Public Transit and the Spatial Distribution of Minority Employment: Evidence from a Natural Experiment

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Abstract

A recent expansion of the San Francisco Bay Area's heavy rail system represents an exogenous change in the accessibility of inner-city minority communities to a concentrated suburban employment center. We evaluate this natural experiment by conducting a two-wave longitudinal survey of firms, with the first wave of interviews conducted immediately before the opening of service, and the second wave approximately a year later. Within-firm changes in the propensity to hire minority workers for firms near the station were compared with those located farther away. Also estimated was the effect of employer distance to the new stations on changes in propensity to hire minorities. Results indicate a sizable increase in the hiring of Latinos near the new stations, but little evidence of an effect on black hiring rates. © 2003 by the Association for Public Policy Analysis and Management.

INTRODUCTION

Racial segregation in housing is a persistent and salient characteristic of American metropolitan areas (Massey and Denton, 1993). This aspect of U.S. cities offers one explanation for persistent wage and employment rate differences between minority and non-minority workers. Specifically, racial housing segregation together with the dispersion of metropolitan employment isolates low- and semi-skilled minority workers from suburban employment opportunities. The resulting excess supply of inner-city labor drives down wages, and to the extent that wages are rigid, employment levels in urban neighborhoods.

Public transit systems designed to facilitate reverse commuting from the inner city to suburban employment centers provide one policy response. Advocates for these policies draw support from research demonstrating the importance of transportation barriers in limiting minority employment opportunities. Several studies have found that firms located in the suburbs or far from public transit stops are relatively less likely to employ blacks (Holzer and Ihlanfeldt, 1996; Ihlanfeldt and Young, 1996; Raphael, Stoll, and Holzer, 2000). In addition, poor households disproportionately reside in areas accessible by public transit, a pattern consistent with a high degree of dependence on public transit (Glaeser, Kahn, and Rappaport, 2000). Researchers have also found strong positive effects of car ownership on the likelihood of being employed, with particularly large effects for minority workers and individuals on public assistance (O'Regan and Quigley, 1999; Raphael and Stoll, 2001).

While this research is instructive, drawing causal inferences from these studies requires making strong identifying assumptions. For example, interpreting the effect of the proximity of employers to transit stops on the likelihood of hiring minority workers as causal requires the assumption that firms choose locations without regard to proximity to regional transit systems. On the contrary, employers who rely upon low-skilled, largely minority, and transit-dependent labor may, for this reason, choose locations near transit stops. Alternatively, firms that wish to avoid minority applicants may choose locations distant from transit stops, thus inducing a spurious correlation between proximity to public transit and the likelihood of hiring minorities. Both conjectures imply that firms located nearer to transit stops may be observed to employ minorities at relatively high rates, even when transportation access has no effect on minority hiring. No labor market studies have resolved this issue satisfactorily. Indeed, no study has identified a clear exogenous source of variation in spatial access to employment opportunities.

In this article, we evaluate a natural experiment created by an expansion of the San Francisco Bay area's heavy rail system, which provides a truly exogenous change in the accessibility of inner-city minority communities to a concentrated suburban employment center. In May 1997, the Bay Area Rapid Transit (BART) system extended services to a rapidly expanding region in the eastern suburbs of the Oakland primary metropolitan statistical area (PMSA). The new BART line provides a direct public-transit link between the predominantly white, high-growth, and low-unemployment suburban cities of Oakland's eastern suburban ring and the metropolitan area's largely minority, low-growth, and high-unemployment urban core.

A two-wave longitudinal survey was conducted of firms in the areas surrounding the stations along the new BART line. The first wave of interviews was conducted immediately before commencement of service, and the second wave approximately one year later. From these surveys, we calculate within-firm changes in the propensity to hire minority workers, as measured by the race and ethnicity of the person hired most recently. The average change in the propensity to hire minority workers at firms near the new stations, less the comparable change for firms farther away provides a difference-in-difference estimate of the effect of the service expansion. We also test for an effect of distance from the new stations on the change in the propensity to hire minority workers after adjusting for several characteristics of the firm. The results indicate a consistent, sizable increase in the relative employment of Hispanic workers near the station, but little evidence of a relative effect on black hiring rates.

SPATIAL MISMATCH AND THE ROLE OF TRANSPORTATION BARRIERS

While the spatial concentration of unemployment, joblessness, and poverty in minority neighborhoods is well-documented (Ihlanfeldt, 1992; Jargowsky, 1997; Wilson, 1987), there is no consensus about causes. On the one hand are explanations where space per se does not exert an independent effect on outcomes. Equilibrium theories of socioeconomic housing segregation suggest that when the income-elasticity of housing demand exceeds the income-elasticity of marginal commuting costs, low-income households will concentrate in urban centers (Muth, 1969). On the other hand, several spatial explanations propose a direct causal link between residential location and socioeconomic outcomes. For example, residents of neighborhoods with high rates of joblessness may have poor access to informal employment information networks (O'Regan and Quigley, 1996). Moreover, the concentration of poverty may adversely affect skill

acquisition, outlook, and the availability of role models—all factors likely to influence employability (Wilson, 1987, 1996).

In this latter vein, several studies document the relative scarcity of employment in minority neighborhoods[1] and the potential barriers to residential and commuting mobility. Barriers to residential mobility include racial discrimination in suburban housing markets, particularly against blacks (Yinger, 1995), and suburban land-use policy that artificially restricts the supply of affordable housing (Fischel, 1985). Barriers to reverse commuting include low minority car-ownership rates (Holzer, Ihlanfeldt, and Sjoquist, 1994; Raphael and Stoll, 2001) and weak public transit links between suburbs and urban centers (Hughes and Sternberg, 1992). Combined, these factors restrict the geographical opportunities of inner-city workers. Moreover, if labor demand relative to supply is lower in urban areas, suburban wage and employment premiums will result. For the most part, this body of research focuses on demonstrating a relationship between measures of spatial accessibility and the employment outcomes of low-skilled minority workers.[2]

Several studies find significant and strong effects of spatial access on the employment of minorities, especially blacks (Ihlanfeldt and Sjoquist, 1990; Mouw, 2000; Raphael, 1998a; Weinberg, 2000), but the mechanisms by which urban space affects accessibility are unclear. However, designing appropriate policy responses requires precise knowledge. For example, if commute costs reduce employment, policies aimed at facilitating reverse commutes will be effective. Alternatively, if the spatial isolation of minority workers restricts access to the informal job information networks that come with residence in a local market, then transportation policy will be less effective.

Some recent research assesses the relative importance of the alternative effects of distance on accessibility. In a study of four metropolitan areas, Holzer and Ihlanfeldt (1996) estimated the effects of the spatial proximity of firms to public transportation and to black residential communities on the propensity of these firms to hire black workers. Proximity to black neighborhoods and public transit stops significantly affected the racial composition of a firm's applicant pool and workforce. In addition, the race of the person in charge of hiring and the percentage of customers that are black affected employment outcomes. The findings of this study suggest that both transportation barriers and discrimination in suburban job markets limit the accessibility of black workers to suburban jobs. In an analysis of the hiring patterns of fast-food establishments in Atlanta, Ihlanfeldt and Young (1996) find similar results.

These studies make important contributions in identifying the specific determinants of racial employment distributions. However, there are alternative explanations for all these findings; explanations in which spatial accessibility plays no

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[1] Kasarda (1985, 1989) documents the postwar decline in the employment bases of U.S. central cities. Stoll, Holzer, and Ihlanfeldt (2000) show that while low-skilled workers are disproportionately concentrated in minority neighborhoods, low-skilled employment opportunities are disproportionately concentrated in non-minority suburban communities. Finally, Raphael and Stoll (2002) show that, for nearly all PMSAs, the spatial dissimilarity between residences of blacks and their employment sites substantially exceeds the dissimilarity between the residences of whites and their employment opportunities.

[2] Researchers have evaluated the mismatch hypothesis using several approaches. One approach compares labor market outcomes of inner city residents to those of otherwise similar suburban residents (Raphael, 1998b; Stoll, 1999a). Others analyze the intra-metropolitan variation in labor demand using such measures as the mean commute time of neighborhood low-wage workers (Ihlanfeldt, 1992; Ihlanfeldt and Sjoquist, 1990, 1991), spatial proximity to total jobs (Ellwood, 1986; Leonard, 1985; O'Regan and Quigley, 1996), as well as spatial proximity to areas of high net employment growth (Mouw, 2000; Raphael, 1998a). An alternative approach exploits cross-city variation in spatial conditions (Cutler and Glaeser, 1997; Raphael and Stoll, 2001; Weinberg, 2000). For an extensive review of this research, see Ihlanfeldt and Sjoquist (1998).

causal role in determining outcomes. For example, firms that use low-skilled labor intensively may consider the spatial accessibility of low-skilled workers when choosing a location. Given that low-skilled workers are relatively transit-dependent,[3] these employers are more likely to choose locations near public transit stops. Since minority workers are disproportionately represented among the low-skilled, a spurious correlation between minority hiring rates and proximity to public transit systems will arise. Alternatively, discriminating employers who wish to avoid minority workers may purposefully locate far from minority neighborhoods and in locations that are difficult to reach by public transit.[4] This geographic sorting would limit the ability of transportation and residential mobility policy to improve the accessibility of minority workers to suburban jobs.

