80**	**1.40242**	**7.57**
pl0070	-35.91	-0.11	38.45	0.13	121.73	0.41	24.06	0.08	54.41	0.18
pl0325	-1070.15	-1.85	-950.21	-1.59	**-1575.63**	**-2.28**	-1166.15	-1.94	**-1622.49**	**-2.40**
pl0335	-279.68	-0.57	-110.27	-0.23	113.55	0.20	-182.34	-0.36	119.19	0.22
pl0398	-734.83	-0.46	-655.73	-0.41	-25.42	-0.02	-539.99	-0.34	90.18	0.05
pl0625	212.05	0.50	140.76	0.34	-173.31	-0.36	37.90	0.09	-440.05	-0.78
pl0685	-708.56	-1.29	-552.73	-0.96	-907.12	-1.58	-798.29	-1.43	-784.50	-1.33
pl0705	**5725.39**	**4.33**	**5645.83**	**4.24**	**4929.26**	**3.78**	**5332.41**	**4.29**	**4776.47**	**3.49**
pl0903	870.80	1.06	675.32	0.87	-485.08	-0.43	385.13	0.46	-718.41	-0.68
pl0904	**-4315.67**	**-3.12**	**-4168.52**	**-3.03**	**-4332.30**	**-3.07**	**-4066.94**	**-2.94**	**-3653.96**	**-2.41**
pl1065	-784.64	-1.53	-871.03	-1.64	-913.54	-1.75	-778.48	-1.54	**-1193.95**	**-2.04**
pl1095	-323.74	-0.75	-137.60	-0.36	12.54	0.03	-225.98	-0.59	-135.06	-0.34
pl1110	-60.74	-0.18	-151.40	-0.43	-8.43	-0.03	-4.48	-0.01	-21.18	-0.06
pl1300	-496.31	-1.30	-497.78	-1.30	-604.00	-1.53	-555.26	-1.44	-768.82	-1.76
pl1347	856.75	1.74	598.69	1.10	194.20	0.32	535.34	1.09	-115.57	-0.17
pl1420	**-1999.59**	**-2.31**	**-2023.06**	**-2.33**	**-2282.88**	**-2.68**	**-2211.90**	**-2.65**	**-2272.67**	**-2.54**
pl1423	300.34	0.35	65.69	0.08	-1070.94	-0.92	-138.29	-0.16	-1367.65	-1.22
pl1424	**9346.44**	**7.52**	**9157.44**	**7.32**	**7615.64**	**4.53**	**8944.17**	**7.15**	**6851.87**	**3.84**
pl1428	190.91	0.34	472.26	0.75	-126.31	-0.22	23.34	0.04	-531.45	-0.79
pl1477	-558.00	-0.67	-422.78	-0.50	-522.42	-0.62	-529.99	-0.64	-561.07	-0.63
pl1615	-207.81	-0.24	-99.29	-0.11	-542.37	-0.60	-299.04	-0.34	-688.70	-0.71
pl1786	875.18	1.04	611.88	0.65	258.15	0.31	559.89	0.72	277.30	0.33
pl1915	-769.11	-1.50	-621.83	-1.35	-112.86	-0.15	-746.93	-1.40	-110.92	-0.18
pl2015	-190.04	-0.44	-287.97	-0.67	-499.27	-1.03	-268.38	-0.62	-590.38	-1.17
pl2195	-781.18	-1.49	-600.86	-1.11	-625.01	-1.15	-714.91	-1.34	-1071.42	-1.85
pl2411	-35.30	-0.03	-4.49	0.00	180.64	0.14	89.86	0.07	375.06	0.28
pl2470	1300.24	1.31	1315.22	1.37	346.54	0.33	1046.92	1.19	322.98	0.32
pl2519	1050.88	1.21	875.69	0.96	642.94	0.76	779.03	0.94	619.58	0.70
pl2570	504.49	1.17	427.85	1.13	310.16	0.80	378.84	1.04	73.52	0.16
pl2650	-556.32	-0.81	-448.29	-0.64	-733.62	-1.10	-645.34	-0.98	-789.71	-1.12

pl2735	**-4651.48**	**-4.03**	**-4679.54**	**-4.07**	**-4730.60**	**-4.06**	**-4886.47**	**-4.24**	**-4317.05**	**-3.45**
pl2800	41.32	0.08	68.62	0.13	-261.02	-0.44	-46.25	-0.09	-384.37	-0.62
pl2965	98.84	0.18	-3.70	-0.01	-534.44	-0.76	-156.82	-0.28	-898.60	-1.12
pl2967	-408.72	-0.53	-536.74	-0.69	59.29	0.07	-200.88	-0.26	131.43	0.15
pl3009	-722.52	-0.89	-706.68	-0.88	-295.31	-0.33	-640.55	-0.78	-271.94	-0.30
pl3085	-95.77	-0.24	-117.08	-0.29	-49.74	-0.12	-75.48	-0.19	-134.92	-0.31
pl3169	417.09	0.64	460.52	0.71	138.59	0.21	232.76	0.35	329.76	0.48
pl9999	-121.45	-0.57	-118.17	-0.56	-322.31	-1.26	-163.58	-0.76	-432.07	-1.56
constant	-875.20	-0.68	-934.89	-1.35	-620.37	-1.40	-565.02	-1.32	-920.03	-1.76
Number of obs	415		415		415		415		415	
F(46, 368)	13.89		13.93		13.38		13.87		12.06	
Prob > F	0		0		0		0		0	
R-squared	0.6455		0.6462		0.6305		0.6432		0.5895	
Adj R-squared	0.599		0.5998		0.5821		0.5964		0.5357	
Root MSE	1692.4		1690.6		1727.6		1697.7		1821.1	

