



Institute of
Business and
Economic Research

Fisher Center for
Real Estate and
Urban Economics

PROGRAM ON HOUSING AND URBAN POLICY

WORKING PAPER SERIES

WORKING PAPER NO. W98-002

ACCESSABILITY AND ECONOMIC OPPORTUNITY

By

Katherine M. O'Regan
John M. Quigley

April 1998

These papers are preliminary
in nature: their purpose is to
stimulate discussion and
comment. Therefore, they are not
to be cited or quoted in any
publication without the express
permission of the author.

UNIVERSITY OF CALIFORNIA, BERKELEY

ACCESSIBILITY AND ECONOMIC OPPORTUNITY

By

Katherine M. O'Regan
Yale University

John M. Quigley
University of California
Berkeley

April 1998

This research is supported by the Transportation Center and by the Fisher Center for Real Estate and Urban Economics, University of California, Berkeley. The paper benefited from the comments of David Ellwood and Jose A. Gomez-Ibanez. We are grateful to Tracy Gordon and David Huffman for research assistance.

I. Introduction

On August 11, 1965, the worst U.S. riot in four decades erupted in Los Angeles. Thirty four people were killed, hundreds injured, and approximately \$35 million of property damage occurred. The McCone Commission's investigation into the underlying causes concluded that lack of jobs, including the lack of adequate transportation to jobs, played a large role in creating conditions that led to urban unrest. In part due to the increasing national concern with this issue, the American Academy of Arts and Sciences asked John Meyer to organize an exploration of the links between transportation and poverty. During the spring of 1968, a dozen papers were commissioned on topics ranging from the impact of free public transit on urban poverty to the calculation of the social costs of urban expressways.

The resulting conference and the collected papers (AAAS, 1968) drew widespread attention to the relationship between accessibility and its employment consequences for low income households. A major conclusion of the initial exploration was that "post-war changes in urban structure and urban transportation systems have conferred significant improvements and greater satisfactions on the majority, [but] they almost certainly have caused a relative deterioration in the access to opportunities, if not in the actual mobility of a significant fraction of the poor (AAAS, 1968, p. 2)." More than thirty years later, concern over the access to jobs and residential mobility

of the poor has not waned. In the face of national welfare reform -- with time-limited benefits and increasingly stringent work requirements -- the link between inadequate transportation and employment outcomes continues to be of critical importance.

This paper reviews those advances in our understanding of the link between employment access and economic opportunities which have arisen during the past three decades. We present new evidence on changes over time in job access for the poor. This new evidence covers the interval 1970-1990 and is based on comparisons of household level data extracted from the Public Use Micro Sample (PUMS) of the 1990 U.S. Census with data published in the 1970 Census of Population. We review, rather selectively, recent analyses documenting the labor market impacts of urban space, including transportation systems and accessibility. Finally, we present a selective review of policy initiatives aimed at increasing economic opportunity through improved transport access.

II. Basic Issues

Standard models of urban location suggest we should observe systematic differences in commuting patterns by household income and demographic conditions. With centralized employment and greater relative demand for central locations, locations differ not only by rents and commute costs, but also in the associated amenities they offer. Central city locations are closer to

employment and other centralized urban amenities, but are more expensive in rent and provide capital-intensive housing rather than spacious accommodations. Household characteristics which affect the consumption of residential services (such as wage income, labor force attachment, family size, wealth, and life cycle influences) all will affect household location.

For example, consider the influence of income. Higher income households with greater demands for space will obtain larger aggregate savings by choosing their more spacious housing at distant locations and incurring longer and more expensive commutes. Since lower income households demand only small amounts of space, lower income households will obtain larger aggregate savings by choosing central locations, paying higher unit prices for space and thereby economizing more on commuting costs.

Similarly, predictable differences in the demand for space or in the cost of commuting will affect household commuting behavior. Households with several workers and those without children may have lower demands for residential space. Multiple worker households whose skills or human capital endowments are more similar (and are less likely to contain a "secondary worker" who searches for employment after the residence has been chosen) may also achieve greater savings from locations with improved access to central workplaces.

Households who receive only a small fraction of their incomes from wages or salaries may be more likely to choose central locations if those locations are more accessible to income elastic urban amenities than outlying areas are.

This model implies a sorting of households across space which accommodates housing and commuting choices. As employment opportunities decentralize, household locations will also, eventually, adjust. However, the benign circumstances that arise in the economic model of equilibrium described above may not be achieved costlessly, and the reassuring normative implications of the neoclassical model are certainly not immune to dynamic considerations. Real capital investments -- in offices and industrial plants and in residences as well as transportation systems -- have long lives. As the location of new workplaces changes in response to demand and production technology, and as the stock of housing suitable to different demographic groups changes only slowly, the transportation system may be called upon to ameliorate large discrepancies in the location of real capital in urban areas. The reliance on transport to buffer a growing mismatch between residential locations and worksites will certainly be harder when the transport system is itself characterized by a fixed capital stock of radial rail or road linkages.

Therefore, while the abstract model assumes costless transitions, the reality of fixed investment means that changes

in urban structure will result in real, and perhaps large, adjustment costs. Several factors reinforce the dynamic disadvantages of central city housing.

First, the rapid decentralization of employment in the post-war period has improved the locational advantage of residences and housing tracts in the suburbs. Simultaneously, this trend has made central city residences less accessible to geographical areas experiencing rapid job growth. For reasons indicated, the areas of improving job access are those more proximate to housing appropriate to middle income households; areas of low-income housing have become less accessible to places of growing employment.

If the housing stock could adjust cheaply and quickly -- so that low income central residential areas could be converted to more spacious high income housing, and so that low income housing in the suburbs could be produced from high income housing -- the decentralization of workplaces need not disadvantage the poor. However, conversion costs are high. Moreover, land use and environmental policies and a mercantile structure of public finance all restrict the production of new housing appropriate for low income populations in the suburbs.

Second, and most importantly, the legacy of racial segregation and housing market discrimination greatly increases mobility problems for minority households. Absent this distortion in the housing market, land rents in central city and

suburban locations could adjust fully -- at least in principle -- to a changed pattern of metropolitan workplaces. However, housing market discrimination and exclusionary zoning prevent minority and poor households from following jobs to the suburbs. These limits on residential adjustment concentrate minority and poor households in central and segregated neighborhoods, decreasing their knowledge of, and increasing their commuting costs to, suburban jobs. Several additional factors exacerbate the situation.