STUDY AREA, EMPLOYER SURVEY, AND EMPIRICAL METHODOLOGY

In this study we present an analysis of the effect of an exogenous change to a commuter rail system on the propensity of firms located near a new transit facility to hire minority workers. We assess whether firms located in the eastern suburbs of Oakland, California, increased their hiring of minorities into low-skilled jobs after a BART extension was completed, one that greatly facilitated reverse commuting.

San Francisco Rail Transport and the Areas Connected by the Service Extension

The BART system, in operation since 1972, serves San Francisco County on the west side of the San Francisco Bay, and Alameda and Contra Costa Counties to the east of the bay. The 13.5-mile Dublin/Pleasanton extension is one of two recent expansions of the original 72-mile system. Planning for the extension began in the early 1980s with the efforts of the Bay Area Rapid Transit District to acquire land for the right-of-way. Funding did not materialize until 1986 when Alameda County voters approved a sales tax intended to fund this and other regional transportation projects (BART, 1983, 1987). Construction commenced in 1991 and transit services began in May of 1997.

The new line adds two stations: one in Castro Valley near the urban core and one in the Dublin/Pleasanton area on the outer suburban ring. The new stations are separated by a 10-mile stretch of undeveloped hilly land. From the Oakland central city,[5] the line travels south along the existing right-of-way, turns east at the Bay Fair station directly south of Oakland, and then travels along U.S. Highway I580 out to the Dublin/Pleasanton area. (See Figure 1.)

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[3] Raphael and Stoll (2001) show that car-ownership rates increase steeply with age and educational attainment. These patterns exist within racial and ethnic groups, though ownership rates are uniformly lower for blacks and Latinos relative to whites.

[4] Several studies attempt to assess whether suburban employers are more likely to discriminate against minorities. Holzer (1996) and Holzer and Reaser (2000) show that the propensity to hire black workers relative to their application rates is lower at suburban firms, suggesting that suburban firms are less likely to hire blacks, holding supply constant. Raphael, Stoll, and Holzer (2000) compare the central city/suburban difference in the propensity to hire blacks at firms where whites are in charge of hiring to that at firms where blacks are in charge of hiring. The authors find that both white and black suburban firms are considerably less likely to hire blacks than are their central city counterparts and that the geographic differences within firm types are comparable in magnitude. A study by Stoll (1999b) finds that the return to spatial search is higher for blacks than for whites, suggesting that employers located far from black communities are willing to hire black workers.

[5] The full path of the Dublin line runs from the city of Dublin to Daly City in South San Francisco. This path is meant to facilitate the San Francisco commutes of those residents in the far suburbs along the north-south corridor near U.S. Highway I680.
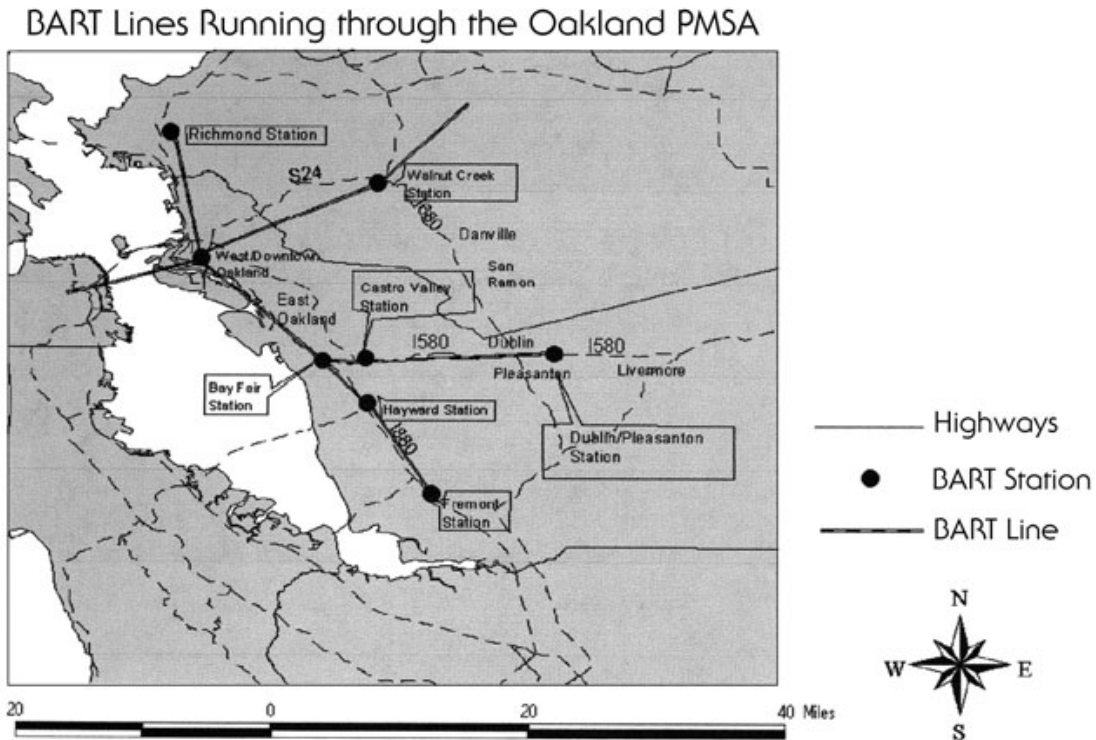
BART Lines Running through the Oakland PMSA

Figure 1. Bay Area Rapid Transit system, Oakland, California.

This new line is the first rail connection between two areas of the region that differ significantly in their patterns of economic growth, their racial and ethnic composition, and the socioeconomic status of their resident populations. The first area is a low-growth, predominantly minority region of the PMSA encompassing the city of Oakland and the cities immediately south of Oakland. The second area is a high-growth region of the PMSA along the eastern suburban ring. There are large concentrations of employment in both areas, with a particularly dense suburban employment node in the area surrounding the new Dublin/Pleasanton station. In the decade before the opening of the new line, most employment growth in the PMSA occurred along the eastern suburban ring, with exceptionally rapid employment growth around the new Dublin/Pleasanton station. In contrast, there were relatively few jobs added in the dense urban area along the bay shore.[6]

These two areas also differ in the racial and ethnic composition of their residents. The black population is concentrated in large geographic clusters in the central cities of Oakland, Berkeley, and Richmond. The Latino population is more evenly distributed along the bay-shore. There are few Latinos and blacks residing in the areas surrounding the Dublin/Pleasanton station. Non-Latino whites basically reside where blacks and Latinos do not.

Finally, differences are large in the averages of residents' socioeconomic characteristics in the region surrounding the new BART station and the area along the bay shore. Table 1 presents a comparison of several socioeconomic characteristics of

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[6] See Raphael (1998b) for a detailed discussion of the economic geography of this region.

Table 1. Socioeconomic characteristics of residents in the area surrounding the new station and the rest of Alameda County, 1990.

	Alameda County	Area Surrounding the New Station	County Remainder
A. Demographic conditions (%)			
Youth unemployment rate	18	11	19
Adult male unemployment rate	7	4	7
Poverty rate	10	4	11
Single-parent households	13	8	14
Households receiving public assistance	10	4	11
Percent black	18	3	20
Percent Latino	14	8	15
B. Incomes (in 1990 dollars)			
Median household income	40,161	54,729	38,473
Per-capita income	17,547	21,242	17,188

All calculations are weighted by census populations and are based on data from the 1990 Census Summary Tape Files 3A. The area surrounding the new station includes all census tracts in the cities of Dublin, Pleasanton, Livermore, San Ramon, and Danville.

census tracts located within the vicinity of the Dublin/Pleasanton BART station with the rest of Alameda County.[7] The area around the new station has below-average unemployment and poverty rates, below-average proportion of households headed by a female head or receiving public assistance, and above-average median household income and per-capita income.

The extent to which the new line improved access for minority workers to the Dublin/Pleasanton area depends on the extent to which the new line lowered the costs of reverse commuting and increased the flexibility of the transit system. The costs of a public transit commute include the monetary costs, the costs associated with in-vehicle travel time, and the time costs of collection, transfer, and distribution. Such costs reduce the net benefits of being employed. The degree of flexibility depends on headway times (times between successive trains or buses), hours and days of operation, and reliability, factors that may determine whether inner-city workers can take and retain distant suburban jobs. For instance, commuting to a suburban job with non-standard work hours may be infeasible for a transit-dependent, inner-city worker if services are offered infrequently outside peak-period hours.[8]

The effects of the new rail line on the reverse commute to the eastern Oakland suburbs are summarized in appendix Table A1. The new line made reverse commuting much easier. In-vehicle commute times as well as time spent in transfer between transit modes were substantially reduced. In addition, for many commuters

[7] Calculations in this table are based on data from the 1990 Census STF 3A files. The remainder of Alameda County includes the area surrounding the portion of the BART line running along the bay, all of the city of Oakland, and the cities of Berkeley, Alameda, and Albany.
[8] There is some evidence that relatively low-skilled minority workers are less likely to work standard hours. Hamermesh (1996) shows that the young and less-educated are more likely to work the shifts from 7 pm to 10 pm and from 10 pm to 6 am. In addition, the author shows that black males are significantly more likely to work these non-standard hours. O'Regan and Quigley (1999) present similar results for single women.

the out-of-pocket costs declined. Finally, the hours of operation are longer and the headway times shorter on the new line relative to what existed previously.

