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Residential Moves Into and Away from Los Angeles Rail Transit Neighborhoods: Adding Insight to the Gentrification and Displacement Debate

August 2020

A Research Report from the Pacific Southwest Region
University Transportation Center

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About the Pacific Southwest Region University Transportation Center

The Pacific Southwest Region University Transportation Center (UTC) is the Region 9 University Transportation Center funded under the US Department of Transportation's University Transportation Centers Program. Established in 2016, the Pacific Southwest Region UTC (PSR) is led by the University of Southern California and includes seven partners: Long Beach State University; University of California, Davis; University of California, Irvine; University of California, Los Angeles; University of Hawaii; Northern Arizona University; Pima Community College.

The Pacific Southwest Region UTC conducts an integrated, multidisciplinary program of research, education and technology transfer aimed at *improving the mobility of people and goods throughout the region*. Our program is organized around four themes: 1) technology to address transportation problems and improve mobility; 2) improving mobility for vulnerable populations; 3) Improving resilience and protecting the environment; and 4) managing mobility in high growth areas.

Disclosure

The Principal Investigator, Co-Principal Investigators, and research staff, conducted this research titled, "Residential Moves Into and Away from Los Angeles Rail Transit Neighborhoods: Adding Nuance to the Gentrification and Displacement Debate" at the Sol Price School of Public Policy, University of Southern California. The research took place from February 1, 2019 to March 31, 2020 and was funded by a grant from the California Department of Transportation via the Pacific Southwest Region UTC in the amount of \$100,000. The research was conducted as part of the Pacific Southwest Region University Transportation Center research program.

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Abstract

We study moves into and away from rail station neighborhoods in Los Angeles. While the literature has focused on whether rail transit stations are sites of low-income residential displacement, very little research has studied whether places persons move to and from when moving into or out of rail transit station areas are less well-resourced to where they lived previously. We use confidential, anonymized agency data on household income and location and open source transit network data to describe the flows of household residential moves into and out of Los Angeles half-mile rail transit neighborhoods, from 2014 to 2015, and to describe the correlates of household moves and the characteristics of neighborhoods that most commonly send and receive households moving into and away from rail transit neighborhoods. By characterizing job access via transit in rail neighborhoods and in the locations where households move to when they leave rail transit areas, we offer a detailed understanding of how residential moves change transit-related job access for households. When households move away from rail transit station neighborhoods, we find that, on average, those households move to locations with reduced transit job access, lower school quality, and higher poverty rates, suggesting that the geography of opportunity should focus on providing job access, quality schools, and economic opportunities in locations that extend beyond rail station neighborhoods.

Research Report

Executive Summary

The Los Angeles Metro rail transit system has grown to 93 stations in the past thirty years. As that system has reshaped the transportation geography of the city and its neighborhoods, several authors have expressed concern that rail transit can catalyze a pattern of low-income displacement from rail neighborhoods. In this report, we focus on a related question: When households move away from rail transit neighborhoods, where do they move to? We also analyze the reciprocal question of where households move from when they move into rail neighborhoods.

The analysis focuses on half-mile areas around all L.A. Metro rail stations that were open as of 2014. We use confidential, anonymized data from the California Franchise Tax Board (FTB) on over 120,000 households living within a half-mile of an L.A. rail transit station in either or both of 2014 and 2015 to see household residential mobility patterns. We characterize the correlates of household residential moves, characteristics of moving and non-moving households, and the characteristics of census tracts that are locations of residential out-movement (receiving tracts) and in-movement (tracts that send residents to rail neighborhoods). We use census data, open source transit access data combined with the commercial Remix transit access software tool, and data on school quality from the California Academic Performance Index.

Key findings from this report include:

- Moving households are younger than households that did not move. For the households living within a half-mile of a rail transit station in 2014, the average age for movers ranges from 34 to 36 years (depending on where the household moved from/to), while households that did not move had a primary tax filer who averaged 42 years of age.
- Households that moved had larger income changes, from 2014 to 2015. Households that moved into station half-mile areas from outside of rail half-mile rail neighborhoods had, on average, an increase in income of \$9,546 from 2014 to 2015 (on an average annual income for that group of \$52,386). Households that move out of half-mile rail neighborhoods to more distance locations within Los Angeles County during that time had an average of \$8,253 increase in income during that time (on an average annual income of \$55,679). Households that stayed within ½ mile of the same station had an income increase of \$3,306 (on an average annual income of \$45,837).
- When households move out of rail station areas, they on average lose transit access to jobs, and households on average gain transit access to jobs when they move into station areas. We note that the transit job access is over all transit modes – bus and rail. Still, that pattern of gain and loss is not surprising, but the magnitudes are important. On average, households moving away from rail transit half-mile areas have a reduction in

transit job access of 138,087 fewer accessible jobs in a 30-minute peak travel time. Households moving into rail station half-mile neighborhoods see an average increase of 162,071 transit accessible jobs, after their move, in a 30-minute peak travel time. Those magnitudes are approximately 20 percent to 25 percent of the highest census tract transit access level. Residential moves into and out of rail station neighborhoods lead to large changes in transit job access.

- When households move away from rail-transit neighborhoods, they move to census tracts that have average public high school academic performance index (API) scores of 698 (compared to a Los Angeles County average API of 744), and average poverty rates of 27 percent (compared to a Los Angeles County census tract average of 18.6 percent).

The results illustrate the importance of focusing on transit access throughout Los Angeles County. Of the 120,281 households within half-mile areas of a station for whom we have income data, nine percent moved between 2014 and 2015. When households move away from rail transit areas, they move to locations that provide, on average, access to almost 140,000 fewer jobs via transit. Planners and policy-makers should focus on providing more robust transit access throughout Los Angeles County. Residential relocation is common at all income levels, and while we do not minimize concerns about displacement, we note that robust transit access in locations away from the rail system can help maintain job access for households who do move away from rail station locations.

Introduction

A growing literature is examining the question of neighborhood gentrification and displacement. Policy activity in California and throughout the world is increasingly focused on those two phenomena. To simplify a large literature, much of the debate has been focused on whether and how frequently neighborhoods gentrify, whether and to what extent that gentrification leads to displacement among persons with low income or communities of color, and appropriate policy responses (e.g. Chapple & Loukaitou-Sideris, 2019; Freeman & Braconi, 2004; Newman & Wyly, 2006; Dragan, Ellen & Glied, 2019.)

While that question is important, a related question has been overlooked. When persons or households move within a city, where do they go? Are the moves to places with similar or different opportunities and amenities? How does the geography of opportunity within a metropolitan area relate to current debates and neighborhood change, gentrification, and displacement?

To make that question more concrete, we study moves into and away from rail station neighborhoods in Los Angeles. Since 1990, the Los Angeles County Metropolitan Transportation Authority (L.A. Metro) has built a rail transit network that has gone from non-existent (in 1990) to 93 stations today. Policymakers are increasingly wondering whether that network contributes to gentrification and displacement. While that is an important question, in this research we address a different set of questions: When households move away from Los Angeles rail neighborhoods, where do they go? Similarly, when persons move into Los Angeles rail station neighborhoods, from where are they moving? Are those moves – from and to rail station neighborhoods – associated with changes in neighborhood quality?

We know almost nothing about these neighborhood-to-neighborhood household flows, in large part because the data needed to answer those questions have typically not been available. We use confidential, anonymized agency data on household income and location and open source transit network data to describe the flows of households into and out of Los Angeles half-mile rail transit neighborhoods, from 2014 to 2015, and to describe the correlates of household moves and the neighborhoods that most commonly send and receive households moving into and away from rail transit neighborhoods.

One of the innovations in our approach is to characterize job access via transit in rail neighborhoods and in the locations where households move to when they leave rail transit. We also do the converse – measure rail transit job access in the neighborhoods that most commonly are the prior residence for households moving into rail station neighborhoods. This allows, for the first time, a detailed understanding of how residential moves change transit-related job access for households. When households move away from rail transit, how and by what magnitude does their transit-related access to jobs change? Understanding that is an

important extension of the traditional gentrification question (i.e. does rail cause neighborhoods to gentrify, and does it increase the displacement of low-income households.) The contribution of this research is, in part, a more detailed understanding of how household moves are related to job access changes. The policy implications include assessments of how well the transit system in Los Angeles County serves households who move away from rail transit neighborhoods. Our contribution does not end there. By tracking flows of household moves into and out of rail transit station areas, we also describe how local characteristics – including school quality and neighborhood demographics – change when households move into and out of rail station neighborhoods.

We proceed in the following steps. Section II reviews related literature. In Section III, we describe the Los Angeles rail system. In Section IV, we describe the data and methods for the analysis. Section V gives descriptive data on household moves into and out of, Los Angeles rail station neighborhoods from 2014 to 2015, using a sample of approximately 120,000 households who lived in Los Angeles half-mile station neighborhoods in 2014 and their residential location in 2015. Section VI describes how job access, via transit, changes for households that move into and out of rail station neighborhoods in Los Angeles. Section VII extends Section VI by given information on the top “sending” and “receiving” census tracts, respectively those tracts from which the largest number of households move into rail neighborhoods (sending tracts) and those tracts to which the largest number of rail-neighborhood households moved to (receiving tracts.) Section VIII closes with a summary and a discussion of policy implications.

I. Literature Review

There is a large literature on gentrification and displacement. The term “gentrification” first appeared in the literature in 1964, in an influential book by Ruth Glass examining neighborhood change in London (Glass, 1964). The topic has since been a mainstay of urban studies and related policy debates.

The literature on gentrification and displacement is too large to review here. For a detailed review, see Chapple and Louikaitou-Sideris (2017). Briefly, gentrification often refers to neighborhood change, and displacement often refers to whether low-income households are forced out of neighborhoods by a pattern of neighborhood change.

