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Toward a Simultaneous Model of Intraurban Household Mobility

ABSTRACT: It has been suggested that a household's decisions to move its residence and workplace locations are interrelated. Some economists, however, mainly as a matter of theoretical convenience, have assumed a specific causality in this relationship, from workplace to residence ("workplace dominance"). An empirical analysis, as reported in this paper, suggests that the workplace dominance concept is of limited applicability. All groups, with the possible exception of black female renters, make their residential and workplace mobility decisions interdependently. However, some groups, most notably black men, appear to be constrained in their locational decisions.

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[I] INTRODUCTION

During the 1960s, many researchers turned their attention to the development of economic theories of spatial location and urban structure. Several theories were developed (e.g., Alonso 1964 and Muth 1969), but they have several limitations, including the assumption of centralized production and employment, concentration on long-run equilibrium solutions, and lack of concern for many distinguishing features of an urban area such as racial segregation and differences in local public goods. To fill some of these voids, the National Bureau of Economic Research (NBER) undertook in the late 1960s to construct an urban simulation model (Ingram et al. 1972). Specifically, the Detroit Prototype version of the NBER model allowed for many kinds of households and heterogeneity in the housing stock; it incorporated explicit microeconomic analyses of the locational decisions and housing supply activities involved; and it focused on the short-run dynamics of disequilibrium in the housing market. A major shortcoming (explicitly recognized) of those early NBER efforts was the assumption that workplace changes caused residential changes but not vice versa; this has been termed the "workplace dominance" assumption. In the model, each household head's workplace location is exogenously determined. A major determinant of the household's residential location is thus the transport cost of the work trip.

A reasonable hypothesis can also be advanced that significant changes in residential location can sometimes cause households to change workplace location. Indeed, it has been suggested that certain ethnic and racial groups are constrained in their housing choices and often must make workplace-location decisions subject to an already known residential location. Households for which housing choices are somehow limited in this way may be termed "residence dominated." In fact, the NBER modelers believed that nonwhite households are better characterized as "residence dominated," and they therefore excluded those households from their model. Also excluded were households headed by retirees or those with no workplace.[1] In short, the journey to work might be adjusted by changing the place of work, the place of residence, or both. The major purpose of this paper is to evaluate the viability or applicability of the workplace dominance assumption by studying both residential and workplace mobility and their interdependent role in a household's decision-making process.[2]

A conceptual model of household behavior can be used to analyze a household's mobility decisions. Let the household utility maximization problem be defined as the following constrained maximization problem:

$$\underset{Z,\, i}{\text{Max}}\ U_h = U(H_i, Z)$$

subject to

$$Y_w - tr_{iw} = p_H H_i + Tx_j + p_Z Z + tr_m$$

where $H_i = H(Pc, A_i, Ne_i, G_j)$, and the variables are defined as follows:

U = utility function of household h.

H_i = bundle of housing services consumed at location i in jurisdiction j, as a function of Pc = physical characteristics, such as lot size, number of rooms, etc.; A_i = accessibility, varying over i; Ne_i = neighborhood characteristics, also varying over i; and G_j = public goods and services in jurisdiction j.

Y_w = household income at a particular workplace location (w).

tr_{iw} = household work-trip transport cost, dependent on both the residential location (i) and workplace location (w) of the household.

p_H = vector of housing service prices; hence $p_H H_i$ is the rent paid for the housing bundle represented by H_i.

Tx_j = taxes paid in jurisdiction j.

Z = composite good representing all other goods, including savings.

p_Z = price of the composite good.

tr_m = miscellaneous transport costs (including shopping, personal and recreational trip costs), which may be expected to vary over alternate residential locations.

In this model, the individual household is assumed to view the government sector as exogenous, that is, the household cannot affect the levels of goods and services (G) or taxes (Tx). It either accepts last period's G and Tx or it forms an expectation of change based on whatever information it has obtained. Likewise, it is assumed that neighborhood characteristics are not affected by a single household, and because of the short-run character of this model, the vector of housing services prices (p_H) and the prices of other goods are viewed as exogenous by the household.[3]

The household in equilibrium has no incentive to change its consumption of housing or the composite good. The equilibrium of the household is subject to dislocation by shocks that are both internal and external to the household. After a dislocation, the household has an incentive to adjust consumption of either the composite good or the housing bundle. In its choice, it considers all the feasible combinations of workplace- and residence-location pairs that are in its opportunity set.

