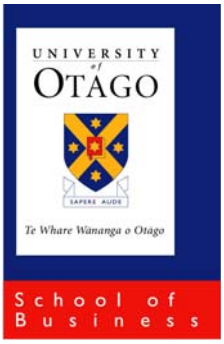

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Tiebout Dynamics: A Small-Area Study of the Response to a Central-City / Suburban House-Price Differential

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Abstract

Differences in the market value of local public services and taxes capitalize into house prices, creating price differentials across service-district boundaries. Henderson (1985) expects these differentials to generate one or more of several supply responses that over time reduce the price differential. We take advantage of an unusual natural experiment – a 1920s subdivision of relatively high-quality housing split neatly in half by a central-city/suburban boundary – to study the response to the relative decline since the 1960s in the quality of central-city services. House sales since 1949 reveal the expected divergence in house prices in the late 1960s, but, contrary to Henderson's prediction, the boundary price differential persists through the end of the century. Census data and survey results indicate that there has been a "supply response": the high quality houses on the central-city side of the subdivision attract households demographically similar to their suburban counterparts who supplement central-city services through a neighborhood association and send their children mostly to private schools. The house-price differential persists to compensate for the costs of the privately-supplied services.

I. Introduction

Tiebout (1956)-type models predict household sorting by preferences for the characteristics of local public goods and services. Household sorting is important because it puts market pressure on local service suppliers to cost effectively provide a desirable mix of public services. Most empirical tests of Tiebout sorting take one of two approaches. The direct approach tests for relative homogeneity in preferences for public services within and/or heterogeneity in preferences across formal public-service districts, such as cities or school districts. An alternative approach takes advantage of the market signals that sorting generates. Households bid up house prices in service districts that offer relatively attractive packages of public services and taxes. Differences across districts in the price of a house with standard characteristics therefore indicates sorting. Henderson (1985) expects price differentials to dissipate over time as property owners in lower-priced districts take steps to capture capital gains. But as Ross and Yinger (1999) argue in their survey article, a variety of constraints on adjustment likely allow price differentials to persist for long periods.

In this paper, we take advantage of an unusual "natural experiment" to investigate both household sorting and the adjustments (or lack thereof) that sorting encourages. The data come from a 160-acre residential subdivision developed in the 1920s in what was then the urban fringe. The unusual aspect of the subdivision is that it is divided neatly in half by the boundary between the central city (and its school district) and a suburb (and its school district). The boundary does not appear to have affected the construction quality of the houses. Indeed, the quality of the houses in the subdivision is generally higher than that of the houses in neighboring central-city developments; the developers in the 1920s implemented suburban-style design features, such as curvilinear streets and large setbacks, and put minimum construction expenditure requirements in the original lot-sale agreements.

Thus we have a case study of an early suburban-style subdivision, half of which is in the central city, half in a suburb.

The opportunity to observe household sorting and its effects comes from the relative decline in the quality of central-city services that began in the 1960s. The central city expanded by annexing most developing areas until the early 1960s. An exception is the suburb in which half of the case-study subdivision resides; it incorporated in the 1890s to provide services to a then-distant summer recreation area. The central city stopped expanding in the early 1960s, and essentially all of the new residential development has since occurred in suburban service districts. The "filtering" to lower-income households of relatively old, low-quality, and high-density housing in the central city led to relative declines in central-city tax revenues and public-services quality. Available measures of service quality, such as crime rates and school test scores and graduation rates, indicate the generally lower quality of central-city services. Thus there appears to be a mismatch in the central-city side of the case-study subdivision in the quality of houses relative to the quality of public services. Of interest is the response to that mismatch.

We begin with a study of subdivision house prices. Recent sales indicate a substantial suburban-side premium: over 40% of the price of a standard house in the central-city side. To investigate the time trend in the price differential we sampled 100 subdivision houses of similar age and style, fifty on each side of the service-district boundary, and collected prices on the 359 sales of the sample houses between 1949 and 2002. The estimated time trend indicates no difference in house prices across the boundary through the mid 1960s; suggesting that central-city services until then were of a quality similar to that in the suburb. The suburban-side price premium opens in the late 1960s, indicating the relative decline in the quality of central-city services. Because local tax rates are lower in the central city, the

price differential appears to provide a lower bound on the value of the difference in service quality across the boundary.

The longevity of the house price differential indicates unyielding constraints on adjustment. The simplest adjustment would be a relatively minor and seemingly sensible shift in the boundary to include all of the subdivision in the suburb. State law, however, requires a city-wide vote on any proposed de-annexation. Though the area is small at 80 acres, the effect on the central-city tax base would be relatively large, which should discourage a favorable vote.[1] No shift in the municipal boundary has been proposed. A shift in the school-district boundary does not, in contrast, require a similar district-wide vote. The process, however, is not straightforward, and no shift in the school district boundary has been proposed. These constraints appear to bind.

We expect household demographics, which are often used as proxies for preferences in tests of sorting, to reflect the differences in house prices and services quality. Census 2000 block data show, however, little difference in household demographics across the boundary within the subdivision. Demographic characteristics change markedly, however, in the central-city neighborhoods that border the subdivision, neighborhoods in which the houses are of lower quality. Thus demographic characteristics vary with house quality rather than with public-services quality, and the relatively high-quality housing in the subdivision appears not to have filtered.

This suggests either that the demographically similar households on the central-city side are content with lower-quality services or that the quality of the services actually consumed by these households differs from central-city norms. We found that a neighborhood association active only in the central-city side of the subdivision supplements municipal services. Crime rates and the quality of neighborhood infrastructure are similar to those in

[1] The situation seems similar to that described in Garasky and Haurin (1997).

the suburban side of the subdivision. The quality of neighborhood public schools (one of which is located in the subdivision) appears, in contrast, consistent with central-city norms. There are, however, several tuition-charging parochial schools proximate to the subdivision. Perhaps households on the central-city side of the subdivision tend not to send their children to the neighborhood public schools.

We test this hypothesis with a survey of 200 households, 100 on each side of the boundary, 70% of whom responded. About 60% of the central-city side respondents with children sent them all or most of the time to private schools, compared to 10% on the suburban side. Though the remaining 40% of central-city side households sent their children most of the time to public schools, some attended prior to 1970, and others attended public "magnet" schools, which restrict entry in an effort to offer central-city households relatively high-quality public education. There are no magnet schools as such on the suburban side. Thus there is a "supply response" to the mismatch between house quality and public-service quality: a neighborhood association and private and alternative public schooling.

Does this reflect Tiebout sorting? Over 80% of the suburban-side survey respondents reported that they were attracted primarily by the quality of the suburb's public schools, and almost all were attracted by the quality of the neighborhood and of the suburb's municipal services. This is clearly consistent with Tiebout sorting. Preferences for education, at least, clearly vary on the central-city side. But education is not strictly a public good as it is both excludable and rivalrous in consumption. Almost all of the respondents on the central-city side reported that the primary attraction of the neighborhood was the relatively low price of the high-quality houses combined with the high quality neighborhood amenities, which are public goods. The central-city-side households appear homogeneous in their preferences for the highly localized public goods that they consume. Given a relative disinterest in the characteristics of suburban public schools, they take advantage of the variety in educational

opportunities available from their central-city location. In this light, the neighborhood association can be viewed as an endogenous and relatively informal (or at least unofficial) service district, and the survey results provide rather strong evidence of Tiebout sorting.

This perspective suggests a re-interpretation of the boundary house-price differential. The price differential clearly does not reflect the value of the difference in the quality of public services consumed. Instead, the price differential appears to reflect mainly the costs of the privately-supplied services, i.e., we have detected "tax" capitalization. The price differential persists in part due to the practical difficulties in shifting the boundary. But it likely also persists in part because neighborhood residents value the rare opportunity to live in a high-quality neighborhood and send their children to private schools at a total cost similar to that experienced by suburban households who send their children to public schools. Put another way, the central-city side households appear to have taken advantage of the decline in the quality of central-city services to establish a new Tieboutian service district.

The remainder of the paper is organized as follows. Section II describes the estimation of the capitalization effect of the service-districts boundary. Section III describes the home-owner response to the boundary effect. Section IV concludes the paper.

II. Estimates of Capitalization

In this section we describe the estimation of the trends in the price of a house with a standard set of observed characteristics on each side of the subdivision from 1949 through 2002. The analysis adds to a list of recent papers that treat the problem common in capitalization studies of missing or poorly measured variables. Inaccurate measures of public-services quality and inaccurately measured or missing house and neighborhood characteristics potentially bias estimates of the capitalization of differences in service quality into house prices. Ross and Yinger, in their 1999 survey article, report that while easily-measured differences in local taxes are consistently found to capitalize into house-prices,

capitalization of differences in public-services quality has been inconsistently detected. In contrast, recent studies that take advantage of relatively good measures of public-school quality and that control relatively well for differences in house quality, e.g., Black (1999), Bogart and Cromwell (2000), Weimer and Wolkoff (2001), Downes and Zabel (2002), Kane, Staiger and Reigg (2005), and Reback (2005), provide consistent support for the capitalization of even modest differences in public school quality.