TABLE 20 SPECIFICATION LEVEL II ABSOLUTE EMPLOYMENT CHANGE WITH LAND USE VARIABLES 1990-1980

Employment change 1990-1980	Inverse Distance W matrix		10 mile labor market area		Contiguity matrix row normalized		Contiguity matrix row non-normalized		Tract-to-tract commute flows	
	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
totpopdl	0.02296	1.43	0.00370	0.63	0.13645	1.32	0.02549	1.24	0.00238	0.02
totpop80	**-0.00717**	**-1.98**	-0.00134	-1.24	0.06965	1.25	0.01738	1.19	0.03316	1.03
emp80	0.04639	1.65	0.04369	1.55	0.03768	1.37	0.03091	1.09	0.01245	0.41
% Retail emp	**-1529.56**	**-2.33**	**-1587.588**	**-2.40**	**-1311.72**	**-2.02**	**-1464.031**	**-2.23**	**-1604.627**	**-2.40**
Toll road dummy	**-1907.545**	**-2.29**	**-1931.257**	**-2.30**	**-2452**	**-2.88**	**-2441.403**	**-2.84**	**-2648.911**	**-2.97**
Highway dummy	379.68	1.42	357.98	1.33	382.53	1.45	376.48	1.40	378.25	1.42
lu2000	-0.07541	-0.18	-0.06129	-0.15	-0.45336	-0.89	-0.28559	-0.67	-0.24705	-0.42
lu3000	0.17076	0.81	0.18669	0.88	-0.12305	-0.46	0.07512	0.34	-0.01742	-0.07
pl0070	231.92	0.61	240.97	0.61	13.44	0.04	27.50	0.08	17.75	0.05
pl0325	776.44	1.05	714.71	0.96	962.75	1.31	845.48	1.15	783.23	1.05
pl0335	-111.77	-0.18	-270.75	-0.42	-445.53	-0.76	-417.75	-0.71	-505.00	-0.87
pl0398	-878.09	-0.43	-995.73	-0.49	-548.80	-0.27	-742.44	-0.36	-978.23	-0.48
pl0625	752.99	1.43	612.55	1.14	764.64	1.46	800.04	1.50	642.33	1.22
pl0685	811.98	1.09	493.20	0.68	520.03	0.74	530.66	0.76	296.81	0.43
pl0705	-87.64	-0.05	311.58	0.19	-97.78	-0.06	718.52	0.45	1036.94	0.61
pl0903	**2105.65**	**2.26**	**1981.24**	**1.97**	**2039.10**	**2.22**	**2119.76**	**2.28**	**2571.95**	**2.88**
pl0904	-871.88	-0.51	-1023.24	-0.59	-629.47	-0.36	-921.35	-0.54	-1454.95	-0.81
pl1065	1071.29	1.67	913.26	1.44	871.84	1.34	775.34	1.19	588.95	0.94
pl1095	-85.61	-0.18	-188.61	-0.40	-303.28	-0.65	-315.87	-0.66	-383.72	-0.83
pl1110	474.01	1.07	465.93	0.98	148.79	0.37	130.17	0.32	62.32	0.15
pl1300	**1230.15**	**2.25**	839.43	1.73	751.09	1.52	754.50	1.51	604.24	1.27
pl1347	603.58	0.87	939.43	1.39	**1233.53**	**2.05**	**1242.07**	**2.03**	**1290.04**	**2.16**
pl1420	302.30	0.28	301.40	0.28	1167.15	1.09	1122.21	1.06	622.61	0.60
pl1423	1757.73	1.77	1697.78	1.57	**2204.79**	**2.34**	**2242.49**	**2.35**	**2613.62**	**2.74**
pl1424	**3197.02**	**2.02**	**3500.00**	**2.20**	2555.18	1.33	**3476.89**	**2.15**	**4491.61**	**2.42**
pl1428	775.62	1.06	671.92	0.89	664.55	0.98	849.18	1.24	667.11	0.98
pl1477	410.41	0.38	321.54	0.30	116.39	0.11	239.68	0.23	116.59	0.11
pl1615	949.34	0.84	911.84	0.80	909.88	0.82	954.71	0.85	684.12	0.61
pl1786	-91.64	-0.09	21.16	0.02	128.12	0.13	285.69	0.28	694.04	0.72
pl1915	-890.44	-1.48	-1026.97	-1.69	-630.06	-1.06	-641.90	-1.08	-857.34	-1.47
pl2015	832.73	1.57	707.98	1.14	897.03	1.69	896.56	1.66	851.14	1.62
pl2195	412.05	0.64	295.64	0.46	663.89	1.02	571.52	0.87	464.32	0.72
pl2411	-80.06	-0.05	-249.51	-0.16	-149.75	-0.10	-189.43	-0.12	-204.20	-0.13
pl2470	488.80	0.39	594.73	0.49	674.56	0.60	1122.06	0.99	1107.23	0.97
pl2519	-446.28	-0.40	-105.35	-0.10	-373.88	-0.33	-252.08	-0.22	412.62	0.39
pl2570	367.25	0.65	711.91	1.45	294.66	0.70	425.13	1.06	524.77	1.28
pl2650	545.54	0.61	529.88	0.54	500.60	0.59	576.06	0.69	271.76	0.32
pl2735	-1381.47	-0.94	-1225.44	-0.83	-636.61	-0.43	-1181.50	-0.80	-895.40	-0.60
pl2800	1113.46	1.58	877.88	1.27	817.61	1.21	795.73	1.15	796.85	1.17
pl2965	**1662.88**	**2.37**	**1748.92**	**2.48**	**1743.43**	**2.54**	**1764.14**	**2.53**	**1849.39**	**2.68**
pl2967	-1448.99	-1.48	-1633.82	-1.61	-1203.51	-1.24	-1392.79	-1.41	-1452.01	-1.48

pl3009	-1100.94	-1.07	-1173.18	-1.13	-1157.41	-1.13	-1175.36	-1.14	-1094.81	-1.07
pl3085	538.75	0.98	329.24	0.62	150.51	0.30	120.57	0.23	102.72	0.20
pl3169	-400.14	-0.48	-312.18	-0.37	-366.11	-0.45	-273.68	-0.34	-198.53	-0.25
pl9999	471.67	1.73	485.21	1.77	**550.32**	**2.06**	524.51	1.94	446.89	1.64
constant	1354.49	0.82	948.74	1.05	-511.16	-0.94	-378.71	-0.69	273.17	0.76
Number of obs	415		415		415		415		415	
F(43, 371)	1.86		1.8		1.93		1.84		1.89	
Prob > F	0.0011		0.002		0.0006		0.0014		0.0008	
R-squared	0.1848		0.1797		0.2036		0.1758		0.1877	
Adj R-squared	0.0854		0.0796		0.1064		0.0753		0.0886	
Root MSE	2166.3		2173.1		2141.2		2178.2		2162.4	

TABLE 21 SPECIFICATION LEVEL II ABSOLUTE POPULATION CHANGE WITH LAND USE VARIABLES 1997-1990

Population change 1997-1990	Inverse Distance W matrix		10 mile labor market area		Contiguity matrix row normalized		Contiguity matrix row non-normalized		Tract-to-tract commute flows	
	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
totempdl	-0.05038	-1.40	0.00548	0.69	-0.21178	-1.92	-0.02757	-1.65	0.13463	1.19
1990 Population	**0.21697**	**8.33**	**0.21577**	**8.34**	**0.20971**	**7.20**	**0.21899**	**8.52**	**0.22113**	**8.50**
Proportion Hispanic	-445.89	-0.81	-582.75	-1.14	-35.28	-0.06	-289.99	-0.57	-635.43	-1.21
Proportion Black	2617.84	0.61	1926.82	0.46	7210.35	1.22	572.89	0.14	-3746.65	-0.65
totemp90 (W x emp90)	**0.00973**	**3.00**	0.00094	1.21	0.01984	1.40	**0.01063**	**2.85**	0.02846	1.66
% pre 1960 housing	-263.63	-0.53	-73.33	-0.15	208.69	0.38	159.85	0.33	-11.45	-0.02
% pre 1940 housing	14.36	0.01	68.81	0.05	-829.67	-0.53	-625.70	-0.46	-132.29	-0.10
Toll road dummy	**2308.24**	**4.31**	**2270.15**	**4.29**	**2873.85**	**4.46**	**2529.64**	**4.74**	**2270.66**	**4.17**
Highway dummy	-90.19	-0.53	-51.05	-0.30	-175.44	-0.90	-230.66	-1.31	-90.23	-0.54
lu2000	**1.64958**	**6.08**	**1.57243**	**6.00**	**1.82484**	**5.88**	**1.71026**	**6.40**	**1.51332**	**5.55**
lu3000	**0.32692**	**2.26**	**0.33304**	**2.34**	**0.40020**	**2.43**	**0.32439**	**2.28**	0.27343	1.84
pl0070	174.58	0.71	233.54	0.93	173.91	0.65	229.26	0.99	359.29	1.51
pl0325	-107.38	-0.23	-140.90	-0.29	-6.02	-0.01	-108.91	-0.24	-253.76	-0.55
pl0335	236.89	0.62	60.66	0.16	131.54	0.31	96.50	0.26	-25.51	-0.07
pl0398	**-7666.65**	**-5.86**	**-7549.66**	**-5.87**	**-7168.66**	**-5.00**	**-7118.91**	**-5.60**	**-6864.73**	**-5.29**
pl0625	114.52	0.33	391.46	1.02	71.94	0.19	105.12	0.31	76.20	0.21
pl0685	286.27	0.59	587.39	1.30	470.14	0.94	370.57	0.83	408.38	0.93
pl0705	1758.31	1.60	1491.91	1.38	439.90	0.38	641.49	0.64	658.27	0.65
pl0903	561.11	0.90	96.36	0.14	117.02	0.18	24.32	0.04	-544.30	-0.80
pl0904	**-4223.75**	**-3.76**	**-4259.70**	**-3.84**	**-2972.41**	**-2.11**	**-3705.96**	**-3.26**	**-4381.45**	**-3.96**
pl1065	-497.42	-1.04	-130.37	-0.28	-208.14	-0.44	-83.76	-0.20	58.00	0.14
pl1095	286.15	0.95	245.50	0.83	174.69	0.53	182.75	0.63	262.34	0.89
pl1110	-369.89	-1.12	-98.87	-0.34	-168.86	-0.54	-39.81	-0.15	156.01	0.55
pl1300	-429.24	-1.00	113.92	0.31	-228.89	-0.63	-152.36	-0.48	119.20	0.35
pl1347	-217.67	-0.50	-577.45	-1.45	-689.67	-1.56	-691.26	-1.78	-795.16	-1.91
pl1420	**1425.18**	**2.03**	1227.85	1.77	967.63	1.28	938.81	1.40	867.97	1.31
pl1423	627.75	0.98	221.31	0.32	-126.41	-0.18	17.36	0.03	-296.04	-0.44
pl1424	**-2956.56**	**-2.91**	**-3250.32**	**-3.21**	**-3698.47**	**-3.32**	**-3430.50**	**-3.46**	**-3830.75**	**-3.86**
pl1428	212.40	0.42	327.78	0.70	-513.91	-0.90	-181.03	-0.40	466.95	0.88
pl1477	-130.05	-0.19	37.88	0.06	-563.29	-0.72	-172.52	-0.26	218.18	0.31
pl1615	36.71	0.05	167.72	0.24	-87.91	-0.11	-88.41	-0.13	-104.72	-0.15
pl1786	1298.07	1.87	752.71	1.04	677.64	0.94	503.82	0.80	-116.66	-0.15
pl1915	134.94	0.30	469.46	1.25	-69.06	-0.15	99.42	0.26	330.86	0.87
pl2015	34.73	0.10	-36.12	-0.09	132.76	0.35	188.23	0.56	166.91	0.50
pl2195	290.72	0.69	316.45	0.76	-35.09	-0.07	184.95	0.44	331.42	0.79
pl2411	99.02	0.10	83.81	0.08	232.26	0.21	226.21	0.23	77.96	0.08
pl2470	**4383.06**	**5.38**	**4002.80**	**5.13**	**3448.40**	**4.29**	**3566.16**	**5.00**	**3071.05**	**3.89**
pl2519	**2007.66**	**2.81**	**1872.69**	**2.66**	1186.06	1.57	**1316.80**	**1.98**	**1341.86**	**2.03**
pl2570	-485.51	-1.52	-322.44	-1.04	-243.26	-0.74	-284.41	-0.98	-299.55	-0.99
pl2650	127.82	0.21	497.67	0.85	-274.38	-0.45	-25.82	-0.05	254.97	0.47