The costs of adjusting the housing bundle (e.g., search and moving costs) are not insignificant. However, a household can change both its residential and its workplace location so as to restore itself to an equilibrium position. For small to medium dislocations, the household may attempt to alter the housing bundle it is presently consuming by, for example, house improvements, depreciation, or a change in workplace location affecting the journey to work. For medium to large dislocations, the advantages of relocation may outweigh the costs and induce the household to move. Large adjustments in the consumption of housing usually require a residential move. On the other hand, a change in residential location, occurring either as a response to disequilibrium or to an ex-

TABLE 1 Disequilibrating Influences on the Household

Shock (changed variable)	Channel of Shock
Exogenous to the household	
1. Accessibility to work places	Housing bundle
2. Neighborhood characteristics	Housing bundle
3. Public goods and services	Housing bundle
4. Prices of housing services (housing supply and/or demand)	Budget constraint
5 Prices of other goods	Budget constraint
6. Transportation costs	Budget constraint
7. Taxes	Budget constraint
Endogenous to the household	
8. Preferences	Utility function
9. Journey to work	Budget constraint
Indirect influences	
10. Income (labor supply and/or demand)	Budget constraint

ogenous factor (such as fire or demolition of the dwelling unit) will affect the journey to work and often create an incentive for a workplace-location change. Renters normally have lower transaction costs than owners[4] and are therefore more likely to move for a given dislocation. Because only a limited number of dwelling units are available at any one time, households do not, of course, necessarily achieve equilibrium positions when they move.

The major shocks that could make a previously satisfactory residential or employment location unacceptable to a household can be deduced by examining the maximization problem presented above. A tabulation of these possibilities is shown in Table 1. Disequilibrating influences can be classified into three types:

1. Shocks that change the position or slope of the budget line such as change in prices, workplace location, or income (lines 4, 5, 6, 7, 9, and 10 in Table 1);
2. Shocks that change the position or slope of the indifference curve, such as a change in preferences resulting from changes in life-cycle stage (line 8 in Table 1);
3. Shocks that change the utility of a given housing bundle to the household, such as a change in the accessibility of a residence location to workplaces or a change in neighborhood characteristics (lines 1, 2, and 3 in Table 1).

Examination of the possible sources of these shocks suggests an empirical model of mobility in which the probability of a change in the household's residential or workplace location is the dependent variable and sources of the shocks are independent variables conditioned on the levels of the socioeco-

nomic variables. In the remainder of this paper I attempt to estimate such a model. Guidance in the selection of independent variables was obtained from the literature on mobility.[5]

[II] DATA SOURCES AND ECONOMETRIC PROCEDURES

In 1965, the Bay Area Transportation Study Commision (BATSC) conducted both a large origin-and-destination survey and a smaller home interview survey of San Francisco Bay Area households. The data from the former survey have been extensively studied elsewhere (Goldstein 1970; Straszheim 1974, 1975). In the interview survey, an effort was made to obtain a retrospective ten-year (1956–1965) history of residences and employment, as well as a personal history, for a sample of 3,187 households.[6]

The description of each residence includes dates and type of tenure (ownership versus rental), value or rent, age of structure, structural type, number of rooms, lot size, and location. All locations are given by census tract. The ten-year employment history includes the beginning and end date of each job held by the household head, hours worked (full time versus part time), job tenure (temporary versus permanent), location of employment (census tract), business or industry of the employer, and occupation of the employee. Finally, for each person who was in the household during the ten-year period, the record includes that person's sex, age, relationship to the head of household, date of entry into the household, and when appropriate, date of departure from the household. In addition, the race, marital status, and education of the head of household, as well as the household's combined income, are available for the date of the survey, 1965. Of course, all information obtained from retrospective surveys must be evaluated with care, owing to possible forgetfulness by the respondent.

A travel time matrix showing travel times between 291 BATSC map zones for 1965 was obtained from BATSC (a BATSC zone is an aggregation of one or more of the 819 Bay Area census tracts). These travel times are the peak-hour zone-to-zone times for auto and public transportation weighted by the modal split for interzonal travel. The survey area consisted of the nine counties covered by four Standard Metropolitan Statistical Areas (SMSAs): the San Francisco–Oakland SMSA (Alameda, Contra Costa, Marin, San Francisco, and San Mateo counties); the San Jose SMSA (Santa Clara County); the Santa Rosa SMSA (Sonoma County); and the Vallejo-Napa SMSA (Napa and Solano counties).