Income constraints on poor households greatly limit their journey-to-work options. For obvious reasons, poor households are less likely to have access to private automobiles for commutation. This increases their commuting costs -- for any given distance traveled.

These increased commuting costs are particularly significant in the oldest metropolitan areas, those served primarily by radial, spoke-and-wheel, public transportation systems and those populated more heavily by minorities.

In sum, two primary forces are responsible for the specific link between transport access and employment which limits the economic opportunities available to low-income and minority households -- slow adjustment in real capital markets to changes in suburban locational advantage and explicit barriers to the residential mobility of low-income or minority households. These

combine to imply that centrally located minorities are at a disadvantage in the labor market.

The first empirical test of the proposition described above was published (Kain, 1968) about the time of the AAAS study organized by John Meyer.¹ The statistical analysis was quite straightforward and rather primitive. Using aggregate data from Chicago and Detroit postal zones -- of very unequal areas and shapes -- Kain measured the fraction of "local" employment, by industry and occupation, held by black workers. Kain found that the fraction of black employment in a postal zone was positively related to the fraction of black residences in that zone and negatively related to its airline distance from the central urban ghetto. The findings suggested that the intrametropolitan distribution of black employment was affected by the pattern of black residences; the intense residential segregation in these two cities affected the spatial distribution of employment for black workers.

In addition to affecting the *location* of employment, the spatial mismatch hypothesis purports to affect labor force participation, and therefore the *level* of employment. In this vein, the results of the statistical models were also used to conduct a striking thought experiment -- to estimate the level of black employment in each metropolitan area in the absence of

¹ However, a preliminary version of the empirical analysis existed much earlier (Kain, 1965), and the mechanism was hinted

residential segregation. This counterfactual was computed by assuming that black households were evenly distributed across the metropolitan area and that the distance to the black ghetto was equal (to zero) for each postal zone. This redistribution was found to increase black employment by about 9,000 jobs in Detroit and almost 25,000 jobs in Chicago. This implied that the existing spatial pattern of black residences had led to net reductions in black employment of 3 to 8 percent in these two metropolitan areas.

This result, combined with historical evidence on the suburbanization of jobs in the two cities, supported the conclusion that constraints on residential patterns increasingly disadvantaged black households in the labor market. The postwar dispersal of jobs had reduced black employment, and the magnitude was not negligible.

The conclusions of the work contained the usual academic disclaimers. Kain indicated that the conclusions and especially the forecasts were "highly tentative" and speculative.² Nevertheless, given the timeliness of the topic and the pedigree of the work, the 1968 paper received widespread attention. It

at in the **Urban Transportation Problem** (Meyer, Kain, and Wohl, 1965).

² The assumed values of the independent variables for Kain's forecasts were certainly within the range of variation of the raw data, but Kain did not present standard errors of the forecasts or other diagnostics.

³ The PUMS (Public Use Microdata Sample) is a stratified random sample of households and their members, containing demographic and work commute information.

certainly affected the substance and conclusions of Meyer's contemporaneous report to the American Academy, as well as the subsequent Kain-Meyer essay on "Transportation and Poverty" in **The Public Interest** (1970).

III. Spatial Trends, Residence and Jobs, Post 1970

In this section we use data from the 1970 and 1990 U.S. Census to review changes in the spatial character of urban areas since Meyer's report.

The first factor affecting job accessibility for poor and minority households is the decentralization of jobs. The post war trend in decentralization noted in Meyer's 1968 report continued from 1970 to 1990. Central cities continued to lose jobs in the declining manufacturing sector, but many also lost jobs in the growing retail and service sectors (Kasarda, 1995). This shift in employment out of central cities can be seen in Table 1 which is based on the PUMS one-percent sample for 1990.³

In 1970, more than half of all jobs held by metropolitan workers and more than sixty percent of jobs held by black metropolitan workers were still located in the central city. By 1990, less than 24 percent of all metropolitan jobs were clearly identified as located in a central city. (Note that changes in Census definitions account for some of this decline.)⁴ While

⁴ Due to changes in the geographic definitions used by the U.S. Census Bureau, areas are now classified as central city, non central city, and "other." The latter includes geographic areas

jobs held by black workers are still more concentrated in the central city than are all jobs, less than forty percent are now found in central cities.

There has, of course, been a concomitant decentralization of population to the suburbs. Panel B of Table 1 compares the residential locations of MSA workers in 1970 to 1990. Large declines occurred for both white and black workers, but the much higher centralization of black workers has been maintained.⁵ In 1990, black workers were still three times as likely as white workers to live in a central city.

Panels A and B are compared in the bottom of Table 1, showing a decline of jobs per worker in central cities over this time period. From 1970 to 1990, jobs per worker declined from a slight surplus to a slight deficit. Over this entire time period, there is a much greater centralization of black workers than of jobs held by black workers. And this mismatch has worsened over time.

To address the question of truly accessible jobs -- by skill requirements and geography -- John Kasarda examined central city employment changes in nine large cities from 1970 to 1990 (Kasarda, 1995). Kasarda classified industries by the mean years of schooling completed by job holders in 1982, distinguishing

that may contain both central city and non central city areas. Here we identify as central city only geographic areas entirely within the central city, potentially understating the centralization of work places.

⁵ Again, changes in Census definitions may overstate this change.

between industries in which the mean level of schooling was twelve years or less from those in which some schooling beyond high school was the norm.⁶ Table 2 summarizes his results.⁷

Cities in the north (and Denver) experienced a decline in the number of central city jobs requiring less than a high school diploma. While this trend generally resulted in a loss of aggregate employment, almost all of these cities gained jobs requiring more than a high school education. For these cities, the net loss in jobs during the past two decades seriously understates the decline in central city jobs available for less skilled workers. In the south and west, job growth occurred in both categories, although here, too, there was a large relative shift from lower educational qualifications to higher qualifications.

Focusing on the match between the educational requirements of central city jobs and central city residents, Kasarda found that the fraction of jobs available to workers with less than a high school education was smaller, frequently a great deal smaller, than the representation of these workers in central city populations.

⁶ The average level of educational attainment is taken as an indication of the educational requirements of the industry.

⁷ Harry Holzer has approached this issue by comparing the number of unemployed and the number of vacant jobs in four large metropolitan areas accounting for in-commuting flows (Holzer, 1996). In each of these cities, there were fewer available jobs for residents in the central city than there were in the suburbs.