The recent literature has had several areas of focus. One strand examined whether gentrification leads to low-income displacement. Early work found, perhaps surprisingly, the low-income households do not move out of gentrifying neighborhoods at rates faster than a “no gentrification” counterfactual (e.g. Freeman & Braconi, 2004; Freeman, 2005.) One argument is that low-income households benefit from improving neighborhood amenities and take steps to stay in place (Freeman & Braconi, 2004), perhaps by paying higher rent burdens

which can still disadvantage the household even if they do not move (Chappel & Loukaitou Sideris, 2017.) More recent research examining whether low-income households move out of gentrifying neighborhoods more often than they would have otherwise has produced mixed results. For example, Dragan, Ellen, and Glied (2019) use geocoded data on low-income children in New York City’s Medicaid program from 2009-2015 to track household moves. They do not find evidence of higher residential move-out rates from gentrifying neighborhoods. Conversely, Aron-Dine and Bunten (2019) use micro-data from credit score data, also geocoded, to track low-income move-out rates. They find evidence that low-income households move out of gentrifying neighborhoods at rates higher than a “no gentrification” counter-factual.

Beyond the question of gentrification and displacement, the literature has begun to focus on the link from transit systems and transit-oriented development to displacement. A recent book by Chappel and Loukaitou-Sideris (2019) gives a comprehensive treatment of the topic. Briefly, transit (especially rail transit) might trigger displacement by increasing land values, signaling additional public investment, or signaling or catalyzing further private investment (e.g. Debrezion, Pels, & Rietveld, 2007; Pollack, Bluestone, & Billingham, 2010.) That literature, like the gentrification-displacement literature, has largely focused either on the causal question (does rail transit induce displacement) or on nuanced questions of near-rail neighborhood change. Both are important, but we note that the literature has rarely focused on a related question: When households move into or out of rail neighborhoods, how does their bundle of neighborhood amenities change? That is the focus of our research.

Only recently has the literature begun to examine the question of household moves and how those are associated with changes in neighborhood amenities in the context of displacement or gentrification. For example, Dragan, Ellen, and Glied (2019) examined neighborhood characteristics in locations where children moved to, often finding little change in those characteristics, but some evidence that households moving out of gentrifying neighborhoods move to locations of lower school quality. Generally, the detailed migration data needed to address that question has often not been available, or has been available only recently. We add to this aspect of the literature by analyzing almost 10,000 household moves into and out of rail transit neighborhoods in Los Angeles, from 2014 to 2015. While we examine several indicators of neighborhood quality, a key innovation of this research is our ability to develop measures of transit access to jobs and compare how those measures change for households moving into and out of rail transit neighborhoods.

II. The Los Angeles Metro Rail System

The LA Metro rail system is comprised of five lines, shown in Figure 1. Since our data span years 2014 to 2015, we focus on the 80 LA Metro rail stations that were open along the Green, Gold, Purple, Red, Expo, and Blue lines during the study period. In 2016, 13 more stations opened along the Expo and Gold lines but since they fall outside of our timeline, we do not consider

households and tracts near these 13 stations. Figure 1 illustrates the whole LA Metro rail system while Table 1 describes when stations were opened along each of the Metro lines and how many stations ended up in our sample under study. It is noteworthy to mention that due to the large overlap between Red and Purple lines, we simplified the analysis by treating the Purple and Red lines as one.

Table 1. Stations by year and number of stops

Line	Number of stops	years opened in	Number of stops in sample
Blue	22	[1990]	22
Expo	17	[2012 2016]	10
Gold	26	[2003 2016 2009]	20
Green	13	[1995]	13
Red	15	[1993 1996 1999 2000]	15

Figure 1. The Los Angeles Metro Rail System



III. Data and Methods

Identifying movers and their aggregate characteristics

For residential mobility and household-level characteristics, we use data from income tax filings obtained from the California Franchise Tax Board (FTB). The data universe contains anonymized information on all households who filed taxes in Los Angeles County in 2014 and 2015, even if they lived outside of the County or California as long as they filed California taxes.

For each year a filer appears in our data, we know the filer status (single, head of household, married filing jointly, married filing singly, qualified widower), whether another tax-filer can claim this person as a dependent, the number of dependents that the filer claims, the filer's age, and their federal and state income and taxes paid. For household income, we use federal wages, reported by the California FTB as Federal adjusted gross income (AGI). Federal AGI is typically income from all sources (wages, interest, dividends), less deductions such as contributions to retirement accounts or business expenses/losses, and is a good representation of available disposable income.

We match households to L.A. Metro rail stations and Census Tracts using the 9-digit Zip code of the address at which the household filed taxes. A household is associated with a L.A. Metro rail station if its 9-digit Zip code resides within .5 miles of the rail station's centroid. Similarly, households are matched to Census Tracts based on the Census Tract in which their 9-digit Zip code is located. Since the 9-digit Zip code level typically represents a very small level of geography such as a block, a block face, or even a large building, for confidentiality reasons the FTB only disclosed 9-digit Zip codes for about 49% of households residing in zip-codes.

We label a filer as a mover if the station with which a filer is associated each year changed between 2014 and 2015. With this method, we can identify 4 patterns of residential mobility which are listed in Table 2.1 If a household lived near a rail station in 2014 but moved out of any rail station's .5-mile radius in 2015 then the household is labeled as one that moved out of rail stations (moved-out). Conversely, if a household did not live within a 0.5-mile (half-mile) radius of any rail station in 2014 but moved to within 0.5 miles of a rail station in 2015 then this household is considered as one that move into a rail station (moved-in). If a household resided near station A in year 2014 but lives near station B in year 2015 then she is labelled as a station-to-station mover. Finally, if the rail station to which a household is associated does not change between 2014 and 2015 then she is labelled a stayer (no move). Note, if a household moves within the half-mile radius of a station between 2014 and 2015 she is still considered a stayer since at our resolution, her access to public transportation did not change. In order to measure residential mobility, we need to observe the household both in 2014 and 2015. However, this means that our estimate of in-movers is underestimated because we cannot identify out-of-state movers (including immigrants) or entrants into the labor force such as college students.

Table 2. Definition of Move / Stay Categories

Name	Definition
Move in	Households that move into a station area from non-station areas
Move out	Households that moved out of a station area to non-station areas
Station to station	Households that moved-into a station area from other station areas
	Households that moved-out to a station area from another station area
No move	Households that did not move and resided within ½ mile of a rail station in 2014

Note: The two station-to-station moves, out of a station area to another and from a station into a station area, each sum to the same number of households.

In order to see how residential mobility affects job access via public transit for households of different incomes, we divide households into 6 income bins based on the household’s average income between 2014 and 2015 (see table 3). Because gentrification and displacement are usually framed as a housing-related issue affecting low-income households, we assign households to income categories that correspond with U.S. Department of Housing and Urban Development (HUD) poverty definitions based on the 2014 Los Angeles County Area Median Income (AMI) of \$60,600. The HUD poverty cutoffs are Extremely Poor (0-30% AMI), Very Poor (30-50% AMI), and Poor (50-80% AMI). We divide non-poor households into 3 categories, 80-100% of AMI, 100-150% of AMI, and 150-400% of AMI. About 1% of LA County filers reported incomes below \$0 and over 400% of AMI so we categorize these households as AMI-NA since their incomes tend to be extreme.

Table 3. Area Median Income (AMI) bins

Income bin as percent of AMI	0-30%	30-50%	50-80%	80-100%	100-150%	150-400%
2014 AMI	\$0-18,180	\$18,180-30,300	\$30,300-48,480	\$48,480-63,000	\$63,000-90,900	\$90,900-242,400

Job access for movers based on census tract of location

Job access calculations for movers based on census tract of location were generated using the automated Remix access tool (aRat), developed by Swayne and Kundaliya (2020) and used in Painter, Boarnet, Swayne, and Miller (2018) and Swayne, Boarnet and Painter (2019). The use of aRat allowed us to make rapid calculations of job accessibility by transit travel time for each of the 2,345 census tracts in Los Angeles County. To do this, we first generated a map of all public transit available in Los Angeles using Remix, a private, online transit planning platform. Remix uses the most recent static General Transit Feed Specification (GTFS) data provided by public transit providers to map existing transit networks and schedules. The transit map used in this analysis relied on the May 2019 GTFS data. Within Remix’s graphical user interface, users

can generate transit travel time isochrones of 15, 30, 45, and 60 minutes from any origin point on the map. The resulting isochrones represent the total area accessible from the origin point based on travel time by transit (bus or rail) and are generated based on published GTFS transit schedules. For this analysis, we have generated all isochrones with a departure time of 8:00 a.m. on a weekday to represent best-case transit access. Once isochrone generation is complete, Remix allows users to download the isochrone shapefiles to their PC one at a time.

With aRat, we automate the Remix isochrone generation and download process to capture the transit access for each census tract. aRat moves the isochrone origin point to the centroid of each census tract and downloads the resultant isochrone. The automated Remix access tool then clips isochrones to underlying census tract geometries to calculate the proportional area of each tract within each isochrone. Proportional census tract areas are then used for areal apportionment of jobs. In this analysis we use the U.S. Census Bureau's Longitudinal Employment Household Dynamics (LEHD) Origin-Destination Employment Statistics (LODES) census block-level data from 2015 to estimate jobs available. Census block job counts were aggregated to census tract geographies. The LODES Workplace Characteristics Data include job totals, broken down by job sector; we use counts of all jobs, regardless of sector. The clipping of isochrones to jobs data through aRat results in a final, tabular dataset with the total number of jobs accessible from each census tract in 15, 30, 45, or 60 minutes by transit.