As noted, one hypothesized determinant of residential mobility is a change in neighborhood quality. To measure that effect, the median income of households in each census tract was obtained from the United States Census of Pop-

TABLE 2 Description of Independent Variables

	Residence Mobility Equation	Workplace Mobility Equation
Age of head of household	X	X
Family size minus 1.0[a]	X	
Decrease in family size	X	
Increase in family size	X	
Education of head of household	X	X
Income of household, 1965	X	
Occupation of head of household		X
Mortgage rate, current year[a]	X	
Change in mortgage rate from previous year[a]	X	
Unemployment rate, current year[a]		X
Change in unemployment rate from previous year[a]		X
Index of neighborhood quality change[a]	X	
Measure of prior mobility[a]	X	
Residence move, current year (RESID)		X
Residence move, previous year (RESIDX)		X
Workplace move, current year (WKPL)	X	
Workplace move, previous year (WKPLX)	X	

[a]These are continuous variables; the others are subdivided into categories.

ulation in 1950, 1960, and 1970 (see detailed list in the References). Levels of median income in the census tracts were ranked from 1 to 5 as follows: 1, well below average; 2, below average; 3, average; 4, above average; and 5, well above average.[7] If a census tract is taken as an acceptable definition of a neighborhood, the assumption may be made that a rise in rank, e.g., from category 3 in 1950 to category 4 in 1960, represents an increase in the "neighborhood quality" of that tract over the indicated years. Similarly, a fall in rank represents a decrease in neighborhood quality.

The other variables—measures of tightness of the labor and the housing markets—were available on a regional basis. For labor markets, information on unemployment rates is available from the State of California Employment Development Department. For housing markets, monthly data were obtained from the Federal Housing Administration on the effective yields on mortgages for the western area of the United States.[8]

The model to be estimated contains two equations. The dependent variables are RESID, a dummy variable for a move of the residence, defined as equaling 1.0 if the household moves its residence and zero otherwise; and WKPL, a similarly defined dummy variable for a move of the workplace. A summary description of the independent variables included in each equation is contained in Table 2. The sample was stratified by race or ethnicity (white, black, Orien-

tal, and Spanish surnamed), sex of the head, and prior tenure (renter or owner). Eleven of these sixteen subpopulations were large enough to study, that is, had more than ten observations in each of the eight years (1957–1964) under investigation.

In this study, the dependent variable can take on only two possible values, move or no move. In econometric studies, a commonly used approach for handling such dependent variables is the linear probability function, in which the expected value of the dependent variable, y, is taken to be a linear function of the regressors, $X = (x_1, \ldots, x_m)$. The conditional expectation of y given the x's may be interpreted as the conditional probability that the event will occur given the x's. Because of several theoretical problems arising with this approach, the logistic model is often suggested as an alternative. However, the latter is computationally complex and expensive to use for large samples and the parameters are difficult to interpret.[9] Since the major objection to a linear probability model—that it predicts out of range—is empirically seldom important in large samples, there is often no need to use the more complex logistic model (see, for example, Goodman 1976). Also, improved estimates of the linear probability model can be obtained by using weighted least squares instead of ordinary least squares.

Another econometric problem arises because of the presence of a time series of cross sections. Each household is present in the sample from one to eight times, representing each year from 1957 through 1964 that the household lived in the Bay Area. If the yearly cross sections were pooled, the implicit assumption of regression analysis—that the sample was independently drawn—would no longer be correct because the intrahousehold variance among years is probably smaller than the interhousehold variance across the cross section.[10]

Fortunately, pooling is not necessary for some of the population subgroups where the sample size is large enough to permit independent estimation of the cross-sectional parameters. A comparison was made among the cross-sectional estimates for one subpopulation, white male renters, with the aim of finding out whether there was consistency or an interpretable pattern in the signs and magnitudes of the coefficients. Chow statistics (Chow 1960) were computed for each year for both mobility equations to test the null hypothesis of equality in the coefficients between that year and the pooled sample. The acceptance of the null hypothesis in fifteen tests at the 5 percent level and all sixteen at a slightly higher confidence level seems a clear indication that pooling is a useful method for improving the estimates.

As noted, the decision to move the residence and the decision to move the workplace are seemingly interrelated. In a frictionless world with perfect markets, the decisions should in fact be simultaneous. Therefore, it makes sense to treat the two equations as jointly determined in a simultaneous model. The problem of the joint estimation of relationships involving

dichotomous dependent variables has been investigated by Zellner and Lee (1965). Their approach is based on Zellner's method of estimating seemingly unrelated regressions (1962) and yields estimators that are, at least asymptotically, more efficient than single-equation techniques.