The Employer Survey and the Natural Experiment

The Dublin/Pleasanton extension provides a unique opportunity to study the effect of transportation improvements on minority access to suburban employment opportunities. The service improvements for reverse commuters were largely the byproducts of other transportation goals. The primary objective of the service extension was to facilitate the in-bound San Francisco commute of suburban residents rather than the reverse commute of urban residents.[9] The extension was not a response to excess labor supply in the area's urban core. Hence, the new line really is exogenous to the processes determining the spatial distribution of minority employment.[10]

To evaluate this natural experiment, we conducted a two-wave longitudinal survey of establishments in the areas surrounding the new line. The survey is based on the multi-city survey of urban inequality described in Holzer (1996). Establishments were sampled in the following manner. First three geographic strata were defined based on postal codes. The three areas roughly correspond to the two areas within 6 miles of the new stations and the areas within 6 to 12 miles of the new stations.[11] To ensure detection of any change in hiring near the new stations, firms in the strata encompassing the new stations were over-sampled.

Within each geographic stratum, three employer size categories (1 to 19 employees, 20 to 99 employees, and 100 plus employees) were defined. Establishments were sampled in proportion to the percentage of workers in each area employed by establishments of each category.[12] This sampling frame increases the likelihood of sampling large employers and decreases the likelihood of sampling smaller employer relative to the sampling probabilities using random sampling. Since larger employers do more hiring over the course of the year, this sampling frame better reflects the distribution of opportunities faced by a job applicant in the region. The first-wave survey was conducted in April and May of 1997 in the four-week period preceding the opening of the new line. The second-wave survey was conducted between April and July of 1998, approximately one year later.

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[9] Several factors indicate that this is the case. For example, the first train of the day in the in-bound direction leaves earlier than the first train of the day making the reverse commute. In addition, the peak-period congestion (that the extension was designed to alleviate) flows from the suburbs to the city during the morning rush hour and from the city to the suburbs in the evening rush hour.

[10] The fact that the new line was either in the planning or construction stage for nearly two decades implies that many employers that would be willing to hire minority workers may locate around the new stations in anticipation of new supply of labor from inner-city Oakland. If this were the case then any employment effect of the transit extension would be biased upwards, since the employers located around the new station would not be a random sample of suburban employers. Nonetheless, even these employers experience a change in the transportation accessibility of their establishments, which if substantive, may be reflected in a change in hiring outcomes. Moreover, given the public focus on the new line as a service for inbound commuters, one might argue that the potential reverse commute labor flow would be a minor consideration in the location decision made by employers in the Dublin/Pleasanton area.

[11] The three strata are the city of Castro Valley (encompassing the Castro Valley station), the cities of Dublin and Pleasanton (surrounding the terminal station), and the cities of Livermore, San Ramon, and Danville.

[12] Pre-sampling information on establishment size was obtained from Survey Sampling Incorporated. Within each geographic stratum/establishment-size cell, establishments were sampled at random. Our sample was purchased from Survey Sampling Incorporated, and the surveys were administered by the Institute for Public Policy and Social Research at Michigan State University.

Telephone interviews were sought with the person in charge of hiring at each sampled establishment. In designing the survey, the authors were cognizant of the fact that employer response rates to surveys about hiring practices and outcomes are typically low, even for telephone surveys (Kling, 1995). Hence, the instrument was brief and focused, and designed to primarily collect information on the establishment's more recent hire. In the first wave, those employers were interviewed who had filled a job vacancy within the last year that did not require a college degree. Of the 537 firms that passed this initial screen, 407 were successfully contacted by telephone. A key question in the interview inquired about the race and ethnicity of "the most recent hire." Of the 407 firms, 365 provided this information. Of those providing complete information during the first wave, 248 responded to the second wave survey.[13] Of these 248 firms, a small number (13) did not hire a new worker during the intervening year, and 29 did not provide second-wave information on the race and ethnicity of the most recent hire. As summarized in Table 2, the final sample consists of 206 firms. A slightly larger proportion of observations were retained for firms located far from the station (61 percent) than were for firms located near the station (54 percent).

Information necessary to assess whether sample attrition between the first and second waves alters the characteristics of the final analysis sample is presented in appendix Table A2. Comparing firms that responded to both waves 1 and 2 to firms that provided complete information in wave 1 but not wave 2, it becomes apparent that the probabilities that the last worker hired in wave 1 was black or Latino are nearly identical. Since these are principal dependent variables, this is a reassuring finding. There are very few statistically significant differences between the establishments that responded to both waves and the establishments that responded only to the first wave for many of the characteristics listed in the table. However, size distributions are notably different. Attrition was especially severe among small firms (less than 20 employees).

A simple quasi-experimental design was employed to investigate the effect of the expansion of the BART system on minority employment in the eastern ring of the metropolitan area. All establishments within 6 miles of a new station were defined as treatment group establishments; all those more than 6 miles from the new stations were defined as members of the control group.[14] For each firm, the before-after changes were calculated in the variables indicating that the last worker hired (1) is either black or Latino, (2) is black, and (3) is Latino and the averages of these changes computed for our treatment and control groups. If the new line improved access to suburban employers, relatively larger increases should appear in the propensity to hire minority workers at firms located near the new stations. Difference-in-difference (DD) estimates were calculated for the transportation effect by subtracting the mean change for the control group establishments from the mean change for the treatment group establishments. This estimate uses the change in the hiring outcomes for the control group firms as a benchmark intended to capture all other factors that change over the year. A positive significant DD estimate indicates an accessibility effect of the transportation extension.

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[13] In a follow-up to the survey, each of the firms which had provided the race/ethnicity of the most recent hire in the first wave but which had refused to provide similar information in the second wave was contacted by one of us in an attempt to conduct the interview in person. Many of the interviewees expressed hostility about the content of the interview, many suggesting that they had been caught unprepared by the questions posed in the first wave. As a result, few of the non-responses to the second wave were converted to responses.

[14] Distance from the nearest BART station was coded in miles according to the shortest surface street route.

Table 2. Summary of establishments surveyed in each wage.

	All Firms		Near Station		Far from Station	
	Sample Size	% of First Wave	Sample Size	% of First Wave	Sample Size	% of First Wave
Responded to wave 1 and provided information on the race of the most recent hire	365	100	229	100	136	100
Responded to wave 2	248	68	151	66	97	71
Lost due to no-new hiring	13	4	10	4	3	2
Lost due to incomplete information	29	8	18	8	11	8
Final sample	206	56	123	54	83	61

"Near Station" = within 6 miles of the transit station.

We also tested for a relationship between the change in the propensity to hire minority workers and distance from the station that adjusts for observable firm characteristics. Using linear regression models, the change was regressed in the variable indicating the race/ethnicity of the most recent hire on linear distance from the station, observable establishment characteristics, and changes in hiring and recruiting methods. Also considered was the appropriately specified multinomial choice model of firm hiring behavior.

EMPIRICAL RESULTS

Summary Results

Figures 2 through 4 report the relationship between establishment proximity to the new stations and the change in the variables indicating the race/ethnicity of the new hire. The figures are constructed as follows. The sample was sorted in ascending order by distance from the nearest station. Then a 30-observation moving average was calculated for the change in the hiring variables. The figures report scatter plots of the 30-observation moving averages against distance in miles from the station.[15] Figure 2 presents results for the change in the variable indicating that the last worker hired is black, Figure 3 present results for Latinos, and Figure 4 presents results for the change in the propensity to hire either blacks or Latinos.

Figure 2 shows no clear relationship between distance from the new stations and the change in the propensity to hire black workers. Establishments that are 3 to 6 miles away actually exhibit larger increases in the propensity to hire blacks than those within 3 miles. Moreover, establishments located more than 6 miles from the station, and especially 8 to 10 miles away, generally increased their hiring of black workers. In contrast, there is a strong negative relationship between the change in the propensity to hire Latino workers and distance from the new stations. Figure 3 reports a general increase in the propensity to hire Latino workers at establishments within 6 miles of the station (especially within the first 2 miles) and a general decline

[15] Plots of the raw data against distance are difficult to visually interpret since the dependent variables only take on values of –1, 0, and 1. These moving averages are presented for descriptive purposes only.
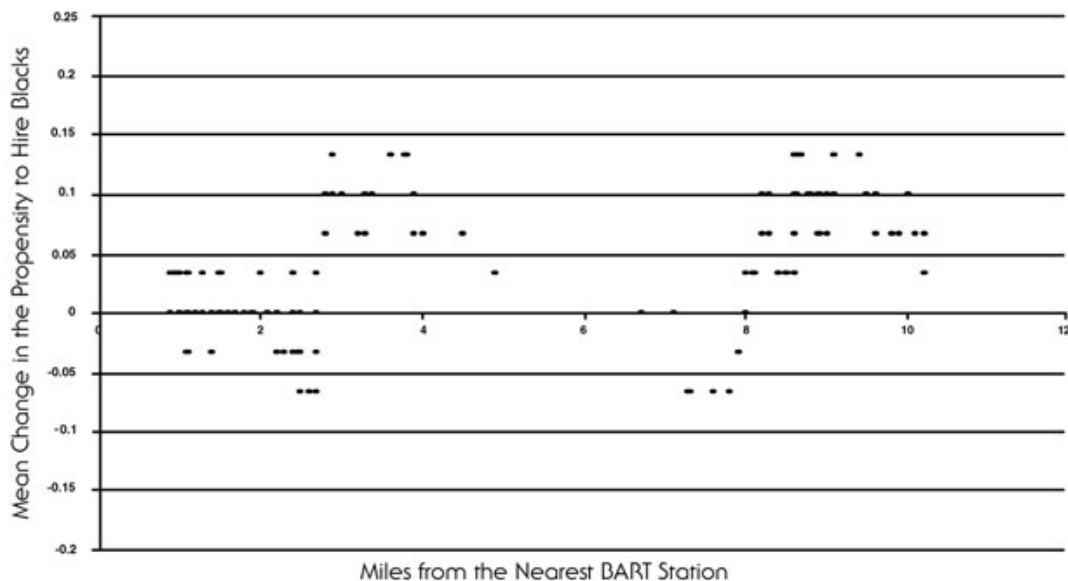
Figure 2. Scatter plots of the changes in the variable indicating that the last worker hired is black against distance from the BART station.

in the propensity to hire Latinos at firms 6 or more miles away. In addition, within the set of establishments that are relatively near the station, there is a negative relationship between distance and the change in the propensity to hire Latinos.