pl2735	**7447.88**	**7.83**	**7308.78**	**7.76**	**7476.36**	**6.99**	**6988.58**	**7.55**	**6794.68**	**7.20**
pl2800	-289.16	-0.60	46.82	0.11	-450.34	-0.84	-256.95	-0.57	135.82	0.30
pl2965	**-1057.86**	**-2.21**	-790.32	-1.75	**-1492.46**	**-2.41**	**-1107.22**	**-2.37**	-608.45	-1.30
pl2967	**1532.19**	**2.39**	**1316.18**	**2.02**	**1891.54**	**2.55**	**1685.32**	**2.64**	**1282.35**	**2.00**
pl3009	123.53	0.19	-84.28	-0.13	-363.92	-0.49	-128.11	-0.20	-9.60	-0.02
pl3085	-244.94	-0.66	-9.41	-0.03	-73.23	-0.20	33.59	0.10	212.18	0.63
pl3169	-137.37	-0.26	-326.68	-0.63	-374.16	-0.64	-491.78	-0.95	-549.07	-1.07
pl9999	155.11	0.84	19.03	0.11	264.03	1.10	89.26	0.49	-125.40	-0.63
constant	**-3340.30**	**-3.48**	**-1551.47**	**-3.00**	**-931.91**	**-2.75**	**-966.81**	**-3.18**	**-1133.42**	**-3.28**
Number of obs	415		415		415		415		415	
F(46, 368)	13.42		13.64		10.84		13.82		13.93	
Prob > F	0		0		0		0		0	
R-squared	0.6314		0.6408		0.5453		0.642		0.6485	
Adj R-squared	0.583		0.5937		0.4857		0.5951		0.6024	
Root MSE	1379.3		1361.6		1532		1359.3		1346.9	

TABLE 22 SPECIFICATION LEVEL II ABSOLUTE EMPLOYMENT CHANGE WITH LAND USE VARIABLES 1997-1990

Employment change 1997-1990	Inverse Distance W matrix		10 mile labor market area		Contiguity matrix row normalized		Contiguity matrix row non-normalized		Tract-to-tract commute flows	
	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
totpopdl	0.03158	0.31	-0.02588	-1.58	-0.28419	-0.65	-0.04558	-1.34	**0.27374**	**2.41**
totpop90	0.00385	0.82	**0.00252**	**2.23**	0.02980	0.33	0.01500	1.17	-0.00036	-0.02
emp90	-0.02476	-0.98	-0.03031	-1.20	-0.02382	-0.89	-0.03011	-1.17	**-0.05779**	**-2.14**
% Retail emp	1208.44	1.46	1146.581	1.40	1075.618	1.24	1193.836	1.44	1366.801	1.70
Toll road dummy	**1929.68**	**2.12**	1655.917	1.83	2788.138	1.91	**1923.482**	**2.10**	303.9611	0.31
Highway dummy	-42.54	-0.15	50.66	0.17	-110.01	-0.36	-104.50	-0.36	-78.22	-0.28
lu2000	0.26004	0.55	0.41505	0.94	0.87368	1.10	0.43019	0.94	-0.60917	-1.20
lu3000	0.40600	1.80	0.36247	1.60	0.59954	1.77	0.41564	1.78	0.01280	0.05
pl0070	-42.30	-0.10	-98.04	-0.23	310.69	0.74	205.75	0.53	108.25	0.29
pl0325	817.90	0.96	712.60	0.90	380.08	0.46	482.01	0.61	670.83	0.87
pl0335	832.73	1.18	370.91	0.56	608.40	0.93	569.74	0.92	548.06	0.91
pl0398	-1352.98	-0.61	-1556.03	-0.71	-3594.19	-0.77	-1290.10	-0.58	1995.47	0.86
pl0625	-217.04	-0.38	-418.16	-0.71	-81.84	-0.13	-125.30	-0.22	-282.37	-0.51
pl0685	764.05	1.01	370.46	0.48	817.77	0.98	704.80	0.95	395.12	0.55
pl0705	286.83	0.16	1145.55	0.61	-174.15	-0.09	-753.81	-0.44	-1566.09	-0.94
pl0903	592.99	0.57	1872.69	1.52	407.98	0.39	82.34	0.08	65.63	0.07
pl0904	**5450.40**	**2.75**	**4366.10**	**2.31**	3857.99	1.42	**5324.43**	**2.88**	**6818.44**	**3.53**
pl1065	-886.62	-1.23	-1121.80	-1.66	-804.42	-1.17	-833.15	-1.25	-836.39	-1.30
pl1095	58.90	0.12	-60.46	-0.12	136.33	0.26	27.42	0.06	-85.83	-0.18
pl1110	-641.52	-1.33	-819.93	-1.70	-377.59	-0.83	-441.33	-1.01	-483.43	-1.14
pl1300	-397.84	-0.58	-909.15	-1.61	-535.18	-1.00	-599.13	-1.17	-600.05	-1.22
pl1347	14.27	0.02	702.78	0.96	-135.83	-0.20	8.74	0.01	130.12	0.21
pl1420	-826.26	-0.58	226.59	0.18	-622.01	-0.39	-361.93	-0.28	-1811.62	-1.66
pl1423	-325.66	-0.29	1071.66	0.82	-575.49	-0.54	-610.88	-0.60	-437.01	-0.43
pl1424	-1529.87	-0.83	-409.15	-0.23	-1923.69	-1.06	-1237.47	-0.70	-900.17	-0.55
pl1428	-865.25	-0.89	-1318.86	-1.70	-1477.97	-1.94	**-1503.11**	**-2.05**	**-1616.33**	**-2.27**
pl1477	-1050.13	-0.88	-1495.95	-1.31	-1312.50	-1.11	-1303.09	-1.15	-1291.87	-1.17
pl1615	952.92	0.75	560.85	0.47	548.81	0.44	609.43	0.51	565.63	0.48
pl1786	976.04	0.79	1933.32	1.55	955.63	0.74	596.04	0.55	155.46	0.15
pl1915	-855.73	-1.33	-785.28	-1.21	-1084.25	-1.62	-1135.97	-1.82	**-1418.57**	**-2.33**
pl2015	-398.74	-0.68	-79.85	-0.13	-180.28	-0.30	-243.88	-0.43	-319.91	-0.57
pl2195	-274.13	-0.40	-294.15	-0.43	-410.90	-0.56	-373.35	-0.54	-321.17	-0.48
pl2411	-118.85	-0.07	-271.79	-0.16	-175.85	-0.10	-101.15	-0.06	-97.82	-0.06
pl2470	1106.87	0.82	1053.63	0.80	1754.80	0.59	639.15	0.48	-1633.81	-1.25
pl2519	-131.10	-0.10	801.98	0.62	-29.11	-0.02	-619.01	-0.53	-1298.81	-1.16
pl2570	195.76	0.39	618.88	1.23	565.45	0.98	464.23	1.01	603.88	1.47
pl2650	-7.95	-0.01	-973.84	-1.00	-783.54	-0.85	-749.82	-0.84	-857.00	-0.99
pl2735	2204.15	1.35	2656.73	1.66	3801.52	1.09	2207.81	1.38	-138.03	-0.08
pl2800	-938.60	-1.28	-1220.96	-1.61	-914.17	-1.18	-912.91	-1.24	-809.80	-1.13
pl2965	**-1671.52**	**-2.05**	**-1537.01**	**-2.05**	**-1631.07**	**-2.06**	**-1531.22**	**-2.02**	-1331.13	-1.80
pl2967	542.17	0.51	866.42	0.81	987.17	0.74	718.96	0.68	12.68	0.01