This continued decentralization of jobs (and more specifically, relevant jobs) has direct implications for the second factor we examine -- commuting patterns and commuting costs of low income and minority workers. Table 3 provides commute flow information for metropolitan areas in 1970, by residence and poverty status. Among non poor workers, both whites and blacks, the dominant form of commuting is within the same residential area: central-city-to-central-city or suburb-to-suburb. For non poor white workers, however, the suburban-suburban commute is most frequent, while for non poor black workers, commutes within the central city strongly dominate. If they are not working in central cities, non poor blacks are most likely to live and work in the suburbs, but this pattern is closely followed by central city residence and a reverse commute to the suburbs. Unlike their white counterparts, non poor blacks working in the suburbs are observed living in the suburbs with far less frequency.

Among poor households, central city residence and worksite is the most prevalent pattern, regardless of race, although there are racial differences in magnitudes. However, unlike their white counterparts, poor black workers not working and living in the central city are somewhat more likely to undertake reverse commutes to the suburbs rather than to live and work in the suburbs. Poor white workers, on the other hand, if not working and living in the central city, are much more likely to live and

work in the suburbs than to undertake reverse commutes. In fact, poor white workers are more likely to live in the suburbs and to commute to the central city than they are to follow the commuting pattern of poor black workers. These racial differences in commuting patterns, after controlling for poverty status, are consistent with constrained residential choices.

Table 4 presents similar -- although not directly comparable -- numbers for 1990. Due to changes in census designation of central cities and area, we include three possible locations: central city, non central city, and "intermediate."⁸ For comparison purposes, we focus on the central city and non central city categories.

While the magnitudes are affected by the new categories, making it hard to assess trends, the dominance of within-area commuting continues among non poor workers of both races in 1990. This pattern is also found among the poor, although with greater centralization. By 1990, it was no longer true that poor black workers were more likely to live in a central city and commute to the suburbs rather than live and work in the suburbs. It is worth noting that, while suburban living has increased for poor black workers, it has also increased for poor white workers -- who are now slightly more likely to live and work in the suburbs than to live and work in the central city. However, given the

⁸ PUMAs which are designated as solely central city or non central city are classified as such. PUMAs which contain both

importance of the "intermediate" category, it is hard to discern more than this.

If there has been some residential adjustment to match the decentralization and restructuring of jobs, then commuting costs might not have increased over this time period. Table 5 examines one aspect of commuting costs -- commute times. (Because comparable commute times are not available for 1970, we limit our analysis to patterns in the 1990 data.)

These data show that black workers (controlling for poverty status) commute longer than white workers do. This is a continuation of trends in work trips in the 1980 census. These findings are consistent with continuing residential constraints for black workers, both poor and non poor.

Table 6, based on Department of Transportation information for 1990, helps to disentangle the role of race, income, and location. The differences in 1990 commute times by race noted in Table 5 are related in part to the concentration of minority workers in large cities. Commute times are higher in larger metropolitan areas, and black workers are more concentrated in large MSAs. However, even within large MSAs and controlling for income, black workers spend more time commuting than do white workers. (Below we examine differences in mode of transit, also a contributing factor.)

central city and non central city portions of an MSA are classified as "intermediate."

Note one additional difference in income-commute patterns by race. While white workers' commute times within similar-sized MSAs generally increase with income, this is less true for black workers. As income rises, blacks generally do not translate their higher earnings into residential choices requiring longer commutes. This suggests that there are pronounced differences in the residential consumption preferences of blacks or, more likely, in their residential options.⁹

While all workers are potentially affected by the changes in the spatial form of cities, low income workers are differentially impacted by the third and fourth factors noted in Section II: their greater concentration in older cities with antiquated transportation systems (including public transit); and their more limited abilities to make residential adjustments to workplace changes.

One form of adjustment to spatial deconcentration of jobs is the increased reliance on the most flexible form of commuting (automobiles). Auto usage increased from 81 percent of worker commutes in 1970 to 88 percent in 1990.

⁹ In addition to time costs, commuting patterns and options are affected by out-of-pocket costs. For travel by private automobile, these costs are large and perhaps, for low income households, prohibitive. Over the twenty years considered, the cost of a new car increased by one-third in constant (1990) dollars, from \$12,000 in 1970 to \$16,000 in 1990. In terms of income, in the 1970s the cost of a new car was equivalent to twenty weeks of the median pay. By 1990, it cost twenty five weeks of median pay. However, total operating costs, inclusive of fuel, maintenance, insurance, etc. has remained more stable. (See Pisarski, 1995, for a discussion.)

Two factors complicate these observed trends. First, reliance on automobiles is lower in the largest metropolitan areas (where poor and minority households are disproportionately represented). Second, many lower income households do not own cars and are limited to public transit.

Table 7 documents differences in car ownership by race, employment, and poverty status. Access to private autos differs dramatically along each of these dimensions. Access rates are much higher for workers, the non poor, and white households, and differences among these groups are quite large. Controlling for residential location, the working poor are twice as likely to have no access to a private auto as are the working non poor. Within the poverty category, workers are almost twice as likely to have access to private autos as those not working. *Ceteris paribus*, blacks are generally twice as likely as whites to be without a car. So, while only 11.5 percent of households nationally are without an auto, 45 percent of central city poor black workers and 60 percent of central city poor no workers have no access to a car.

Tables 8 and 9 examine public transit use from 1970 to 1990. Even after controlling for commute pattern, we find that non poor blacks rely much more heavily on public transit than do poor whites. Location does play an important role, however. Within any racial and poverty category, those working or living in the central city rely more upon public transit. For whites, after

controlling for commute pattern, poverty only increases public transit use for those living in the central city, and the increase is generally small. For blacks, poverty has a larger and more systematic effect on transit mode. Both being poor and being black affect public transit use, most strongly among central city residents.

These differences in commute mode have a large impact on the time spent commuting. Table 10 presents one-way commute times by residence-workplace pairs and commute mode for 1990. Within any residence-workplace pair, commuting by public transit takes considerably more time. For workers living and working in the central city, relying on public transit doubles commute time, amounting to more than an hour a day. For non central city residents, the public transit commute times are frequently much longer.

The role of the public transit system itself in commute times can be seen by examining commute times for non transit users. Here, for all categories of workers, commute times are considerably shorter for within-area commutes. For public transit users, this is rarely true. The commute times do not vary in such a systematic way. Clearly, spatial distance is not the prime determinant of commute time.

