

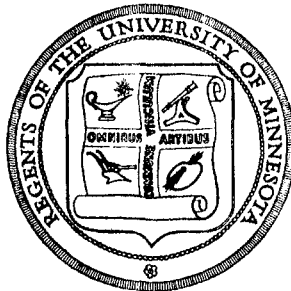
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AN EMPIRICAL ANALYSIS OF MINNEAPOLIS-ST. PAUL
SUBURBAN HOUSING STARTS

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Charles Tiebout [1956] pointed out in the late 1950's that proliferating suburban governments allowed urban residents to shop around among suburbs, selecting a suburban community providing a desired level of public services for a given tax outlay. This ability to shop around, Tiebout concluded, encourages competition among suburban governments to differentiate public services and set tax rates corresponding to perceived differences in resident preference standards. This competition among suburban government centers on new housing starts, since initial housing construction determines the long term character of any suburban community. The prize of this competition is high value housing starts which adds considerably to the local tax base, while requiring nearly the same level of services as low value housing starts.

From an empirical standpoint this simple bundling of public services and tax rates appears insufficient to explain variation in the location of housing starts. Kaiser [1968] found for Greensboro, North Carolina that socio-economic rank, distance to major street, distance to nearest elementary school, distance to employment opportunity areas, distance to central business district, the amount of contiguous new and old residential development, as well as zoning protection influenced the selection of residential building sites. Harris, Tolley, and Harrell [1970]

found that zoning, income range of local residents and tenancy were relevant explanatory variables in explaining the variation in the price of building sites for Raleigh, North Carolina. These findings on the characteristics of new building sites leads to the conclusion that economic and social characteristics are of more importance in selecting a new residential building site than local governmental services and tax rates.

The above studies dealt directly with building sites extrapolating to the critical assumption made by Tiebout: that broad differences among suburban communities influence the location of new residential construction. The following study was undertaken specifically to determine if policy and/or nonpolicy difference among suburbs surrounding Minneapolis-St. Paul influence the location of new housing starts.

Metropolitan Background

Before an analytical study of a specific metropolitan area can be undertaken, the general postulates of location theory need to be placed in perspective with unique local conditions. The Minneapolis-St. Paul Metropolitan Area politically incorporates a seven county area with 195 Minor Civil Divisions. Of these 195 Minor Civil Divisions, only 67 are considered core suburbs of Minneapolis-St. Paul. The homogeneous population of the Minneapolis-St. Paul Metropolitan Area precludes racially segregated suburbs. There is, however, from a historical perspective considerable income segregation within the Metropolitan Area. The central

cities of Minneapolis and St. Paul represent two distinct foci of influence within the metropolitan structure. Minneapolis, locally, is considered the dominant of the two central cities in terms of influencing the total physical shape of the Metropolitan Area. The value placed on residential access to recreational areas, especially water, is considerable. The large number of lakes and parks located in suburbs distant from the central cities are believed to stretch the urban fringe first into areas offering access to these amenities.

Minnesota has statewide building codes but zoning is under local control and is perceived as a means of protecting property values and providing local governments a tool to influence the location of housing starts. The type and level of zoning activity is relatively uneven among the suburban communities surrounding Minneapolis-St. Paul. The perceived negative impact on residential property values of multi-family housing and mobile homes is used as justification for limiting their presence in many suburban communities.

The impact of commercial and industrial property on number and value of housing starts is unclear. The competition among suburban communities for commercial and industrial property became so intense that Minnesota passed legislation requiring gains in property tax from these sources to be shared among all metropolitan communities. Many suburban communities were attempting to develop a large industrial and/or commercial base in order to lower the property tax rates to present and potential residents.

It was argued, however, that all suburban communities did not seek such development. Industrial development and to some extent commercial property develops sight pollution with new residential construction attempting to avoid close proximity to such facilities. Roads then become necessary public investments reducing travel time to shopping and industrial facilities while allowing the maximization of the distance between such facilities and the residence site.

Tiebout's contention that residents 'shop around' for high level of public services and low property tax rates is complicated by a number of considerations for the Minneapolis-St. Paul Metropolitan Area. First, the tax rate and assessed valuation determine the effective local property tax burden. A composite tax burden per dollar of evaluation, therefore, must be estimated by potential residents to evaluate the relative differences in local property tax rates. Second, the political boundaries of the suburbs' governments and those of suburban school districts are not the same. Clear suburban differences in educational services cannot be determined and the school tax rate for any suburban area must be constructed as a weighted average of the school districts overlapping a suburban government's boundaries. Further, the Minnesota Legislature has taken steps to equate effective property tax rates for public schools throughout the state. Significant variations in the effective property tax rates still exist but the real question concerns whether persons seeking new housing sites expect these variations to continue or diminish with time.