pl3009	-793.55	-0.72	-647.98	-0.59	-889.92	-0.77	-962.60	-0.87	-1140.59	-1.06
pl3085	-524.05	-0.89	-728.12	-1.25	-303.38	-0.53	-371.44	-0.67	-356.94	-0.66
pl3169	131.31	0.15	382.31	0.42	-226.82	-0.25	-222.67	-0.26	-195.01	-0.23
pl9999	**791.58**	**2.71**	**791.85**	**2.71**	**701.42**	**2.32**	**713.89**	**2.46**	**623.41**	**2.19**
_cons	-4535.50	-1.03	-654.44	-0.64	-270.48	-0.37	-551.88	-0.98	-181.19	-0.48
Number of obs	415		415		415		415		415	
F(43, 371)	2.14		2.17		1.89		2.07		2.49	
Prob > F	0.00		0.00		0.00		0.00		0	
R-squared	0.2112		0.2103		0.135		0.1987		0.2398	
Adj R-squared	0.115		0.114		0.0295		0.101		0.1471	
Root MSE	2315		2316.3		2424.2		2333.2		2272.5	

TABLE 23 SPECIFICATION LEVEL III ABSOLUTE POPULATION CHANGE WITH LAND USE VARIABLES 1990-1980

Population change 1990-1980	Inverse Distance W matrix		10 mile labor market area		Contiguity matrix row normalized		Contiguity matrix row non-normalized		Tract-to-tract commute flows	
	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
totempdl	-0.00985	-0.50	0.00519	0.63	-0.02178	-0.19	-0.01910	-0.76	0.10358	1.22
1980 Population	**0.20576**	**3.79**	**0.20757**	**3.83**	**0.21898**	**3.94**	**0.21877**	**4.02**	**0.20236**	**3.76**
Proportion Hispanic	**1547.74**	**2.03**	**1519.49**	**1.99**	**1553.09**	**2.03**	**1540.81**	**2.05**	1447.03	1.94
Proportion Black	1814.30	0.37	1536.75	0.32	938.54	0.19	1211.97	0.25	2225.35	0.46
totemp80	0.00588	0.81	-0.00081	-0.28	0.02440	1.06	**0.01362**	**2.03**	0.00370	0.16
% pre 1960 housing	-377.71	-0.67	-235.22	-0.44	-252.99	-0.47	-213.02	-0.41	-190.96	-0.37
% pre 1940 housing	**2889.06**	**2.02**	2784.29	1.95	2699.20	1.86	2648.55	1.90	2392.26	1.71
Toll road dummy	**1413.99**	**2.15**	**1476.13**	**2.24**	**1539.94**	**2.22**	**1546.45**	**2.37**	**1696.83**	**2.54**
Highway dummy	-109.14	-0.53	-97.92	-0.47	-157.09	-0.71	-200.44	-0.92	-150.81	-0.73
lu2000	**2.46373**	**7.48**	**2.43545**	**7.39**	**2.47118**	**7.50**	**2.49889**	**7.66**	**2.47706**	**7.71**
lu3000	**1.47306**	**8.73**	**1.48314**	**8.88**	**1.47837**	**8.82**	**1.46736**	**8.84**	**1.46653**	**8.93**
pl0070	-55.24	-0.17	28.88	0.10	15.33	0.05	-34.03	-0.12	62.41	0.23
pl0325	-1067.05	-1.85	-979.12	-1.64	-1083.97	-1.81	-985.37	-1.70	**-1221.71**	**-2.15**
pl0335	-306.35	-0.63	-136.66	-0.29	-325.12	-0.68	-401.68	-0.85	-195.38	-0.43
pl0398	-726.48	-0.46	-681.05	-0.43	-624.90	-0.39	-633.38	-0.41	-459.17	-0.30
pl0625	228.62	0.54	145.91	0.35	118.95	0.28	74.21	0.18	10.54	0.02
pl0685	-714.85	-1.30	-581.22	-1.02	-740.77	-1.34	-699.25	-1.28	-739.15	-1.38
pl0705	**5729.17**	**4.33**	**5673.15**	**4.27**	**5378.86**	**4.32**	**5463.17**	**4.46**	**5266.95**	**4.35**
pl0903	920.49	1.14	707.58	0.91	667.94	0.82	868.11	1.12	342.07	0.47
pl0904	**-4340.93**	**-3.14**	**-4188.23**	**-3.04**	**-4146.25**	**-3.00**	**-4129.18**	**-3.02**	**-4123.03**	**-3.04**
pl1065	-771.65	-1.51	-878.81	-1.66	-785.42	-1.55	-742.22	-1.49	-877.66	-1.76
pl1095	-357.55	-0.86	-159.82	-0.42	-290.56	-0.77	-360.25	-0.97	-217.26	-0.61
pl1110	-56.35	-0.17	-145.32	-0.41	-36.48	-0.11	-28.36	-0.09	-29.52	-0.09
pl1300	-494.11	-1.29	-499.49	-1.31	-557.73	-1.44	-537.52	-1.41	-578.04	-1.52
pl1347	879.85	1.81	647.73	1.22	676.91	1.33	679.43	1.42	550.82	1.11
pl1420	**-1994.35**	**-2.30**	**-2014.27**	**-2.32**	**-2218.81**	**-2.66**	**-2234.54**	**-2.71**	**-2199.56**	**-2.70**
pl1423	347.11	0.42	107.37	0.13	103.57	0.12	324.53	0.40	-236.04	-0.30
pl1424	**9373.86**	**7.56**	**9197.08**	**7.37**	**9151.31**	**6.95**	**9303.14**	**7.67**	**8646.10**	**7.01**
pl1428	175.25	0.31	419.40	0.68	60.88	0.11	46.95	0.09	-19.54	-0.04
pl1477	-571.15	-0.68	-446.65	-0.53	-585.08	-0.70	-590.97	-0.72	-563.82	-0.69
pl1615	-215.13	-0.25	-118.75	-0.14	-285.84	-0.33	-256.72	-0.30	-353.96	-0.41
pl1786	894.08	1.07	680.99	0.73	589.74	0.75	664.33	0.86	547.20	0.72
pl1915	-804.96	-1.61	-624.28	-1.36	-897.63	-1.67	**-1038.68**	**-2.11**	-645.85	-1.35
pl2015	-175.51	-0.40	-275.98	-0.64	-183.81	-0.43	-146.72	-0.35	-256.00	-0.62
pl2195	-797.28	-1.53	-632.74	-1.17	-802.49	-1.54	-864.23	-1.67	-822.38	-1.62
pl2411	-29.74	-0.02	-15.61	-0.01	-37.21	-0.03	-42.44	-0.04	37.78	0.03
pl2470	1297.30	1.31	1311.35	1.37	1045.55	1.15	1124.53	1.29	869.68	1.00
pl2519	1058.04	1.21	922.30	1.01	824.04	1.00	903.76	1.11	792.17	0.99
pl2570	533.09	1.26	430.85	1.13	490.21	1.35	437.66	1.23	424.89	1.17
pl2650	-562.43	-0.82	-459.57	-0.66	-670.00	-1.02	-637.62	-0.98	-700.70	-1.09
pl2735	**-4653.42**	**-4.03**	**-4673.32**	**-4.06**	**-4791.81**	**-4.19**	**-4752.09**	**-4.19**	**-4677.66**	**-4.18**

pl2800	44.20	0.08	57.92	0.11	40.44	0.07	51.29	0.10	-52.09	-0.10
pl2965	106.84	0.20	21.86	0.04	20.49	0.04	-26.48	-0.05	-113.48	-0.20
pl2967	-395.91	-0.51	-514.05	-0.66	-380.96	-0.48	-330.81	-0.43	-330.02	-0.43
pl3009	-722.79	-0.89	-713.68	-0.89	-795.95	-0.97	-775.69	-0.97	-691.62	-0.87
pl3085	-88.21	-0.22	-119.57	-0.30	-98.60	-0.25	-106.61	-0.27	-98.80	-0.25
pl3169	422.36	0.65	447.33	0.69	326.03	0.51	414.60	0.64	322.21	0.52
pl9999	-122.42	-0.57	-120.09	-0.56	-136.85	-0.62	-131.74	-0.62	-203.19	-0.96
constant	-781.69	-0.63	-893.87	-1.30	-383.83	-0.95	-405.18	-0.99	-492.99	-1.22
Number of obs	415		415		415		415		415	
F(46, 368)	13.88		13.93		13.82		14.21		14.5	
Prob > F	0		0		0		0		0	
R-squared	0.6453		0.6462		0.6432		0.6515		0.6598	
Adj R-squared	0.5988		0.5998		0.5964		0.6058		0.6152	
Root MSE	1692.8		1690.5		1697.7		1677.9		1657.8	