After controlling for residence-workplace location and commute mode, there is a remaining difference in commute times worth noting.

Examining differences by poverty status, for each mode choice, non poor whites commute longer than poor whites. This is consistent with expectations. However, we do not find this pattern among blacks. For those commuting by car, there is very little difference in commute times between non poor and poor blacks. For public transit users, poor blacks frequently have slightly longer commutes than do non poor blacks.

Holding poverty status constant, there remains a difference in commute times across the races. Within each residence-workplace pair, blacks commuting by car travel slightly longer than do whites commuting by car. This is also true for public transit commuters in almost all categories -- always for central city residents. The commute time differences suggest that either residential or workplace options for black households are more constrained than for whites.

Finally, since the AAAS report, there has been increased attention to the spatial concentration and isolation of poverty households (Wilson, 1987, Jargowsky, 1997). Much of this is distinct from transport considerations and the isolation of low income workers from jobs. Instead, the concern is that the poor increasingly live in neighborhoods with other poor and are isolated from those who are not poor.

Comparing 1970 through 1990 Census data, Jargowsky (1997) found that the number of high-poverty census tracts (with poverty rates greater than forty percent) more than doubled, and that the

total number of persons living in such areas almost doubled (see Table 11). While the majority of poor do not live in these areas, the share who do so has increased from 12 to 18 percent. This increase was not distributed equally among different demographic groups. The concentration of poverty increased principally among the white poor and among the black poor. However, as Table 11 shows, the initial concentration levels of the white and black poor were dramatically different. While the percent of white poor living in high poverty tracts doubled in this time period, only 6.3 percent of white poor lived in areas of concentrated poverty in 1990. For black poor, the comparable number (33.5 percent) is five times as large. By 1990, about a third of the black poor lived in neighborhoods where at least forty percent of their neighbors were also poor.

The increase in the concentration of urban poverty in particular neighborhoods changes those neighborhoods in ways that may affect human capital production -- the quality of schools, the rates of crime, and the availability of role models, and so forth. Furthermore, the lower employment levels and the dearth of informal contact with employed people in these neighborhoods undoubtedly creates obstacles for informal job search and acquisition of general labor market knowledge.

To summarize these trends: the observed decentralization of jobs and the centralization of minority and poor households which caused concern in the 1960s has clearly persisted. Jobs,

particularly those available for low-skill workers, are increasingly located outside central cities. The residences of minorities and poor have also decentralized, although not nearly as much as jobs, and their car ownership rate has increased. The one condition, however, that has irrefutably worsened, and may be of increasing labor market importance, is the spatial concentration and isolation of the poor themselves.

IV. Subsequent Empirical Evidence

Over this same time period, as the shape of urban areas has evolved, so too has the academic literature assessing its consequences on access to jobs for the poor. Kain's original work was rather quickly challenged and subjected to reanalysis -- using the same data, using better data, and using completely different (sometimes even contradictory) models.¹⁰

¹⁰ For example, Offner and Saks (1971) soon established that small changes in the statistical model led to large changes in the estimates of jobs lost to black workers. Others emphasized that the average access of black urban workers to urban jobs was no worse than the access of white workers, or else these scholars disputed the extent of suburbanization of low skilled jobs (Noll, 1970; Lewis, 1969; Fremon, 1970). Still others enriched the simple model of relative employment in a variety of ways. For example, Mooney analyzed the average ratio of employment to population in ghetto census tracts in large metropolitan areas. Masters (1975) devoted an entire monograph to the analysis of the effect of segregation on the relative incomes of black and white males. Harrison (1972, 1974) compared the earnings of black and white households residing in suburban and central city neighborhoods. Vrooman and Greenfield (1980) found that suburban black residents had substantially higher earnings than black residents of central cities. This finding was confirmed in a more credible analysis by Price and Mills (1985), who reported about a one-third difference in the annual earnings of full-time

Important additional evidence was provided by the analysis of data from the 1980 census. Leonard (1987) used 1980 census tract data for Los Angeles and Orange Counties and geocoded data from the Equal Employment Opportunity Commission to analyze average commuting times. For a large sample of census tracts, he related average commute times to a variety of aggregate sociodemographic characteristics, including the percent of residents who are black and Asian, the proportion of local jobs in blue collar and manufacturing, commuting modes, and a variety of measures of accessibility. He found a negative and significant relationship between the average distance to jobs in a census tract and the commute times of residents of the tract. He also found, however, a positive relationship between the percent black in a neighborhood and average commute times -- a relationship that was robust to a variety of specifications of job access as well as measures of other demographic conditions. Thus, for a given distribution of surrounding jobs, black workers had longer commutes. Leonard's findings suggested that active discrimination in employment, not accessibility per se, caused blacks to search further afield, on average, to find employment.

Ihlanfeldt and Sjoquist (1989) analyzed the net (of commuting) annual earnings of central city heads of household as a function of individual demographic factors, and metropolitan

male black and white workers. Of this, five or six percentage points (or almost 18 percent) could be attributed to central city-suburban residential patterns. All of these findings were based upon data collected in the 1950's, 1960's, and 1970's.

wide data on employment, racial composition, and job location, all taken from the 1980 census. They found that the net incomes of both white and black male workers were reduced by job decentralization. For low-skilled workers, the magnitude of the estimated effect was large. For female workers the effects of job decentralization on net earnings were much smaller.

The influential book by Wilson, published in 1987, drew further attention to the isolation of the inner city poor whose access to jobs, schools, and decent neighborhoods had declined. In **The Truly Disadvantaged**, Wilson described the hopelessness of those "left behind" as the more able had left decaying neighborhoods. His rich verbal analysis points to a major scientific problem in the interpretation of all those studies which have related the spatial access of locations to the employment and earnings of individuals. It is certainly possible that those with less strong attachments to the labor force will "choose" to live in less accessible neighborhoods. Indeed, since housing in more accessible neighborhoods is more expensive, those who "plan" less attachment to the labor market will be better off living where job access is reduced. This statement about sample selectivity may seem callous to those who are not disabled by training in the dismal science, but it is, of course, exactly the logical implication of Wilson's argument.

Thus, sample selectivity, by itself, could provide a logical explanation for the findings previously reported -- suburban

black residents with higher earnings than inner city residents, ghetto residents with lower levels of labor force participation and employment. Many of the implications of sample selectivity can be overcome by the detailed measurement of household demographic factors, in an attempt "to hold constant" their effects. Nevertheless, the interpretation of much of the evidence comparing the labor market outcomes for adult workers is open to some question.