House-price data from the case-study subdivision offer another opportunity to control for difficult-to-measure variables. All of the houses in the data set are within a half mile of each other, so there is little variation in general accessibility or environmental conditions. And all of the houses are of similar style and vintage, and were subject to minimum construction-expenditure requirements. There is probably relatively little variation in construction quality. We do not measure the quality of public services directly. Rather, we take advantage of the relative decline in the quality of the package of central-city municipal and school-district services over time as a consequence of the general filtering of central-city housing. We expect to see little difference across the public-services boundary in the price of a standard house in the period prior to the 1960s because the central city was able to annex most developing areas; developers apparently found the quality of central-city services generally acceptable. Whether or not there was any prior difference in house prices, any subsequent change in the boundary-price differential reflects the relative decline in the quality of central-city services.

The Data

The subdivision, named Ottawa Hills, was platted in three phases in 1922, 1923, and 1924 in the urban fringe of Grand Rapids, Michigan. The location of the subdivision is shown in Figure 1, which also shows the territorial expansion over time of the central city of Grand Rapids. The western half of the subdivision is in the central city, which annexed the

area in 1891. The eastern half of the subdivision is in the City of East Grand Rapids (EGR), which was first incorporated as a Village, also in 1891, to provide services to a lakeside summer recreation area.[2] The Village became a city in 1926 in response to the expansion from the west of Grand Rapids residential development toward the Village. The central city continued to expand around East Grand Rapids until the early 1960s, at which time it essentially stopped annexing new territory.[3] While the population of the central city has experienced little gain since 1960, then and now about 190,000, the population of the Grand Rapids urbanized area (central city plus suburbs) grew from about 350,000 persons in 1970 to about 540,000 in 2000.[4] Nearly all of the new residential development since the 1960s has occurred in suburban jurisdictions.

Figure 2 shows the layout of the building lots in the subdivision and the location of the public-services boundary. The subdivision occupies a square area roughly one-half mile on a side, or roughly one-quarter square mile in area. The parcel was originally developed as a golf course, and the layout of the fairways influenced the novel street design. The original configuration contained 583 lots. Purchases of multiple lots and numerous lot-line adjustments over time resulted in a current total of 456 building lots in the subdivision, eight of which are not built on (these are typically used as yards). The *current* characteristics of every house and lot in the subdivision were collected from the Grand Rapids and East Grand Rapids tax assessors' offices, and are summarized in Table 1.[5]

A key characteristic is the year of house construction. The median year built is 1927 on the Grand Rapids side, and 1939 on the East Grand Rapids side. Figure 3 shows the

[2] The lake is about a mile to the northeast of the subdivision.

[3] There were two small annexations to the central city in the 1990s to the north of East Grand Rapids. These are large commercial developments that the central city was better prepared to serve than was the mostly residential suburban jurisdiction.

[4] This pattern appears to be typical. Mieszkowski and Mills (1993) report that about 57% of metropolitan-area population lived in central cities as recently as 1950. That proportion fell to about 37% by 1990.

[5] In Michigan, each city or township conducts its own assessment of property value for the purpose of taxation. A county "equalization" office monitors the local jurisdiction's performance.

distribution of houses built by year on each side of the subdivision. The houses on the Grand Rapids side are *on average* older, smaller, and on smaller lots than those on the East Grand Rapids side. Part of the reason for the slower development in the suburban side is that the recently chartered City of East Grand Rapids was still organizing its public-service delivery systems in the 1920s. Important for this study, however, is that the older houses that are on the suburban side – those most comparable to the houses on the central-city side – are concentrated in the northern part of the subdivision, the area north of Alexander Rd. A likely contributor to this north-to-south development pattern was the presence of a sewerage settling pond in the 1920s and 30s to the southeast of the subdivision.

We collected sales data on a sample of fifty houses of similar age and style from the northern half of each side of the subdivision, one hundred houses in total. All of the houses in the sample were built between 1924 and 1935, have two-stories, at least three bedrooms, brick veneer, and significant amounts of ornamental trim.[6] There are a total of fifty-two houses of this style and age in the northern half of the East Grand Rapids side of the subdivision (i.e., north of Alexander Rd.), two of which are on a relatively busy street that borders the subdivision. We use the remaining fifty houses as our suburban sample. We chose a sample of fifty houses randomly from the larger population of houses of similar age, style, and location away from the border streets in the northern part of the central-city side of the subdivision.

The current observable characteristics of the sample are summarized in Table 2. Note that the range in these characteristics is similar on each side of the subdivision, though the houses and lots on the suburban side are somewhat larger on average than their counterparts on the central-city side. While there is considerable variation in the size of the houses in the sample, the variation in house and neighborhood characteristics that are unmeasured –

[6] The developers placed restrictions on the sale of each building lot that specified, among other things, the minimum allowable expenditure on the structure, usually $8000 to $10,000.

accessibility to urban centers, construction quality, and neighborhood environmental quality – appears to be unusually small, and not correlated with the public-services boundary. Public-services quality and taxes vary only across the boundary.

An issue is the extent to which the characteristics of the houses changed over the time period. The assessors' offices maintain a folder for each property in the jurisdiction. Each folder contains an annotated history, back to 1950, of the assessed values of the house and lot. The annotations include dates and characteristics of most additions and of some renovations. The dates of the additions are noted if a building permit was obtained. Otherwise, the date that the assessor's staff "discovered" the addition, presumably in the course of a periodic survey, is reported. Thus, from the photos and the records maintained by the assessors' offices, we appear to have reasonably accurate data about the additions to floor space since 1950. There are, however, house characteristics, including current condition and interior updates and renovations, that are omitted or only crudely measured by the assessor.

We collected the price and date of each sale of each house in the sample since mid-1949.[7] The information is recorded on the deed of sale, which is kept on file at the county offices.[8] Until the 1990s, the sale price did not have to be recorded on the documents available to the public, and the standard practice was to record the transaction price as "one dollar and other valuable considerations". However, the sale price can reliably be calculated from the value of stamps affixed to the deed that verify payment of the state real estate transfer tax. We identified a total of 359 usable arms-length sales over the 53-year time period, 189 of which are in East Grand Rapids and 170 in Grand Rapids.

[7] The year 1949 is the cut-off because sampling indicates that the effects of the Depression on property sales affected the market through the early 1940s. The cost of additional data collection seemed to outweigh the benefit.

[8] We collected most of the information from copies of the deeds kept on file in the Grand Rapids office of TransNation Title Insurance Company. These copies are considerably easier to retrieve than those on file at the County. We thank Monte Reinert, Eilleen Mueller, and members of their staff for invaluable assistance in collecting and interpreting the sale prices analyzed in this study.

The number of times a house sold over the time period varies. Two houses on each side of the boundary did not sell over the period. Roughly half of the houses sold three times or more, while the maximum number of sales of any single house was seven. We rejected sales as not arms length that involved buyers and sellers with the same surname. We also observed that on occasion a house sold twice within a short period of time (less than two years), with the later sale at a significantly higher price than the earlier one. We were advised that a house in relatively poor condition is often purchased by someone who renovates it, then resells it. Consistent with Clapp and Giaccotto (1999), we used only the later of these sales. We regressed the number of times a house sold on the observed characteristics of the house and found no significant relationships. The variation in the number of sales is either random or correlated with unobserved variables. The fact that the largest number of sales is seven – an average of 7.5 years between sales – suggests that none of the houses have unobserved characteristics that induce especially rapid turnover.

There are an average of 6.65 sales per year, with a standard deviation of 2.85 sales. Figure 4 plots sales per year, which shows little trend over this long time period: the estimated coefficient on year of sale in a regression of sales per year on year of sale is positive, but small, 0.02, and statistically insignificant (the standard error is 0.025). An exception is the recession of the early 1980s; only seven houses sold in the years 1980 through 1984. That recession had an especially strong impact on the interest-rate sensitive manufacturing economy in Michigan.

Figure 5 plots sale price per square foot of floor space over the 53-year time period. The plot indicates only a slow increase in prices over the first twenty years of the period. Importantly, sale prices appear similar on both sides of the boundary until the late 1960s, consistent with the hypothesis of a unified neighborhood prior to suburbanization. Sale

prices diverge after about 1970 as expected given the relative decline in central-city services quality with suburbanization and filtering.

Estimation

The sale-price scatter in Figure 5 controls only for differences in house size. We extend this analysis in two steps. First, to get a feel for the time path of prices, we estimate a subdivision house-price index for each side of the boundary. We then estimate the time trend in the boundary-price differential directly to test if and when house prices differ statistically.