The absolute criteria for locating new housing starts is the availability of vacant land. Since land area increases by the square of the distance from the central city it is possible that both available land and distance to central city could have little influence upon the location of new housing starts. The low population density of the Minneapolis-St. Paul Metropolitan Area has produced considerable amounts of buildable land still relatively close to the central cities. Suburban communities 7.5 miles from the center cities still have 90 percent of their total area in undeveloped land. It is possible that neither available land or distance from the central cities are predominant determinants of housing starts of the Minneapolis-St. Paul Metropolitan Area.

Analytical Procedure

The principal analytical problem for a study of this type is to determine a set of variables that discern meaningful differences among suburban communities that potential new home residents do consider. This study uses data generated by the Metropolitan Council and the Minnesota Highway Department to discern physical as well as governmental difference among the 67 suburban communities surrounding the central cities of Minneapolis-St. Paul. To a limited extent this information is directly available to urban residents. To this set were added distance measures and effective property tax burdens which were perceived as analytically necessary but not contained in the

original data base. The independent variables included in the study are listed in Table 1. The variables in Table 1 are divided into three general groupings. The variables in the first grouping are under the jurisdiction of suburban governments located in the Minneapolis-St. Paul Metropolitan Area. Suburban governments directly control the amount of commercial and industrial development that occurs within their boundaries as well as the number of mobile homes and multi-family housing units. Suburban governments also enact and enforce zoning regulations and set local property tax rates. The second grouping represents possible economic and social differences among the suburban communities, while the third grouping defines possible locational and physical differences.

The number and average value of housing starts by suburban communities for 1970 to 1974 are used as dependent variables. Utilizing these two separate dependent variables permits an evaluation of possible housing segregation by income class within the Minneapolis-St. Paul Metropolitan Area. If income segregation is present it is expected that the independent variables explaining variations in the number of housing starts will differ from those explaining the variation in the value of housing starts.

A data base of the type used in this study presents a number of analytical problems. First is the proper perspective on causation. A positive correlation or regression sign may imply no causal effect while a negative correlation or regression sign implies a causal effect. An example of this is the

TABLE 1. Variables Included in the Study

A) Political Unit Variables

- 1) Building permits multifamily 1970-1974
- 2) Building permits multifamily 1966-1969
- 3) Building permits mobile home sites 1970-1974
- 4) Building permits mobile home sites 1966-1969
- 5) Recreational area
- 6) Roads area
- 7) Commercial property acreage
- 8) Industrial property acreage
- 9) Size of political subdivision
- 10) Minimal lot size
- 11) Maximum density per acre
- 12) Effective property tax rate per dollar of assessed valuation

B) Social-Economic Characteristics

- 13) Households in low income quartile
- 14) Households in low middle income quartile
- 15) Households in upper middle income quartile
- 16) Households in upper middle income quartile
- 17) School age population
- 18) Average family income 1970
- 19) Value of occupied housing
- 20) Number of single family units 1970

c) Locational and Physical Characteristics

- 21) Distance from center of Minneapolis
- 22) Distance from midpoint between Minneapolis and St. Paul
- 23) Distance from center of St. Paul
- 24) Single family building permits 1962-1965
- 25) Single family building permits 1966-1969
- 26) Total water area
- 27) Vacant and agricultural acreage

interpretation of positive or negative correlations between the number of single family housing starts and the presence of multi-family housing units. A positive correlation implies that development of both types of housing is occurring simultaneously with the presence of multi-family units having no causal effect on the location of single family housing. A negative sign implies an avoidance and thus a causal effect. Second, a general data base used to specify differences among suburban communities is expected to be highly multicollinear.

The simple correlation matrix showed a large number of the independent variables to be highly correlated. The matrix also showed a low correlation between the two dependent variables. This lends considerable support to the supposition that high value housing starts are not locating in the same suburban communities as the majority of starts.

