The Philadelphia Story: urban renaissance and shifting travel behavior in a Northeast region

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16. Abstract

We examine changes in travel behavior in the Philadelphia region between 2000 and 2012. We use two household regional travel surveys over a decade apart, the 2000 and 2012 surveys, from the Delaware Valley Regional Planning Commission (DVRPC). Previous research, at the national scale, has highlighted changes among the Millennial cohort. We use these two regional datasets to examine the changing travel behavior among Millennials and to put these changes in context by comparing them with changes among other social groups of interest: women and minorities. We find that the travel behavior of young people did not change substantially between 2000 and 2012. Where there are changes, these pale in comparison to the changes among women and black residents. And finally, we find that the built environment factors appear to influence travel more in 2012 than in 2000. Taken together, our findings fit an overarching narrative about urban gentrification and the suburbanization of poverty, rather than a story of Millennials' changing travel behavior.

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Table of Contents

Chapter 1. Introduction

Since 2000, many once-declining cities in the United States have experienced an economic and population resurgence – but what does this mean for travel behavior and to what extent do changes in settlement patterns, demography, the economy, and preferences contribute to changes in metropolitan travel? In this article, we examine how changes in travel are playing out in Philadelphia and its suburbs. We use two household travel surveys over a decade apart, the 2000 and 2012 surveys, from the Delaware Valley Regional Planning Commission (DVRPC), the region's Metropolitan Planning Organization. We pay particular attention to the changes among adults in their 20s and 30s, women, and minorities, as well as changes related the urban environment where people reside.

Philadelphia's decline and modest rebound is typical of older, formerly industrial cities in the US. In the decades after World War II, urban populations and employment opportunities declined spectacularly in cities throughout the North and East in the US as populations, particularly white residents, and jobs fled to the suburbs and Sun Belt cities in the South (Beauregard, 2006). In Philadelphia, population in the city fell from just over 2 million to 1.5 million between 1950 and 2010, while the suburban population more than doubled, from 1.8 to 4.1 million. Since 2005, population in the city has increased, though it comprises just under a quarter of the regional population growth. And the growth has centered on a few specific and popular neighborhoods, with most Philadelphia Census tracts continuing to lose population in recent years. These new residents have reshaped many neighborhoods through gentrification and growing immigrant enclaves (The Pew Charitable Trusts, 2016). The urban newcomers in Philadelphia, as in many US cities, are primarily immigrants (Cortright, 2014; Singer et al., 2008; The Pew Charitable Trusts, 2014) and young people (20- to 34-years old). While some neighborhoods are gentrifying, many city residents remain very poor. The city has the highest rate of deep poverty – families living below one-half of the poverty line – among big cities in the country (Lubrano, 2014, 2013). Roughly 183,000 people (12.2%) in the city lived in deep poverty in 2014. Of course, poverty is not only a city problem. Like in many regions in the country, poverty has suburbanized (Howell and Timberlake, 2014; Raphael and Stoll, 2010).

Demographic changes are closely tied to changes in travel behavior, so it makes sense that these changes in Philadelphia and similar cities have implications for travel. While scholars have long studied travel changes associated with gender, race and ethnicity, recent work has highlighted changes associated with Millennials, seniors, and immigrants.

Young people in the US and peer countries have been making fewer trips by car, participating in fewer out-of-house activities, and driving fewer miles (Delbosc and Currie, 2013; Le Vine and Jones, 2012, 2012; McDonald, 2015; Ralph, 2017). They are also less likely to obtain driver's licenses, or at least delay obtaining these for a few years (Delbosc, 2016; Sivak and Schoettle, 2012). Recent studies have largely relied on publicly available cross-sectional national surveys at the national or regional level (c.f. Circella et al., n.d.; Delbosc and Nakanishi, 2017). From this work, scholars offer three explanations for Millennials' changing travel behavior: declining economic opportunities; changing preferences; and adoption of information and communication technology (ICT). McDonald (2015) gives more weight to the adoption of ICT and changing preferences than economic factors. Others argue that use of the internet is more likely to play a complementary role in travel, rather than acting as a substitute (Le Vine et al., 2014). Still, others have come down on the side of economics, life-cycle factors, and demographics (Brown et al., 2016; Klein and Smart, 2017; Manville et al., 2017; Smart et al., 2013).