We use standard hedonic techniques. A general hedonic house-price function can be expressed as:

$$\ln P = \mathrm{f}(H, A, S, \varepsilon) \tag{1}$$

where $\ln P$ is the natural log of the sale price of the house, H is the quantity of housing services supplied by the house and lot, A represents accessibility or the cost of transportation to urban centers, S represents the quality of public services, neighborhood amenities, and taxes, and ε captures the randomness in price formation. Accessibility does not vary across our sample of houses. We proxy housing services, H, by a vector of observable house characteristics. Public services and taxes vary only with the city/school-district boundary.

The price index on each side of the service-district boundary can be estimated using a standard specification:

$$\ln P = X\beta + f(t) + g(t) + \varepsilon \tag{2}$$

where X is a vector of observed house characteristics, $f(t)$ is the time trend in the price of a standard house in one service district, and $g(t)$ is the corresponding price index in the other service district. This specification involves several assumptions. First, the coefficient vector β, which shows the market values of marginal changes in observed house characteristics, does not vary across the public-services boundary. The rationale is that arbitrage equalizes the marginal value of those characteristics, such as floor space and number of bathrooms, that

can relatively easily be adjusted and the costs of making those adjustments, i.e., the prices of labor and materials, do not vary across this small area. Second, the βs do not vary over time. The rationale is that while improvements in technology over time reduce the unit cost of building materials, the relative costs of various improvements remain essentially unchanged. Finally, the observed characteristics in the vector X effectively control for house characteristics. The houses in the sample were chosen to minimize the variation in difficult-to-measure characteristics.

A key issue is how to specify f and g in (2). A critical characteristic of the estimator is flexibility as theory offers no guidance on the form of the trend in prices over time. There are a variety of flexible procedures, each with its advantages and disadvantages: time dummies, a high-order polynomial in time, local linear regression, kernel regression, cubic splines, and the flexible Fourier form. Time dummies are especially undesirable in this context because the number of observations in any relatively short time period, such as a year, is small. We chose to use the flexible Fourier expansion because it is flexible, efficient, and easy to implement. Pagan and Ullah (1999) describe the general procedure and McMillen and Dombrow (2001) apply it to the estimation of house-price indices.

The Fourier expansion derives its flexibility from the use of sine and cosine wave functions. Following McMillen and Dombrow, the time trend $f(t)$ can specified as:

$$f(t) = \alpha_1 z + \alpha_2 z^2 + \sum_{q=1}^{Q} (\lambda_q \sin(qz) + \gamma_q \cos(qz)) \tag{3}$$

where $z = 2\pi t / \max(t)$, which transforms the sale date, t, to lie between 0 and 2π, $z^2 = 2\pi t^2 / \max(t)$, and Q defines the number of terms in the expansion.[9] A larger Q adds higher-frequency sine and cosine waves. As a practical matter, the number of terms usually need not be large, with Q equal to 1 or 2, when the form is applied to only one regressor.

[9] In this case we observe the date of sale. So the variable t, which measures the number of years since the beginning of 1949, is essentially continuous and takes a value from 0 to 53. The term *max(t)* is simply 53.

Substituting (3) and a similar expression for *g* into (2) allows estimation of the hedonic price function by OLS. The estimated coefficients can be used to calculate the price index at any series of target times.

The estimates of the coefficients on the house and lot characteristics in equation (2), using the Fourier form with *Q* equal to 2, are reported in the first column of results in Table 3. The data include all 359 observations on sample sales from 1949 through 2002. The dependent variable is the natural log of sale price. The estimated coefficients on the variables that measure house characteristics for the most part appear reasonable. An additional 100 square feet of floor space increases sale prices by about 1.5%, while an additional 1000 square feet of lot space increases sale prices by about 2.8%. An additional bath increases sale prices by about 9%. That the age of the house at the time of sale has no effect supports our assumption that the houses built from the mid 1920s through the mid 1930s are of similar construction quality. It is a bit surprising that additional garage space has no effect. The coefficients on the terms in the Fourier time trend are not reported in the table because they individually do not offer a straightforward interpretation. The regression explains about 95% of the variation in houses prices, much of which is explained by the time trends.

Figure 6 plots the estimated time trends for a house with characteristics that correspond to the means in the 100-house sample over a scatter of the natural log of sale prices.[10] The estimated trends again show modest price appreciation through most of the 1960s, and importantly, there appears to be little difference in house prices during that time period across the central-city/suburban boundary. As expected a price differential opens in the late 1960s as prices in EGR begin rising while prices in GR continue their previous flat trend until about 1973. The price differential persists through the end of the study period. Though there is a

[10] The estimated time trends and coefficients on house characteristics are substantially unchanged using alternative flexible estimators for the time trend, such as a high-order polynomial in time.

hint that the differential is closing toward the very end of the time period, flexible estimators tend to be unreliable at the "edges" of the data.[11]

We test the early-period equivalence of prices across the boundary using a less efficient, but intuitively appealing, estimator. We define (arbitrarily) a ten-year window beginning in January 1949, and estimate (2) assuming that $g(t) = f(t)$ + constant. That is, we simply include a dummy equal to one if the house is in the suburb, East Grand Rapids. We then slide the earlier end of this ten-year window through time at one-quarter year intervals from 1949 through the third quarter of 1992. This exercise produces 175 quarterly estimates of the ten-year average boundary effect (the coefficient on the EGR dummy) and its standard error over the 53-year time period.

Figure 7 plots over time the estimated boundary effect and its 95% confidence interval. Each quarterly estimate of the price differential is plotted at the mid-point of the ten-year window, i.e., the results from the first regression, 1949 through 1959, are plotted at 1954. Consistent with the Fourier estimates, the estimated boundary effect is close to zero and statistically insignificant in the 1950s through the mid 1960s. There is no significant difference in house prices across the boundary in any ten-year period prior to that centered on 1967. The boundary effect becomes significant in the late 1960s,[12] and, though things get messy during the recessionary early 1980s, does not appear to shrink on average throughout the remaining thirty years covered by the data.[13] Indeed, the boundary effect exceeds 40% of central-city side prices in the 1990s.

[11] Increasing Q to 3, i.e., adding higher-frequency sine and cosine terms, increases considerably the flexibility in the estimated time trend. The general trend in the boundary differential is similar, but the trend line appears more sensitive to individual observations among the relatively few observations in a given year.

[12] The small number of sales per year do not allow an accurate estimate of the year in which house prices began to diverge. It does not appear that an accurate estimate is needed in the current context.

[13] The series of regression results shows no trend in the coefficient on any of the house characteristics, though the coefficient estimates cycle, suggesting the effect of influential observations in the relatively small sub-samples.

We can check that our 100-house sample is representative by comparing the sample results to the results from the population of subdivision sales since 1991. The assessors in each jurisdiction have readily-accessible records of all house sales, 372 in total, in each side of the subdivision since the beginning of 1991. We estimate a simple linear trend in the boundary price differential by including an EGR dummy and the EGR dummy interacted with time of sale. The results are shown in the middle and right-hand columns of results in Table 3. The point estimate on the EGR dummy (the boundary effect in 1991) is large and highly significant in both samples, and the dummy interaction (the trend in the boundary effect since 1991) is small and insignificant. That the results are similar indicates that the 100-house sample is representative.

That the estimated coefficient on the EGR dummy is larger using the full population of sales supports concerns about bias from unobserved heterogeneity in house characteristics. Eliminating the dummy interaction term in the regression reduces the estimates of the coefficients on the EGR dummies to 0.345 in the 100-house sample and 0.386 in the full population of sales. The houses in the full population of sales on the EGR side, especially those in the southern half of the subdivision, tend to be newer, larger, and of more varying style than those on the central-city side. The resulting unobserved differences in house characteristics probably bias upward the estimate of the boundary effect from the full population of sales.

These results indicate that by the late 1990s the boundary differential was about 41% of the price of a standard house in the central-city side of the subdivision.[14] This represents a differential of about $100,000 on the median sample house in year 2000. There are three potential sources of this differential: higher local taxes, poorer (unobserved) house condition,

[14] Exp(0.345) – 1 = 0.412, or about 41%.

and/or lower quality neighborhood amenities and public services on the central-city side of the subdivision.

Differences in local taxes appear not to be the culprit. The property tax rate on the central-city side of the subdivision is about half that on the suburban side: currently about $22 per thousand dollars of taxable value versus $44 on the suburban side.[15] But the central-city imposes a tax on income of 1.3%, while there is no suburban income tax. We can easily get a feel for the relative sizes of these taxes. Assuming, optimistically, that household income on the central-city side of the subdivision equals the median suburban-side income of $85,000 in year 2000, the income tax payment is roughly $1100.[16] The difference in the property tax payment on the median central-city side house, worth about $250,000, is roughly $2750 (taxable value equals half of market value, thus $44 - $22 times 125 thousands equals $2750). The difference in the property-tax exceeds the income tax, so the effective tax rate is lower in the central-city side of the subdivision. The lower tax rate reduces the price differential, all else the same.