TABLE 24 SPECIFICATION LEVEL III ABSOLUTE EMPLOYMENT CHANGE WITH LAND USE VARIABLES 1990-1980

Employment change 1990-1980	Inverse Distance W matrix		10 mile labor market area		Contiguity matrix row normalized		Contiguity matrix row non-normalized		Tract-to-tract commute flows	
	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
totpopdl	-0.00051	-0.03	-0.00284	-0.52	0.00074	0.01	0.00697	0.37	-0.07811	-0.77
totpop80	-0.00473	-1.41	-0.00072	-0.72	**0.11515**	**2.18**	0.00857	0.62	**0.06959**	**2.26**
emp80	**-0.13469**	**-3.70**	**-0.13657**	**-3.78**	**-0.13473**	**-3.78**	**-0.13263**	**-3.69**	**-0.18436**	**-4.73**
% Retail emp	103.65	0.15	100.65	0.15	361.36	0.53	249.35	0.36	-137.98	-0.20
Toll road dummy	**-2012.46**	**-2.63**	**-2059.05**	**-2.68**	**-2227.49**	**-2.82**	**-2247.13**	**-2.85**	**-2795.54**	**-3.40**
Highway dummy	6.6744	0.03	36.6720	0.14	6.4018	0.03	43.9871	0.17	-12.6156	-0.05
lu1210	**7022.56**	**2.48**	**7015.66**	**2.48**	**8299.33**	**2.90**	**7186.17**	**2.53**	**7174.48**	**2.53**
lu1220	-1828.49	-1.01	-2035.92	-1.13	-2644.95	-1.48	-2410.82	-1.33	-1028.66	-0.56
lu1230	**5394.82**	**2.28**	**5566.46**	**2.36**	**5084.66**	**2.18**	**5036.75**	**2.14**	**5404.51**	**2.30**
lu1240	6623.99	1.33	6822.53	1.36	6322.39	1.27	6530.67	1.30	7641.64	1.52
lu1310	**10579.50**	**6.41**	**10684.65**	**6.49**	**10530.52**	**6.45**	**10365.43**	**6.31**	**10924.48**	**6.64**
lu1320	8923.85	0.82	9010.51	0.83	11271.83	1.04	9873.49	0.91	10310.12	0.95
lu1340	-2794.61	-0.55	-3018.41	-0.60	-4343.83	-0.86	-3326.00	-0.65	-2113.75	-0.42
lu2000	0.03684	0.10	0.05380	0.14	0.00771	0.02	-0.08280	-0.21	0.02099	0.04
lu3000	0.26317	1.36	0.26159	1.34	0.16158	0.65	0.22889	1.14	0.09882	0.42
pl0070	40.04	0.11	44.56	0.12	-198.65	-0.59	-168.26	-0.49	-165.70	-0.49
pl0325	270.00	0.39	205.33	0.30	432.40	0.63	457.76	0.67	290.95	0.42
pl0335	-449.68	-0.78	-621.57	-1.03	-575.24	-1.05	-429.83	-0.78	-632.82	-1.15
pl0398	-1044.55	-0.56	-1183.72	-0.64	-1192.40	-0.64	-1392.16	-0.74	-1324.47	-0.71
pl0625	899.62	1.84	889.39	1.79	862.66	1.76	891.65	1.80	825.04	1.68
pl0685	370.43	0.54	225.17	0.34	254.37	0.39	412.27	0.64	181.89	0.28
pl0705	266.53	0.17	484.56	0.31	1049.88	0.66	1213.84	0.82	1777.92	1.12
pl0903	**2086.68**	**2.41**	**2086.04**	**2.23**	**1991.19**	**2.33**	**2360.71**	**2.75**	**2500.55**	**3.01**
pl0904	-2579.33	-1.61	-2643.80	-1.65	-2527.58	-1.56	-2487.38	-1.55	**-3431.86**	**-2.03**
pl1065	1067.32	1.81	1041.60	1.78	695.73	1.16	838.05	1.40	624.95	1.08
pl1095	-66.83	-0.15	-114.75	-0.26	-257.30	-0.60	-161.89	-0.37	-289.13	-0.67
pl1110	542.61	1.33	503.61	1.15	173.74	0.46	238.07	0.63	130.82	0.35
pl1300	796.45	1.56	647.19	1.44	436.49	0.94	645.59	1.39	456.34	1.04
pl1347	**1674.24**	**2.58**	**1861.47**	**2.93**	**2014.50**	**3.52**	**1894.73**	**3.32**	**2091.45**	**3.67**
pl1420	235.37	0.24	371.68	0.37	803.84	0.82	928.52	0.96	541.82	0.57
pl1423	**1846.09**	**2.02**	1926.37	1.94	**2019.10**	**2.30**	**2207.55**	**2.50**	**2740.14**	**3.08**
pl1424	**3823.81**	**2.63**	**3930.99**	**2.71**	**4435.23**	**2.50**	**4236.23**	**2.86**	**5818.20**	**3.36**
pl1428	234.61	0.35	119.11	0.17	396.53	0.63	600.47	0.95	410.31	0.65
pl1477	197.27	0.20	103.72	0.10	-59.12	-0.06	229.84	0.24	137.75	0.14
pl1615	183.26	0.18	87.86	0.08	190.05	0.18	357.57	0.34	-4.29	0.00
pl1786	45.94	0.05	165.55	0.17	314.36	0.34	539.68	0.57	876.83	0.96
pl1915	-864.55	-1.54	-863.73	-1.52	-721.03	-1.29	-591.07	-1.06	-741.03	-1.35
pl2015	668.91	1.35	864.44	1.49	517.63	1.03	616.07	1.22	599.97	1.21
pl2195	-355.22	-0.59	-339.10	-0.56	-208.09	-0.34	-226.92	-0.37	-226.22	-0.37
pl2411	49.55	0.03	-22.67	-0.02	127.59	0.09	-1.64	0.00	237.72	0.16
pl2470	653.60	0.57	858.35	0.77	1293.08	1.24	1596.46	1.54	1746.73	1.66

pl2519	-193.85	-0.19	-57.54	-0.06	228.03	0.22	231.64	0.22	689.43	0.70
pl2570	940.40	1.78	**1028.93**	**2.25**	447.13	1.14	543.55	1.45	533.45	1.39
pl2650	229.49	0.28	95.54	0.11	353.65	0.45	597.22	0.77	347.78	0.45
pl2735	-1490.70	-1.10	-1416.34	-1.05	-1129.60	-0.83	-1153.89	-0.85	-1157.98	-0.85
pl2800	218.19	0.33	122.73	0.19	91.10	0.14	102.56	0.16	57.78	0.09
pl2965	**2127.16**	**3.28**	**2191.53**	**3.37**	**2006.98**	**3.14**	**2111.13**	**3.29**	**2140.74**	**3.34**
pl2967	-1464.04	-1.62	-1376.43	-1.47	-1352.13	-1.49	-1417.98	-1.56	-1460.41	-1.61
pl3009	-455.44	-0.48	-419.47	-0.44	-642.18	-0.68	-405.43	-0.42	-532.61	-0.56
pl3085	438.52	0.87	309.10	0.63	139.77	0.29	178.30	0.37	79.51	0.17
pl3169	133.47	0.18	78.63	0.10	257.41	0.34	361.66	0.48	357.68	0.48
pl9999	**507.10**	**2.00**	**504.38**	**1.98**	**558.95**	**2.22**	**568.40**	**2.25**	462.22	1.82
_cons	2186.03	1.42	1050.14	1.25	**-1137.86**	**-2.18**	-539.51	-1.05	-457.78	-1.24
Number of obs	415		415		415		415		415	
F(43, 371)	3.4		3.4		3.47		3.33		3.55	
Prob > F	0.00		0.00		0.00		0.00		0.00	
R-squared	0.3283		0.3279		0.3328		0.3223		0.323	
Adj R-squared	0.2319		0.2314		0.237		0.225		0.2257	
Root MSE	1985.2		1985.9		1978.6		1994.1		1993.1	