The Zellner-Lee method, however, does not correct for the inconsistency of the parametric estimates. One solution to this problem would be to use two-stage least squares to obtain consistent estimates of the structural model. When two or more equations in a system of simultaneous equations are overidentified (as in this model, where both equations are overidentified), the additional technique of three-stage least squares, developed by Zellner and Theil (1962), may be applied. That, too, uses Zellner's method to obtain asymptotically more efficient consistent estimates.

Neither weighted least squares (WLS) nor Zellner-Lee joint estimation (ZLJE) provides better point estimates of the parameters than ordinary least squares (OLS) for the two equations, but the WLS and ZLJE estimates each have smaller standard errors. Two- and three-stage least squares offer more consistent estimates, but OLS, WLS, and ZLJE give results very similar to these two simultaneous methods.[11]

Pooling cross sections over time (eight years) provides a larger sample and decreases the standard errors of the coefficient estimates. Balancing these considerations, I chose ZLJE to estimate linear probability models using the pooled sample.

[III] ESTIMATION OF THE MOBILITY MODEL

One way of testing whether the mobility decisions are sequential, as proponents of the workplace and residence dominance theories suggest, or independent, as many sociologists maintain, would be to examine cross tabulations of residential and workplace mobility. A finding that a sizable number of households moved their workplace but not their residence would be evidence that the workplace dominance theory does not hold exactly. Similarly, a finding that a sizable number of households moved their residence but not their workplace would be evidence that residence dominance does not hold. The problem with such deductions, however, is that other influences are not held constant. There are several other reasons for moving the residence or workplace. Even simultaneous mobility is not evidence of interdependence unless these other influences are somehow controlled for.

Regression techniques accomplish this and make it possible to examine the theories in isolation. The coefficients of the two workplace-related variables, WKPL and WKPLX, in the residential mobility equation and of the two residence-related variables, RESID and RESIDX, in the workplace mobility equa-

TABLE 3 Workplace- and Residence-related Coefficients (figures in parentheses are standard errors of the coefficients)

Subpopulation	Workplace-related Coefficients: Residential Mobility Equation			Residence-related Coefficients: Workplace Mobility Equation		
	WKPL	WKPLX	Sample Size	RESID	RESIDX	Sample Size
White male renters	.150	.033	2,670	.079	.027	3,011
	(.023)	(.028)		(.015)	(.018)	
White male owners	.054	.034	7,968	.066	.019	8,199
	(.011)	(.011)		(.012)	(.010)	
White female renters	.269	.164	628	.123	.002	694
	(.049)	(.060)		(.032)	(.034)	
White female owners	.090	−.013	597	.096	.073	593
	(.041)	(.040)		(.043)	(.042)	
Black male renters	.064	.130	276	.043	.135	318
	(.078)	(.080)		(.049)	(.053)	
Black male owners	.060	.004	456	.056	.118	467
	(.049)	(.049)		(.048)	(.040)	
Black female renters	.034	−.143	83	.023	−.078	92
	(.131)	(.145)		(.088)	(.093)	
Oriental male renters	.208	−.133	154	.090	.004	165
	(.104)	(.128)		(.067)	(.086)	
Oriental male owners	−.016	.066	211	−.066	−.068	222
	(.074)	(.074)		(.070)	(.053)	
Spanish-surnamed male renters	.133	.184	143	.084	.017	164
	(.111)	(.121)		(.067)	(.078)	
Spanish-surnamed male owners	−.076	.021	130	−.169	−.204	136
	(.081)	(.086)		(.107)	(.073)	

NOTE: WKPL is a dummy variable equaling 1.0 when a workplace move occurs in the current year and is zero otherwise. WKPLX is identically defined for the previous year. RESID is a dummy variable equaling 1.0 when a residence move occurs in the current year and is zero otherwise. RESIDX is identically defined for the previous year.

The Zellner-Lee joint estimation technique was used. Samples exclude those households that moved their residence (in the residential mobility equation) or their workplace (in the workplace mobility equation) during the previous year.