We lack the data to control for systematic differences across the boundary in house condition. Indeed, one might expect that the lower sale prices on central-city houses since the late 1960s might encourage lower expenditure on maintenance and improvements. The effects of this lower expenditure on house condition are difficult to observe. But it seems sensible to include any effects on house condition as part of the total effect of the difference in public services and taxes. Thus, while the estimate of the boundary differential may be a biased estimator of the effect of the difference in public-services and taxes on the price of a strictly *standard* house, it can reasonably be considered an unbiased estimator of the total

[15] When a house sells in Michigan its taxable value is set equal to its assessed value, which is half of market value. Between sales, taxable value falls over time as a proportion of assessed and market value due to a regulatory ceiling on taxable-value inflation.

[16] Income is not available at the block level from census statistics.

effect on house values of the relative decline in central-city services, which includes any effect on house condition.[17]

These arguments suggest that the price differential can be interpreted as a lower-bound on the value of the differences between central-city and suburban public-services quality. It appears that we have detected public-services capitalization. The differential is only a lower bound because capitalization of the lower central-city taxes reduces the differential.

III. Evidence of Sorting

The disparity in service quality clearly reflects the general disparity in household incomes between central city and suburban jurisdictions. Mieszkowski and Mills (1993) discuss two classes of theories that explain this income disparity. The "natural evolution" story explains the suburbanization of higher-income households: given improvements in transportation infrastructure, middle and higher-income households are more willing to trade off short commutes for the lower congestion, higher environmental quality, and newer and better houses in suburban areas. Of interest is that the City of Grand Rapids until the early 1960s was able to annex and extend services to these developing suburban areas.[18] The "flight-from-blight" theory motivates the formation of separate suburban jurisdictions: the older, smaller, and more crowded housing in the central city filters to lower-income households, who cannot afford to support the relatively high-quality urban public services, especially educational services, that the growing number of middle-income households demand. Why the 1960s is the watershed in Grand Rapids is not obvious, though racial tensions may have played a role.

Though probably common at central-city boundaries, it is still somewhat surprising that such a large price differential has persisted for so long among the otherwise similar houses in

[17] See Wang and Zorn (1997) for an interesting discussion of the objectives in the estimation of house-price indices.

[18] The expansion in some directions was constrained by pre-existing cities, such as East Grand Rapids.

the case-study subdivision. We would expect to see a supply response to the price differential. Henderson (1985) argues that a supply response is likely because entrepreneurial land owners and developers can respond in a variety of ways: they can pressure district officials to adjust district boundaries, alter the characteristics of existing development, or change the characteristics of public services. In some Tiebout-type models, such as Hamilton (1975) and Henderson (1991), these long-run adjustments eliminate price differentials: households sort by preference for public services, but the price of a standard house does not in long-run equilibrium vary across service districts. Ross and Yinger (1999) argue in their review article that practical constraints inhibit supply adjustment, and observe that most Tiebout-type models correspondingly include assumptions such as a fixed number of jurisdictions and inflexible boundaries. That the price differential across the subdivision has persisted for more than thirty years indicates binding constraints. In this section we first describe the constraints on supply adjustment, and then report the results of a survey of household preferences to test Tiebout sorting.

Supply adjustments

An obvious home-owner response to the rather large house-price differential is to try to organize a shift in the public-services boundary to bring the central-city half of the subdivision into the suburb. This "de-annexation" from the central city, which would be relatively small at eighty acres, would reunite what appears to have been a cohesive neighborhood.[19] State law in Michigan, however, requires a city-wide vote on any proposed de-annexation from a city.[20] One would expect such a vote to go against the de-annexation because the property-tax payments from houses in the central-city side of the Ottawa Hills

[19] Henderson (1985) reports about 1.4% as many de-annexations as annexations nationwide between 1950 and 1976. Epple and Romer (1989) similarly find about 1.7% as many de-annexations as annexations between 1970 and 1979, where the average de-annexation is small at 285 acres. These de-annexations arguably represent the marginal adjustments to service-district boundaries that dissipate rent differentials.

[20] Procedures for municipal boundary adjustments are described in *Local Government Law and Practice in Michigan*, J. J. Rae, editor, published in 1999 by the Michigan Municipal League.

subdivision average more than twice the central-city average; the boundary adjustment would have a disproportionately large impact on central-city finances.[21] This case is apparently similar to that in Ohio described by Garasky and Haurin (1997) in which an attempted de-annexation failed, but the voting margin was smaller than expected because voters in precincts close to the city boundary tended to support the de-annexation. City officials report that there have been no attempts to de-annex the western half of the Ottawa Hills subdivision.

Shifting the school-district boundary does not, in contrast, require a city or district-wide vote. And it may be that the difference in the quality of the public schools explains a relatively large portion of the price differential. Output measures, such as test scores and graduation rates, indicate that the public schools in the suburb are of considerably higher quality than the central-city schools that serve the Ottawa Hills neighborhood. School district and city boundaries do not generally coincide. Two-thirds of the households in Grand Rapids' Ottawa Hills neighborhood could initiate the process of de-annexation by filing a petition with the county Intermediate Service District (ISD), a public agency that supplies various services to the school districts in the county. The ISD then works with the two school district boards to resolve the petition.

At least two practical considerations appear to work against the school district de-annexation. First, a Grand Rapids school district building is located in the subdivision, in the large area labeled '477' in Figure 2. East Grand Rapids already has a surplus of school space due to the general reduction in the number of children per household, so would likely welcome the additional children from the de-annexation, but would likely prefer not to purchase and maintain the building.[22] Second, in addition to paying the higher property taxes

[21] The prices of the approximately 13,000 sales of houses in the central city from 2000 through 2002 averaged about $110,000, compared with an average of $259,000 for the nine sales in the central-city side of the Ottawa Hills subdivision.

[22] East Grand Rapids closed one of four elementary schools in the district and allows entry to the district through a lottery to fill remaining seats.

that come with higher house values, residents on the central-city side of the neighborhood would have to continue to contribute toward the service of Grand Rapids school district debt. So the higher house prices from a boundary shift would look good for the long term, but home owners in the short term would see more than a doubling of their property taxes. To date, no petition has been filed with the ISD.

Prevented (or discouraged) from de-annexing, entrepreneurial owners of homes on the Grand Rapids side of the subdivision might try to alter the characteristics of development. Demolition and redevelopment of the area seems an undesirable option because the housing stock in the neighborhood is historic, of high construction quality, and difficult to duplicate in the suburbs. A more plausible option would be to ease zoning restrictions from the current single-family residential zoning to allow multi-unit residential and/or commercial uses in existing structures. The current zoning in the central-city areas to the immediate north, west, and south of the subdivision is less restrictive, allowing multi-family use. This suggests that a relaxation of zoning should be relatively easy to accomplish.

A look at the history of zoning in the area is instructive. Until 1951, zoning in the subdivision (and its nearby environs) was less restrictive than the current single-family zone, allowing one and two-family dwellings, churches, schools (hence the school located in the subdivision), libraries, and even "farming and truck gardening". The case-study subdivision, and only this subdivision, was up-zoned to single-family residential in 1951, and so it remains (since 1969 in the "R-1" zone).[23] The neighborhoods around the subdivision were also up-zoned to residential, but the zone, currently known as "R-2", allows smaller building lots (4000 versus 7200 square feet) and two-family dwellings. Lot sizes are smaller in these neighborhoods. Interestingly, the area immediately to the north of the subdivision was rezoned R-1A in 1988, which is less restrictive than R-1, but more restrictive than R-2. Area

[23] With one exception: two-family dwellings are allowed on corner lots that front on a major street.

residents felt that the variances being allowed under the R-2 zone were leading to degradation in the quality of the neighborhood. Thus while zoning is probably more flexible than are service-district boundaries, there appear to be limits to this flexibility in this primarily residential area. Nevertheless, the central-city side of the subdivision remains an island of relatively restrictive single-family zoning.

No boundary adjustment and no alteration in the characteristics of development leave as a supply response only adjustment in the characteristics of the local public goods and services consumed by the households in the neighborhood. We found that an active neighborhood association operates in the central-city side of the subdivision. There is no formal association operating in the suburban side of the subdivision nor in the central-city neighborhoods that border the subdivision.[24] The association's budget consists mainly of householders' time rather than revenue from fees or dues. Key activities supplement municipal services. The association organizes home owner efforts to maintain neighborhood security, lobbies for prompt and quality delivery of city services, and organizes neighborhood clean-ups and an annual neighborhood celebration. Crime rates in the case-study neighborhood are far below the central-city average, and are comparable to those on the suburban side of the subdivision. Neighborhood infrastructure and aesthetics are also comparable to the suburban side.[25] Thus the activities of the association appear to close much of the gap in the quality of several key local public goods.

Perhaps the most highly-valued public service is K through 12 schooling. Of interest is that access to relatively high-quality private/parochial schools in the area is good. There are seven parochial elementary schools and two parochial high schools within a few miles of the subdivision. This raises the possibility that the quality of the services consumed by

[24] There are neighborhood associations active in several other central-city neighborhoods, but no formal neighborhood associations are active in any of the East Grand Rapids neighborhoods.