TABLE 25 SPECIFICATION LEVEL III ABSOLUTE POPULATION CHANGE WITH LAND USE VARIABLES 1997-1990

Population change 1997-1990	Inverse Distance W matrix		10 mile labor market area		Contiguity matrix row normalized		Contiguity matrix row non-normalized		Tract-to-tract commute flows	
	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
totempdl	-0.02685	-0.91	0.00289	0.39	-0.11128	-1.47	-0.01787	-1.21	0.09470	1.25
1990 Population	**0.21594**	**8.41**	**0.21470**	**8.31**	**0.21297**	**7.88**	**0.21941**	**8.57**	**0.21912**	**8.56**
Proportion Hispanic	-566.03	-1.06	-574.57	-1.13	-231.66	-0.43	-354.21	-0.70	-570.10	-1.13
Proportion Black	2048.60	0.49	1788.55	0.43	4070.74	0.80	427.00	0.10	-2356.61	-0.47
totemp90	**0.00872**	**2.83**	0.00105	1.36	0.01971	1.49	**0.01021**	**2.76**	0.02565	1.59
% pre 1960 housing	-222.05	-0.45	-93.56	-0.19	159.35	0.31	169.78	0.35	4.95	0.01
% pre 1940 housing	115.65	0.08	133.74	0.10	-639.10	-0.44	-592.30	-0.44	-197.91	-0.15
Toll road dummy	**2293.93**	**4.34**	**2262.46**	**4.28**	**2665.20**	**4.57**	**2487.43**	**4.69**	**2312.39**	**4.32**
Highway dummy	-77.03	-0.46	-44.31	-0.26	-150.19	-0.83	-215.58	-1.23	-89.26	-0.54
lu2000	**1.6093**	**6.06**	**1.5811**	**6.05**	**1.7286**	**6.14**	**1.6728**	**6.33**	**1.5457**	**5.87**
lu3000	**0.3341**	**2.34**	**0.3342**	**2.35**	**0.3660**	**2.41**	**0.3234**	**2.28**	**0.2897**	**2.01**
pl0070	154.49	0.64	209.67	0.84	218.72	0.89	236.17	1.02	337.28	1.45
pl0325	-62.52	-0.13	-94.27	-0.20	-79.98	-0.16	-117.54	-0.26	-225.91	-0.49
pl0335	200.37	0.53	60.91	0.16	51.55	0.13	59.21	0.16	-26.80	-0.07
pl0398	**-7719.00**	**-5.98**	**-7543.02**	**-5.88**	**-7189.32**	**-5.39**	**-7153.77**	**-5.65**	**-6975.15**	**-5.48**
pl0625	171.94	0.50	329.97	0.87	134.42	0.38	124.01	0.37	98.87	0.28
pl0685	397.56	0.85	567.34	1.26	456.54	0.98	393.91	0.89	423.24	0.96
pl0705	1832.17	1.70	1506.33	1.40	615.36	0.58	709.90	0.71	717.38	0.72
pl0903	457.90	0.76	186.74	0.28	11.11	0.02	-26.33	-0.05	-410.75	-0.66
pl0904	**-4215.21**	**-3.81**	**-4285.98**	**-3.87**	**-3570.07**	**-2.86**	**-3846.12**	**-3.42**	**-4342.11**	**-3.94**
pl1065	-350.42	-0.77	-183.82	-0.40	-116.00	-0.27	-47.51	-0.12	26.38	0.06
pl1095	243.57	0.82	232.42	0.79	182.05	0.59	181.47	0.63	242.64	0.83
pl1110	-249.83	-0.81	-120.80	-0.42	-77.99	-0.27	-11.77	-0.04	117.42	0.43
pl1300	-240.39	-0.61	51.24	0.14	-143.02	-0.43	-110.46	-0.35	68.84	0.21
pl1347	-347.14	-0.84	-539.81	-1.36	-667.92	-1.62	-692.94	-1.79	-751.25	-1.86
pl1420	**1415.62**	**2.04**	1227.81	1.77	919.51	1.30	925.25	1.39	874.18	1.32
pl1423	548.55	0.87	310.05	0.45	-51.55	-0.08	30.02	0.05	-195.14	-0.31
pl1424	**-2995.94**	**-2.99**	**-3208.62**	**-3.17**	**-3682.30**	**-3.55**	**-3495.86**	**-3.55**	**-3772.19**	**-3.84**
pl1428	353.70	0.73	364.49	0.78	-241.12	-0.49	-101.07	-0.23	354.60	0.75
pl1477	-56.82	-0.08	2.26	0.00	-349.77	-0.49	-137.82	-0.21	122.97	0.18
pl1615	96.80	0.14	134.36	0.19	-92.68	-0.13	-81.61	-0.12	-98.69	-0.14
pl1786	1193.35	1.76	830.97	1.16	552.41	0.83	483.59	0.77	52.49	0.08
pl1915	295.18	0.71	487.50	1.30	99.17	0.24	156.20	0.42	310.55	0.83
pl2015	19.85	0.06	24.90	0.06	159.03	0.45	183.56	0.55	177.66	0.54
pl2195	288.07	0.69	309.84	0.75	95.67	0.21	216.76	0.52	299.52	0.72
pl2411	96.83	0.10	78.52	0.08	143.15	0.14	178.54	0.18	74.91	0.08
pl2470	**4426.07**	**5.51**	**4010.27**	**5.15**	**3452.72**	**4.61**	**3563.90**	**5.02**	**3196.19**	**4.30**
pl2519	**2055.44**	**2.92**	**1874.93**	**2.67**	1312.92	1.88	**1368.32**	**2.07**	**1380.79**	**2.10**
pl2570	-479.55	-1.52	-307.58	-1.00	-210.18	-0.69	-270.06	-0.93	-271.96	-0.92
pl2650	289.56	0.50	434.90	0.74	-114.28	-0.20	20.42	0.04	195.66	0.37
pl2735	**7436.18**	**7.93**	**7270.93**	**7.74**	**7262.62**	**7.37**	**6983.96**	**7.57**	**6872.38**	**7.41**

pl2800	-153.99	-0.33	17.79	0.04	-250.84	-0.53	-185.53	-0.42	87.45	0.20
pl2965	**-955.43**	**-2.06**	-760.24	-1.69	**-1168.10**	**-2.20**	**-1027.65**	**-2.22**	-659.48	-1.45
pl2967	**1500.47**	**2.37**	**1369.12**	**2.11**	**1703.68**	**2.51**	**1646.50**	**2.60**	**1332.49**	**2.11**
pl3009	115.07	0.18	-56.47	-0.09	-214.93	-0.31	-76.64	-0.12	-35.24	-0.06
pl3085	-134.46	-0.38	3.95	0.01	4.01	0.01	56.25	0.17	173.80	0.53
pl3169	-188.06	-0.36	-334.37	-0.64	-433.66	-0.80	-504.59	-0.98	-527.35	-1.03
pl9999	118.56	0.66	27.93	0.16	136.98	0.67	57.90	0.32	-89.34	-0.48
constant	**-3313.18**	**-3.50**	**-1561.33**	**-3.02**	**-911.40**	**-2.89**	**-974.24**	**-3.22**	**-1074.08**	**-3.34**
Number of obs	415		415		415		415		415	
F(46, 368)	13.75		13.67		12.46		13.91		14	
Prob > F	0		0		0		0		0	
R-squared	0.641		0.6417		0.6056		0.6451		0.6501	
Adj R-squared	0.5939		0.5947		0.5539		0.5986		0.6042	
Root MSE	1361.3		1359.9		1426.7		1353.4		1343.9	