SOURCE: Appendix tables A-2 and A-3, available on request to the National Bureau of Economic Research.

tion are shown in Table 3.[12] A pattern of signs consistent with the workplace dominance theory would be positive workplace-related coefficients in the residential mobility equation and zero or negative residence-related coefficients in the workplace equation: workplace moves induce residential moves but not vice versa.[13] Conversely, a pattern of signs consistent with the residence dominance theory would consist of zero or negative coefficients in the first two columns of Table 3 and positive coefficients in the last two: residential moves induce workplace moves but not vice versa. The first conclusion to be drawn is

that both simple hypotheses—"workplace change affects residential mobility in a positive direction" and "residence change affects workplace mobility in a positive direction"—are confirmed.

Furthermore there is very strong evidence that white men are neither workplace nor residence dominated. A change in workplace location increases the probability of a residential move by 15.0 percentage points for renters and 5.4 percentage points for owners, while a change in residential location increases the probability of a workplace move by 7.9 percentage points for renters and 6.6 percentage points for owners. In addition, there is a sizable lagged effect. For those families not moving their residence in the previous year, a workplace move in the previous year increases the probability of a residential move in the current year by 3.3 percentage points for renters and 3.4 percentage points for owners. For those household heads not moving their workplace location in the previous year, a residential move in the previous year increases the probability of a workplace move in the current year by 2.7 percentage points for renters and 1.9 percentage points for owners.

The relationship between the magnitudes of the coefficients of WKPL and WKPLX and between the coefficients of RESID and RESIDX gives some additional information. The larger the coefficient of the lagged term relative to the concurrent term, the more difficult it is to adjust the residential or workplace location in response to workplace or residential mobility, respectively.[14] Thus, white male owners find it more difficult to adjust their residence in response to a workplace location change than do white male renters (0.034 is a larger fraction of 0.054 than 0.033 is of 0.150). There is little difference in the workplace adjustment speeds of renters and owners in response to residential location changes (0.027 is approximately the same fraction of 0.079 as 0.019 is of 0.066). For white male renters, the coefficient of RESIDX is a larger percentage of the coefficient of RESID than the coefficient of WKPLX is of the coefficient of WKPL (34 percent versus 22 percent). This seems to confirm, for white male renters at least, that it is harder to change workplace than it is to change residence. The opposite, however, holds for white male owners.

White females also do not appear to be either residence or workplace dominated. The large coefficient of WKPLX for white female renters indicates they may have difficulty adjusting their residential location in the same period as a workplace move since the sample excludes households moving their residence in the previous year. Similarly, the large coefficient of RESIDX for white female owners indicates they have difficulty adjusting their workplace location in the same period as a residential move.

Black male renters and owners are likewise neither workplace nor residence dominated. The renters seem to be very constrained in their residence-location choices, and all black males seem to be very constrained in their workplace-location choices. This is suggested by comparing the coefficients of the lagged terms with the coefficients of the concurrent ones; the former are at least

twice as large as the latter. The slow speed of adjustment holds for Spanish male renters' residential mobility as well: their WKPLX coefficient is about one and one-half times as large as the coefficients of WKPL. Oriental male renters, by contrast, act much more like white male renters than like the other nonwhite groups in terms of the speed of adjustment of their residential location. Oriental male renters' socioeconomic characteristics such as income and education make them more like white male renters than like the other two nonwhite renter groups. Any segregation that does take place for this group is probably because of ethnic bonds rather than discrimination. The behavior of both Oriental and Spanish male renters in terms of workplace mobility is more similar to that of white than of black male renters.

The coefficients for black female renters, though in some cases large in magnitude, are never greater than their standard errors. This is an indication that their workplace- and residence-location decisions are *not* closely linked. The negative coefficients of the lagged terms show that if such a household does not move right away in response to a workplace or residential move, it is even less likely to move in subsequent years. Oriental and Spanish male owners appear likely to be residence dominated. Residential moves make it less likely for workplace mobility to take place, while workplace moves have an insignificant effect on residential mobility.

This evidence is an important confirmation of the view that the residential and workplace mobility decisions are made interdependently. Of the eleven subpopulations studied here, only black female renters appear to make their decisions to move the residence and the workplace independently, and this conclusion is not firm because of the large standard errors of the coefficients (owing to the small sample sizes). There is no strong evidence that households in general are either residence or workplace dominated. Households in only two of the subpopulations, Oriental and Spanish male owners, seem residence dominated in their mobility decisions, and none appears to be workplace dominated.[15]

[IV] SUMMARY OF RESULTS

In this study a linear probability model of residential and workplace mobility was estimated using the Zellner-Lee joint estimation technique. A time series of cross sections was pooled, allowing more efficient estimation, use of additional independent variables, and wider coverage of the sample subpopulations (stratified by race, sex of the head, and prior tenure).