[25] The association, for example, convinced the City to install ornamental street lighting different from (and more expensive than) the standard street lights used in neighboring areas.

subdivision residents varies significantly less across the service-district boundary than that indicated by municipal and public-school performance measures. A plausible hypothesis is that the similar houses and neighborhood attract households demographically similar to their suburban counterparts who demand services of similarly high quality. The neighborhood association and the nearby private suppliers of educational services meet this demand. The persistent house-price differential under this hypothesis compensates for the additional cost of the privately-supplied services, rather than for the low quality of central-city services.[26] That the nearby private schools are parochial schools may provide an especially strong indicator of Tiebout sorting: the households on the central-city side prefer suburban-quality housing and a key service characteristic, religiously-based education, that suburban public school districts cannot legally supply.[27]

Tests of household sorting

Tiebout models predict sorting by preferences for local public goods and services, but preferences are difficult to observe. Using demographic characteristics as proxies for preferences has produced mixed results. Using a cross-section of 1990 Census demographic data, Heikkila (1996), for example, finds that municipal boundaries correspond with clusters of demographically-similar census tracts, consistent with Tiebout sorting. Rhode and Strumpf (2003), in contrast, find that the heterogeneity in census demographics across municipalities has surprisingly decreased over the last 150 years during which reductions in transportation costs have facilitated sorting. Studies that take advantage of more direct measures of preferences, such as surveys, e.g., Gramlich and Rubinfeld (1982), or actual

[26] The four Catholic elementary schools in the area charge about $2600 per year for one student, one of the Protestant elementary schools charges about $3200, and the other two about $5200. Quantity discounts apply for additional children from the same family, and actual fees vary with ability to pay at the higher-priced schools. We lack a good estimate of the actual average fees paid at the elementary level. Fees at the Catholic high school are about $5000 per student, and at the Protestant high school about $6200.

[27] Of the 61 non-public, tuition-charging schools that provide K-12 education in Kent County (the county that houses most of the Grand Rapids urbanized area), fifty-nine are parochial schools. Approximately 16% of school-age children attend one of these 61 private schools, 97.5% of whom attend a parochial school.

intra-metropolitan relocations, e.g., Hanushek, Kain, and Rivken (2004), consistently provide evidence of Tiebout sorting. We analyze both demographic and survey data.

Table 4 summarizes subdivision demographic characteristics on each side of the service-district boundary. The four columns on the left-hand side of the table show data for the subdivision obtained from Census 2000 block data. The four columns on the right-hand side of the table show corresponding data for the *remainder* of the census tract occupied by each side of the subdivision (the census tract boundary coincides with the service-district boundary because census tracts aggregate to cities).[28] The demographic characteristics within the subdivision are surprisingly similar across the boundary given the differences in both house prices and the quality of municipal and school district services. Only the proportion of the population that is African-American differs: 12% on the central-city side relative to 1.2% on the suburban side.

The data from the remainder of the census tracts are more consistent with expectations: the demographic characteristics of the rest of the central-city census tract differ starkly from those in the suburb and from those in the central-city side of the subdivision. Not surprisingly, median household income in the central-city census tract is less than half that in the suburban census tract.[29] Thus the relatively high-quality housing on the central-city side of the subdivision appears to attract households demographically much more like their suburban counterparts than like their central-city neighbors. Demographic characteristics would not indicate Tiebout sorting across the boundary within subdivision.

We test our hypothesis of differences in preferences for school characteristics with a simple survey. The objective of the survey is to investigate whether location affects school choice, and whether prior preference for private versus public school affects the choice of

[28] The central-city side of the subdivision occupies the southeast quarter of census tract 33 in the City of Grand Rapids, and the suburban side of the subdivision occupies the southwest sixth (or so) of census tract 124 in the City of East Grand Rapids.

[29] Median household income is not reported at the block level, so we cannot compare household incomes across the boundary within the subdivision.

location. We ask (1) when the household moved to the neighborhood (as opposed to their current house), (2) whether they have, have had, or plan to have school-age children and when the children attended school, (3) whether their children attend private (tuition-charging) school, public school, or a mix, (4) whether their preference for private versus public schooling influenced their decision to locate in the neighborhood, and (5) what the key factors were that determined their location decision (an open-ended question).

We sent this short survey, with return postage paid to the owner-occupiers of 200 houses in the northern half of the subdivision, 100 on each side of the public-services boundary. We started with the owners of the houses in our original 100-house sample (described in the previous section) who assessors' records show occupy their house, plus an additional sample of owner-occupiers chosen randomly from the northern half of the subdivision. We received 121 completed surveys via return mail and completed 19 more through follow-up phone calls for a total of 140 completed surveys (70%), 72 from the central-city side and 68 from the suburban side of the subdivision.

The results, which are shown in Table 5, indicate clear differences across the school-district boundary in the choice of schools. On the suburban side, of the 63 households with children, 48 (76%) sent (send, or intend to send) them exclusively to the local public school. Of the ten households whose children attended a mix of schools, six sent them to private school less than a quarter of the time, and three sent their children to private elementary school and then to public high school. Thus, over 90% of the suburban respondent households sent their children at least half of the time to the local public schools.

As expected, a solid majority of the 62 central-city side households with children sent them all or most of the time to private schools.[30] Still, it is a bit of a surprise that as many as

[30] To avoid discouraging a response we did not ask respondents to tell us the name of the private school to which they sent their children. We did, however, leave room for comments. Of the 47 respondents on the central-city side whose children attended private school at least part of the time, 16 volunteered the name of the

40% sent their children to public schools. Some of these children attended the public schools before the relative decline in school quality: 8 of 25 attended in the 1950s or 1960s, and another 8 attended in the 1970s. Excluding some or all of these households as irrelevant increases the proportion of households sending their children mostly to private schools. Importantly, some of those who more recently sent their children to GR public schools indicated that they sent them to GR public magnet schools, rather than to the neighborhood public schools. Magnet schools restrict enrollment to relatively capable students. The magnet schools are an effort by the central-city public school district both to accommodate diversity in the abilities and needs of children and to increase the range of public school characteristics offered within the district. The City magnet high school is particularly well regarded. Thus both the private schools and the magnet schools supply educational services of a quality higher than the central-city norm. It appears that the households on the central-city side of the neighborhood are supplied with services of a quality commensurate with house and neighborhood quality.

Of interest is the homogeneity of the stated preferences for those services. On the suburban side fully 81% of respondents indicated that the quality of the suburban public schools was a primary determinant of their decision to locate in the suburb. Respondents generally were attracted by the quality of houses, schools, and municipal services in the suburb. This is consistent with Tiebout sorting. In contrast, only just over half of the 37 respondent central-city side households who sent their children mostly to private schools were attracted by the proximity to those schools. Indeed, over 40% of the households with children, wherever they sent them, reported that they moved to the neighborhood without consideration of schools (compared with 6% on the suburban side). This lack of homogeneity in preferences appears inconsistent with Tiebout sorting.

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school(s): consistent with the overall preponderance of parochial schools, 15 of these 16 sent their children to parochial school.

There is, however, a rationale for discounting this conclusion. Almost all of the central-city side households reported that the low costs associated with the high quality houses and neighborhood amenities were the primary attraction of the neighborhood. Neighborhood amenities are local public goods, i.e., they are non-rival and non-excludable to neighborhood residents, while education is not strictly a public good because it is excludable. Private schools operate even in areas with good public schools. These households appear to have been attracted to the central-city side of the subdivision out of a shared preference for the neighborhood amenities, which are similar to those on the suburban side of the subdivision, and a shared disinterest in the characteristics of suburban public schools. The central-city side of the subdivision, with its neighborhood association, appears to be an endogenous or informal Tiebout service district.

This suggests a re-interpretation of the boundary house-price differential. The low house prices compensate for private-school tuition payments and the time and out-of-pocket costs associated with the neighborhood association, i.e., the price differential represents "tax" capitalization. The value of the differential across the boundary in the package of public services and taxes is apparently even larger because these households outbid other households, of which there apparently are many in the central city, who would be willing to consume standard municipal services and send their children to the neighborhood public schools.

IV. Concluding Remarks

This study takes advantage of an unusual natural experiment that minimizes many of the measurement problems that hamper tests of Tiebout hypotheses: a subdivision developed in the 1920s bisected by the boundary between the central city and a suburb. The quality of the houses and neighborhoods appears similar across the boundary. Consistent with appearance, house prices were the same on both sides of the boundary until the late 1960s. Census

demographics were also the same in 1960. A boundary price differential opened in the late 1960s with the decline in the quality of central-city public services. While Census 2000 census tract demographics are consistent with filtering, block data from the subdivision indicate that the relatively high quality houses on the central-city side of the subdivision did not filter.[31] Our survey responses indicate Tiebout sorting: households demographically similar to their suburban counterparts have similar preferences for neighborhood amenities but differ in their preferences for school characteristics. Rather than compensating for the lower quality of central-city services, much of the house-price differential apparently compensates for the additional costs of consuming privately-supplied services in the central city, especially private schooling.