TABLE 26 SPECIFICATION LEVEL III ABSOLUTE EMPLOYMENT CHANGE WITH LAND USE VARIABLES 1997-1990

Employment change 1997-1990	Inverse Distance W matrix		10 mile labor market area		Contiguity matrix row normalized		Contiguity matrix row non-normalized		Tract-to-tract commute flows	
	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
totpopdl	0.03511	0.35	-0.02768	-1.73	-0.26048	-0.58	-0.03421	-1.01	**0.26343**	**2.38**
totpop90	0.00414	0.90	**0.00270**	**2.46**	0.03046	0.32	0.01066	0.84	0.00515	0.25
emp90	-0.06725	-1.84	**-0.07790**	**-2.12**	**-0.07860**	**-2.02**	**-0.07608**	**-2.07**	**-0.11907**	**-3.00**
% Retail emp	**2099.63**	**2.32**	**2034.07**	**2.26**	**2056.58**	**2.17**	**2084.77**	**2.29**	**2106.26**	**2.39**
Toll road dummy	**1775.32**	**2.01**	1468.92	1.67	2538.98	1.78	**1789.89**	**2.01**	59.67	0.06
Highway dummy	-148.10	-0.52	-60.26	-0.21	-237.51	-0.78	-213.34	-0.75	-210.98	-0.77
lu1210	3380.82	1.08	3962.44	1.25	4172.10	1.09	3616.57	1.14	2870.05	0.93
lu1220	-2913.46	-1.40	-2949.68	-1.43	-3129.14	-1.26	-2923.87	-1.38	-1584.15	-0.78
lu1230	-1629.46	-0.61	-1022.96	-0.38	-1410.12	-0.50	-1241.66	-0.46	-243.51	-0.09
lu1240	**-15536.66**	**-2.81**	**-15584.16**	**-2.81**	**-14251.78**	**-2.38**	**-15274.89**	**-2.74**	**-14937.47**	**-2.73**
lu1310	-469.49	-0.25	-250.24	-0.13	251.25	0.12	-152.31	-0.08	392.81	0.21
lu1320	22083.92	1.82	21625.93	1.79	18811.16	1.44	20517.46	1.68	**23601.45**	**1.99**
lu1340	**18048.04**	**3.20**	**17357.55**	**3.06**	**18035.88**	**3.04**	**17601.10**	**3.08**	**18045.99**	**3.26**
lu2000	0.34177	0.75	0.50780	1.20	0.91266	1.15	0.51525	1.17	-0.54820	-1.12
lu3000	0.41081	1.88	0.36714	1.67	0.58831	1.77	0.42026	1.85	0.00857	0.04
pl0070	135.98	0.34	54.87	0.13	484.42	1.17	394.04	1.03	281.83	0.75
pl0325	565.82	0.69	445.83	0.58	110.37	0.14	210.83	0.28	360.13	0.48
pl0335	731.20	1.05	223.98	0.34	483.40	0.76	462.36	0.76	348.13	0.59
pl0398	-1397.63	-0.66	-1630.43	-0.78	-3369.95	-0.72	-1199.06	-0.56	1845.34	0.82
pl0625	30.29	0.06	-201.31	-0.35	178.24	0.30	110.82	0.20	-3.33	-0.01
pl0685	617.20	0.84	184.24	0.25	623.92	0.78	515.77	0.71	269.80	0.39
pl0705	360.35	0.21	1258.55	0.69	-244.10	-0.13	-768.54	-0.47	-1565.11	-0.97
pl0903	728.84	0.73	2100.10	1.75	489.06	0.49	232.53	0.24	161.39	0.18
pl0904	**4210.96**	**2.17**	3024.53	1.63	2617.87	0.94	**4004.56**	**2.21**	**5415.87**	**2.84**
pl1065	-876.59	-1.24	-1132.31	-1.72	-773.91	-1.16	-796.27	-1.23	-770.72	-1.24
pl1095	4.92	0.01	-113.85	-0.24	67.91	0.14	-5.33	-0.01	-115.96	-0.25
pl1110	-633.88	-1.35	-824.03	-1.76	-331.59	-0.76	-387.55	-0.91	-457.68	-1.12
pl1300	-463.24	-0.69	-1019.44	-1.85	-603.43	-1.15	-645.73	-1.29	-648.18	-1.36
pl1347	54.02	0.06	806.45	1.11	-32.73	-0.05	59.42	0.09	320.04	0.51
pl1420	-670.15	-0.49	465.14	0.37	-527.86	-0.33	-465.81	-0.38	-1706.06	-1.63
pl1423	-259.42	-0.24	1227.39	0.97	-534.28	-0.52	-575.90	-0.58	-246.98	-0.25
pl1424	-1200.10	-0.67	24.27	0.01	-1605.69	-0.91	-1067.28	-0.63	-459.64	-0.29
pl1428	-746.56	-0.79	-1251.05	-1.66	-1426.09	-1.94	**-1447.26**	**-2.04**	**-1593.18**	**-2.32**
pl1477	-1088.37	-0.95	-1567.21	-1.42	-1370.95	-1.19	-1349.82	-1.23	-1290.85	-1.22
pl1615	1172.81	0.94	709.43	0.60	719.99	0.59	769.96	0.66	705.65	0.62
pl1786	826.04	0.69	1842.59	1.53	712.09	0.58	365.28	0.35	114.04	0.11
pl1915	-846.94	-1.34	-799.14	-1.26	-1123.10	-1.74	-1171.80	-1.90	**-1384.34**	**-2.31**
pl2015	-315.58	-0.55	19.58	0.03	-92.13	-0.15	-154.68	-0.28	-220.65	-0.41
pl2195	-370.89	-0.55	-404.15	-0.60	-538.59	-0.76	-503.51	-0.74	-421.27	-0.64
pl2411	-251.30	-0.16	-384.84	-0.24	-264.57	-0.16	-225.59	-0.14	-137.94	-0.09
pl2470	1363.55	1.05	1308.79	1.04	1776.43	0.59	620.67	0.49	-1370.59	-1.08

pl2519	-138.50	-0.11	857.76	0.69	-140.61	-0.10	-655.14	-0.59	-1266.25	-1.17
pl2570	395.22	0.81	841.71	1.71	811.80	1.39	776.44	1.72	**818.13**	**2.04**
pl2650	-12.41	-0.01	-1064.52	-1.12	-840.15	-0.93	-823.84	-0.95	-859.07	-1.02
pl2735	2014.51	1.28	2491.97	1.62	3407.14	0.98	1905.44	1.24	-221.30	-0.13
pl2800	-1396.71	-1.95	**-1701.07**	**-2.29**	-1359.89	-1.81	-1342.81	-1.86	-1318.69	-1.89
pl2965	-1501.57	-1.89	-1338.89	-1.83	-1401.17	-1.82	-1342.25	-1.82	-1094.88	-1.52
pl2967	320.60	0.31	650.66	0.63	684.92	0.55	437.00	0.42	-137.25	-0.14
pl3009	-922.13	-0.86	-755.26	-0.71	-1030.30	-0.92	-1088.77	-1.01	-1221.88	-1.18
pl3085	-350.84	-0.62	-571.53	-1.01	-117.30	-0.21	-166.32	-0.31	-205.16	-0.39
pl3169	326.44	0.38	597.08	0.68	-45.47	-0.05	-29.64	-0.04	27.27	0.03
pl9999	**626.97**	**2.19**	**635.45**	**2.22**	542.12	1.83	544.36	1.90	481.83	1.73
_cons	-4711.73	-1.10	-471.58	-0.47	-103.06	-0.14	-227.03	-0.41	-93.88	-0.23
Number of obs	415		415		415		415		415	
F(43, 371)	2.71		2.73		2.4		2.59		3.09	
Prob > F	0		0		0		0		0	
R-squared	0.2842		0.2809		0.2139		0.2701		0.3133	
Adj R-squared	0.1814		0.1776		0.101		0.1653		0.2146	
Root MSE	2226.4		2231.5		2333.1		2248.2		2180.7	