Interestingly, the plots in Figures 2 and 3 also suggest a greater increase in the hiring of blacks than Latinos in the overall area. The mean hiring rates by race in the data confirm this impression. For the sample with complete information in both waves, the hiring of blacks increased by about 30 percent, the hiring of Latinos was relatively unchanged, while the hiring of either blacks or Latinos increased by roughly 15 percent.[16] Since the period covered by the surveys coincides with a major tightening of the labor market (both nationally and regionally), the relatively greater growth of black hiring in this area may well reflect a greater sensitivity of their hiring rates to labor market conditions.[17] However, the geographic distribution of these new hires appears to have been more affected by the new subway system among Latino workers than blacks.

A comparison of Figures 2 and 3 also suggests that there may be inter-group competition between blacks and Latinos for jobs, with Latino workers displacing blacks. The figures indicate that where there are increases in Latino hiring rates there are no increases (or even decreases) in black hiring rates, and visa versa. If these two distance profiles perfectly offset one another, there may be no relative increase in the hiring of minority workers (workers that are relatively under-represented among the residential populations of these areas) at establishments nearer to the new stations.

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[16] While these are sizable increases relative to the base hiring rates, these increases are only marginally significant, given the size of our sample.
[17] The unemployment rate in the Oakland metropolitan area declined from 4.2 to 3.7 percent in the period between the two surveys. For evidence on the relatively strong sensitivity of black employment to local economic conditions see Bound and Holzer (2000).
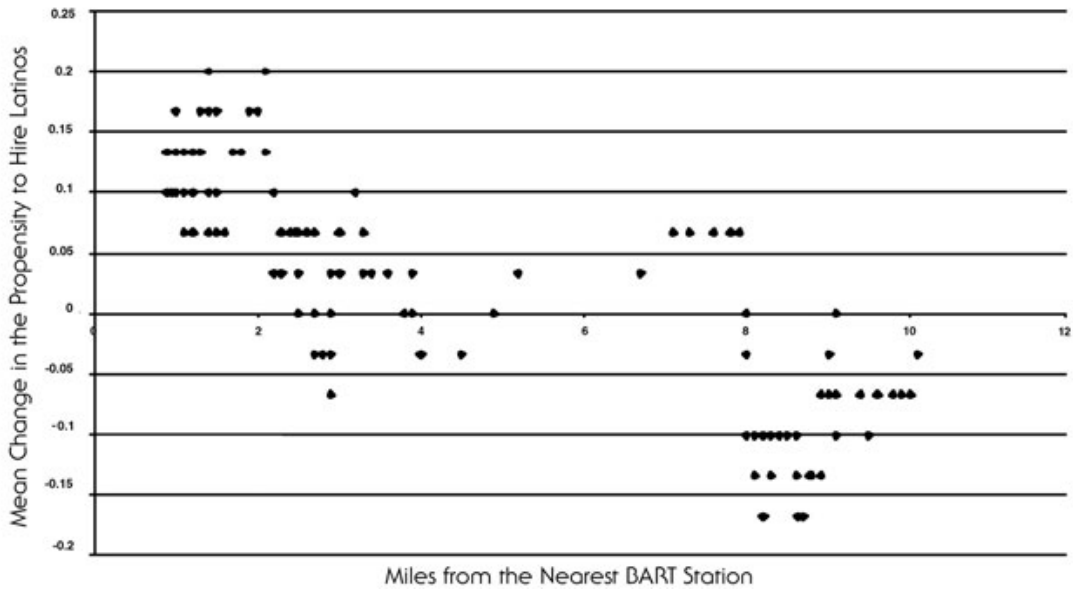
Figure 3. Scatter plots of the changes in the variable indicating that the last worker hired is Latino against distance from the BART station.

Figure 4 presents a similar geographic profile for the change in the variable indicating that the last worker hired was either black or Latino. Defined in this manner, the figure indicates a clear increase in the hiring of minority workers at firms located within 6 miles of the station relative to firms located farther away. Hence, the increases in hiring among Latinos near the new stations are not completely offset by employer substitution away from blacks.

Table 3 presents hiring rates for minority workers by survey wave and by whether the establishments are within 6 miles of the station. The table also presents before-after changes within areas, near and far differences within sample period, and DD estimates of the relative increase in the propensity to hire minority workers at firms near the station. The table presents three DD matrices using the entire sample and three matrices eliminating establishments located within Castro Valley.[18] For each sample, DD matrices are presented for each of the three outcomes analyzed in Figures 2 through 4.

Table 3 reveals several patterns not revealed in the graphical analysis. The pre-expansion hiring statistics indicate that Latinos were hired at a considerably higher rate than blacks even before the opening of the new stations. For firms near the new stations, nearly 20 percent of newly hired workers were Latino before the service

[18] These additional calculations are presented for several reasons. First, all of the firms in the Castro Valley area are located within approximately two miles of the station. Second, the Castro Valley station is located quite close to the urban areas along the bay shore. To be certain that the transportation effects do not arise solely from the establishments located around the Castro Valley station, we present parallel estimation results in Table 3 (and in all tests that follow) omitting observations from this area. This restriction eliminates roughly 20 observations.
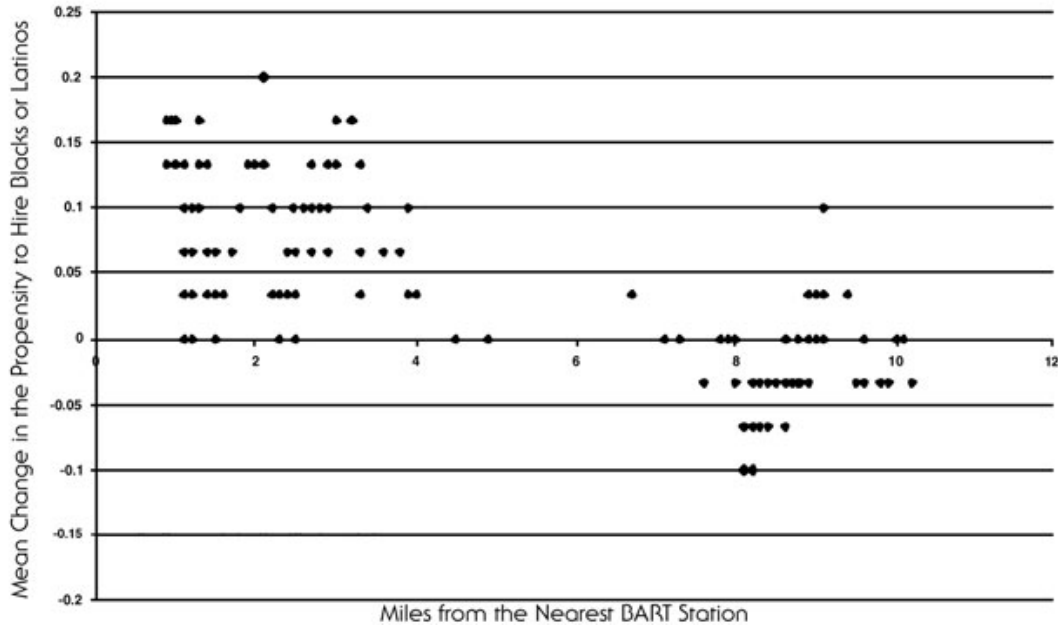
Figure 4. Scatter plots of the changes in the variable indicating that the last worker hired is either black or Latino against distance from the BART station.

extension compared with approximately 10 percent who were black. For firms located far from the stations, approximately 32 percent of newly hired workers were Latino compared with 10 percent who were black. These patterns are similar when excluding observations in Castro Valley.[19]

Thus, neither blacks nor Latinos were more likely to be hired near the new stations than farther away before they were constructed. In contrast, the hiring of Latinos increased more at locations near the new stations than at those farther away after construction was completed. The hiring rates of Latinos rose near the stations and declined farther away by approximately 10 percentage points (both significant at the 10 percent level). The hiring of blacks increased to 12 and 16 percent respectively in the same locations.