There are several additional points worth noting. First, though small relative to the size of the public-service districts involved, the subdivision appears to reflect an appropriate geography for tests of Tiebout hypotheses. Most tests use municipalities or other special service districts as the unit of observation. But public-service districts in practice must trade off accommodating intra-district diversity in demand for public services to exploit scale economies, internalize spatial externalities, and accommodate concerns about equity. Our results suggest that home owners, private suppliers, and to some extent the public-service district can respond to the diversity in demand for highly localized public goods and services. The usual focus on cities and other public service districts may frequently be too coarse: sorting probably occurs across the smaller neighborhoods within service districts. The larger the variation across the service district in house and neighborhood characteristics, the more of this intra-district sorting and private supply of services we would expect to see.

[31] Census tract data indicate significant change in racial composition between 1960 and 1970. The 1960 census reports a total of five African-American individuals (one family?) living in the central-city census tract occupied by the west half of the subdivision. By 1970 that number had increased to 1261, roughly a quarter of the population.

The second point regards the timing of the "supply response" to the boundary price-differential within the subdivision. The demand for high-quality services on the central-city side of the subdivision is met, in part, by the nearby private schools. Interestingly, most of these schools were in operation well before the decline in the relative quality of central-city public schools. Three of the seven parochial elementary schools were established in the 1920s, three in the 1950s, and the seventh in 1965. One of the two high schools was established in 1906, and the other in 1962. In general, the private suppliers were there prior to the relative decline in central-city services, apparently serving the similar households who prefer a parochial school, but who at the time had to pay both the private-school tuition and their share of public-school costs through property taxes. Only after suburbanization are some of these households able to enjoy a "price break" through the discount on central-city houses and local taxes. Things in the subdivision may, however, have been different had the private suppliers not already been there.

The third point regards the Tiebout-model prediction of homogeneity within service districts in preferences for public services. Our survey results suggest that this rather stringent standard is nearly met on the suburban side of the subdivision. The vast majority of the respondents chose the neighborhood for the combination of neighborhood characteristics, public school quality, and the quality of other suburban public services. Households on the central-city side appear similarly homogeneous in their preferences for neighborhood public goods. But the availability of both private and magnet schools allow diversity in school preferences, diversity that neighborhood residents appear to value.

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Table 1. Current Characteristics of the Population of Subdivision Houses

East Grand Rapids (suburb)	Mean	Median	Std Dev	Min	Max
Floor space (sq ft)	2589	2551	706	1000	4993
Year Built	1940	1939	12.4	1919	1999
Baths	2.79	2.5	0.80	1	5
Lot area (sq ft)	12,475	12,000	4,828	5,590	27,300
Garage space (sq ft)	484	450	140	216	1446
Grand Rapids (central city)					
Floor space (sq ft)	2190	2112	498	1081	4345
Year Built	1931	1927	8.25	1922	1956
Baths	1.97	1.5	0.71	1	5.5
Lot area (sq ft)	7281.4	6500	2481	3953	23,098
Garage space (sq ft)	397	399	87.7	0	850

There are 193 houses in the East Grand Rapids portion, and 255 houses in the Grand Rapids portion.

Table 2. Current Characteristics of Houses in the Sample

East Grand Rapids (suburb)	Mean	Median	Std Dev	Min	Max
Floor space (sq ft)	2689	2660	470	1621	3571
Year Built	1929	1929	2.37	1923	1934
Baths	2.92	2.5	0.63	1.5	4.5
Lot area (sq ft)	9955	9810	2960.5	5590	18,893
Garage space (sq ft)	445.5	407	116.0	220	915
Grand Rapids (central city)					
Floor space (sq ft)	2486	2439	543.8	1640	3599
Year Built	1927.2	1927	2.40	1923	1935
Baths	2.22	2.5	0.77	1.5	4
Lot area (sq ft)	8140	6790	3520	4615	23,098
Garage space (sq ft)	400.0	400	70.7	228	600

There are 50 houses in the sample on each side of the urban boundary, 100 houses in total.

Table 3. Regression Results

	Price Indices		Boundary Differential since 1991	
	Sales since 1949		Sample sales	All subdivision sales
Floor space (100s of sq ft)	0.0149 (4.61)		0.0184 (3.54)	0.0217 (8.47)
Lot size (1000s of sq ft)	0.0277 (5.21)		0.0352 (4.05)	0.0135 (4.12)
Baths	0.0901 (4.60)		0.0551 (1.60)	0.0706 (4.00)
Garage size (100s of sq ft)	-0.0001 (0.00)		0.0210 (0.90)	0.0129 (1.41)
Age at sale (decades)	0.0483 (0.94)		0.0673 (0.81)	0.0251 (2.36)
		Sale date (years)	0.0722 (5.96)	0.0717 (17.66)
		EGR dummy	0.3710 (5.17)	0.4171 (10.63)
		EGR*sale date	-0.0046 (0.44)	-0.0054 (0.98)
Number of observations	359		95	372
Adj R-squared	0.953		0.849	0.886

t-statistics in parentheses.

Dependent variable is the natural log of sale price.

Table 4. Demographic Characteristics

	Subdivision (block data)				Remainder of Census Tract			
	Central City		Suburb		Central City		Suburb	
Household Type								
Married-couple family	197	79.1%	158	82.7%	410	33.3%	746	66.5%
Male-headed family	2	0.8%	1	0.5%	43	3.5%	22	2.0%
Female-headed family	14	5.6%	10	5.2%	262	21.4%	115	10.2%
One person	24	9.6%	19	9.9%	404	32.8%	201	17.9%
Unrelated persons	12	4.8%	3	1.6%	111	9.0%	38	3.4%
Household Tenure								
Owner-occupiers	248	99.6%	188	98.4%	760	61.8.%	1031	93.9%
Renters	1	0.4%	3	1.6%	470	38.2%	91	8.1%
Total Households	249	100.0%	191	100.0%	1230	100%	1122	100%
Age								
Under 18	242	31.3%	208	34.5%	1015	27.3%	1032	32.8%
18-64	467	60.3%	334	55.4%	1835	49.4%	1835	58.4%
Over 65	65	8.4%	61	10.1%	865	23.3%	277	8.8%
Race								
White	653	84.4%	578	95.9%	1687	45.4%	3061	97.4%
Black	92	11.9%	7	1.2%	1845	49.7%	14	0.4%
Other	29	3.7%	18	3.0%	183	4.9%	69	2.2%
Total Population	774	100.0%	603	100.0%	3715	100%	3144	100%
Med Household Income	NA*		NA		$41,191		$92,738	

Source: Census 2000 Summary File 1 census tract and block data. Household income from Summary File 4.

* Median household income is available at the census tract, but not the block, level.

Table 5. Survey Results

	Suburb		Central City	
Children				
Households with children	63	92.6%	62	86.0%
Average number of kids	2.43		2.44	
Median number of kids	2		2	
School Choice (HHs w/children)				
Attended only public school	48	76.2%	15	24.2%
Attended only private school	5	7.9%	27	43.5%
Attended a mix of public & private	10	15.9%	20	32.3%
At least half time public	9	14.3%	10	16.1%
At least half time private	1	1.6%	10	16.1%
Total with kids	63		62	
Neighborhood choice (HHs w/children)				
Moved to send kids to public school	51	80.9%	13	21.0%
Moved to send kids to private school	3	4.8%	20	32.3%
Liked the option of public/private	5	7.9%	3	4.8%
Moved w/out consideration of school	4	6.4%	26	41.9%
Total with kids	63		62	
Total responses	68		72	