At the other end of the age spectrum, researchers have found that older Americans are holding on to their cars longer, driving them more, and – even after ceasing to drive – increasingly traveling as passengers in private vehicles (Bauer et al., 2003; Rosenbloom, 2001). While the portion of the Philadelphia metro area aged 65 and over has remained stable for decades at 13% to 14%, if this group has adopted the automobile and abandoned transit at rates similar to those nationwide, this could spell a meaningful shift in regional travel behavior. Countering this trend, perhaps, is the state of Pennsylvania's policy to provide free and steeply reduced-price public transportation for senior citizens, enacted in 1986 (Commonwealth of Pennsylvania, n.d.).

The liberalization of immigration policy in the late 1960s has led to steady increases in the immigrant population in the United States, a group that is less likely to drive and more likely to take transit, walk, and cycle (Blumenberg and Shiki, 2007; Chatman and Klein, 2009; Smart, 2010;

Tal and Handy, 2010). In areas with a large share of foreign-born population such as California, immigrants can account for half of all transit riders (Blumenberg and Evans, 2007) despite comprising just a quarter of the state's population. Moreover, the decline in households of married couples with children almost certainly influences where households choose to live and how their members travel.

Other demographic factors continue to play an important role. From the beginning of the automobile era, women's rates of driver's licensure have steadily increased, reaching near-parity with men in the mid-1990s, and becoming a slim majority of all drivers in 2005 (Sivak, 2013). This, combined with women's increasing participation in the paid labor market and deeply entrenched gender roles, has led to women's increasingly complex travel patterns, typically in a private automobile (Blumenberg, 2016; Taylor et al., 2015). Similarly, race and ethnicity play an enduring role in shaping travel behavior (Giuliano, 2003) with racial and ethnic minorities less likely to drive alone and owning fewer cars, on average. Although the proportion of low-income households relying on cars has increased, low-income remains one of the strongest predictors of traveling without a car (Klein and Smart, 2017; Wang, 2015).

Beyond the demographic changes, the Philadelphia metropolitan regions' transportation environment has also changed, albeit marginally. Between 2000 and 2012, traffic congestion has increased by under 15 percent according to the Texas Transportation Institute (Texas Transportation Institute, n.d.). Transit infrastructure and routing have changed slightly over the same period while transit service has increased, with the region's transit vehicles plying roughly 16 percent more miles in 2012 than they did in 2000 (Federal Transit Administration, 2015). In the urban core and some outlying areas, investments in pedestrian and bicycle infrastructure increased, while the use of bicycles for the journey to work has increased in tandem, largely within the city of Philadelphia (cycling grew from about one percent of all commutes in 2000 to about two percent in 2012). In particular Census tracts in South Philadelphia and West Philadelphia, cycling has grown quite rapidly, from about nine percent in 2000 to over fifteen percent of all commutes in 2012 (U.S. Census Bureau, n.d.).

The following section describes our research approach. We then present our findings. First, we summarize the changes in travel in the region using the data from the US Census and the two DVRPC surveys, finding evidence of reduced automobile ownership and use, gentrification, and the suburbanization of poverty. Second, we model the changes in travel behavior using the surveys, controlling for a host of possible covariates. We conclude with a discussion of our findings, where we emphasize three takeaways: (1) the travel behavior of young people does not change substantially between 2000 and 2012 relative to other age groups or when controlling for income and geographic location; (2) the changes among young people pale in comparison to the changes among women, black residents, and residents in low-income households; and (3) built environment factors like neighborhood population density appear to be more important in 2012 than 2000.

Chapter 2. Research Approach

We take two basic approaches to examining changes in travel behavior over time in the Philadelphia region. The first is to plot changes in where households reside and how members commute to work using available Census data. The Census sources provide the largest available samples of how residential location and commute patterns have changed by age cohorts and socioeconomic groups. But the Census data only provide travel information on the commute trip and individual level data (PUMS) do not include detailed information about residential location.

The second approach addresses these limitations by relying on travel diary data for individual households to test whether travel behavior has changed over time in the Philadelphia region. We estimate models of travel behavior using data from the 2000 and 2012 household travel surveys collected by the regional metropolitan planning organization, the Delaware Valley Regional Planning Commission (DVRPC), and compare the parameter estimates statistically. The household travel surveys provide the richest available data on household members' complete travel behavior on a typical weekday. However, the sampling strategies across the two years are inconsistent and sample weights are designed to provide robust metropolitan estimates of travel behavior, rather than an accurate picture of, say, the percent of low-income white Philadelphians between the ages of 24 and 34 who used a car on the survey day. Our estimation strategy thus provides insight into whether the behavior of this type of individual differs statistically from other

individuals or across the two survey periods, not whether this group of individuals has become smaller or larger relative to the total population.