In the lower right-hand corner of each sub-matrix, the table presents the DD estimate of the relative increase in the propensity to hire minority workers. For the variable indicating that the last worker hired was black or Latino, the estimate of the increase in the relative propensity to hire minorities near the station is 0.158 for the full sample and 0.170 for the sample eliminating the Castro Valley observations. If there were no effect of the improved transport system on minority hiring, these results would be expected only about 10 percent of the time (i.e., the *p*-values are 0.11 and 0.10, respectively). Again, the relative increase in the propensity to hire black workers is not significant among firms that are nearer to the new stations. This result holds in both samples. Finally, the DD estimates for

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[19] Both blacks and Latinos are hired at rates that exceed their representation in the residential populations (see Table 1). This likely reflects a focus of the survey about the hiring of workers into relatively unskilled jobs.

the relative increase in the propensity to hire Latinos are large and significant. For the full sample, firms nearer to the station increase their hiring of Latinos by 0.203 relative to firms far from the station for the restricted sample, the comparable point estimate is 0.213. Both estimates are highly significant and would occur only one time of 50 by chance.

By making some suburban jobs more accessible to urban Latinos, the new subway line has apparently raised the overall demand for Latino labor in the Oakland PMSA. What is the magnitude of this increase? According to the 1990 Census, the municipalities of Castro Valley and Dublin/Pleasanton accounted for about 11.5 percent of all jobs in Alameda County. If Latinos now obtain roughly 10 percent more of those jobs than before, and if that group accounts for about 14 percent of all employment in the county (based on their population share in Table 1), then the new employment opportunities constitute roughly an 8 percent increase in the demand for Latino labor in Oakland.[20]

Of course, any positive shift in the labor demand for a particular group can raise their wage levels or employment rates, with the exact effect depending on their labor demand and supply elasticities. Net employment in the area does not appear to have risen for Latinos, since employment expansion near the new stations are roughly offset by their declines farther out.[21] Consistent with the notion that labor supply for this group is relatively inelastic, the primary effect of the new subways appears to be lower commuting costs for Latinos, and therefore higher wages net of these costs. In contrast, while the new stations do not appear to have shifted labor demand for blacks, the overall net increase in their suburban employment noted above (that is likely attributable to the business cycle) suggests either more elastic labor supplied or a surplus of labor among that group before the increases occurred.

Regression Results

The DD results confirm the findings presented visually; they also demonstrate that where there are visible transit effects, these effects are statistically significant. Since the DD estimates are based on changes in hiring patterns within establishments, they already account for any influence of establishment characteristics that do not change across waves. Nonetheless, there may be factors that change across waves and that do affect hiring outcomes. For example, establishments may change recruiting methods or qualification requirements in a manner that is either more or less likely to result in the hiring of a minority worker. Alternatively, the race of the person in charge of hiring may change between waves, with consequent effects on unobservable indirect recruiting opportunities. In addition, establishments with different fixed characteristics may respond differently (in terms of their hiring patterns) to the change in transportation infrastructure. Larger firms may be more likely than small

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[20] These calculations assume that the hiring changes observed will be permanent, and reflect the new steady-state employment equilibrium that would ultimately be reached under these circumstances. They also assume stability in the new rates of hiring and employment between these different geographic areas over time.

[21] As of the 1990 census, there were 58,000 jobs in the areas where the new subway stations were located and roughly 74,000 in the inaccessible areas. As the former areas have been growing somewhat more rapidly than the latter, the two areas are no doubt more comparable in employment today. Hence, similar increases and decreases in percentage terms constitute roughly offsetting changes in magnitudes as well. Of course, it is quite likely that at least some of the new employment for Latinos near the suburban subway stops went to those who had earlier worked in or nearer to the city of Oakland, who in turn might have been replaced by those who previously commuted by car to the more distant areas but no longer needed to.

Table 3. Before-after comparisons of the race/ethnicity of the last employee hired into a position not requiring a college degree by distance from the new stations.

	Both Stations Combined			Dublin/Pleasanton Station Only		
	Near Station (within 6 miles)	Far from Station (beyond 6 miles)	(Near-Far)	Near Station (within 6 miles)	Far from Station (beyond 6 miles)	(Near-Far)
Panel A: last hire is black or Latino						
Before	0.295	0.410	–0.116	0.290	0.410	–0.120
	(0.043)	(0.056)	(0.069)	(0.047)	(0.056)	(0.049)
After	0.402	0.359	0.043	0.409	0.359	0.050
	(0.047)	(0.055)	(0.072)	(0.051)	(0.055)	(0.075)
(After-Before)	0.107	–0.051	0.158	0.119	–0.051	0.170
	(0.065)	(0.073)	(0.098)	(0.071)	(0.073)	(0.103)
Panel B: last hire is black						
Before	0.106	0.096	0.009	0.107	0.096	0.011
	(0.028)	(0.033)	(0.043)	(0.031)	(0.033)	(0.045)
After	0.122	0.157	–0.035	0.126	0.157	–0.030
	(0.030)	(0.040)	(0.048)	(0.033)	(0.040)	(0.051)
(After-Before)	0.016	0.060	–0.044	0.019	0.060	–0.041
	(0.042)	(0.043)	(0.061)	(0.048)	(0.043)	(0.066)
Panel C: last hire is Latino						
Before	0.196	0.316	–0.119	0.194	0.316	–0.122
	(0.038)	(0.054)	(0.064)	(0.041)	(0.054)	(0.067)
After	0.295	0.211	0.084	0.301	0.211	0.091
	(0.043)	(0.047)	(0.065)	(0.048)	(0.047)	(0.068)
(After-Before)	0.098	–0.105	0.203	0.108	–0.105	0.213
	(0.058)	(0.066)	(0.089)	(0.064)	(0.066)	(0.093)

Standard errors are in parentheses. Complete information was obtained for: 171 observations on race and ethnicity; 206 observations on race; and 188 observations on ethnicity. Accordingly, 206 and 188 observations are used in calculating the figures for blacks and Latinos, respectively.

firms to increase the hiring of minorities in response to an increase in minority application rates. Establishments that contract with the federal government may be more eager to hire out of the fresh applicant pool to meet federal equal employment opportunity requirements. If these variables differ systematically by distance from the new stations, the changes in hiring patterns may arise from factors other than the greater exposure of nearby firms to the transportation extension.

To explore these possibilities, multivariate statistical models were estimated where the dependent variable is the change in the race/ethnicity of the most recent hire. Table 4 presents mean values for selected variables for the overall sample. Mean values are also presented by proximity to the stations. Distance in miles from the station is used rather than the dichotomous dummy indicating within 6 miles (the implicit "treatment" used in the DD calculations). Included were several variables as levels

Table 4. Means of explanatory variables, all firms and by proximity to the nearest BART station.

	All firms	Near station	Far from station
A. Variables entered as pre-expansion levels			
Miles from station	4.872	1.999	9.129
Contracts with feds.	0.301	0.293	0.313
Percent union	9.152	12.722	4.000
Firm size			
Less than 20 employees	0.451	0.464	0.434
20 to 50 employees	0.282	0.276	0.289
50 to 100 employees	0.165	0.171	0.157
100 to 500 employees	0.087	0.081	0.096
500 plus employees	0.015	0.008	0.024
Industry			
Manufacturing	0.117	0.089	0.157
Wholesale or Retail Trade	0.296	0.365	0.193
Services	0.519	0.495	0.554
Other Industry	0.068	0.051	0.096
B. Variables entered as post-pre expansion changes			
Black person does hiring	0.015	0.033	−0.012
Latino person does hiring	−0.005	0.008	−0.025
Recruitment methods			
Help-wanted signs	0.034	−0.019	0.108
Newspaper ads	−0.023	−0.048	0.014
Walk-ins	0.017	−0.029	0.082
Employee referrals	−0.011	−0.049	0.041
State agency referrals	−0.029	−0.049	0.000
Private agency referrals	0.051	0.019	0.096
Community referrals	−0.006	−0.039	0.042
School referrals	−0.091	−0.137	−0.027
Union referrals	0.017	0.038	−0.014
Job qualifications that are either absolutely necessary or strongly preferred			
High school diploma	0.015	0.049	−0.036
Experience	0.005	−0.024	0.048
References	−0.039	−0.074	0.012
Training	0.005	−0.008	0.025
Daily Job Tasks			
Direct customer interaction	−0.073	−0.073	−0.073
Read instructions	0.034	0.017	0.061
Write paragraphs	0.010	−0.016	0.048
Arithmetic	−0.074	−0.116	−0.012
Use computers	−0.054	−0.074	−0.024
N^a	206	123	83

[a] This gives the number of observations where the race of the most recent hire is observed in both waves. There are missing values for several of the covariates listed in the table.

(using the pre-expansion values) to test for differential responses by fixed establishment characteristics to the service extension.[22] Also controlled for were several variables that may change across waves, such as the race of the hiring agent, recruitment methods used in the search for the recently hired employee, the job qualifications that employers demand from applicants, and descriptions of daily job tasks.

Overall, the means in Table 4 indicate that few fixed characteristics of establishments vary with proximity to the new transit stations. Specifically, establishments located nearby are more likely to be unionized and to be in the trade sectors, while those located farther away are more likely to be in manufacturing. Little clear pattern of variation can be found by proximity in the variables that change over time.