Figure 1. Grand Rapids Annexations and East Grand Rapids

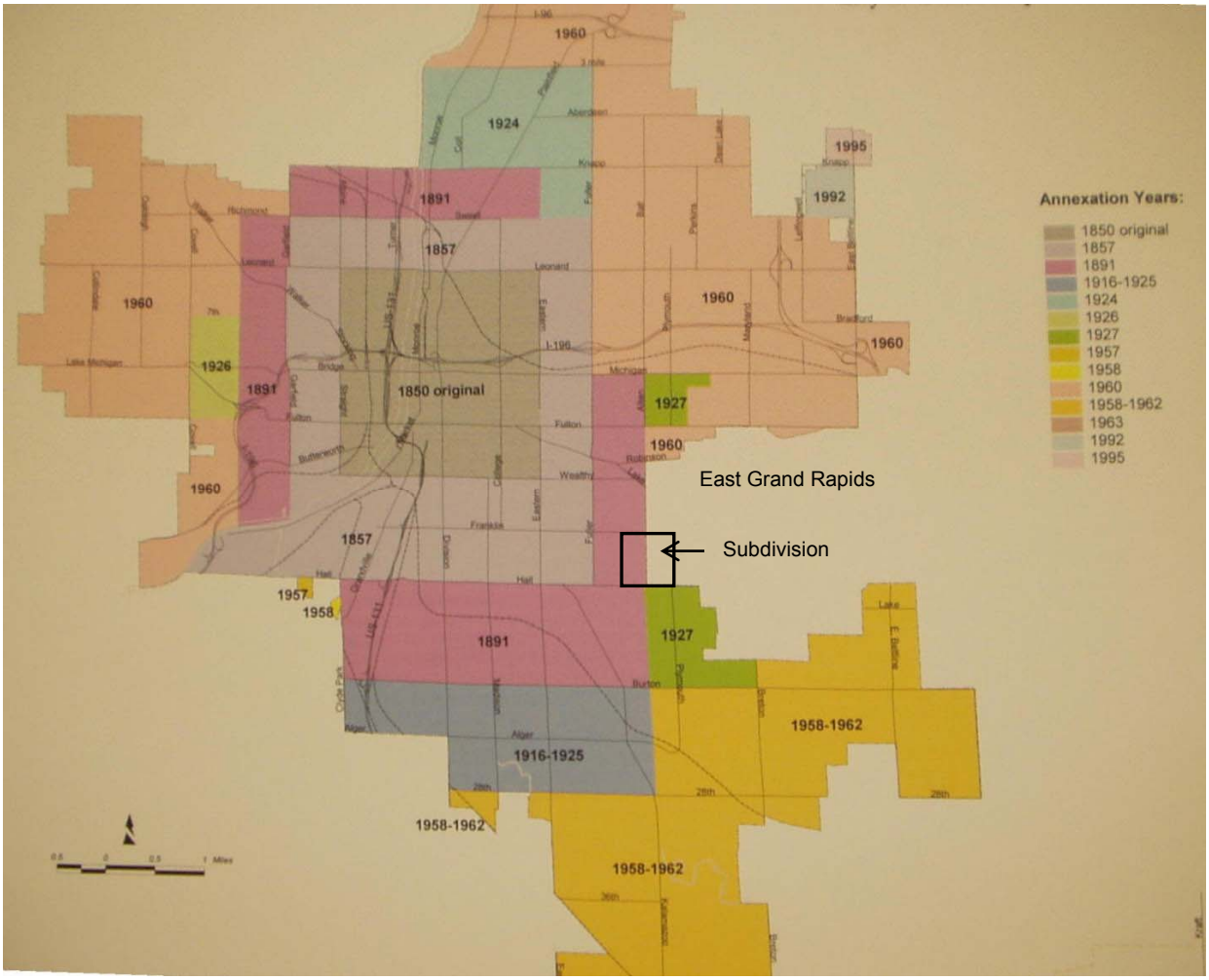

Figure 2. Plat of the Subdivision

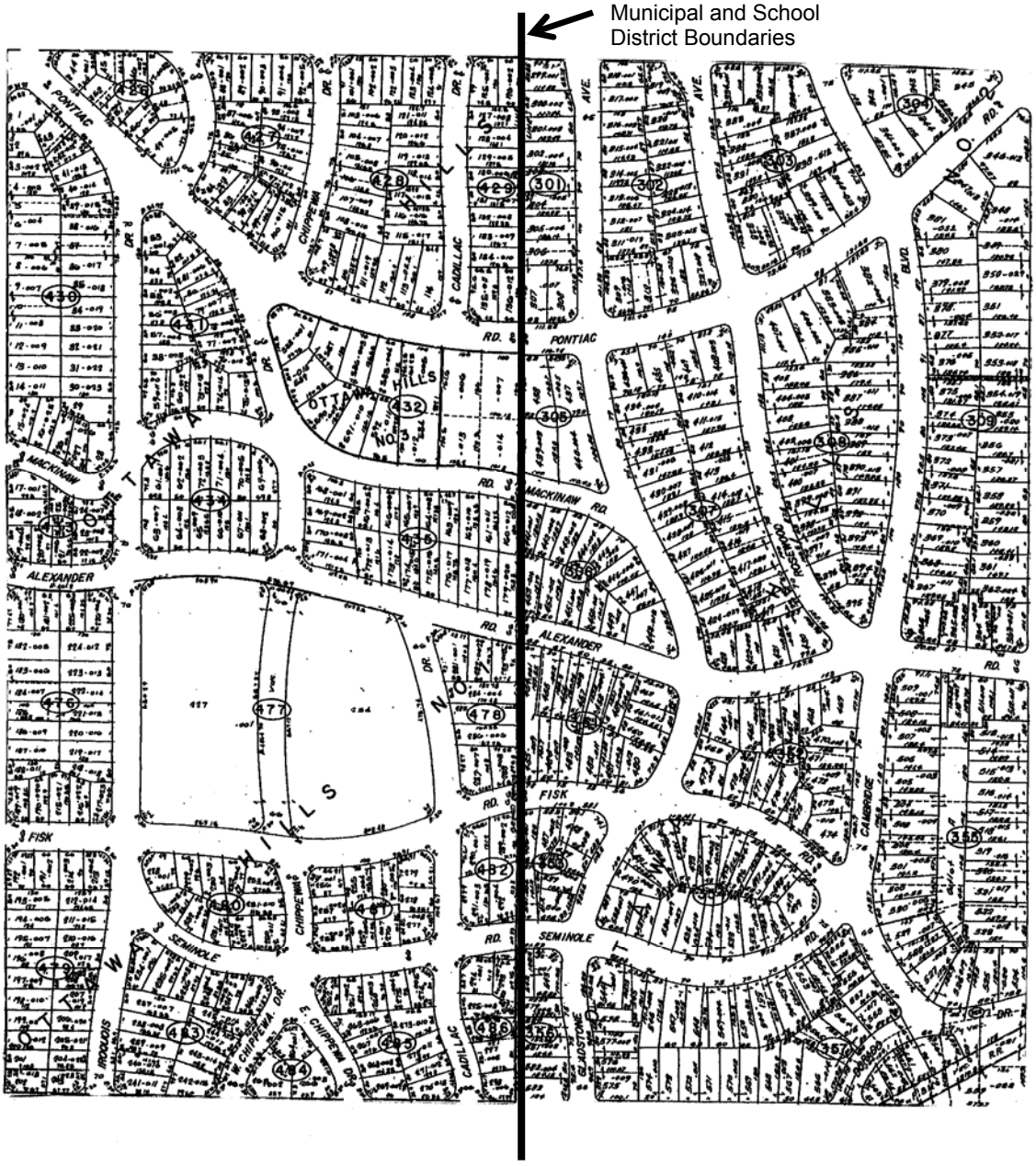

Figure 3. Distribution of the Number of Subdivision Houses Built Over Time, East GR Versus GR