We focus our analysis of the travel diary data on car-free travel, that is, individuals who completed their daily travel exclusively by foot, transit, taxi, or bicycle on the survey day. These are the individuals most likely responsible for reported increases in cycling and transit-use, and who are most likely to fit the narrative of people moving to the city and living a car-free lifestyle. To develop a more nuanced understanding of the underlying behavioral mechanisms, we compare these against two control groups: those whose travel involved a private car and those who did not travel on the survey day. This is similar to a fully specified multinomial choice model with three alternatives but has the added advantage of showing the relationships between the predictor variables and each of the three choice variables. Begg and Gray (1984) find the procedure statistically and computationally efficient but with more conservative estimates of standard errors than a multinomial logit model.

Table 1 provides summary statistics for the full data samples of the individual- and household-level data from DVRPC's household travel survey (for additional details on the survey data and methods, see Delaware Valley Regional Planning Commission, 2017)[1]. To improve consistency across the two DVRPC datasets and remove outliers, we exclude people who report more than three hours of daily travel from the sample (10.6% of the survey data in 2012 and 6.7% in 2000). To this data, we added measures of neighborhood (Census tract) walkability using Walk Score ("Walk Score," n.d.), transit accessibility[2] (Owen and Levinson, 2014), and population density.

TABLE 1 Summary statistics (full unweighted sample)

	2000		2012	
	Mean	SD	Mean	SD
Some or all travel by car	0.770	0.421	0.675	0.468
All travel by other modes	0.063	0.244	0.099	0.298
No travel	0.167	0.373	0.226	0.418
Age 18 - 24	0.078	0.268	0.062	0.241
Age 25 - 34	0.111	0.314	0.096	0.295
Age 35 - 44	0.232	0.422	0.114	0.318
Age 45 - 54	0.227	0.419	0.189	0.391
Age 55 - 64	0.144	0.351	0.247	0.431
Age 65+	0.208	0.406	0.293	0.455
White	0.852	0.355	0.887	0.316
Other race/ethnicity	0.042	0.201	0.042	0.201
Black	0.106	0.308	0.071	0.256
Household size	2.860	1.403	2.554	1.233
Kids in household	0.408	0.491	0.303	0.460
Low-income	0.136	0.343	0.161	0.368
Female	0.541	0.498	0.545	0.498
Employed	0.649	0.477	0.573	0.495
Philadelphia household	0.156	0.363	0.182	0.386
Population per acre	9.58	12.90	10.31	14.92
Walk Score (0-100)	40.53	29.54	37.14	31.25
Transit accessibility	38,423	92,838	40,779	99,747
Observations	5,886		12,736	

In 2012, approximately 10 percentage points fewer respondents traveled exclusively by car. This decrease is matched by a six percentage point increase in people not traveling, perhaps as a result of the recession, and a four percentage point increase in those traveling by modes other than car. In 2012, the surveyed households were more likely to live in Philadelphia and reported older household members, fewer black members, fewer children, higher poverty rates, and lower levels of employment.

Chapter 3 Findings

Below, we summarize the changing travel patterns within and outside of Philadelphia across age and race/ethnicity categories using Census data and the two DVRPC surveys. We then present the results of the statistical models predicting car-free daily travel routines by age, race, gender, income, and neighborhood features like population density, transit accessibility, and Walk Score.

3.1 Changing Travel Behavior in the Philadelphia Region

Households across the Philadelphia region appear to be giving up cars. The ratio of cars per adult by household slipped from in 1.10 in the 2000 Census to 0.99 in the 2010-2014 5-year American Community Survey. Figure 1 compares rates of car ownership by race and by age cohort. For consistency with the DVRPC survey data, we reclassify our racial/ethnic categories to non-Hispanic whites, non-Hispanic blacks, and all other people of color.

For each of the race and age categories, we observe declines in car ownership both within and outside the central city. Across age groups, the rate of car ownership decline is roughly comparable, at 11% to 16% decline. The sharpest drop in car ownership was among older people outside the central city (16% decline), while the most modest decline was among people aged 35 to 64 living in the central city (11% decline). Among the racial/ethnic categories, the drop was sharpest among non-Hispanic whites living in the central city (15% decline), compared to between 6% and 9% declines for other groups. The results suggest that the changes are broad-based, and may have more to do with race than with age.