The major conclusions are that a change in workplace significantly increases the probability of a residential move and a change in residence significantly increases the probability of a workplace move. Only black female renters may

make these two decisions independently of each other. Neither the workplace dominance nor the residence dominance theory fully describes the interactions between residence and workplace location for most of the groups. Possible exceptions are Oriental and Spanish male owners, who appear to be residence dominated. When current-year data only are used, several groups appear to be residence or workplace dominated but there is no evidence of dominance when a longer period of adjustment is used (two years in this case). Theories of mobility must address the interdependence of these decisions explicitly.

Conceptually, the results reported here are only a first step toward the development of a truly simultaneous model of household workplace and residential choice. Ideally, one would like to study not only the household's residential and workplace mobility decisions, but also actual locational decisions, modal choice for work trips, and asset ownership decisions, particularly on autos and homes.

NOTES

1. In the current version of the model, the workplace dominance assumption is relaxed, both workplace and residential changes are modeled explicitly, non-whites and families without a working head are included, as are endogenous job changes, and an improved micro-analytic simulation technique is used.
2. It is important to note, however, that market imperfections such as leases and contracts as well as household expectations make it impossible to infer causation from observed mobility behavior.
3. See Kain and Quigley (1975) for a discussion of hedonic indexes and the pricing of housing services.
4. Owners have made a large, immobile capital investment, costly to turn over, especially if taxes must be paid on any realized capital gain.
5. See Weinberg (forthcoming) for a detailed discussion of these other determinants.
6. The description of the data base is, in part, adapted from a description in Brown (1975), which is also a study of household mobility.
7. Specifically, the means and standard deviations of the median incomes were obtained for each year separately. The census tracts were then separated into categories as follows: (1) more than two standard deviations below the mean; (2) one to two standard deviations below the mean; (3) within one standard deviation of the mean; (4) one to two standard deviations above the mean; and (5) more than two standard deviations above the mean.
8. As the unemployment rate rises, it seems plausible to expect less voluntary unemployment and, consequently, less workplace mobility. Likewise, a tight housing market is expected to lead to less residential mobility. Since data on vacancy rates (as well as several other variables) were not available, the mortage rate was used as a proxy for housing market tightness.
9. Programming advances since this analysis was completed (1975) have made logit estimation cheaper and easier to use, though still somewhat expensive for large samples.
10. One econometric solution to the problem of pooling is to use an error components model (see, for example, Maddala 1971). To use that model, it is necessary to have observations on each household in each time period and a satisfactory distributed error term—conditions that are not met here.

11. See Weinberg (1975) for further discussion and comparative estimation results.
12. Appendix tables A-2 and A-3 contain complete regressions results for the mobility equations. (The appendix is available from the National Bureau of Economic Research.) The results for the socioeconomic and exogenously determined variables are discussed in Weinberg (1977). Note that the conventional tests of significance for the t statistics do not apply (see Nerlove and Press 1973, pp. 5–6).
13. Negative coefficients for RESID and RESIDX would suggest that the household was so tied down to its workplace that an adjustment of the journey to work occurs only via residential mobility. Positive coefficients on RESID and RESIDX would be consistent with a workplace dominance theory only if the sole reason for a residential move was a preceding (or planned) workplace move.
14. If there were no market imperfections, all adjustments to the disequilibrium created by a workplace or residential move would take place concurrently. The more important the barriers to adjustment become, the longer becomes the lag in the response to the disequilibrium. In the sample used in this article, only households not adjusting either the workplace or the residential location during the previous year are included; therefore, the relative magnitudes of the lagged and concurrent terms give some information on the delaying effects of any imperfections. The larger the coefficient on the current term relative to the lagged term, the more likely it is for an adjustment to have taken place concurrently rather than with some delay, suggesting easier adjustment than if the relative magnitudes were reversed. These lagged coefficients may have other meanings; for example, they could represent differences in behavioral response among the subpopulations. Nonetheless, their interpretation as representing either difficulty in adjustment or differences in behavioral response (or some combination of the two) does not affect the conclusions reached about residence and workplace dominance.
15. One problem with the analysis is its partial equilibrium nature. The general equilibrium problem involves several considerations not dealt with in this analysis, including the changing distribution of the housing stock (as the stock depreciates and replacement, conversion, and expansion take place in different areas) and the changing distribution of jobs and firms in the urban area.

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