Characteristics of top receiving and sending census tracts

We identify census tracts that receive and send the highest number of households based on the number of corresponding movers each census tract contains. Recall that we have four different residential mobility patterns but only two of them are relevant for sending and receiving tracts. The move-out households are those that resided within a half mile of a rail station in 2014 but did not reside within a rail station in 2015. The move-in households are those that did not reside within a half mile of a rail station in 2014 and do reside in rail station areas in 2015. The top receiving census tracts are those that have the largest number of move-out households in 2015 while the top sending tracts are those that contain the largest number move-in households in 2014. To clarify the notation, "receiving tracts" are tracts where persons move to, in 2015, after living in a rail transit neighborhood in 2014 (tracts that "receive" those out-movers), and "sending tracts" are tracts that were outside of rail transit neighborhoods but which "sent" in-movers into rail neighborhoods. After identifying those top sending and receiving tracts, we use American Community Survey (2015) and data on California Academic Performance Index for the public high school that serves each tract (2013, which is the most recent data available) to examine characteristics of sending and receiving tracts.

IV. Characteristics of Movers and Non-Movers, Into and Out of Los Angeles Rail Station Areas

Characteristics of Filers, by Move / Stay Category

We begin by characterizing the households in each of the move categories, based on their 2014 and 2015 filing data. Table 4 shows the age distribution by move status for filers. Approximately eight percent of the households living within a half-mile of a station in 2014 moved in 2015. This follows our convention of identifying a change in filing status as a move. Recall that households that moved within the same station area are not counted as movers, and so the counts of moves and move rate will understate total moves. (We follow the convention of referring to tax filers as households.)

As would be expected, households that moved are younger than households that did not move. The average age of moving households ranges from 34 to 36 years, compared to a mean age of 42 years for households that stayed within the same station area. Table 4 shows similar gaps in median age – movers had median ages of 32 or 33 years (depending on the move category) compared with a median of 40 years for “no move” households.

Table 4. Filer Age by Move Status

	Move in	Station to Station	Move out	No move
Count	3,691	1,414	4,631	109,682
Mean	36	34	36	42
Standard deviation	12	10	12	15
25 th percentile	27	27	27	30
50 th percentile	32	32	33	40
75 th percentile	43	41	43	53

Income levels, averaged over 2014 and 2015, are shown for filers grouped by move status in Table 5. Note that there are minor differences in the number of households for which income data are available, versus for which age data are available.

Filing households who moved into or out of station areas had higher incomes than “no move” households. Households moving into station areas had average incomes of \$52,386, while households moving out of station areas had average incomes of \$55,679, compared to average income of \$45,837 for “no move” households. Median income for each group is somewhat lower than the mean – income is skewed right. The differences in median income across move groups is similar, but with smaller gaps. “Move in” households had a median income of \$31,150 (averaged across the two years), “move out” households had median income of \$33,050, and “no move” households had median income of \$29,550. Households that moved had larger

income increases, 2014 to 2015, than did “no move” households. Mean income changes, year to year, for moving households range from \$6,555 for “move out” households to \$9,546 for “move-in” households, compared to \$3,306 for “no move” households.

As would be expected, filers that move have fewer children. We proxy children by number of dependents. Of the households that moved, from 36 to 41 percent had dependents (not necessarily children, but the best proxy for children that we can obtain.) Of “no move” households, 47 percent had children. Households that stayed in place more commonly had dependents, as shown in Table 6 and Figure 2 below.

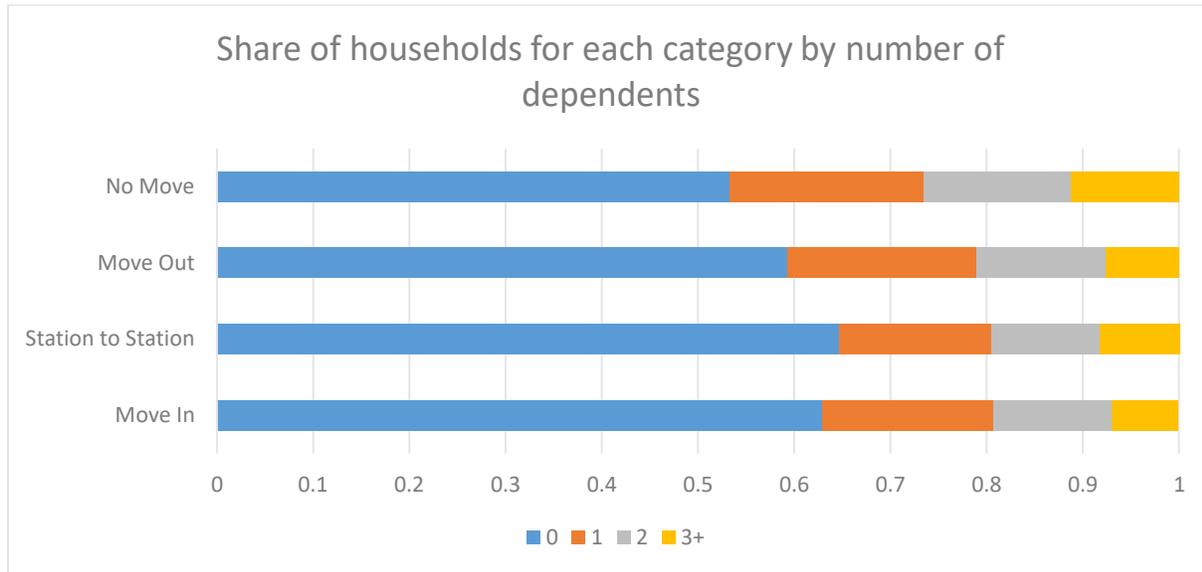
Table 5. Filer Income by Move Status

	Average Income 2014 – 2015, in dollars			
	Move in	Station to Station	Move Out	No Move
Count	3,731	1,426	4,680	110,444
mean	\$52,386	\$43,519	\$55,679	\$45,837
Std. Dev.	\$114,357	\$58,230	\$101,964	\$253,449
25 th percentile	\$16,975	\$15,950	\$17,850	\$16,750
50 th percentile	\$31,150	\$28,250	\$33,050	\$29,550
75 th percentile	\$57,975	\$51,900	\$66,825	\$53,150
	Income Difference 2014 to 2015			
Count	3,729	1,426	4,677	110,444
Mean	\$9,546	\$8,253	\$6,555	\$3,306
Std. Dev.	\$102,571	\$39,612	\$100,937	\$108,277
25 th percentile	-\$1,600	-\$1,100	-\$1,700	-\$1,600
50 th percentile	\$3,100	\$3,500	\$3,400	\$1,900
75 th percentile	\$11,900	\$11,975	\$12,900	\$7,700

Table 6. Dependents by Move Status

	0	1	2	3+
Move In	0.629	0.178	0.123	0.069
Station to Station	0.647	0.158	0.112	0.084
Move Out	0.593	0.197	0.134	0.076
No Move	0.533	0.202	0.153	0.112

Figure 2. Dependents by Move Status



Changes in Filer Characteristics, by Move Status, 2014 to 2015

Residential moves are associated with changes in life status – for example, changes in marital status, dependents, or job changes that, in our income tax data, might be reflected as large changes in income. We show changes in income, 2015 minus 2014, for filing households by move category in Table 7 and Figure 3 below. Households that moved into station areas had a mean annual income difference, 2015 income minus 2014 income, of \$9,546, which is approximately 18% of the two-year mean income in that category. Households that moved station to station had a mean annual income difference of \$8,253, approximately 19% of two-year mean income in that category.

Households that moved out of station areas had a mean annual income difference of \$6,555, approximately 12% of the two-year mean income in that category. Households that stayed within the same half-mile station area had a mean annual income difference of \$3,306, approximately 7% of the two-year mean income in that category. The households moving into station areas, from outside of station areas or from other station areas, had the largest income changes, both in nominal values and as a percentage of their two-year average income.

Table 7. Income Changes (2014 to 2015) by Move Status, in dollars

	Move In	Station to Station	Move Out	No Move
Mean	\$9,546	\$8,253	\$6,555	\$3,306
5 th percentile	-\$23,380	-\$18,875	-\$21,520	-\$17,300
10 th percentile	-\$10,800	-\$9,550	-\$11,639	-\$8,900
25 th percentile	-\$1,600	-\$1,100	-\$1,700	-\$1,600
50 th percentile	\$3,100	\$3,500	\$3,400	\$1,900
75 th percentile	\$11,900	\$11,975	\$12,900	\$7,700
90 th percentile	\$28,420	\$27,950	\$30,640	\$17,600
95 th percentile	\$48,859	\$44,700	\$48,419	\$28,400
99 th percentile	\$137,467	\$117,150	\$122,147	\$78,400

Figure 3. Income Changes by Move Status

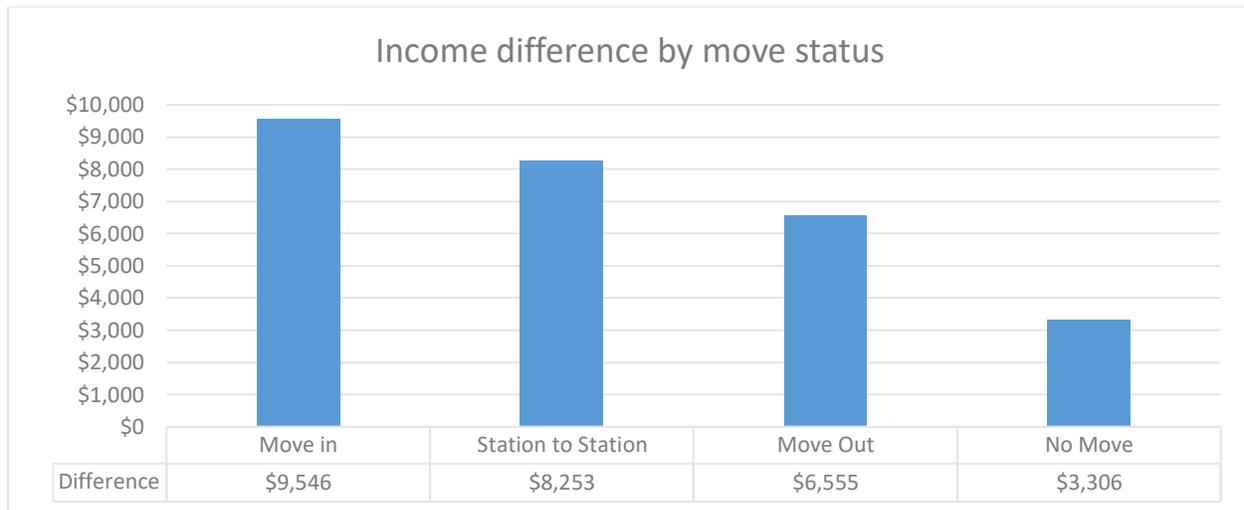


Figure 4 shows income changes, 2014 to 2015, by more detailed percentiles sorted by household move category. Throughout the percentile distribution, the income change for “no move” households is lower than the income change for households that moved, reinforcing the pattern from an analysis of means.