Map 1: Orange County Toll Roads and Highways

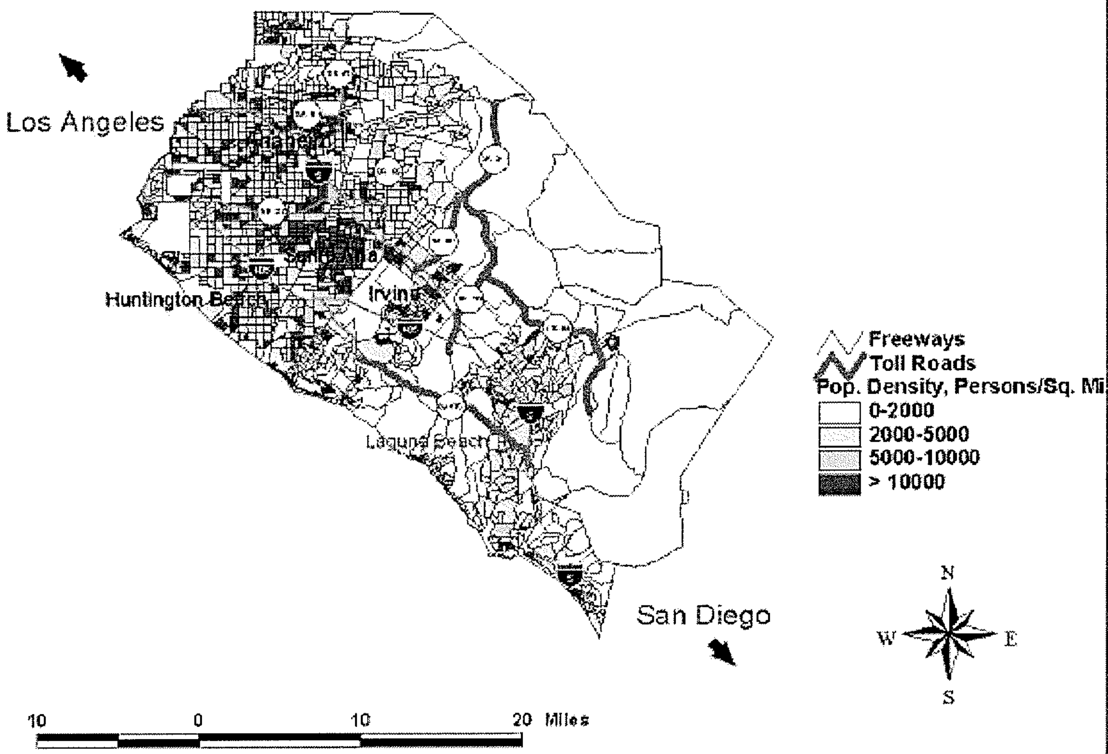


FIGURE 2 House Price Indices in FTCBB Corridors

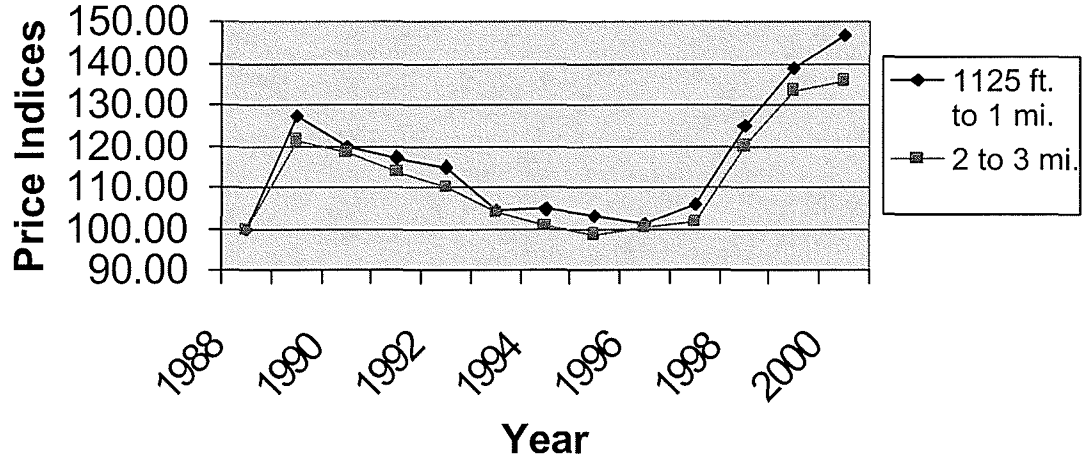
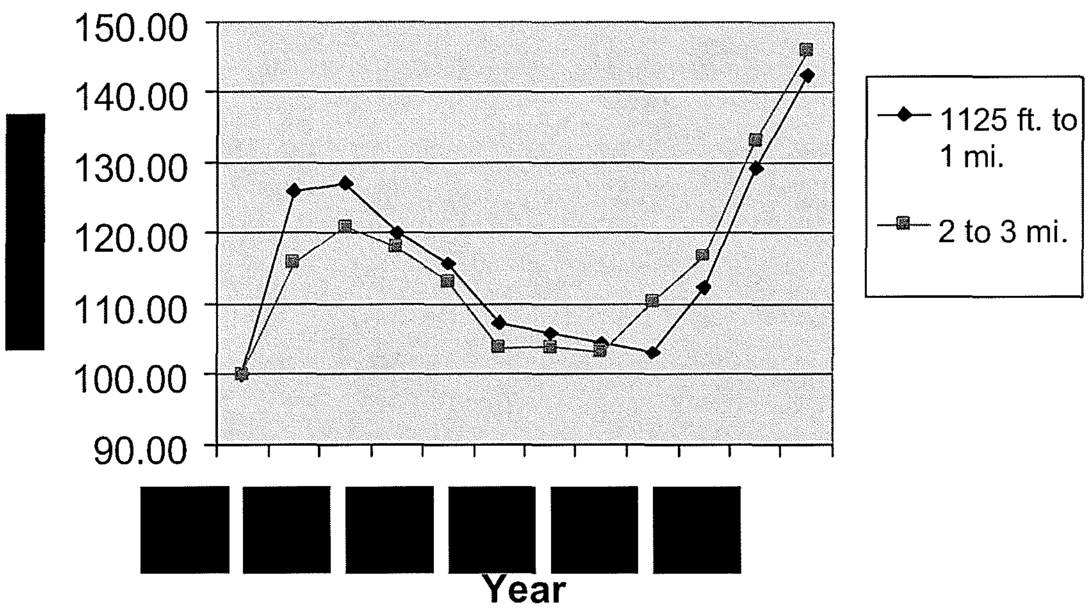


FIGURE 3 House Price Indices in SJHTC Corridors



APPENDIX 1 REGRESSION RESULTS FOR THE MULTIPLE SALES PRICE ANALYSIS FOR FTCBB

	1125 ft. to 1 mi.		2 to 3 mi.	
Variables	Coeff.	t-stat.	Coeff.	t-stat.
Y88	-0.0176	-2.1160	0.0286	2.7430
Y89	0.2232	27.4040	0.2223	19.8160
Y90	0.1639	18.2810	0.1975	17.5240
Y91	0.1420	16.0150	0.1582	13.4770
Y92	0.1206	13.5740	0.1243	10.6340
Y93	0.0270	2.9760	0.0681	5.7170
Y94	0.0294	3.2310	0.0366	3.0790
Y95	(dropped)		0.0159	1.3040
Y96	-0.0048	-0.5250	(dropped)	
Y97	0.0389	4.3570	0.0473	4.0730
Y98	0.2043	23.4800	0.2114	19.0520
Y99	0.3102	34.5120	0.3170	27.5590
Y00	0.3647	21.8940	0.3342	16.3360
No. of obs.	2016		1594	
R-squared	0.6901		0.5899	
Adj. R-squared.	0.6882		0.5868	

APPENDIX 2 REGRESSION RESULTS FOR THE MULTIPLE SALES PRICE ANALYSIS FOR SJHTC

	1125 ft. to 1 mi.		2 to 3 mi.	
Variables	Coeff.	t-stat.	Coeff.	t-stat.
Y88	-0.0477	-4.1150	-0.4473	-11.1570
Y89	0.1823	15.8240	-0.3011	-7.3210
Y90	0.1913	15.5370	-0.2581	-6.2950
Y91	0.1346	10.6240	-0.2824	-6.8100
Y92	0.0981	7.4890	-0.3235	-7.4590
Y93	0.0231	1.6980	-0.4109	-9.8240
Y94	0.0091	0.7110	-0.4097	-10.2590
Y95	(dropped)		-0.4155	-9.9790
Y96	-0.0172	-1.2950	-0.3489	-8.3490
Y97	0.0685	5.6740	-0.2921	-7.2800
Y98	0.2083	16.4830	-0.1617	-4.0110
Y99	0.3057	23.8900	-0.0695	-1.6950
Y00	0.3459	14.0850	(dropped)	
No. of obs.	1644		479	
R-squared	0.5784		0.5303	
Adj. R-squared.	0.5753		0.5182	