The high level of multicollinearity among the independent variables combined with a limited number of observations precluded an initial simultaneous testing of the independent variables. A series of simple bivariate regressions was run as the first step to understanding the influence of the independent variables on the dependent variables. The coefficients, standard errors, R^2 's, and significance for each of the independent variables are given in Table 2. Fifteen of the independent variables proved significant, but none are significant for both dependent variables. Dominant variables are apparent for both dependent variables. The multicollinearity among the independent variables is again

Table 2. Simple Bivariate Regression

Variable	Number of Housing Starts			Average Value of Housing Starts		
	Coefficient	Standard Error	R ²	Coefficient	Standard Error	R ²
1 ^{a/}	.26	.07*	.15	3.21	1.65	.05
2	.02	.03	.01	-.27	.72	.00
3	.03	.10	.01	1.98	2.14	.01
4	.64	.31	.06	-3.59	6.86	.00
5	.19	.13	.03	7.08	2.59*	.10
6	.41	.08*	.32	.32	1.95	.00
7	.63	.45	.02	18.87	9.50*	.06
8	.44	.18*	.08	2.69	3.90	.01
9	.03	.00*	.37	-.11	.13	.01
10	.00	.00	.00	.42	.19*	.07
11	-5.25	3.37	.03	-54.89	72.67	.01
12	-3.87	4.88	.01	-73.58	103.65	.01
13	.04	.78	.00	-1.19	1.65	.01
14	.05	.05	.02	-1.11	1.08	.02
15	.04	.03	.02	.20	.79	.00
16	.04	.02	.03	1.73	.54*	.14
17	.02	.01*	.07	.14	.20	.01
18	-.12	.01	.01	2.20	.15*	.77
19	.01	.01	.04	1.15	.14*	.49
20	.02	.01	.04	.39	.29	.03
21	-.26	.78	.00	-34.12	16.09*	.06
22	.06	.76	.00	-13.01	16.21	.01
23	.27	.65	.00	3.54	13.94	.00
24	.52	.08*	.39	1.84	2.19	.01
25	.63	.08*	.46	2.03	2.43	.01
26	-.01	.07	.00	1.14	1.50	.01
27	.03	.00*	.32	-.20	.14	.03

^{a/} Variables are listed according to Table 1.

* Significant at the .05 level.

apparent since a number of the independent variables have nearly the same level of significance and explanatory power for the identical dependent variables.

The bivariate regression demonstrated that only a few of the independent variables are significantly associated with the dependent variables. However, from the bivariate regressions it is not altogether clear which variables can be treated as independent measures of structural differences that exist among the sample communities. Factor analysis is often used to determine recognizable patterning of variables and thus determine structural differences within a group of observations where such differences cannot be specified a priori with certainty. Adelman and Morris [1965], Cottell [1949], and Dorf and Hoppe [1977] used factor analysis to determine basic structural economic and social difference among observations where specific relationships cannot be specified a priori. In this study, the independent variables were factored using the standard Varimax rotation. The Varimax rotation was selected since it minimizes the variance between the variables that comprise the underlying factors and maximizes the variance between the underlying factors. The resulting factors should then represent statistically independent differences existing among the suburban communities under study. The factor loadings are given in Table 3; the letter in parenthesis indicates which variables in Table 2 have a significant bivariate relationship with the dependent variables. The factored data set produced seven underlying groupings of variables. Of the seven underlying groupings

TABLE 3. Factor Loadings for Independent Variables^{b/}

Variable ^{a/}	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
1	.54(N)	.18	-.17	.32	.04	-.32	-.04
2	.29	-.13	.05	-.06	-.09	-.18	-.11
3	-.02	.17	.03	.00	.71	-.04	.00
4	-.02	-.01	-.05	-.10	.76	.10	-.04
5	.65(V)	.11	.01	.30	.11	.07	.05
6	.76(N)	.48	-.12	.06	.20	.07	.01
7	.90(V)	.01	-.07	.16	-.03	-.08	.01
8	.50(N)	.32	-.24	.20	-.03	-.17	-.11
9	.15	.95(N)	.06	-.02	.12	.19	-.02
10	-.07	.24	.01	.23	.02	.59(V)	.02
11	.16	-.13	.00	-.05	-.08	-.68	-.08
12	.08	-.20	.14	-.13	.12	.03	.46
13	.79	-.25	-.09	-.24	-.20	-.06	-.19
14	.88	-.16	.15	-.28	.04	-.04	-.03
15	.92	-.08	-.22	-.06	-.02	-.05	.04
16	.85(V)	-.04	-.07	.36	.00	-.10	.02
17	.96(N)	.00	-.17	.01	.01	-.02	.03
18	.08	-.10	-.04	.84(V)	-.10	.12	.01
19	.13	.14	-.17	.87(V)	-.06	.17	-.07
20	.96	-.06	-.12	.09	.01	-.04	.01
21	-.39	.14	.69(V)	-.29	-.01	.06	.07
22	-.28	.11	.93	-.14	-.02	.01	.13
23	-.16	.02	.83	-.01	.01	-.03	.18
24	.66(N)	.24	-.15	.17	.22	-.06	-.03
25	.60(N)	.26	-.15	.15	.14	-.06	-.09
26	-.05	.46	.11	-.14	-.23	.38	-.45
27	-.07	.93(N)	.09	-.09	.13	.16	-.08

^{a/} Variables listed according to Table 1.