Figure 4. Income Changes (2014 to 2015) by Move Category, Detailed Percentile Distribution

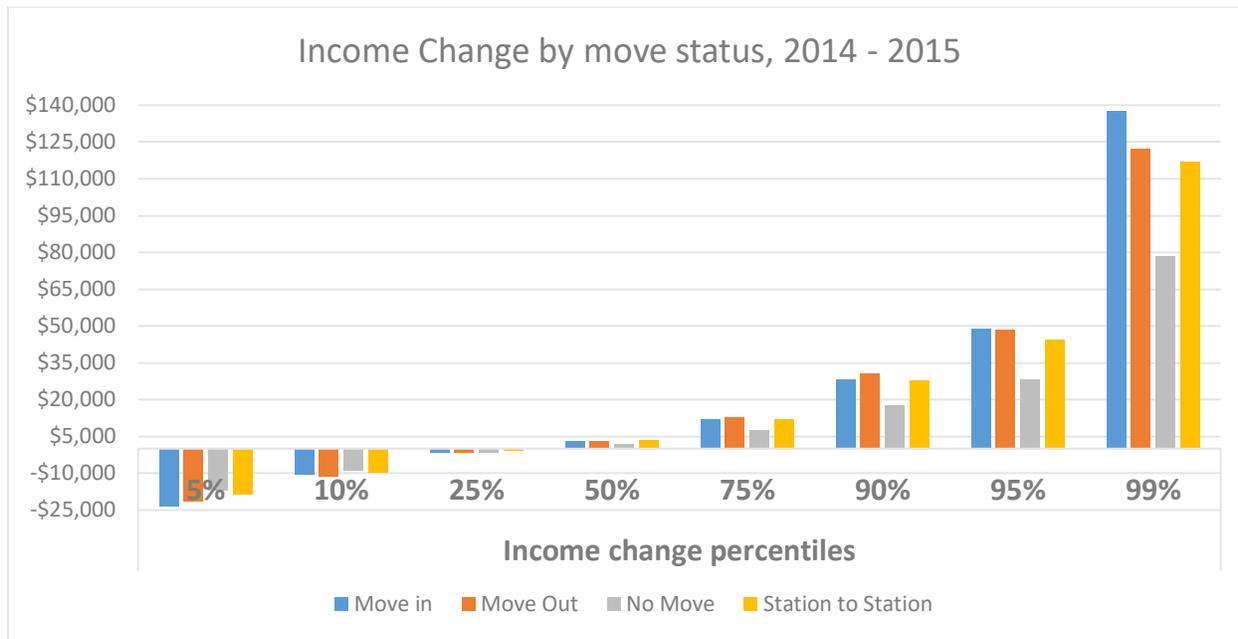


Table 7 and Figures 5 and 6 below show income changes for households by move status, sorting those households into income categories based in part on 2014 HUD AMI categories and using on a household’s average income between 2014 and 2015. For every income band, moving households had larger changes in income than “no move” households (based on the median changes by income group in Figure 5), and the households that moved into station areas generally, but not always, had higher income changes than households that moved out (Figure 6.)

Figure 5. Income Changes, Movers vs. Non-Movers, by Income Band

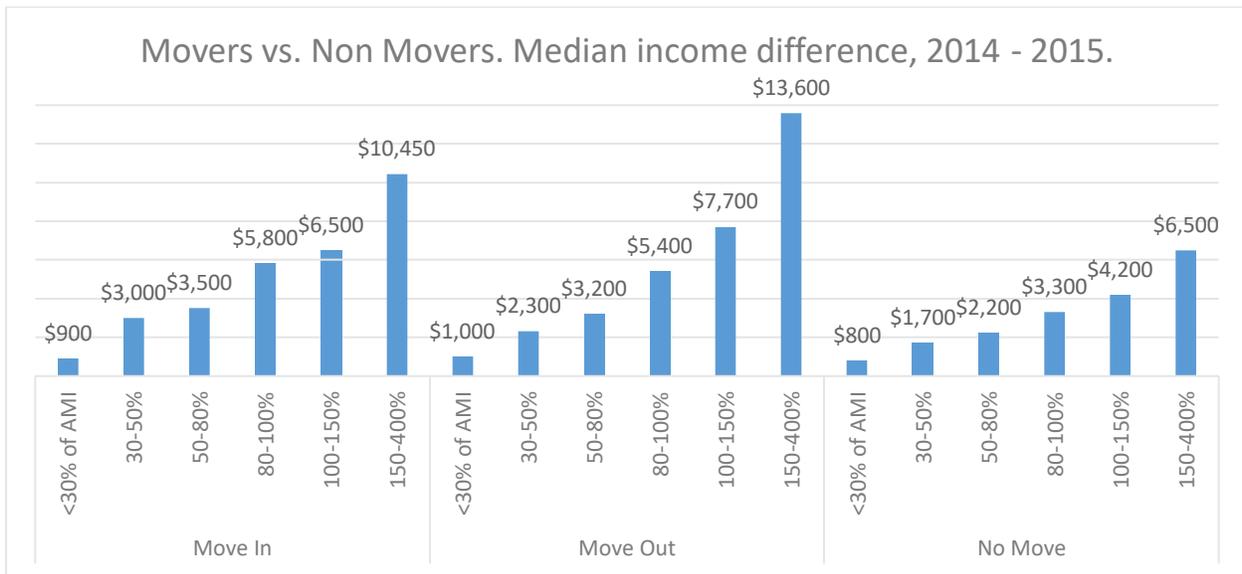
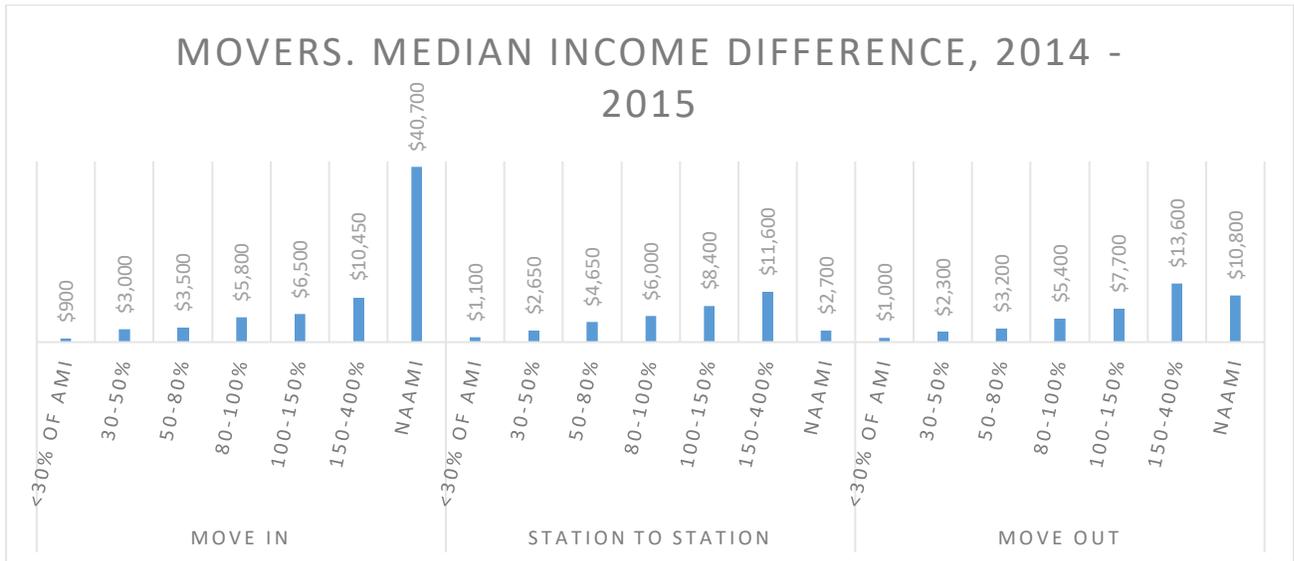


Table 8. Income Changes, 2014 to 2015, by Income Band and Move Status, in dollars

	Average BIN	Count	Mean	Std	25%	50%	75%
Move In	<30% of AMI	997	1,210	12,580	-2,400	900	5,400
	30-50%	793	4,216	14,335	-1,000	3,000	9,800
	50-80%	737	5,497	17,890	-1,000	3,500	11,600
	80-100%	294	8,786	23,181	-1,175	5,800	16,375
	100-150%	431	9,159	27,446	50	6,500	17,750
	150-400%	370	14,254	57,483	-5,425	10,450	33,650
	NAami*	107	141,981	574,429	-8,850	40,700	119,750
Station to Station	<30% of AMI	414	2,258	8,552	-1,875	1,100	6,475
	30-50%	326	3,872	12,173	-850	2,650	9,075
	50-80%	282	6,962	18,708	-325	4,650	14,075
	80-100%	101	12,345	26,042	1,100	6,000	18,100
	100-150%	143	8,156	36,513	-1,000	8,400	20,850
	150-400%	129	22,819	58,890	-500	11,600	30,100
	NAami*						
Move Out	<30% of AMI	1,178	1,642	8,273	-2,300	1,000	5,800
	30-50%	947	3,492	12,463	-1,600	2,300	8,800
	50-80%	847	5,282	19,920	-1,700	3,200	11,150
	80-100%	359	8,108	22,322	-250	5,400	14,950
	100-150%	547	10,255	26,914	100	7,700	20,550
	150-400%	669	20,256	49,692	-300	13,600	36,500
	NAami	130	-8,672	588,334	-31,900	10,800	70,050

* Results suppressed due to low cell size.