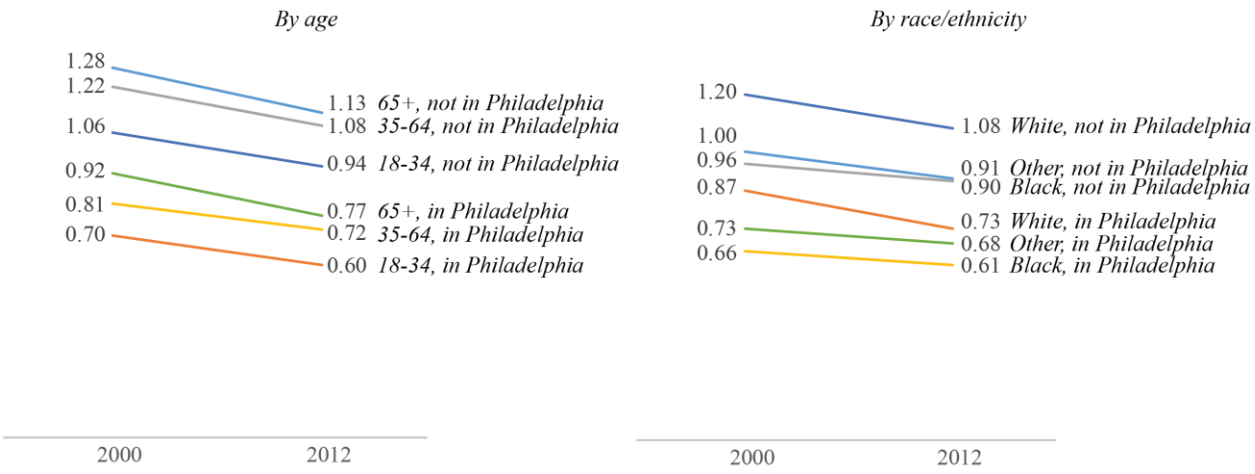

FIGURE 1 Ratio of Cars to Adults in household by race and age, 2000 and 2012. Sources: Census 2000 and 2010-2014 5-year American Community Survey

Changes in access to transit, in contrast to changes in access to cars, are more complex. Figure 2 compares the changes in the number of jobs accessible from the survey respondent's home Census

tract by 30 minutes, including walk time. The differences across age cohorts lend some support to the notion that Millennials are at least partially driving changes in travel behavior. Only the youngest group (age 18 to 34) living in the central city increased their access to transit, with a 5% growth in the number of jobs accessible by transit from their home location. All other groups saw small declines, suggesting they have moved somewhat further from transit, or jobs, or both.

The changes by racial/ethnic categories are much starker. While non-Hispanic whites living in Philadelphia have increased their access to transit considerably over time (+11%), non-Hispanic blacks (-12%) and all other people of color (-6%) in the central city have seen their access decline. Outside of the central city, transit access to jobs declined somewhat for all groups.