^{b/} (V) is placed after variable significant in Table 2 for value of housing starts.

(N) is placed after variable significant in Table 2 for number of housing starts.

only two factor groupings contained variables significant for number of housing starts while four factor groupings contained variables significant for the average value of housing starts. Only one of the factor groupings contained variables significant for both dependent variables.

The underlying factors and their associated loading can be analyzed to determine their principle meaning while the eigenvalues of the matrix reduction can be used to determine the amount of variance in the total system explained by each factor. The assigned meanings for each factor, their eigenvalue and percent variance explained are given in Table 4. The first factor with its high loadings on population and developed areas is a composite measure for already developed areas. The second factor deals with the variance in the physical size of the suburban communities. Apparent is the close association between the size of the suburban communities and available vacant land. In comparison to factor one this implies that the older areas are smaller in area than the newly developing suburban communities. Factor three is a distance measure from the central city. The factor demonstrates the high degree of correlation between the three distance measures used and the low level of correlation of the other independent variables with distance from the central cities, either Minneapolis or St. Paul. The fourth factor confirms the high correlation between average family income and average value of housing for the suburban communities surrounding Minneapolis-St. Paul. Also demonstrated is the low association between the wealth variables,

TABLE 4. Assigned Factor Meanings, Eigenvalues, and Percent of Variance Explained

Factors With Assigned Meanings	Eigenvalue	Percent of Variance	Cumulative Variance
1. Stage of development	11.40	46.5	46.5
2. Physical size of suburbs	4.45	18.1	64.6
3. Distance to central cities	2.54	10.3	74.9
4. Income and value of housing	2.13	8.7	83.6
5. Mobile home locations	1.38	5.6	89.3
6. Zoning regulations	1.24	5.0	94.3
7. Effective property tax rate	.77	3.1	97.4

average family income 1970, and value of occupied housing, with the remaining independent variables in the study. For the fifth factor, the location of mobile home starts are the main explanatory variables. This singular response supports the contention that the location of mobile homes is restricted to areas where other forms of urban development are not occurring. The sixth factor is composed primarily of the zoning variables while the seventh factor indicates the relative independence of the effective property tax rate from the other independent variables.

Having specified both the existence and nature of structural differences among the suburban communities surrounding Minneapolis-St. Paul, the hypothesis is formulated that variations in both the number and value of housing starts are a function of the independent difference specified by the use of factor analysis. Surrogate variables were selected for each of the underlying factors and regressed against the two dependent variables. The variables selected as surrogates were single family housing starts 1966-1969 for factor 1, vacant and agricultural land for factor 2, distance from Minneapolis for factor 3, average family income for factor 4, building permits for mobile home starts 1966-1969 for factor 5, minimal lot size for factor 6, and effective tax rate for factor 7. The results of regressing the surrogate variables with the dependent variables are given in Table 5. Table 5 shows the location decisions for housing starts in the Minneapolis-St. Paul area to be rather simplistic. The majority of housing starts were located in reference to areas developing in the pre-

TABLE 5. Coefficients and Standard Errors for Surrogate Variables in Multiple Regression

Variable	Number of Housing Starts 1970-1974		Average Value of Housing Starts 1970-1974	
	Coefficient	Standard Error	Coefficient	Standard Error
Single Family Building Permits 1966-1969	.5672	.0755*	1.8950	1.2997
Vacant and Agricultural Acreage	.0242	.0046*	-.1625	.0788*
Distance From Minneapolis	.3808	.5412	15.3083	9.3114
Average Family Income 1970	-.0044	.0096	2.1632	.1653*
Building Permits Mobile Sites 1966-1969	.2751	.2173	2.2546	3.7401
Minimal Lot Size	-.0045	.0060	.2359	.1025*
Effective Property Tax Rate Per Dollar of Assessed Valuation	-.2806	2.9550	-9.8426	50.8395
Constant Term	127.0460	324.3818	-6462.3654	5580.8080
	$R^2 = .66$		$R^2 = .79$	
	$F = 19.05^*$		$F = 33.31^*$	
	$N = 67$		$N = 67$	

*Significant at the .05 level.

ceding years having available vacant land for development. Value of housing is influenced primarily by income considerations, concentrated in relatively small suburban communities offering zoning protection.