If this sample selectivity issue is important, then evidence on the labor market outcomes for youth living at home is potentially quite important. It is implausible to expect that youth living at home have chosen their residential sites in response to the calculus described above. It is more reasonable to presume that their residential locations are given exogenously (by the "choices" -- perhaps severely constrained -- made by their parents). Youth take their neighborhood locations and their job access as a given and search for employment. If inadequate spatial access impairs labor market opportunity, we should observe this in the labor market outcomes of teenagers. The effects, if any, cannot be attributed to non random sampling.

Ellwood's (1986) study of the employment of Chicago youth provided the first quantitative evidence on this issue. Ellwood used 1970 census tract data, and access data for 116 gross neighborhoods, to relate out-of-school youth employment fractions to three measures of access: the number of jobs within a half

hour commute by public transit; the neighborhood job-to-resident ratio; the average commute time for neighborhood residents. In a series of multiple regressions, controlling for a variety of aggregate socioeconomic characteristics, the three proximity measures were statistically significant. Yet none explained a substantial share of the variation in youth employment rates. Ellwood interprets: "...the result is not consistent with a model in which the likelihood of finding a job is sharply reduced when jobs are not located very nearby (p. 172)." The most important determinant of youth employment rates in these models was the racial composition of the census tract.

Ellwood re-estimated the model to allow for fixed neighborhood effects, and the result persisted. After controlling for any neighborhood-specific effects, the effect of the racial variable was at least as important as before.

A third test of the link between access and youth employment relied upon the differences in employment access between the West and South Sides of Chicago. Ellwood used data from the 1970 Census Employment Surveys (CES) to evaluate a "natural experiment," finding essentially no improvement in the labor market outcomes for youth living in the far more accessible West Side as compared to the South Side.

Finally, Ellwood used the 1970 CES to analyze the employment patterns of workers of differing races, finding that racial differences swamped all other differentials.¹¹

Leonard (1986b) replicated part of Ellwood's analysis using aggregate data from the 1980 census for Los Angeles. Leonard related average youth employment rates by census tract to measures of job proximity and to the aggregate socioeconomic characteristics of the tract's residents. Leonard measured job access by the number of blue collar jobs within a fifteen minute commute, as a fraction of resident adults. In common with Ellwood's study -- in a very different city a decade earlier -- Leonard found highly significant effects of job access on average youth employment rates, but the magnitudes were also quite small. Using aggregate census tract data, the effects of job proximity on the employment outcomes for youth were estimated to be quite small.

In contrast to these studies using aggregate data, those based upon the analysis of more recent micro data on individuals and their households have found sizeable effects. Ihlanfeldt and Sjoquist have conducted a series of analyses based upon the Public Use Micro Sample (PUMS) of the 1980 census and the National Longitudinal Sample of Youth cohorts for 1981-82. For example, using PUMS data for at home youth in 43 MSAs, Ihlanfeldt

¹¹ Ellwood's careful analysis has been criticized by Leonard (1986a), Kasarda (1989), and Kain (1992). None of these criticisms is really damaging.

and Sjoquist (1991) related individual employment probabilities to the average travel times of low wage workers who live in their neighborhoods, and to a variety of individual and household characteristics. They also included the MSA unemployment rate and measures of metropolitan occupational structure. In these statistical models, average commuting time was an important predictor of youth employment; differential commuting times between black and white youth were reflected in differential employment rates.

In a related paper, the same authors (Ihlanfeldt and Sjoquist, 1990) estimated a more detailed empirical model using 1980 PUMS data for Philadelphia. Again, measures of neighborhood commuting time proved to be important predictors of youth employment. The authors were also able to estimate a version of this model for 1980 for Chicago and also for the Los Angeles metropolitan area. Their results establish the importance of access in affecting employment -- in contrast to the results obtained earlier for the same MSAs by Ellwood and by Leonard using more primitive methods.

The Ihlanfeldt and Sjoquist methodology was employed more recently by Holloway (1996) in an analysis of youth employment in 50 MSAs in 1980 and 1990. Holloway confirmed the importance of neighborhood commute time as a predictor of male youth employment.

Steven Raphael's recent analyses of Oakland (forthcoming a, b) introduced several more sophisticated measures of youth employment access, documenting a growing spatial disadvantage of black households in an expanding metropolitan area. This analysis is also based on micro data from the 1990 Census.

In a series of recent papers (O'Regan and Quigley, 1996a, 1996b, forthcoming), we have extended these analyses of youth employment using data from the 1990 census and using a more comprehensive definition of "accessibility." As Holzer (1987), O'Regan (1993), Fernando and Harris (1993), and others have emphasized, most information about employment is disseminated informally through contacts -- friends, relatives, and associates. Some, perhaps most, of these contacts (Granovetter, 1974) are residence based. Thus, the labor market access of youth living in neighborhoods of high unemployment or low labor force attachment is likely to be impaired. Individuals with whom these youth have informal contact are likely to impart less information about employment opportunities than those in other neighborhoods.

We tested the importance of these various dimensions of accessibility upon youth employment outcomes by matching the census records of individual at-home youth and their families to neighborhood information provided by census tract aggregates and also to job proximity information. This was accomplished by building and analyzing a linked data set within the Bureau of the

Census, thereby preserving the confidentiality of respondents (but also linking individual records to census tract identifiers).

The access of each census tract to metropolitan employment was computed from MSA zone-to-zone commute flows by census tract. Other neighborhood characteristics were measured by census tract aggregates -- the percent white, percent poor, percent on public assistance, percent unemployed, and the percent of adults not working.

We analyzed two outcome measures for 16-19 year old youth, separately for whites, blacks, and hispanics -- employment and "idleness" (i.e., not employed and not enrolled in school). For four metropolitan areas in New Jersey, the results were remarkably similar. First, the social access and job proximity of neighborhoods made a substantial difference in the employment or idleness probabilities of youth. Job proximity per se was more important in predicting employment or "idleness" for black youth than for hispanics or whites. Second, each of the other measures of the demographic or social composition of neighborhoods "mattered" in the employment of youth -- regardless of race. *Ceteris paribus*, teenagers who live in neighborhoods with larger fractions of adults on public assistance or larger fractions of adults not working have lower probabilities of employment and higher probabilities of idleness.