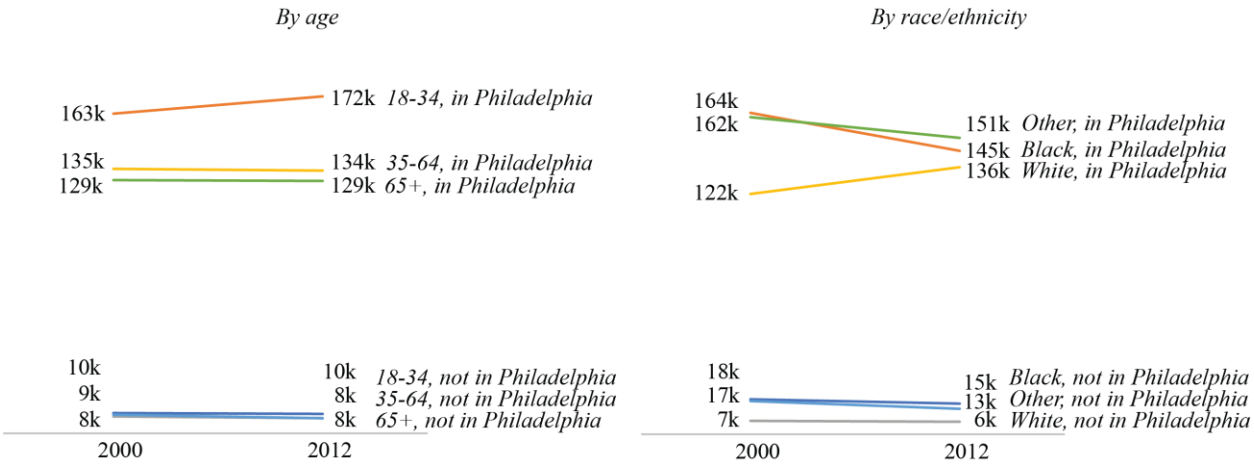

FIGURE 2 Accessibility to jobs via transit, 2000 and 2012. Sources: Census 2000 and 2010-2014 5-year American Community Survey

Examining the trends by poverty status tells a similar story (not shown here): outside of the central city, both poor and non-poor households' access to jobs by transit declined (by 11% and 9%). But within the city, poor households saw a decline (-8%) while non-poor households saw a modest increase (+3%). Poor households' loss of transit access to jobs further corresponds with a modest suburbanization of poverty in the region; the percent of poor families residing in the central city slipped from 57% of all poor families to 55% over these twelve years.

These changes are largely mirrored in Figure 3, which shows residential density. Within the city, all age groups lived in Census tracts with higher densities in 2012 than in 2000. This increased residential density was particularly pronounced for the youngest age group. Again, white Philadelphians saw their residential density grow (+6%) while black Philadelphians saw the opposite (-3%). Interestingly, other people of color saw increases in residential density, despite decreases in transit access to jobs (Figure 3), suggesting relocation to denser tracts further from transit, or jobs, or both.

Despite these changes in transit access to jobs, we see little change in the percent of workers using transit for the journey to work. Across the age and racial/ethnic groups, the prevalence of transit use for commuting (not shown here) stayed nearly unchanged, increasing at most two percentage points (for the youngest group, in Philadelphia), and decreasing at most one percentage point (for blacks and other people of color living outside the central city).

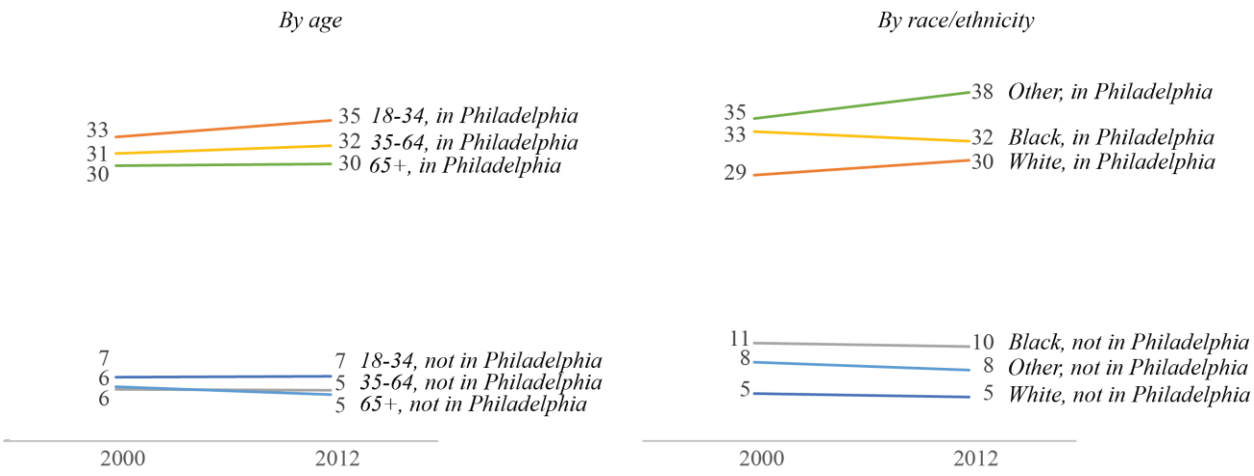

FIGURE 3 Residential density in people per acre, 2000 and 2012. Sources: Census 2000 and 2010-2014 5-year American Community Survey

Between 2000 and 2012, Philadelphia has become a somewhat younger city (35% of the region's people aged 18 to 35 live in the city, up from 32%), while older people have left the city for the suburbs (76% live outside the central city, up from 71%). All three racial/ethnic groups we examined have continued to suburbanize over time. Non-Hispanic blacks continue to have the highest rate of living in the central city, though this figure has slipped from 61% to 56%. Non-

Hispanic whites saw little change, dropping from 17% to 16% living in the central city. Other people of color saw a four-percentage point decline, from 40% to 36% living in the central city.