Analysis and Conclusions

The analytical results from the bivariate regressions, the factor analysis, and multiple regressions can be used to develop a detailed picture of new housing starts in the Minneapolis-St. Paul Metropolitan Area. In general, the results supports Tiebout's contention that difference among suburban communities influence the location of housing starts. The predominant influence on housing starts, however, is not political, but rather economic and social.

By number, housing starts are locating in suburban communities where land is available and development is a continuation of past trends. Segregation of housing by income classes is occurring. High value housing is locating in suburban communities in which high income families and high value housing are already located. The decrease in value of housing starts with larger numbers of low income families in the bivariate equation lends to further support the contention of income segregation within the Minneapolis-St. Paul Metropolitan Area. The negative sign between value of housing starts and vacant and agricultural land indicates an avoidance by high value housing of areas where larger low value housing development is taking place. Those suburban communities that are attracting high value housing appear to use effectively

minimal lot size zoning to discourage a large number of low value housing starts.

The distance measures produced rather confusing results. In the bivariate regressions distance from Minneapolis was negative for both dependent variables and significant for value of housing starts. In the multiple regression distance from Minneapolis had a positive sign and was insignificant for both dependent variables. The alternating signs are indicative of a coefficient close to zero leading to the conclusion that distance from the central cities was of no significance on the location or value of housing starts.

Neither multi-family nor mobile home sites were significant variables in explaining the variation in either the value or number of housing starts. The factor loading shows multi-family housing to be occurring in the same areas as single family housing starts and the regression confirms that their presence has no influence on housing starts. For mobile home sites the singular factor loading indicates they have been effectively limited from most suburban communities. The location of commercial and industrial property is correlated with already developed areas showing the close association of housing and commercial-industrial development in the past. This indicates that potential new home residents either do not perceive these activities as negative attributes or perceive them as development risks. The signs of the bivariate regressions support the contention that higher value housing tends to avoid industrial areas and either locates close to or allows

commercial development.

Vacant agricultural land is highly correlated with the physical size of the suburban community. The negative sign between vacant and agricultural land and average value of housing starts demonstrates that smallness of political area is a positive attribute. The plausible explanation is that smallness of political area affords more perceived local control and thus protection from undesirable future development. Further, a small physical size limits the amount of developable land and thus the potential for future development. The new high value housing resident appears to be selecting established suburbs offering less potential of development and risk of loss in property values. This desire for protection of property values is again shown by the positive association between increases in minimum lot size and the negative association with number of housing starts.

The equations for number of housing starts, either bivariate or multivariate, had coefficients between .5 and .6 for the independent variables, number of building permits 1960 to 1965 and 1965 to 1969. The equations capture the housing construction slowdown which plagued the Minneapolis-St. Paul Metropolitan Area between 1970 and 1974 when the rate of housing starts was a fraction of the rates recorded for the previous ten years. The coefficients also confirmed that the majority of the starts between 1970 and 1974 were in the same areas where starts were locating in the previous ten years. The income coefficient shows a steep increase in value of housing as the average income of a suburban community increased.

Summary

The study demonstrated the high level of multicollinearity that can be found among data describing difference between suburban communities. With proper care and analytical steps this multicollinearity can be used to come to a better understanding of the problems under study. The study further demonstrates that Tiebout's basic contention was correct that people do select residences based on differences among suburban communities. For the Twin Cities Metropolitan Area the effect of governmental action on housing location is minimal. The predominant variable is social class segregation. The majority of new housing starts are in suburban areas with available land where development has been occurring in the past. The high value housing starts are influenced by the economic and social class residing in a suburban community. To a lesser extent they are impacted by local land use controls.

REFERENCES

- Adelman, Irma., Morris, Cynthia. 1965. "Factor Analysis of the Interrelationship Between Social and Political Variables and Per Capita Gross National Product." *Quarterly Journal of Economics* (November):555-578.
- Cattell, R. B.. 1949. "The Dimensions of Culture Patterns by Factorization of National Characteristics." *Journal of Abnormal and Social Psychology* :443-469.
- Dorf, Ronald., Hoppe, Robert. 1977. "An Analysis of Nonmetropolitan Growth in Minnesota." *Regional Science Perspectives* (Volume 7):19-42.
- Harris, R. N. S., Tolley, G. S., Harrell, C.. 1970. "The Residence Site Choice." *The Review of Economics and Statistics* (May):24-247.
- Kaiser, Edward. 1968. "Locational Decision Factors in a Producer Model of Residential Development." *Land Economics* (August): 351-362.
- Tiebout, Charles. 1956. "A Price Theory of Local Expenditures." *Journal of Political Economy* (October):416-424.