Figure 6. Income Changes by Move Category and Income Band, 2014-2015



Section V. Job Access by Transit – Cross-Sectional Patterns and Changes by Household Move Status

Job access increased notably for filers who moved into rail station areas while for households that moved out job access generally decreased. Table 8 shows the mean transit job access by move status. On average, households moving into station areas (“move-in” households) could access 138,087 more jobs via transit in a 30-minute trip than they could at their 2014 (before move) residential location. Households moving out of a rail station neighborhood (“move-out” households) had access to an average of 162,071 fewer jobs in a 30-minute commute after their move. Table 8 also shows the change in transit job access throughout the distribution, from the 5th to the 99th percentile, by move status. At each point in the distribution shown in Table 8, “move-in” households have a larger gain (or smaller loss) in transit job access than do “move-out” households. Lastly, note that the very small change in the mean transit job access for “no move” households indicates households who moved but stayed within station areas, and hence are classified as “no move”.

Table 9. Job access change by move status, jobs accessibility within 30 and 60 minute transit travel time isochrones

	30 min.				60 min.			
	Move in	Station to Station	Move Out	No Move	Move in	Station to Station	Move Out	No Move
Mean	138,087	-17,326	-162,071	7	554,412	-45,273	-625,884	-30
5%	-56,839	-387,718	-499,845	0	-238,707	-765,633	-1,548,658	0
25%	10,175	-79,170	-335,082	0	121,890	-267,070	-1,001,034	0
50%	63,872	-5,511	-80,172	0	511,980	-9,948	-614,324	0
75%	264,593	42,599	-18,668	0	939,032	156,432	-190,523	0
95%	492,677	342,268	35,074	0	1,517,443	645,246	164,190	0
99%	562,427	484,578	144,440	0	1,904,139	1,109,798	525,922	0

As seen in figures 7 and 8 filers, who moved into rail station areas had the largest transit job access increase, at all points shown in the distribution.

Figure 7. Job access for Movers within 30 minutes isochrones

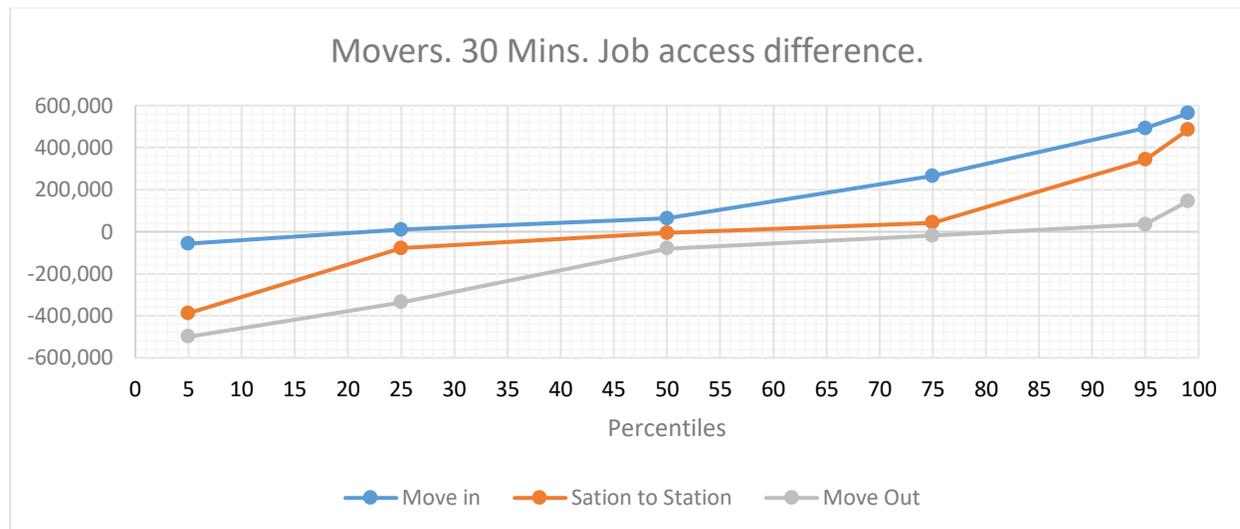
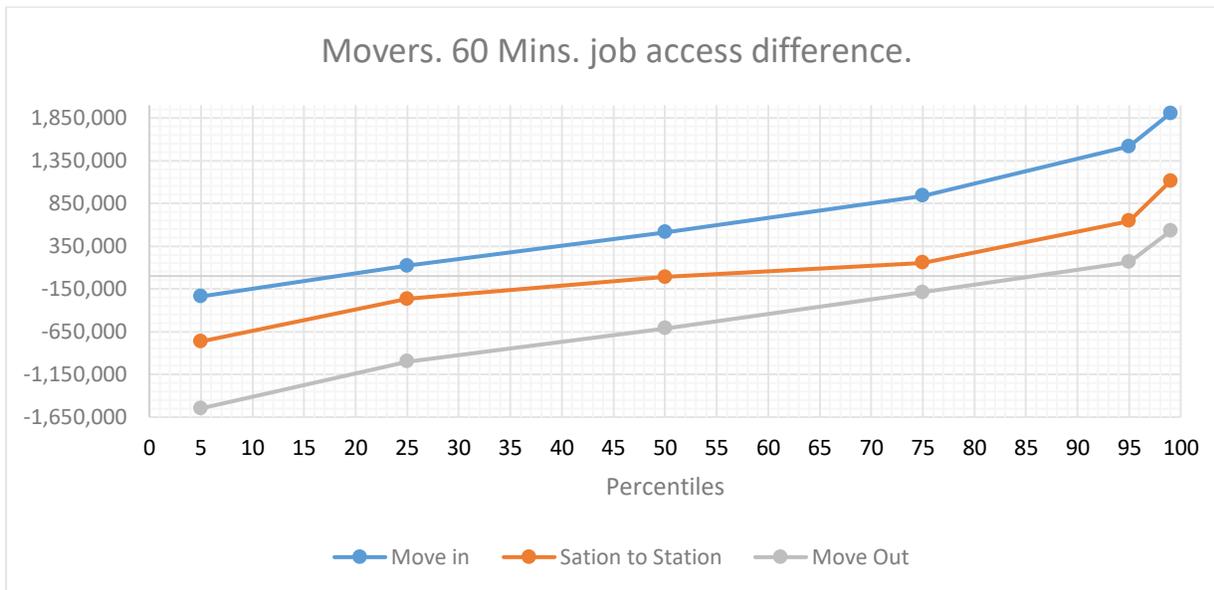


Figure 8. Job access for Movers within 60 minutes isochrones



Figures 9 and 10 show kernel density plots of changes in transit job access, by move status, for 15, 30, 45, and 60-minute travel-time isochrones. The graphs are skewed right for in-movers (showing a tendency toward more gain than loss in job access) and skewed left for out-movers (showing more likely loss than gain in job access.)