Third, the combined effects of poor social access and inaccessible residential locations greatly affect minority employment. For example, the "average Newark youth" (i.e., one with the average level of human capital and household characteristics) had about a 44 percent employment probability if s/he lived in the "average neighborhood" in which white youth reside. But if s/he lived in the "average neighborhood" in which hispanic youth reside, employment probability declined to 37 percent; if s/he lived in a neighborhood with the average job proximity and social access provided to black youth, employment probability declined to 33 percent.

Fourth, and perhaps most crucial: the largest source of differences in the employment probabilities of white and black youth is the systematic variation in the measured human capital and household attributes of youth. Roughly two-thirds of the difference in black-white youth employment rates in the metropolitan areas studied was attributable to individual and household characteristics. The other third arose from variations in spatial proximity to jobs and from social access (O'Regan and Quigley, 1998).¹²

The importance of these neighborhood factors helps explain why more recent empirical studies find spatial effects on labor

¹² While the relative importance of transportation access versus neighborhood characteristics varied across cities, the latter effect was dominant. Overall, the independent effect of transportation access generally accounted for 6 percent or less of observed employment differences across race and ethnicity.

markets. These empirical findings may not arise from improved methodology but rather from the measurement of an increasingly important factor in urban labor markets.

V. Policy Insights: Past Lessons and Current Prospects

Policy interventions to address this isolation can take three forms: (1) Moving people to jobs (integration of the suburbs), (2) Moving jobs to people (redevelopment of central cities), or (3) Improving the *movement* of central city people to suburban jobs (improving transportation access).

The first addresses directly both neighborhood and access concerns. While results from one such program currently being replicated in ten cities do suggest improved employment outcomes, large scale integration of the suburbs faces serious political opposition (Rosenbaum and Popkin, 1991; Ladd, 1997). Conversely, widespread political support for large scale redevelopment is hindered by economic feasibility. We address here the third of these approaches, focusing on transportation interventions.

At the time of Meyer's initial analysis of transportation and poverty, there were a variety of "demonstrations" or "experiments" underway, seeking to address the imbalance between residential locations of the poor and the sites of potential employment.¹³ Several of these demonstrations were funded by the

¹³ The AAAS report describes several demonstrations initiated in 1966 and 1967 which were a substantial departure from historical practice. Until 1961, the federal government had played a very

federal government in direct response to the McCone Commission report.

The earliest projects were community-based and were focused on improved bus service. For example, one demonstration provided express bus service between the growing industrial parks in Nassau and Suffolk Counties in New York and concentrations of low income populations in Long Beach, Hempstead, Hicksville, and other parts of Long Island close to the central city. Similar experiments using express busses were undertaken in St. Louis, Los Angeles, and Boston, among other places.

The overwhelming consensus is that these projects of the 1960's and 1970's demonstrated only meager success, at best (Meyer and Gomez-Ibanez, 1981, and Altshuler, 1982). As reported by Black (1995), many of the job openings at the suburban destinations of new express bus programs remained unfilled. Minimum wage jobs with no scope for advancement remained unattractive because bus commute times could not be shortened enough to reduce the reservation wages of potential workers. Second, as indicated in the previous section, a more important obstacle to the employment of urban poor and ghetto residents was the lack of skills and education required to qualify for non menial suburban jobs.

minor role in urban transit. Federal transit aid was first authorized in 1961, and capital investment subsidies were first appropriated in 1965. But only two years later, federal transport policy was seen by some as a way to combat poverty.

A few demonstrations proved to be successful in increasing the employment opportunities of the poor. Ironically, these projects were not financially viable. When experimental programs were successful in helping the unemployed to get jobs, the newly employed workers were likely to use their earnings to buy autos in order to economize on commuting times. Thus, an experiment "successful" in alleviating poverty might have few riders and a larger deficit than other routes serving stable middle-income workers. Maintaining adequate numbers of riders on such reverse commute lines then required the continual recruitment of new riders.

More recent reverse commute programs have taken a much wider range of forms. Those specifically focused on inner-city employment were generally sponsored by private non-profit agencies in a variety of forms (i.e., social service agencies, tenant management associations), or public non-transit agencies (frequently agencies directly focused on inner-city employment problems). In a study of these projects through the early 1990's, Rosenbloom (1992) reiterates that, as discovered earlier, transport is not the only or perhaps even the primary obstacle to employment.

Those programs succeeding in increasing employment did not merely improve transport access. Rather, transportation was one component in a package of employment services provided. And the transportation provided was generally transitional. Establishing

a financially viable permanent transportation system was usually not an objective of the program.

These conclusions from policy demonstrations are consistent with the research findings. While job access does play a role in gaining employment, at least for youth, none of the research suggests it is the primary determinant. Individual characteristics (education, job skills) and labor market conditions (unemployment, industry mix) clearly dominate. This suggests that transportation policies pursued in isolation may be largely unsuccessful.

One example of a more comprehensive approach to job access is provided by the Public-Private Ventures' "Bridges to Work Program," located in several cities around the nation. Participants are provided counseling and assistance with job search, and the program emphasizes creative locally-designed interventions to meet transportation needs.

Another example is the Administration's proposed Access to Jobs, a DOT/FTA funded response to welfare reform and to the increased pressure to place large numbers of welfare recipients in jobs. While comprehensive transportation planning is the major emphasis of the proposed program, access to jobs is by no means the only component. Access to the related support services necessary for attaining and sustaining employment are considered.

A similar approach has already been taken by the state of New Jersey is designing its transportation response to recent

welfare reforms. Using a geographic information system to map welfare recipients, their prospective employers, and ancillary support services (day care centers, employment and training services, educational institutions), transportation needs are identified and addressed. Addressing these transport needs is one part of a larger state welfare reform, in which a collection of additional poverty services is also provided. Of course, we do not now know the effectiveness of these efforts. But their basis in transport research is clear.

As suggested by the discussion of workplace changes above, policy proposals to increase automobile ownership among the poor may offer real promise. For dispersed employment, automobile ownership is the best solution for the non poor. And automobile ownership may have larger employment effects for the poor as well. For example, in their survey of lower skilled workers in the Detroit area, Farley et al. (1997) specifically focused on job search patterns. They found systematic differences in the search patterns of the unemployed who owned cars compared to the unemployed who did not. For example, those with cars searched for work over a wider range of areas, and this wider range affected the type, number, and character of job opportunities discovered. Differences in auto ownership also seem to have affected success in a recent program designed for non custodial fathers of welfare recipient children. Participants in the program were provided job and training assistance. The Manpower

Demonstration Research Corporation's (MDRC) analysis of attrition concluded that car ownership was an important prerequisite to participation in the program and to successful labor market outcomes. (See Brock, et al., 1997.)