Figure 4 plots changes in travel behavior across the two DVRPC travel diaries. We show two categories: those who travel, but do not use an automobile, and those who use an automobile on the travel day. We exclude a third category of non-travelers from the graph, for reasons discussed above. Throughout the region, the share of respondents who drive exclusively decreased while those who travel, but never in a car, increased. The changes are much greater within Philadelphia than in the region's suburbs, though we observe few notable differences in the *rate* of change across racial/ethnic categories or by age. In 2012, the middle age-group and whites continue to travel more by car than the youngest group and people of color, just as they did in 2000. While young people in Philadelphia are substantially less likely to travel by car in 2012 than in 2000, this decrease in car travel is not greater than the decrease for the older age categories.

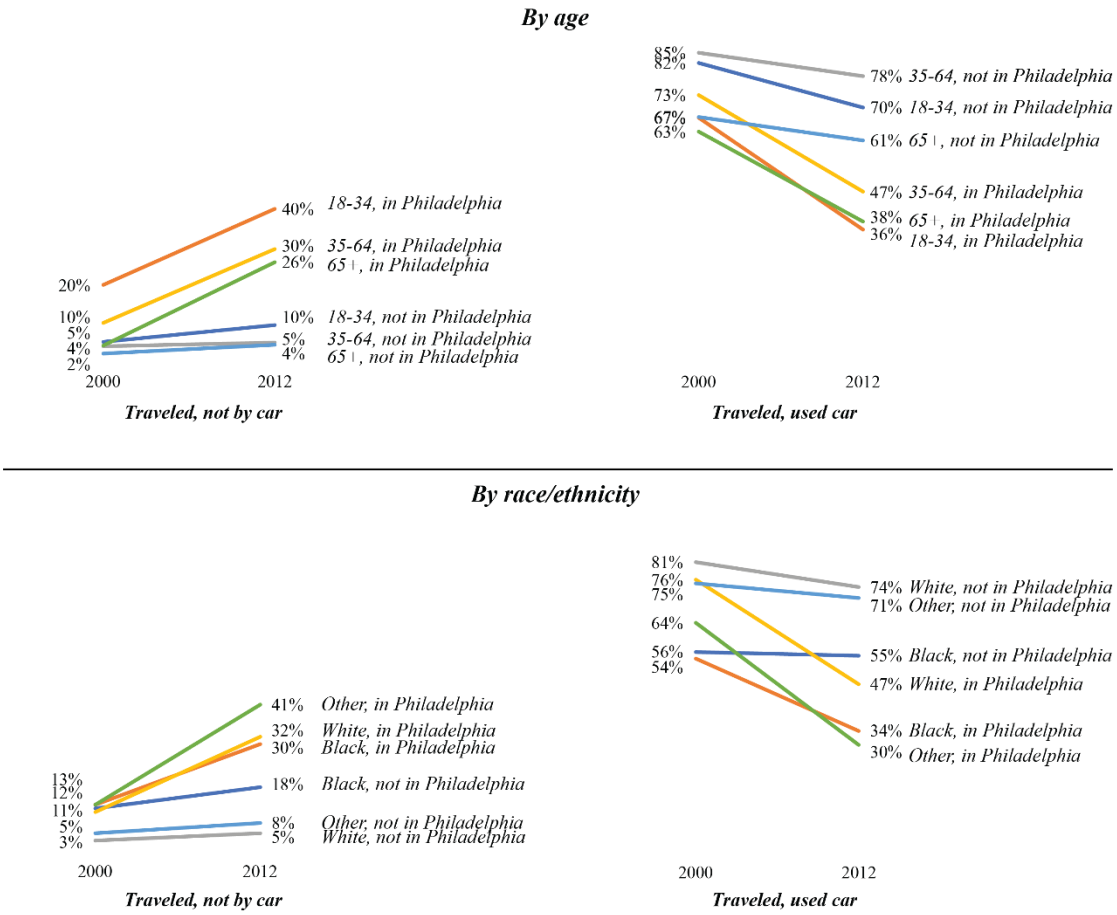

FIGURE 4 Traveler Type, 2000 and 2012. Sources: Census 2000 and 2010-2014 5-year American Community Survey