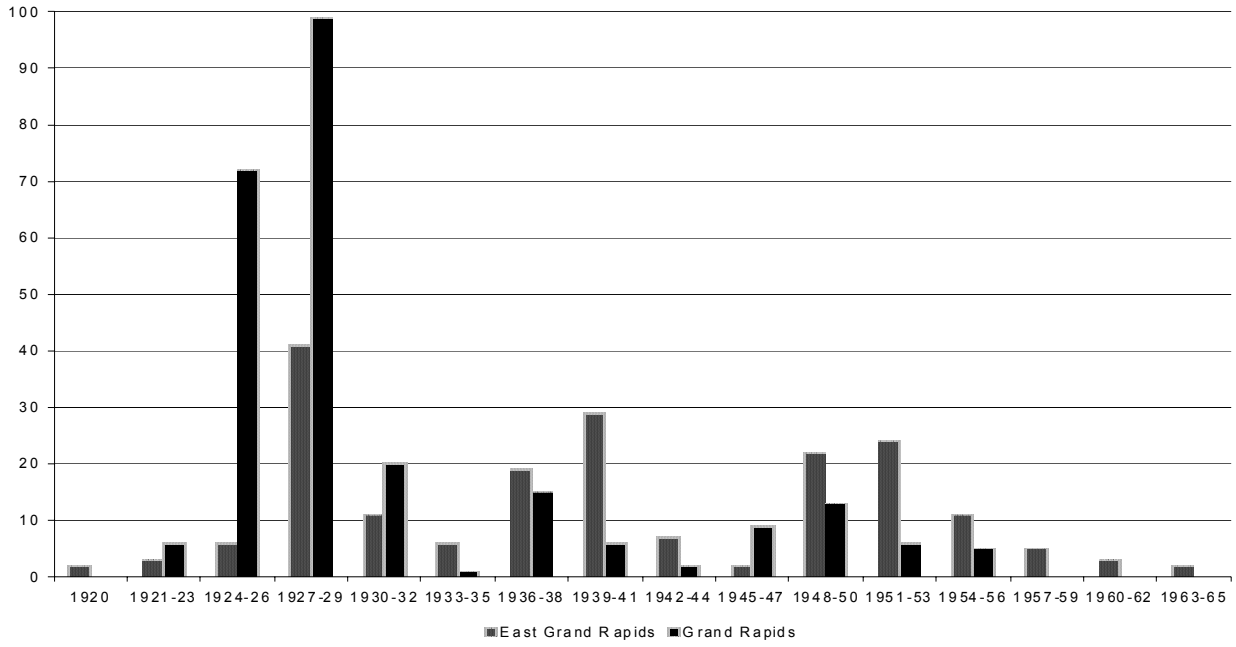

Figure 4. House Sales per Year in the 100-House Sample

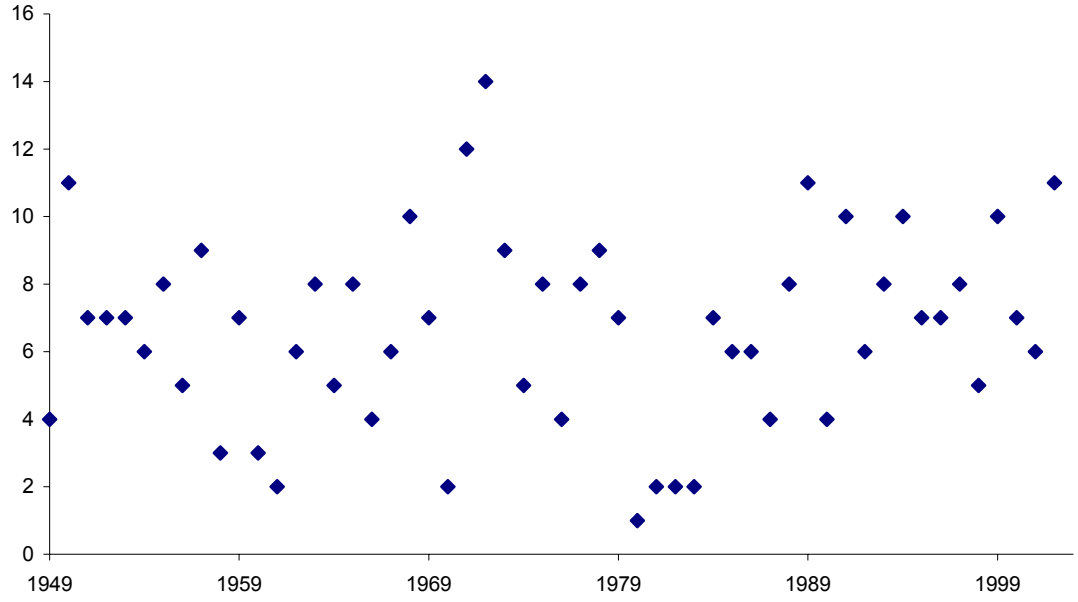

Figure 5. Sale Price per Square Foot, 1949 – 2002

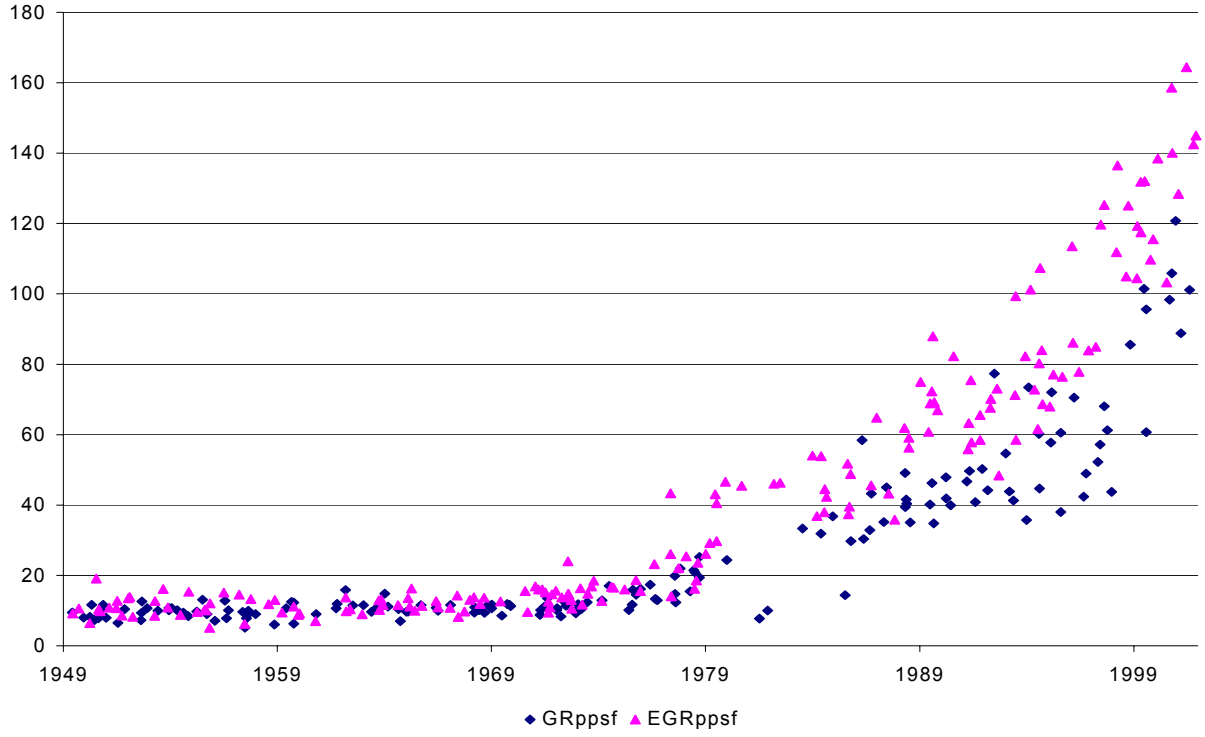

Figure 6. Fourier Time Trends in the Natural Log of Sale Price, 1950 – 2002

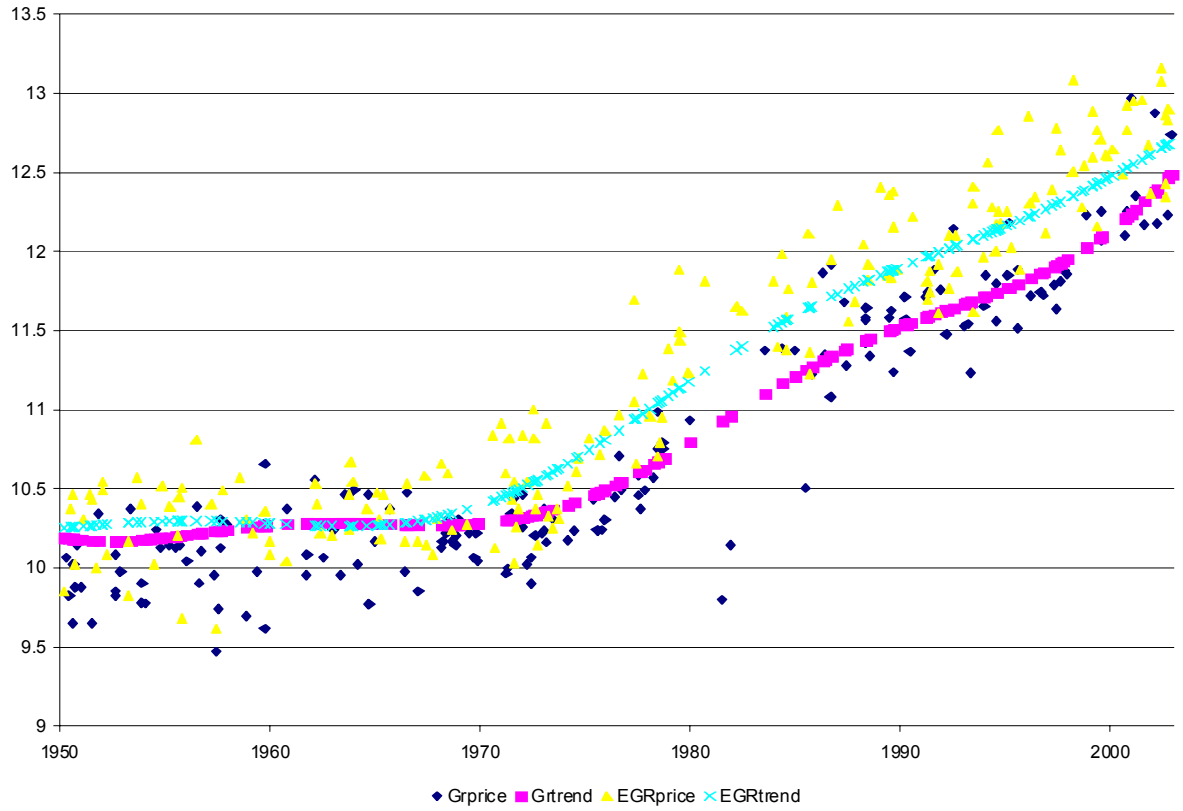

Figure 7. Trend and 95% Confidence Interval in the Ten-Year Average Boundary Differential