Table 5 presents estimation results for the entire sample while Table 6 presents results omitting establishments in Castro Valley. For each of the dependent variables, three specifications were estimated. The first model regresses the change in the race/ethnicity of the most recent hire on distance in miles from the nearest station. The second specification adds all of the level variables listed in Table 4 and the two variables indicating a change in the race/ethnicity of the person in charge of hiring. The final specification adds all of the other change variables listed in Table 4. The first three regressions in each table present results where the dependent variable is the change in the variable indicating that the last hire is either black or Latino. The next three regressions provide results for the change in the propensity to hire black workers while the final three regressions provide results for the change in the propensity to hire Latinos.

Controlling for the variables listed in Table 4 does not change the estimated effects of distance from the station. In the models where the dependent variable is the change in the propensity to hire blacks or Latinos, the negative effect of distance actually increases and becomes more significant as we expand the model specification. In both Tables 5 and 6, the distance effects are negative in the first two specifications and marginally significant. In the final specification, the distance effects become more negative and are significant at the 5 percent level. Again, no relationship can be found between the change in the propensity to hire blacks and distance from the station. Finally, the distance effect for propensity to hire Latinos is large and significant at the 5 percent level in all models.[23]

Only a few of the other variables included in the model specification are statistically significant. In several models, the percentage of workers that are unionized in the pre-expansion wave exerts a significant negative effect. The coefficients on the establishment-size dummies indicate that larger establishments are more likely to increase their hiring of minorities in response to the service extension, though none of these coefficients are statistically significant. Finally, we do not find significant effects of changes in the race of the hiring agent. This latter result, however, may arise because we observe very few changes in these variables across waves.

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[22] This set of variables includes a dummy indicating whether the firm contracts with the federal government, the percent of non-managerial workers that are unionized, four establishment size dummies (the omitted category being less than 20 employees), and three industry classifications. Permitting establishment size to enter as levels in these regression models is particularly important, since the between-wave attrition was not random with respect to size. If our results hold up after controlling for the differential hiring responses of establishments by size category, concerns over selection bias due to attrition are less salient.

[23] As is evident in Tables 5 and 6, the size of the sample used to estimate the regression models is smaller in the more complete specifications. This is an artifact of missing data for many of the variables listed in Table 4. To insure that the changing sample is not responsible for the distance effects evident in Table 5 and 6, we also estimated each model restricting the sample to those observations with complete information on all variables used in the final complete specification. The distance effects using the restricted samples are nearly identical to the results presented in Tables 5 and 6.

Table 5. Linear regressions of changes in the race/ethnicity of the last worker hired on the firm's distance from the nearest BART station and other covariates (both stations combined).

	Last worker hired is black or Latino			Last worker hired is black			Last worker hired is Latino		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Miles to station	-0.020	-0.024	-0.041	0.007	0.007	0.0003	-0.026	-0.030	-0.038
	(0.013)	(0.015)	(0.019)	(0.008)	(0.009)	(0.012)	(0.012)	(0.014)	(0.018)
Contracts with feds	—	-0.043	-0.092	—	0.082	0.086	—	-0.073	-0.111
		(0.119)	(0.152)		(0.075)	(0.097)		(0.111)	(0.150)
Percent unionized	—	-0.004	-0.002	—	-0.002	-0.001	—	-0.003	-0.001
		(0.002)	(0.002)		(0.001)	(0.002)		(0.002)	(0.002)
Firm size									
20 to 50	—	0.015	0.029	—	0.113	0.110	—	-0.087	-0.100
		(0.131)	(0.160)		(0.082)	(0.105)		(0.122)	(0.157)
50 to 100	—	-0.073	-0.119	—	0.055	0.096	—	-0.128	-0.203
		(0.155)	(0.195)		(0.094)	(0.122)		(0.142)	(0.191)
100 to 500	—	0.041	0.126	—	0.007	0.078	—	-0.067	-0.108
		(0.204)	(0.248)		(0.122)	(0.156)		(0.188)	(0.240)
500 plus	—	0.145	0.279	—	0.401	0.441	—	-0.241	-0.224
		(0.407)	(0.554)		(0.261)	(0.361)		(0.374)	(0.542)
Black person does hiring	—	0.228	-0.534	—	0.163	-0.079	—	0.202	-0.055
		(0.337)	(0.446)		(0.176)	(0.218)		(0.309)	(0.436)
Latino person does hiring	—	-0.251	-0.112	—	-0.071	-0.025	—	-0.178	-0.071
		(0.187)	(0.201)		(0.115)	(0.127)		(0.172)	(0.196)
Controls for in recruiting methods, job qualifications, and daily tasks	No	No	Yes	No	No	Yes	No	No	Yes
R^2	0.012	0.059	0.301	0.004	0.058	0.145	0.025	0.072	0.259
N	190	153	118	206	167	130	188	151	116

Standard errors are in parentheses. All regression include intercepts. Regressions including recruitment methods, qualifications, and job tasks include the variables listed in Table 4. All regressions with the exception of (1), (4), and (7) include three dummies for broad industry groupings.

Table 6. Linear regressions of changes in the race/ethnicity of the last worker hired on the firm's distance from the Dublin/Pleasanton BART station and other covariates (omitting Castro Valley firms).

	Last worker hired is black or Latino			Last worker hired is black			Last worker hired is Latino		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Miles to station	-0.022	-0.026	-0.043	0.007	0.008	0.002	-0.027	-0.034	-0.043
	(0.014)	(0.017)	(0.020)	(0.009)	(0.011)	(0.014)	(0.013)	(0.015)	(0.019)
Contracts with fed. govt.	–	0.009	-0.068	–	0.101	0.121	–	-0.041	-0.101
		(0.131)	(0.167)		(0.084)	(0.116)		(0.121)	(0.166)
Percent unionized	–	-0.004	-0.0003	–	-0.002	-0.002	–	-0.003	0.0005
		(0.002)	(0.002)		(0.001)	(0.002)		(0.002)	(0.003)
Firm size									
20 to 50	–	0.105	0.119	–	0.137	0.141	–	-0.024	-0.060
		(0.141)	(0.171)		(0.090)	(0.119)		(0.131)	(0.168)
50 to 100	–	-0.021	-0.081	–	0.079	0.138	–	-0.099	-0.156
		(0.161)	(0.203)		(0.102)	(0.136)		(0.147)	(0.198)
100 to 500	–	0.057	0.109	–	0.016	0.107	–	-0.076	-0.122
		(0.214)	(0.256)		(0.131)	(0.172)		(0.196)	(0.249)
500 plus	–	0.176	0.375	–	0.581	0.532	–	-0.380	-0.252
		(0.494)	(0.556)		(0.327)	(0.389)		(0.452)	(0.549)
Black person does hiring	–	0.332	-0.793	–	0.195	-0.031	–	0.303	-0.178
		(0.396)	(0.560)		(0.202)	(0.262)		(0.362)	(0.548)
Latino person does hiring	–	-0.243	-0.177	–	-0.070	-0.072	–	-0.171	-0.099
		(0.197)	(0.204)		(0.125)	(0.139)		(0.179)	(0.198)
Controls for in recruiting methods, job qualifications, and daily tasks	No	No	Yes	No	No	Yes	No	No	Yes
R^2	0.014	0.061	0.366	0.003	0.076	0.167	0.027	0.078	0.330
N	171	137	104	186	150	115	169	135	102

Standard errors are in parentheses. All regressions include intercepts. Regressions including recruitment methods, qualifications, and job tasks include the variables listed in Table 4. All regressions with the exception of (1), (4), and (7) include three dummies for broad industry groupings.

Alternative Estimates Using a Multinomial Model

Multinomial logit models were estimated using a more flexible specification to analyze the effects of the transit extension on firm propensities to hire minority workers. Specifically, $P_{White,i}$, $P_{Black,i}$, and $P_{Latino,i}$ were defined as the probability that the second-wave most recent hire for firm i is white, black, and Latino, respectively. The probability of hiring a black worker conditional on hiring either a black or white worker is given by $P_{Black,i}/(P_{White,i} + P_{Black,i}) = F(\beta_B X_i)$, where $F(\cdot)$ is the cumulative density function for this conditional probability. The comparable conditional probability for hiring a Latino worker is given by $P_{Latino,i}/(P_{White,i} + P_{Latino,i}) = F(\beta_L X_i)$. If we assume that $F(\beta_B X_i)$ and $F(\beta_L X_i)$ are logistic cumulative distribution functions, than the parameter vectors, β_L and β_B, can be estimated using multinomial logit.

The two-period structure is used for the data set by including a dummy variable indicating that the last worker hired in the first wave was black and a dummy variable indicating that the last worker hired in the first wave was Latino among the set of explanatory variables. Controlling for first wave outcomes completely summarizes all of the information on the pre-expansion propensity of each firm to hire minority workers.[24] The other control variables are the second-wave values of the all of the explanatory variables listed in Table 4. Finally, the key explanatory variable is the firm's distance in miles from the new stations.

Table 7 presents the partial derivatives of the probability of hiring a worker of each given race/ethnicity category with respect to firm distance from the new BART stations. These derivatives are based on the parameter estimates from three increasingly complex specifications of the multinomial logit models.[25] The table also reports the *p*-value testing whether the effects of distance on the probability of hiring a black or Latino worker differs significantly from the effect of distance on the likelihood of hiring a white worker.