3.2 Predicting Travel Behavior in 2000 and 2012

Table 2 presents the results of the models predicting whether people had a car-free daily travel routine in 2000 and 2012. We compare car-free travel against a daily routine involving at least a single car trip and against no daily travel. Within each model, we present a parameter estimate for both years and the additional 2012 parameter estimate (the full 2012 effect is calculated by summing the 2000 and 2012 parameters). For example, a female resident has a predicted 0.168 logit units higher likelihood of car-free travel in 2000, but 1.99 fewer logit units likelihood of car-free travel in 2012 (The -0.199 result is obtained by summing the coefficient for female residents, 0.168, and the 2012 coefficient -0.367). All else equal, this suggests that, compared to men, women

had 18% *greater* odds of car-free travel in 2000 (0.168 exponentiated is 1.18), and 18% *lower* odds (-0.199 exponentiated is 0.82) twelve years later. We tested other model formulations and the results were consistent[2].

While some socioeconomic parameter estimates are stable over time, others exhibit strong changes. None of the age groups exhibited any different behavior from 2000 to 2012, even when we cut the data by race, county, and car-ownership (not shown here). By contrast, women and black people were substantially less likely to travel exclusively by transit and non-motorized modes in 2012 than in 2000. Furthermore, women were more likely to travel without a car than men in 2000 but less likely in 2012. To demonstrate the relative importance of gender, race, and income, we compare how the model predicts travel in 2000 and 2012 if the entire sample were comprised of black women from low-income households. In 2000, our model predicts 21% (up from 6%) of people having a car-free daily travel routine compared to 17% (up from 10%) in 2012. The increased constant in 2012, relative to 2000, also indicates that the overall utility unaccounted for in the models of car-free travel is higher in 2012 than in 2000.

TABLE 2 Binomial logit model predicting car-free travel against all other travel and no travel, DVRPC 2000 and 2012

	Dependent variable: Car free travel			
	vs. Other travel		vs. No travel	
		(2012)		(2012)
Philadelphia household	1.616***	-1.094***	1.442***	-1.046***
	(0.174)	(0.236)	(0.206)	(0.275)
People per acre	-0.005	0.028***	-0.004	0.015*
	(0.005)	(0.007)	(0.006)	(0.008)
Walk Score (0 - 100)	0.003	0.009**	0.001	0.015***
	(0.003)	(0.004)	(0.004)	(0.005)
Transit accessibility	0.176***	—	0.099***	—
	(0.031)		(0.031)	
Household size	-0.057	—	-0.171***	—
	(0.042)		(0.049)	
Kids in household	-0.115	—	0.370***	—
	(0.121)		(0.135)	
Low-income household	1.023***	-0.365*	0.162	—
	(0.151)	(0.193)	(0.114)	
Female	0.168	-0.367**	0.250*	-0.320*

	(0.123)	(0.161)	(0.141)	(0.185)
Black	0.639***	-0.507**	-0.132	—
	(0.154)	(0.227)	(0.127)	
Employed	-0.105	—	1.199***	—
	(0.094)		(0.105)	
Age 18 - 24	1.102***	—	0.854***	—
	(0.151)		(0.170)	
Age 25 - 34	0.433***	—	0.371**	—
	(0.131)		(0.156)	
Age 35 - 44	0.301**	—	0.22	—
	(0.135)		(0.156)	
Age 45 - 54	0.274**	—	0.494***	—
	(0.118)		(0.135)	
Constant	-5.155***	0.434**	-3.162***	-0.27
	(0.300)	(0.203)	(0.306)	(0.217)
Observations	9,462		3,251	
Log Likelihood	-2,276.03		-1,512.82	
McFadden Pseudo R2	0.26		0.23	

Notes: Coefficients for 2012 are additive with those from 2000; stars indicate statistical significance, *p<0.1; **p<0.05; ***p<0.01; — indicates that the parameter for 2012 was not statistically significant (the 2012 effect was not different from the 2000 effect) is excluded from the final model estimates.