Figure 9. Density Plots job access difference for in-Movers by isochrones

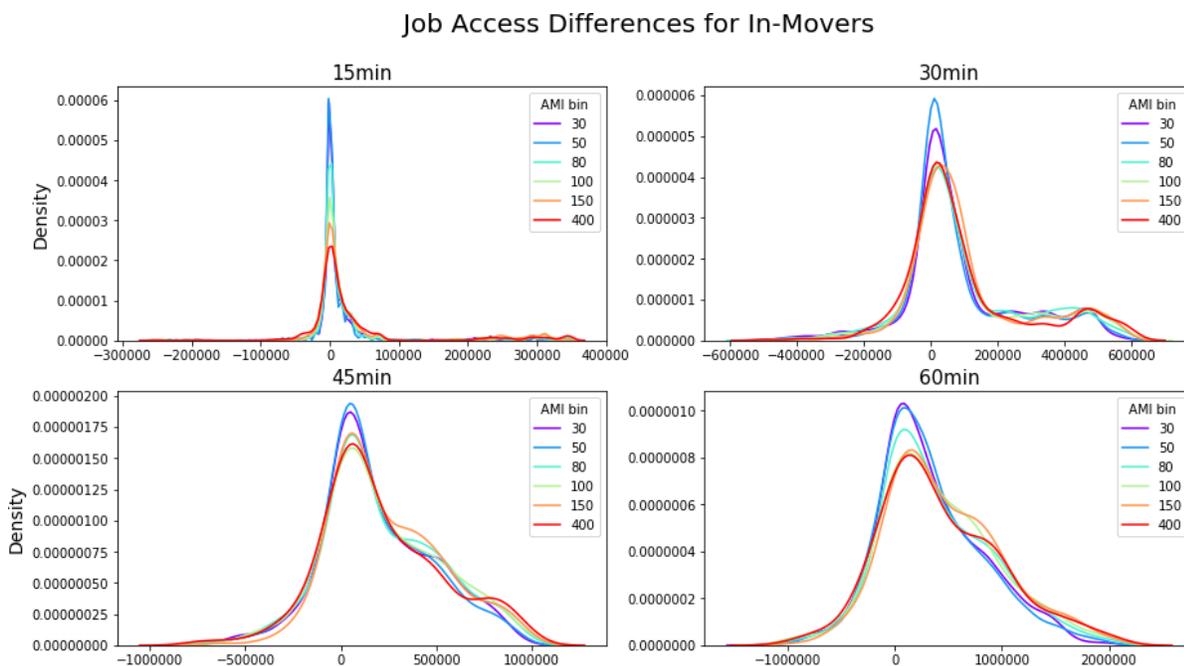


Figure 10. Density Plots job access difference for out-Movers by isochrones

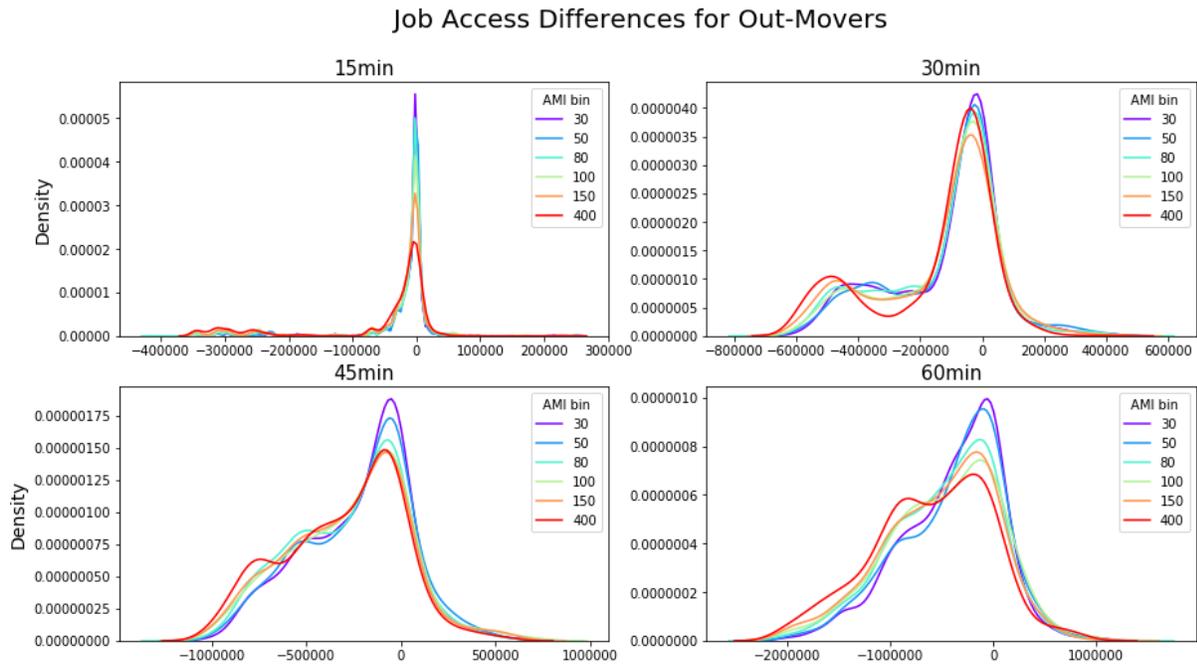


Table 9 shows job access changes by income band. Low income households (0-80% of AMI) who moved into rail station areas had a mean job accessibility of 134,217, while higher levels of income (80% to 400%) had a mean of 142,989 in the case of 30 minutes isochrone. For the case of 60 minutes isochrone, higher levels of income had a mean of 590,688 job accessibility, while for lower levels was of 535,634. High income does not seem to affect job accessibility, since the maximum difference between the lowest income and the highest is only 60,353 (60 minutes isochrone). See table 8 for more details.

Table 10. Job access by AMI, move status and 30 and 60 minutes isochrones

	Move In		Station to Station		Move Out		
	median	mean	median	mean	median	mean	
30	<30%	62,771	134,158	-435	-3,977	-73,836	-150,287
	30-50%	55,387	125,447	-9,302	-24,284	-78,664	-159,170
	50-80%	63,158	143,047	-453	-1,595	-80,890	-165,440
	80-100%	64,616	141,192	-6,825	-28,107	-80,160	-164,034
	100-150%	70,544	142,585	-9,376	-38,891	-78,612	-162,701
	150-400%	69,436	145,190	-7,123	-45,306	-82,265	-173,481
	NAami	97,193	187,394	-8,045	-14,514	-102,760	-205,348
60	<30%	491,243	517,268	0	-10,088	-531,116	-560,869
	30-50%	459,572	506,377	-16,896	-37,770	-520,604	-572,453
	50-80%	569,433	583,258	-8,856	-14,338	-658,365	-654,603
	80-100%	559,003	581,364	-12,895	-86,401	-687,954	-682,582
	100-150%	589,419	613,079	-39,121	-107,603	-648,872	-639,547
	150-400%	484,381	577,621	-35,026	-124,539	-706,843	-705,896
	NAami	633,150	682,544	-51,800	-124,110	-832,756	-824,567

The Spatial Pattern of Job Access Changes

To understand the spatial pattern of changes in job access, we start by illustrating the spatial pattern of the static, year 2015 job access by census tract. Figures 11 through 14 show the 15, 30, 45, and 60-minute job access levels for census tracts in Los Angeles County. The highest access tracts (locations where the most jobs can be reached via transit) are downtown and along the Red-Purple line west of downtown toward Hollywood. The Gold Line, north of downtown to Pasadena, is also an area of high transit job access. Intuitively, one would expect that movers into those areas with good transit job access would have larger increases in their own job access, and we find just such a pattern in a regression analysis of changes in transit job access for moving households.