As in the OLS models, the strongest effects of proximity are estimated for Latino workers. The range of estimates suggests that the probability of hiring a Latino worker declines by between 1.5 and 2.9 percentage points for each mile of distance from the new station. This effect is not quite significant for the first two specifications (*p*-values of 0.14 and 0.13, respectively), but is highly statistically significant in the final specification (*p*-value of 0.005). For the first two specifications, no effect of distance from the station was found on the propensity to hire black workers. For the final specification, a small, weakly significant (at the 11 percent level of confidence) negative effect was found of distance from the station on the likelihood of hiring a black worker in the second wave. The derivative indicates that an additional mile from the station reduces the probability of hiring a black worker by 1.2 percentage points. Finally, there is little relationship between distance from the stations and the likelihood of hiring white workers. If anything, white workers are more likely to be hired by employers located farther from the new stations. Hence, the multinomial logit results in Table 7 basically confirm the results from the simple OLS regression.

[24] The changes specification presented in Tables 5 and 6 basically constrains the coefficient on lagged hiring outcomes to 1.

[25] The specifications are: (1) a specification including distance and the two dummy variables indicating the race/ethnicity of the first wave hire; (2) the first specification plus the percent union, a dummy variable indicating that the firm contracts with the federal government, firm size dummies, industry dummies, a dummy indicating that the person in charge of hiring is black, and a dummy indicating that the person in charge of hiring is Latino; and (3) the second specification plus wave-2 level measures of the recruitment methods, job qualifications, and daily job tasks.

Table 7. Multinomial logit estimates of the effect of distance from the new BART stations on the probability that the most recent second-period hire is either white, black, or Latino.

	$\delta P_{White}/\delta distance$	$\delta P_{Black}/\delta distance$	$\delta P_{Latino}/\delta distance$
Specification (1)	0.007 (–)	0.008 (0.374)	–0.015 (0.142)
Specification (2)	0.007 (–)	0.010 (0.364)	–0.017 (0.132)
Specification (3)	0.040 (–)	–0.012 (0.107)	–0.029 (0.005)

Figures in parentheses are the *p*-values from a test of whether the distance effects on the probability of hiring black or Latino workers differ significantly from the distance effect on the probability of hiring a white worker. The dependent variable of the multinomial logit model in all three specifications are the three race/ethnicity possibilities for the second-period most recent hire (i.e., white, black, or Latino). Specification (1) includes distance from the station in miles, a dummy variable indicating that the first period hire is black, and a dummy variable indicating that the first period hire is Latino. Specification (2) includes all of the variables in specification (1) plus the percentage union, a dummy variable indicating that the firm contract with the federal government, firm size dummies, industry dummies, a dummy indicating that the person in charge of hiring is black, and a dummy indicating that the person in charge of hiring is Latino. Specification (3) includes all of the variables in specification (2) plus two-wave level measures of the recruitment methods, job qualifications, and daily job tasks variables listed in Table 4.

Discussion of the Results

The results of the DD calculations and the more elaborate statistical models yield a consistent portrait of the effect of the transportation service extension on the rates at which minority workers are hired in the eastern suburbs of the Oakland PMSA. Among the establishments in our sample, the hiring of Latino workers increased considerably for establishments located nearby the new stations, while it declined at establishments located farther away. The difference in results across these two areas is statistically significant and remains so after controlling for a host of establishment characteristics. Overall, these results indicate that the new stations increased the demand for Latino labor by about 8 percent. This increase appears to result in lower commuting costs, and potentially higher wages, rather than higher overall employment levels in the region.

In contrast, no relative increase among nearby firms was found in the propensity to hire black workers—if anything, the hiring of blacks increases somewhat among establishments located farther away, but remains relatively constant nearby. Some evidence indicates that the employment gains experienced by members of one minority group were partially offset by the employment losses experienced by the other, although inter-group substitution alone does not explain the transit effect for Latino workers. More specifically, an analysis of the change in the propensity to hire either blacks or Latinos finds that establishments nearer to the new stations increased such hiring relative to establishments farther away. Finally, employing an alternative multinomial estimator yields findings that are qualitatively similar to those from the simple models.

The disparity in the results begs the question of why the transportation extension seemed to affect the hiring of Latinos more than blacks, especially since much (though not all) of the evidence on the employment effects of "spatial mismatch" focuses on the latter group. Several factors may explain these patterns. To start, as is evident in Table 3, Latinos were employed at nearly twice the rate of blacks before the service extension. To the extent that this provided relatively stronger information flows to predominantly Latino communities, Latino job seekers may have been better poised to respond to the new opportunities created by the service extension.

Employer responses to questions concerning their recruitment methods indicate a heavy reliance on employee-referrals. In the final sample, 84 percent of employers report using employee-referrals in recruiting the last worker hired. Moreover, this recruiting method is the one most frequently used (see appendix Table A1). These recruiting patterns combined with the greater pre-expansion hiring of Latinos suggest that the information flow to Latino job seekers concerning employment opportunities in the newly accessible area was relatively stronger than the flow of information to black job seekers. Whether there is an interaction effect between information flows and the accessibility afforded by the public transit system is an issue for future research.

An alternative explanation of the differential impact of the transit extension may be that Latino residences are simply nearer the areas made accessible by the service extension. Analysis of maps of the region do indicate that Latinos are more likely to reside in the vicinity of the Bay Fair station, the point of departure of the new BART line from the old system. To explore this possibility further, Figure 5 plots the cumulative Latino and black populations within a half-hour public transit commute from the Bay Fair station (the point of departure for the new line). The area shown covers all those within an approximate one-hour public transit commute from employers in the Dublin/Pleasanton area.[26] Despite the fact that the black population of the Oakland PMSA is larger than the Latino population, the figure clearly shows that the number of Latinos within an hour public-transit commute of the Dublin/Pleasanton area exceeds the comparable number of blacks.[27] Within a distance of 30 minutes from the Bay Fair station, the Latino population exceeds the black population by slightly more than 17,000 persons. These patterns suggest that Latinos stood to benefit more (in terms of accessibility to jobs in the eastern suburbs) from the transit extension than blacks.

Another explanation of the differential effect may be that Latinos are willing to travel farther for employment than blacks, and hence were more likely to alter the geography of their supply behavior in response to the transit extension. To investigate this possibility, group-specific gravity models were estimated where the dependent variable is the aggregate journey-to-work flow of black (or Latino) workers traveling by public transit between the public use microdata areas (PUMAs) of the Oakland PMSA. The key explanatory variables are the number of potential black (or Latino) workers in the origin PUMA, the number of jobs in the destination PUMA, and the distance (in public transit minutes) between the origin and destination. If

[26] Calculations from the 1990 Census 5 Percent Public Use Micro Data Sample indicate that the overwhelming majority of black and Latino public transit commuters in the Oakland PMSA have one-way commutes of an hour or less. For black public transit commuters, 45 percent commute 30 minutes or less, 72 percent commute 45 minutes or less, and 89 percent commute one hour or less. The comparable figures for Latino public transit commuters are 38 percent, 63 percent, and 86 percent, respectively. A zone-to-zone public transit travel time matrix for 1990 provided by the Bay Area Metropolitan Transportation Commission and population data from the 1990 Census were used to construct Figure 5. The travel time matrix provide estimate of the inter-zone commute time (between zone centroids) using the 1990 public transit system. Raphael (1998a) discusses these data in detail. Assuming a 5-minute transfer at the Bay Fair station, 15 minutes of in-vehicle travel time to the Dublin/Pleasanton station, another 5-minute transfer at the end of the line, and a 5-minute bus ride (since very few firms are within walking distance of the new station), then Figure 5 portrays the population within a one-hour public transit commute to Dublin/Pleasanton employers.

[27] Within the traffic analysis zone containing the Bay Fair station, the Latino population is more than three times that of the black population (9351 vs. 2934). The flat portion of the profile up till 17 minutes is due to the fact that the nearest neighboring traffic analysis zone is a 17-minute public-transit commute away from the centroid of the traffic analysis zone that encompasses the Bay Fair station.
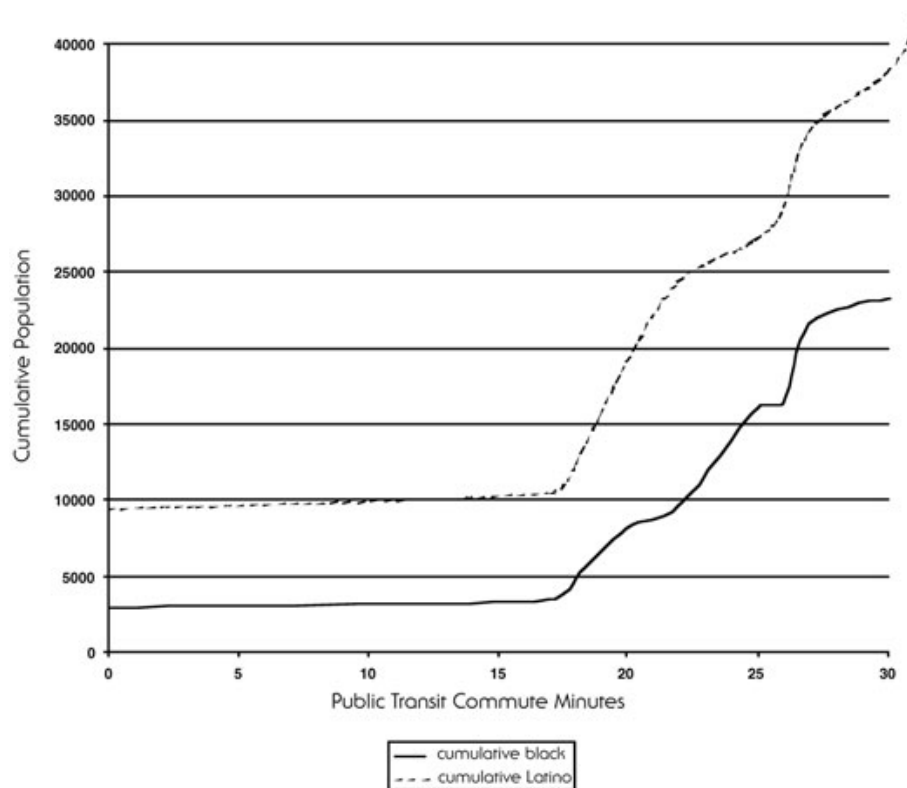
Figure 5. Cumulative black and Latino population within a 20-minute public transit commute of the Bay Fair station.