Currently, auto ownership is lowest among the poor who are recipients of welfare. Family asset limitations under the prior welfare law made owning a functioning car difficult. Under the current welfare system, states have broad latitude to determine asset limits. Many states have extended the cap on assets to the point where it does not preclude car ownership; other states have eliminated this restriction completely. These reforms open the door to car ownership solutions.

Some areas have gone further in encouraging car ownership among welfare recipients. Philadelphia has created a donation system, where the donated cars are inspected for serviceability by mechanics from a local car dealership. Perhaps the most impressive system is in Kentucky, where fleets of cars donated by corporations are repaired and maintained by students at local technical schools, as part of auto mechanic training courses. Other states, less supportive of car ownership which may burden welfare recipients with high repair and insurance costs, are creating "car clubs," in which a car is shared among a group of welfare recipients. Again, the impact of these programs is unknown, and at this point the number of participants is quite limited.

VI. Conclusion

The 1968 report organized by John Meyer focused systematic attention on the link between inadequate transportation and urban poverty. In the ensuing thirty years, trends suggest that access to employment enjoyed by poor and minority households has declined. Jobs have continued to decentralize -- much faster than the suburbanization of the low income population. Low-skill jobs in particular are now less available in central city locations. While automobile ownership has increased overall, among the central city poor -- particularly minorities -- car ownership is not high, and convenient public transit options are limited. Documentation of most of these trends is only available through 1990, but there is no reason to expect that these trends have been disrupted. The causal evidence accumulated since John Meyer's report reinforces those insights about the effects of urban space upon employment outcomes and incomes. A variety of cross-sectional analyses based on aggregate census data and, more recently, upon micro data on individual workers has sought to quantify the importance of these linkages. As with most social science research, more sophisticated analyses of access and employment reveal more complexities and ambiguities in their effects.

Our own assessment of this literature is that it establishes that limitations on the access provided to low income and

minority workers do affect labor market outcomes. The literature based on the behavior of adults in the labor market is equivocal in its quantitative conclusions and is, for technical reasons (i.e., sample selectivity) more ambiguous in its interpretation. For this reason, we are more persuaded by more recent micro analyses based on the behavior of youth. Our conclusion about the strength of the link between transport access and poverty is more confident than that put forward by Jencks and Mayer (1990), but their assessment was made before much of the research on teenage employment was available.

These results probably overstate the importance of space in affecting the behavior of adults. Presumably, adults have some greater level of mobility (both residential relocation and adaption of transportation options) than youth. In terms of employment mobility, it is not clear whether adjustment is easier for youth or adults; with work experience comes increased likelihood of employment, but also increased specificity of employment. And there may be reason to think that observations on cross sections of individuals understate the impact of space, which could increase over time. With turnover in the labor market, and advancement achieved through the progression to new, better jobs, living in a neighborhood for a long period of time that lacks access to jobs may have a more pronounced impact on labor market outcomes. In studies comparing youth who recently moved with those who had live in the neighborhood more than five

years, the importance of neighborhood influences appeared larger for longer term residents (O'Regan and Quigley, 1997). In addition, the increased employment noted in the Gatreux project applied to both youth and adults. However, we simply have too limited a knowledge base at this point in time to draw confident conclusions for adults.

Furthermore, it is worth noting that other factors beyond transportation are more important in affecting the employment of low income and minority workers. Education, training, skills, and the overall health of the economy are all more important in affecting the labor market outcomes of disadvantaged workers than is transportation or access per se.

Finally, many of the most important policies to improve the labor market access of disadvantaged workers may not be transportation policies at all. Policies directed towards the elimination of obstacles to the construction of low cost housing in the suburbs and policies which enforce more vigilantly equal opportunity in the housing market may be more effective than policies emphasizing the daily movement of people in urban areas.

VII. References

Altshuler, Alan with James P. Womack and John R. Pucher, **The Urban Transportation: Politics and Policy Innovation**, Cambridge, MA: MIT Press, 1979.

American Academy of Arts and Sciences (AAAS), **Conference on Poverty and Transportation, June 7, 1968**, US Department of Commerce, Clearinghouse for Federal Scientific and Technical Information, PB-180-956, 1968.

Brock, Thomas, et al., "Creating New Hope: Implementation of a Program to Reduce Poverty and Reform Welfare," New York, NY: Manpower Demonstration Research Corporation, October, 1997.

Ellwood, David, "The Spatial Mismatch Hypothesis: Are There Teenage Jobs Missing in the Ghetto?" in **The Black Youth Employment Crisis**, edited by Richard B. Freeman and Harry J. Holzer, Chicago: University of Chicago Press, 1986.

Farley, Reynolds, Sheldon Danziger, and Harry Holzer, "Detroit Divided: Race Location and Skills in the Housing and Labor Market," unpublished paper, 1997.

Fernando, Roberto M. and David Harris, "Social Isolation and the Underclass," in **Drugs, Crime, and Social Isolation**, edited by Adele V. Harrell and George E. Peterson, Washington, DC: The Urban Institute, 1993.

Fremon, Charlotte, **The Occupational Patterns in Urban Employment Change, 1965-1967**, Washington, DC: The Urban Institute, January 1970.

Granovetter, Mark, **Getting a Job: A Study of Contacts and Careers**, Cambridge: Harvard University Press, 1974.

Harrison, Bennet, "The Intrametropolitan Distribution of Minority Economic Welfare," **Journal of Regional Science**, 12, 1972: 23-43.

Harrison, Bennet, **Urban Economic Development**, Washington, DC: The Urban Institute, 1974.

Holloway, Steven R., "Job Accessibility and Male Teenage Employment, 1980-1990: The Declining Significance of Space?" **Professional Geographer**, 48(4), 1996: 445-458.

Holzer, Harry, J., **What Employers Want: Job Prospects for Less-Educated Workers**, New York, NY: Russell Sage Foundation, 1996.

Holzer, Harry J., "The Spatial Mismatch Hypothesis: What has the Evidence Shown?" **Urban Studies**, 28(1), 1991: 105-122.

Ihlanfeldt, Keith R., "Intrametropolitan Variation in Earnings and Labor Market Discrimination: An Economic Evaluation of the Atlanta Labor Market," **Southern Economic Journal**, 55, 1989: 123-140.