Figure 11. Job accessibility by census tracts within 15 minutes isochrones

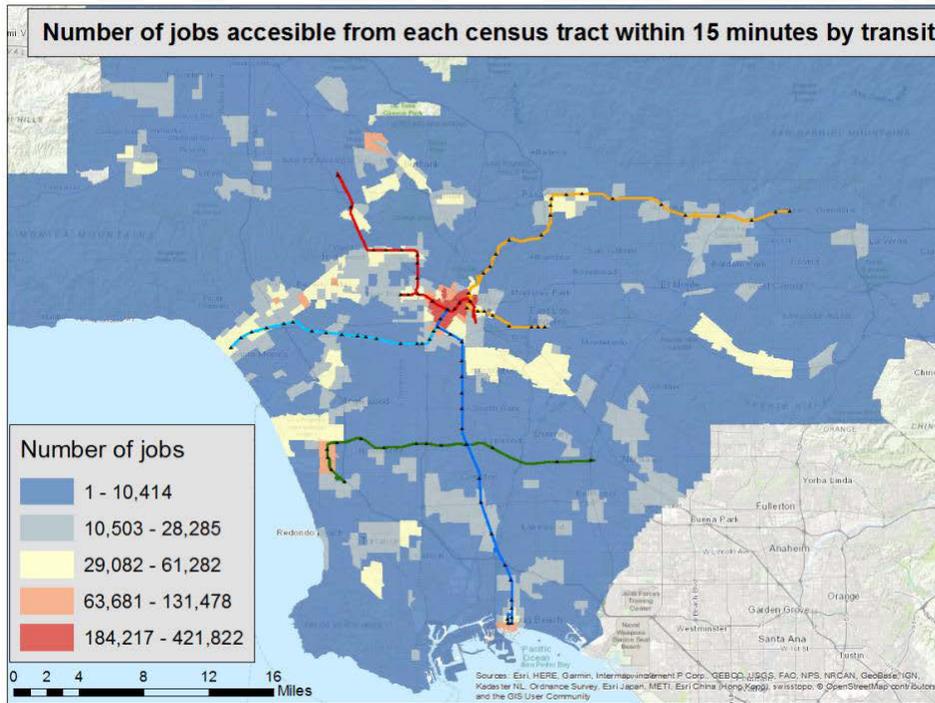


Figure 12. Job accessibility by census tracts within 30 minutes isochrones

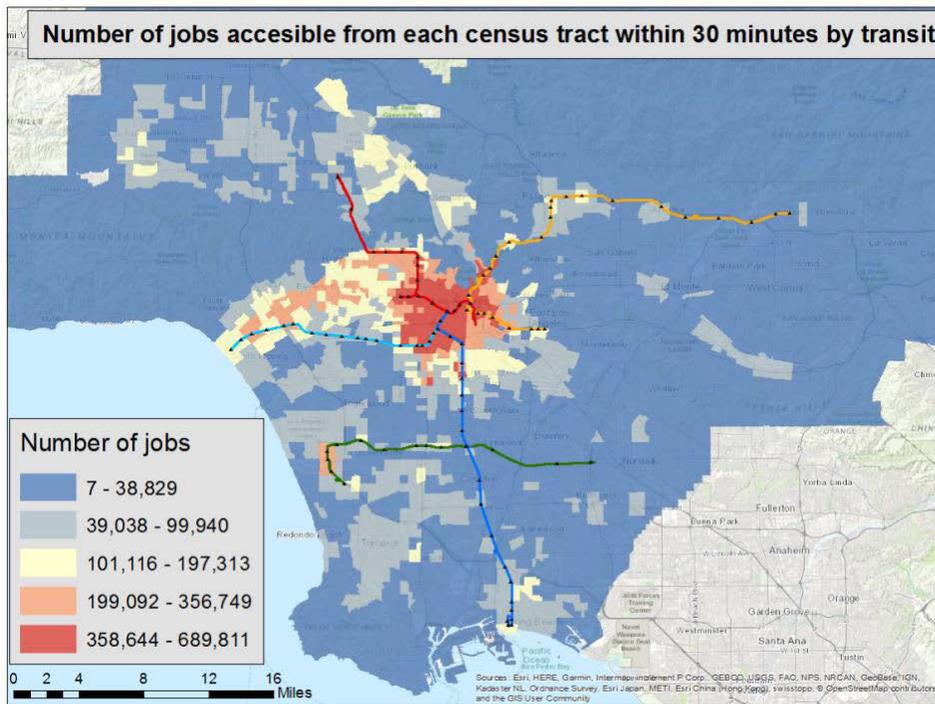


Figure 13. Job accessibility by census tracts within 45 minutes isochrones

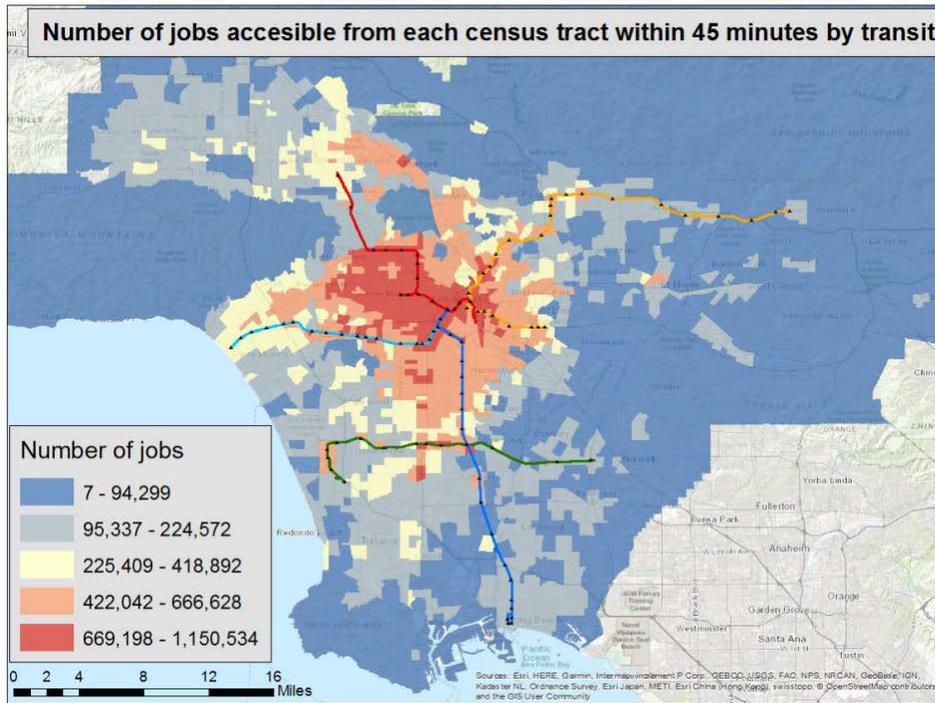
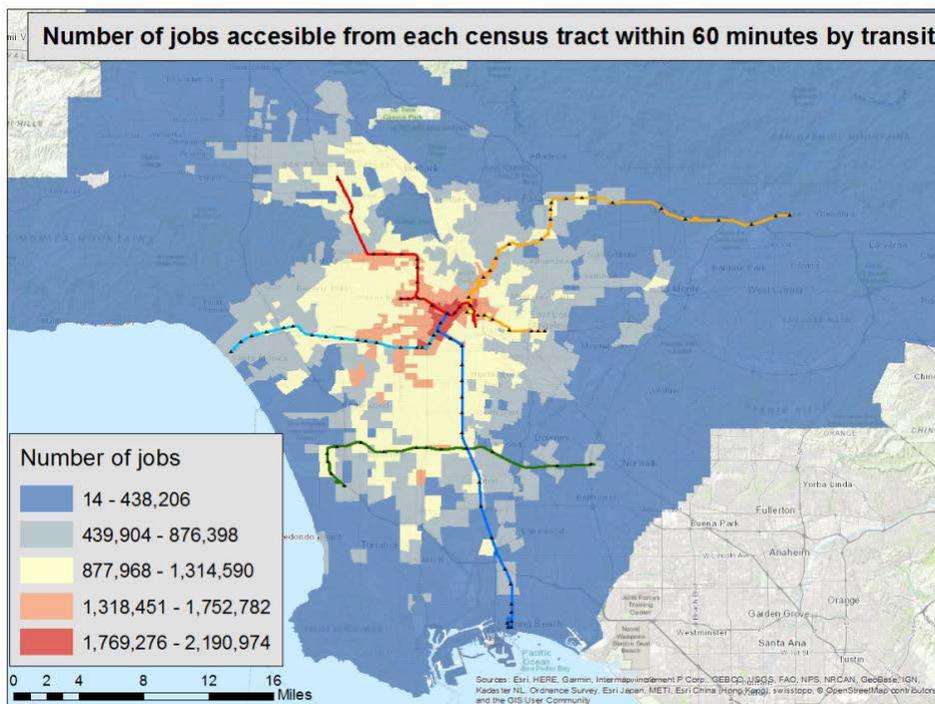


Figure 14. Job accessibility by census tracts within 60 minutes isochrones



To understand the correlates of changes in transit job access for moving households, we estimated the regression model reported in Table 11. The dependent variable was changes in transit job access for moving households. (The unit of observation for the regression is moving households.) Independent variables included dummy variables that indicated the rail line of move-in (for “move-in” households) or rail line of move-out (for “move-out” households.) Other independent variables were characteristics of the household, listed in Table 10, and the distance that the household moved, in meters.

Table 11. Regression model

	Moved-in	Moved-out
Expo line	16230.432	14382.263
Gold line	61214.473***	-24444.364***
Green line	40324.881***	84108.916***
Red line	42639.723***	-161679.248***
Joint filing	-6985.805	-17655.409**
Married filing separately	-25849.601	29863.95
Head of house	-23652.452***	-1358.548
distance moved	7017.494***	-6075.713***
number of dependents (2014)	-13500.545***	3344.088
2014 income	0.078**	-0.024
Adjusted R-Squared	0.0703	0.2234
N	4286	4941
Condition Number	5558698.513	1282353.571

*** p<.01, **p<.05, * p<.1

There are 5 lines that run along the LA Metro: Blue, Expo, Gold, Green, and Red (includes Purple line). We made a dummy variable for each of the lines and let the Blue line serve as our reference line. Along the Gold, Green, and Red lines, if a household moved into the station in 2015 then that household experienced a net increase in job access relative to that household moving near the Blue line. Conversely, if a household moved out of the Gold or Red line station areas, then the household experienced on average a loss of job access relative to moving away from a Blue Line station area. On the other hand, if a household move out of the Green line station area, it experienced an increase in job access relative to moving away from the Blue line.

As expected, households that move into rail stations from further distances experienced greater increases in job access. As seen in figures 11 to 14, census tracts with high job access tend to be concentrated near the existing metro lines and downtown. It makes sense then that

households that moved over larger distances from further will move from areas with lower levels of job access into areas with higher levels of job access. The converse is true when we look at households that move far away from rail station areas. For households moving out of rail stations, larger move distance is associated with a larger decrease in job access.

Households with larger number of dependents tend to experience a decrease in job access after moving into rail stations. This suggests that when larger households do move into rail station areas, they move to stations that provide less job access than their prior residence. When moving into rail station areas, higher income households tend to experience higher increases in job access.

Section VI. Where do Households Move From and To? Characteristics of Top Sending and Receiving Census Tracts

As shown in table 11, households, over all move categories, move an average of 3.3 kilometers. As expected, households in the 400 AMI category move, on average, over longer distances, and households in the lower AMI categories (<30% and 30-50% of AMI) move, on average, shorter distances.

Table 12. Distance moved by Income, in Kilometers

Income (AMI) group	Move in	Station to Station	Move out	Average
<30% of AMI	3.63	1.66	3.72	3.00
30-50%	3.64	1.75	3.67	3.02
50-80%	4.20	1.62	4.22	3.35
80-100%	4.25	1.78	4.12	3.38
100-150%	4.96	2.08	4.21	3.75
150-400%	5.61	1.89	4.65	4.05
NAami	9.14	1.02	4.55	4.91
All	4.18	1.73	4.01	3.30

We illustrate the top sending and receiving census tracts in figures 15 to 20. Due to sensitivity and data disclosure requirements, we do not disclose exact numbers of movers for each census tract but instead group census tracts into the top 10th percentile, 20th percentile, and 30th percentile of sending and receiving tracts in Los Angeles County.