Latinos are willing to travel farther than blacks, then the rate at which transit flows decay with distance should be lower for Latinos than for blacks. No evidence indicates that this is the case, and there is little reason to suspect that a differential "willingness to commute" contributes to the differences in employment results.[28]

To be sure, other factors may explain this difference. One might contend that blacks are more likely than Latinos to encounter employment and wage discrimination at suburban employers, though the existing evidence on this question is mixed (Holzer and Reaser, 2000; Raphael, Holzer, and Stoll, 2000; Stoll, 1999b). Alternatively, the average skill endowment of Latino workers may be superior to that of black workers, though this too seems unlikely given that average black educational attainment exceeds that of Mexicans (the numerically dominant Latino group in California) by several years (Trejo, 1997). Finally, it may be the case that employers discriminate in favor of Latino workers to the detriment of blacks. The patterns evident in Figures 2 through 4 lend some support to this interpretation.

The relatively closer proximity of Latinos and the higher pre-expansion hiring levels of Latinos may well be the most likely explanations for the differential results. While increases in the hiring of blacks in the overall area (which were likely due to

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[28] The gravity model results are available upon request. Also estimated were models controlling for the number of intervening opportunities (the number of jobs that are closer to the origin than the jobs located in the destination) and found similar results. For a complete discussion of gravity models and their application to commute flows, see Raphael (1998c).

the growing tightness of labor markets in that region) were greater than increases among Latinos, the geographic distribution of new hiring was affected by the new subway only among the latter group.

To be sure, the estimated effect of the transit extension presented in this study likely reflects short-run shifts in the distribution of minority employment. In the long run, several factors may lead to a larger effect of the new transit line. For one, the improved accessibility to the regional transit system is likely to make the areas around the new station more attractive to transit-dependent households. To the extent black and Latino households are disproportionately represented among the transit-dependent, the resident minority population around the new stations may increase. This, in turn, would increase the representation of blacks and Latinos among the local workforce.[29] In addition, firms that draw heavily from transit-dependent applicant pools may find that locations around the new stations relatively more attractive than they were previously. Again, this would be likely to increase the proportion of local jobs held by minority workers.

CONCLUSION

What do the survey results imply about the ability to use public transit policy more broadly to connect urban, transit-dependent workers to suburban jobs? Findings suggest that employment effects are greatest for those residing nearest to the origin of the new transit route. Findings also suggest that accessibility improvements (as is evidenced by changes in hiring behavior) decline sharply with distance from the destination of the new transit route. Given some of the extreme distances between urban neighborhoods and suburban employment centers in modern metropolitan areas, along with the low-density sprawl development that characterizes many suburban employment centers, these patterns indicate that the potential of transit policy to foster large increases in reverse commuting is limited.

Nonetheless, the estimated employment effects for Latinos are large in magnitude and statistically significant. These results clearly suggest that public transit policy has the potential to improve employment opportunities for disadvantaged minorities. However, whether this potential is realized depends on the proximity of the new transit line to specific urban populations as well as to suburban employers. Had the origins of the new subway line been built closer to areas of black residential concentration, the transport investment might well have had a more positive effect on black employment. Moreover, had the new transportation system been combined with efforts to disseminate information about suburban job openings or to improve job placement more generally, the improvement might have been even greater in magnitude.

These findings do have implications for the long-standing debate about the importance of spatial mismatch as a determinant of inter-racial and inter-ethnic inequality. The results show that for those workers best situated to take advantage of new reverse-commuting possibilities, accessibility matters in determining where one works. Hence, for transit-dependent minority workers, accessibility or lack thereof determines their employment opportunity sets. The results of this article,

[29] See Glaeser, Kahn, and Rappaport (2000) for evidence that the location choices of poor and minority households are sensitive to local transit services.

combined with the growing body of research finding that spatial mismatch explains a substantial portion of racial differences in employment outcomes, emphasizes the importance of the accessibility of minority workers to employment as a factor in urban transport policy.

One caveat that merits mentioning concerns the fact that the current study focuses on one metropolitan area and one type of public transit extension. Whether the results for Oakland generalize to other metropolitan areas is a question that cannot be answered with the data analyzed here. However, there have been several extensions of public transit systems across the country, each of which provides fertile ground for future inquiry. Further research along these lines would provide useful policy relevant information on the potential effectiveness of public transit policy in addressing urban employment problems.

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APPENDIX

Table A1. Summary of the effect of the BART extension on the reverse commute from the Oakland/San Leandro area to the Dublin/Pleasanton area.

	Before (via BART Express Shuttles)	After (via the BART extension)
In-vehicle travel time	20 to 22 minutes	15 minutes
Headway times	20 to 40 minutes peak period, 60 minutes during off-peak hours.	15 minutes from 6am to 8pm weekdays, 20 minutes otherwise.
Service hours	Two shuttle buses provide peak-period service only during weekdays. Third shuttle provided service 6am to 8pm weekdays only.	Rail service seven days a week. Weekday service commences at 5am while weekend service commences at 6am Saturdays, and 8am Sundays. Last train leaves Dublin at midnight seven days a week.
Transfers	At least one transfer.	One or fewer transfers.
Out-of-pocket costs	$1.10 for shuttle bus from the Bay Fair station and costs of reaching shuttle bus departure point.	$1.10 from Bay Fair Station to Dublin. Possible cost declines for riders originating at more distant BART stations.

Table A2. Pre-expansion descriptive statistics for firms with complete information that responded to wave 1 and firms with complete information that responded to both waves 1 and 2.

	All Firms	Firms with Complete Info, Waves 1 and 2	Firms with Incomplete Info, Wave 2	Difference
Last hired worker is black	0.098	0.102	0.094	0.008
Last hired worker is Latino	0.227	0.237	0.215	0.022
Miles from station	4.730	4.872	4.547	0.323
Contracts with feds.	0.299	0.301	0.296	0.005
Percent unionized	9.010	9.152	8.835	0.316
Firm size				
Less than 20 employees	0.633	0.422	0.905	−0.483[a]
20 to 50 employees	0.173	0.282	0.031	0.250[a]
50 to 100 employees	0.099	0.165	0.012	0.152[a]
100 to 500 employees	0.063	0.087	0.031	0.056[b]
500 plus employees	0.016	0.015	0.018	−0.004
Industry				
Manufacturing	0.121	0.117	0.126	−0.009
Wholesale or retail trade	0.274	0.296	0.245	0.051
Services	0.532	0.519	0.547	−0.027
Other industry	0.074	0.068	0.082	−0.014
Black person hires	0.039	0.039	0.039	0.000
Latino person hires	0.078	0.092	0.058	0.034
Recruitment methods				
Help-wanted signs	0.254	0.267	0.236	0.031
Newspaper ads	0.552	0.568	0.531	0.037
Walk-ins	0.699	0.732	0.654	0.077
Employee referrals	0.796	0.841	0.736	0.105[b]
State agency referrals	0.207	0.216	0.194	0.022
Private agency referrals	0.117	0.126	0.104	0.023
Community referrals	0.142	0.170	0.104	0.066[c]
School referrals	0.324	0.383	0.248	0.135[a]
Union referrals	0.072	0.074	0.069	0.005
Job qualifications, either necessary or strongly preferred				
High school diploma	0.658	0.660	0.654	0.006
Experience	0.626	0.626	0.627	−0.001
References	0.730	0.769	0.679	0.090[c]
Training	0.540	0.495	0.597	−0.102[c]
Daily job tasks				
Direct customer interaction	0.674	0.718	0.616	0.102[b]
Read instructions	0.607	0.603	0.611	−0.009
Write paragraphs	0.404	0.380	0.434	−0.053
Arithmetic	0.725	0.721	0.730	−0.009
Use computers	0.629	0.648	0.604	0.045
N	365	206	159	

[a] The difference is statistically significant at the 1 percent level.
[b] The difference is statistically significant at the 5 percent level.
[c] The difference is statistically significant at the 10 percent level.