Ihlanfeldt, Keith R., "The Effect of Job Access on Black and White Youth Employment: A Cross Section Analysis," **Urban Studies**, 28, 1991(a): 255-265.

Ihlanfeldt, Keith R., **Intra Urban Job Accessibility and Youth Employment Rates**, Atlanta, GA: Policy Research Center, Georgia State University, 1991(b).

Ihlanfeldt, Keith R. and David L. Sjoquist, "The Impact of Job Decentralization on the Economic Welfare of Central City Blacks," **Journal of Urban Economics**, 26, 1989: 110-130.

Ihlanfeldt, Keith R. and David L. Sjoquist, "Job Accessibility and Racial Differences in Youth Employment Rates," **American Economic Review**, 80, 1990: 267-276.

Jargowsky, Paul, **Poverty and Place: Ghetto, Barrios, and the American City**, New York: Russell Sage Foundation, 1997.

Jencks, Christopher and Susan E. Mayer, "Residential Segregation, Job Proximity, and Black Job Opportunities," in **Inner City Poverty in the United States**, edited by Lawrence E. Lynn, Jr. and Michael G.H. McGeary, Washington, DC: National Academy Press, 1990.

Kain, John F., "The Effect of the Ghetto on the Distribution and Level of Nonwhite Employment in the Urban Areas," **Proceedings, Social Statistics Section of the American Statistical Association**, 1965.

Kain, John F., "Housing Segregation, Negro Employment, and Metropolitan Decentralization," **Quarterly Journal of Economics**, 82(2), 1968: 175-197.

Kain, John F., "The Spatial Mismatch Hypothesis: Three Decades Later," **Housing Policy Debate**, 3(2), 1992: 371-460.

Kain, John F. and John R. Meyer, "Transportation and Poverty," **The Public Interest**, 18(Winter), 1970: 75-87.

Kasarda, John, "Urban Change and Minority Opportunities," in **The New Urban Reality**, edited by Paul E. Peterson, Washington, DC: The Brookings Institution, 1985.

Kasarda, John, "The Interaction of Residential Segregation and Employment Discrimination," **Journal of Urban Economics**, 23(1), 1986: 323-346.

Kasarda, John, "Urban Industrial Transition and the Underclass," **Annals of the American Academy of Political and Social Science**, 501, 1989: 62-47.

Leonard, Jonathan S., "Space, Time, and Unemployment: Los Angeles 1980," Center for Real Estate and Urban Economics, University of California, Berkeley, 1986(b).

Leonard, Jonathan S., "Comments," in **The Black Youth Employment Crisis**, edited by Richard B. Freeman and Harry J. Holzer, Chicago: University of Chicago Press, 1986(a): 185-190.

Leonard, Jonathan S., "The Interaction of Residential Segregation and Employment Discrimination," **Journal of Urban Economics**, 21, 1987: 323-346.

Lewis, W., **Urban Growth and Suburbanization of Employment**, Washington, DC: The Brookings Institute, 1969.

Masters, Stanley H., **Black-White Income Differentials**, 1975.

Meyer, John R. (editor), **Techniques of Transport Planning**, Washington, DC: The Brookings Institution, 1971.

Meyer, John R., John F. Kain, and Martin Wohl, **The Urban Transportation Problem**, Cambridge: Harvard University Press, 1965.

Mooney, Joseph D., "Housing Segregation, Negro Employment, and Metropolitan Decentralization: An Alternative Perspective," **Quarterly Journal of Economics**, May, 1969: 59-70.

Noll, Roger, "Metropolitan Employment and Population Distribution and the Conditions of the Working Poor," in **Financing the Metropolis, Volume 4**, edited by John Crecine, Beverly Hills, CA: Sage Publications, 1970.

Offner, Paul and Daniel H. Saks, "A Note on John Kain's 'Housing Segregation, Negro Employment, and Metropolitan Decentralization,'" **Quarterly Journal of Economics**, 85, 1971: 147-160.

O'Regan, Katherine M., "The Effect of Social Networks and Concentrated Poverty on Black and Hispanic Youth Unemployment," **Annals of Regional Science**, 27, 1993: 327-342.

O'Regan, Katherine M. and John M. Quigley, "Teenage Employment and the Spatial Isolation of Minority and Poverty Households," **Journal of Human Resources**, 30(3), 1996: 692-702.

O'Regan, Katherine M. and John M. Quigley, "Spatial Effects upon Employment Outcomes: The Case of New Jersey Teenagers," **New England Economic Review**, May/June 1996: 41-57.

O'Regan, Katherine M. and John M. Quigley, "Where Youth Live: Economic Effects of Urban Space on Employment Prospects," **Urban Studies**, 35(7), 1998: 1287-1305.

Price R. and E.S. Mills, "Race and Residence in Earnings Determination," **Journal of Urban Economics**, 17, 1985: 1-18.

Raphael, Steven, "The Spatial Mismatch Hypothesis and Black Youth Joblessness: Evidence from the San Francisco Bay Area," **Journal of Urban Economics**, forthcoming (a).

Raphael, Steven, "Intervening Opportunities, Competing Searches, and the Intra Metropolitan flow of Male Teenage Labor," **Journal of Regional Science**, forthcoming (b).

Rosenbaum, James and Susan Popkin, "Employment and Earnings of Low Income Blacks who Move to the Suburbs," in **The Urban Underclass**, edited by Christopher Jencks and Paul Peterson, Washington, DC: The Brookings Institute, 1991.

Rosenbloom, **Sandra**, Reverse Commute Transportation: Emerging Provider Roles, the Drachman Institute for Land and Regional Development Studies, FTA-TX-11-0021-92-1, Tucson, AZ: University of Arizona, March 1992.

Vrooman, John and Stuart Greenfield, "Are Blacks Making It in the Suburbs? Some New Evidence on Intrametropolitan Spatial Segmentation," **Journal of Urban Economics**, 7, 1980: 155-167.

Wilson, William Julius, **The Truly Disadvantaged: The Inner City, the Underclass, and Public Policy**, Chicago: The University of Chicago Press, 1987.

Zax, Jeffrey S., "Race and Commutes," **Journal of Urban Economics**, 28, 1990: 336-348.

Zax, Jeffrey S., "Compensation for Commutes in Labor and Housing Markets," **Journal of Urban Economics**, 30, 1991: 192-207.