Figure 16. Top 10% Receiving Tracts



Figure 15. Top 20% Receiving Tracts

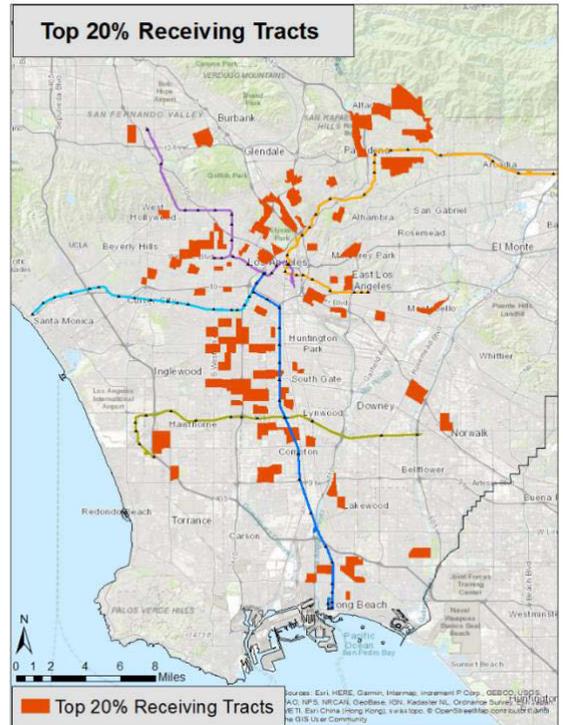


Figure 17. Top 30% Receiving Tracts

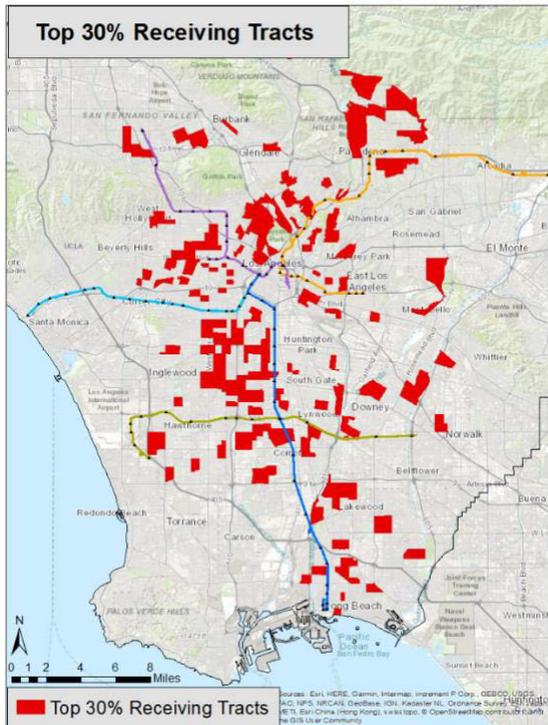


Figure 18. Top 10% Sending Tracts

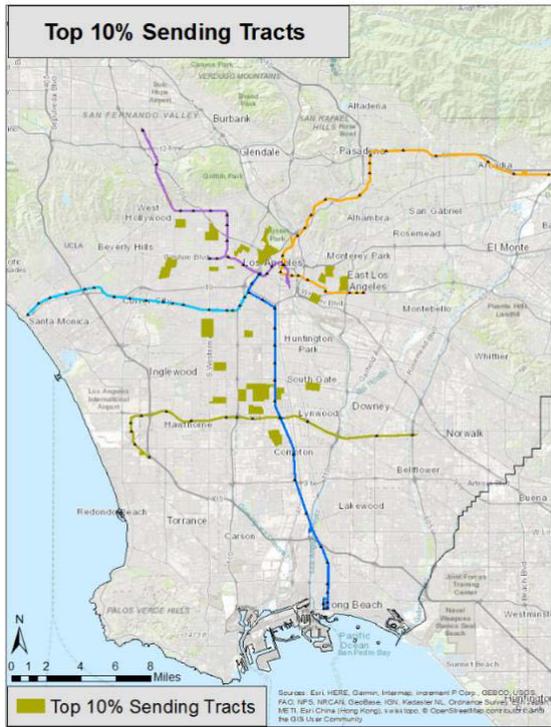


Figure 19. Top 20% Sending Tracts

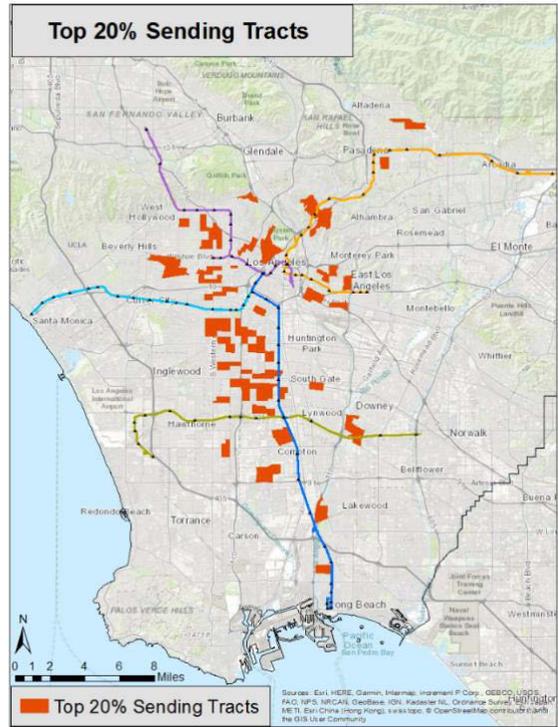
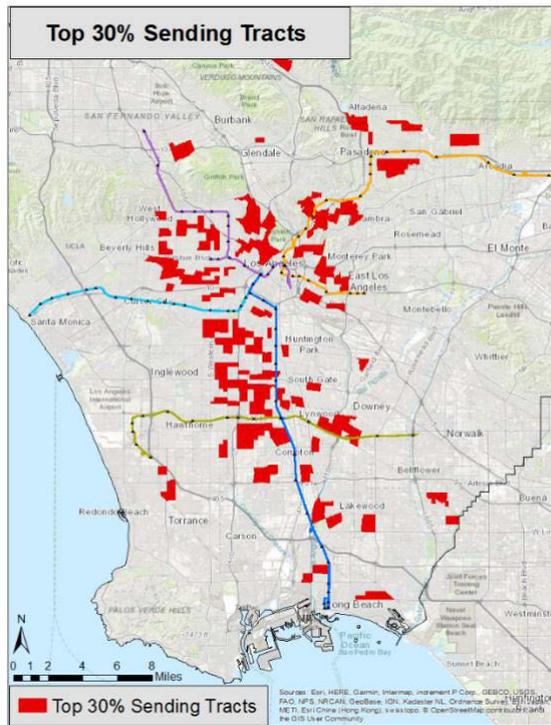


Figure 20. Top 30% Sending Tracts



From Figures 15-20, it is evident that households that move out of rail stations or move into rail stations tend to be near rail transit areas already.

The top tracts tend to cluster in:

- 10% Receiving tracts: Downtown, South LA, Pasadena.

Sending tracts: Downtown, South LA.

- 20% Sending tracts: South LA, West Hollywood, East LA.

Receiving tracts: Pasadena, South LA, West Hollywood.

- 30% Receiving tracts: Pasadena, South LA, West Hollywood, Griffith Park.

Sending tracts: South LA, West Hollywood, East LA.

We analyzed some sociodemographic characteristics and the High School Academic Performance Index (API -year 2013) characteristics for the top sending and receiving census tracts. The API is a 10 point score (10 is the highest) based on student test scores in high schools, and is often regarded by home buyers and residents as an indicator of school quality.

As seen in Table 12, the tracts that received the most movers away from rail neighborhoods are locations with lower API scores, higher poverty rates, and higher proportions of black and Hispanic residents, compared to Los Angeles County averages.

Table 13. Sending and Receiving Tracts Characteristics

	High School API score	Poverty Rate		Race	
		Below 100%	Below 200%	% Black	% Hispanic
All LA County	744	18.6	40.8	8.5	47.7
Receiving Tracts					
Top 10% receiving tracts	698	27.0	55.4	14.2	58.6
Top 20% receiving tracts	700	24.8	52.9	13.8	58.7
Top 30% receiving tracts	698	22.6	49.9	14.3	54.4
All receiving tracts	735	19.7	43.1	9.3	51.2
Sending Tracts					
Top 10% sending tracts	687	26.5	58.4	14.7	61.3
Top 20% sending tracts	685	28.6	59.4	14.5	64.2
Top 30% sending tracts	699	26.8	56.3	15.5	61.0
All sending tracts	735	19.6	42.8	9.3	50.4

Section VII. Policy Interpretation and Conclusion

The geography of opportunity literature has rightfully been concerned with whether households that move away from transit stations are being displaced to locations with lower job accessibility and reduced amenities. However, large quantitative studies have not been able to access this concern directly. This study fills this gap in the literature by providing novel evidence on changes in job accessibility for households that both move away from and near a transit station. The evidence is not definitive that households are worse off if they move away from rail stations.

The results of our study are clear that locations near transit stops have better job accessibility, lower poverty levels and are near schools with higher ratings on the state’s performance index compared to locations where households move to when leaving a rail transit neighborhood. However, those that move away from transit stops have higher year over year income changes than those that do not move away from transit stops. This suggests that moving to the neighborhoods away from transit stops may be driven by other factors beyond the

neighborhood characteristics that we measured. For example, the data suggest that those that move away from a transit stop have more dependents, which might suggest a tradeoff for more affordable space in neighborhoods away from transit.

Despite the lack of conclusive evidence on outcomes, for those that move away from transit stops, there are issues that future research and planning should focus on. For example, these data only allow for analysis of one year. It will be very important to determine whether the income trajectories of those that move away from transit differ in important ways from those that stay. If so, transportation planning must focus on maintaining effective transit access in non-rail neighborhoods. This is especially important because the most likely move for households was to an adjacent neighborhood. Further, it remains concerning that the educational performance of schools differs by proximity to transit. This suggests that one investment strategy could be to target schools in non-rail neighborhoods to improve the geography of opportunity.

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Data Management Plan

Products of Research

We used two primary data sources. Confidential and anonymized data on household income and zip code made available per research agreement from the California Franchise Tax Board (FTB). Those data cannot be released per the terms of the agreement with the FTB. We used those data to track flows of residential moves matched to census tracts. We used general transit feed system (GTFS) information, and the Remix software tool, to develop measures of job access by transit. Those data are in the Dataverse repository. We also report aggregated data on household moves and characteristics, at the level of detail given in the report, which is the level of aggregation allowed by the FTB agreement.

Data Format and Content

Data are in CSV format.

The file job_access.csv contains census tract number "GeoID", and counts of jobs that can be reached by transit in 15, 30, 45, and 60 minute travel times, "jobs_15", "jobs_30", "jobs_45", and "jobs_60", respectively.

Aggregated individual data correspond to the information reported in the final report, sorted by move status as defined below:

inin: Households that moved into a half-mile rail transit station neighborhood in 2015 but lived beyond ½ mile from a station in 2014.

outout: Households that moved out of a half-mile rail transit station neighborhood in 2015 but lived within ½ mile from a station in 2014.

insta2sta: Households that moved into a half-mile rail transit station neighborhood in 2015 and lived within a ½ mile of a different station in 2014.

outstat2sta: Households that moved out of a half-mile rail transit station neighborhood in 2014 and moved into a different half-mile station neighborhood in 2015.

stay: Households that lived within ½ mile of a rail transit station neighborhood in 2014 and lived within the same half-mile station neighborhood in 2015.

Data Access and Sharing

Data provided as part of the DMP can be used by the public. Confidential data cannot be provided to the public via the DMP.

Reuse and Redistribution

The restricted data were not deposited in Dataverse. The non-restricted data can be accessed on Dataverse: https://dataverse.harvard.edu/dataverse/LAtransit_GentrificationDisplacement/