In terms of the built environment, living in Philadelphia was less associated with car-free travel in 2012 than it was in 2000. This may relate to the increase in higher-income households living in the city in 2012 relative to 2000. Another explanation may be that the travel behavior of suburbanites and urban residents are converging. The combined 2012 parameter estimate for whether a person lives in Philadelphia is substantially smaller in 2012 than in 2000. Running separate models for those living inside and outside of Philadelphia, black suburban residents have become less likely to engage in car-free travel in 2012 relative to 2000. By 2012, there was no difference in car-free travel within Philadelphia by any socioeconomic group other than low-income households. In the suburbs, women were more likely to use cars than men. Furthermore, younger residents in the suburbs were more a bit more likely to be car-free in 2012 than in 2000, but slightly less likely within Philadelphia. This does not fit the theory that Millennials are opting for central residences and living car-free lifestyles.

By contrast, people living in dense neighborhoods with higher Walk Scores were more likely to have daily car-free travel routines in 2012 but not in 2000. People in transit-accessible neighborhoods were as likely to travel without cars in 2000 and as in 2012. In both years, a one percent increase in transit accessibility corresponds with around a 0.2% increase in the odds of car-free travel. To better show how the relationship has changed over time, Figure 5 plots the predicted share of car-free travelers against the 10th to 90th percentile of neighborhood population density and Walk Score values. To create the plots, we apply our model to the survey data, but change the neighborhood population density or Walk Score to the appropriate percentile value for all survey respondents. For example, if all households lived in an area with the median Walk Score (33) in 2012, our model predicts that around 9% of daily travel would be car-free, as opposed to 12.5% at the 75th percentile Walk Score (64). Car-free travel increases modestly until the 75th percentile value density (10.5 people per acre) at which point it increases rapidly. By contrast, there is no almost no difference in how our model predicts the proportion of car-free travel in different built environments in 2000 (i.e., the plotted lines are flat).

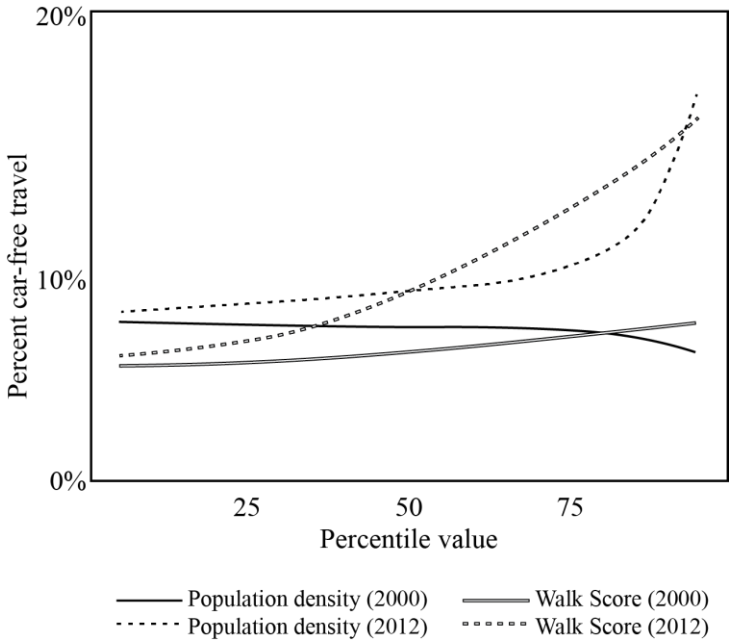

FIGURE 5 Simulated model predictions based on varying neighborhood population density and Walk Score for all survey respondents, DVRPC 2000 and 2012

Chapter 4. Discussion & Conclusion

From these findings, we draw three primary conclusions that help tell the story of Philadelphia's changing travel behavior. First, the travel behavior of young people changed, but so did the travel behavior of older groups. In the Philadelphia region, Millennials are not unique in their declining travel by car. Similarly, car-ownership rates declined at about the same rate for all age ranges over the period. There was also little change in the commute to work by transit, as measured by the Census. Most notably, across all model specifications, we find that the independent effect of being young remains unchanged from 2000 to 2012, though this group was consistently the most likely age-group to be car-free and to not have traveled on the survey day.

Second, the changes we observed by age-cohort pale in comparison to the changes by gender, race, and income. Women were statistically significantly more likely than men to have a car-free travel day in 2000, but significantly *less* likely in 2012. This finding held when we analyzed the data across urban, suburban, white, and black respondents. This increase in the relationship between being a women and traveling by car may reflect women's more complicated travel routines which are better accommodated by cars (Blumenberg, 2016, 2004), coupled with a change in women's access to cars (Sivak, 2013). Black respondents also reported substantial relative changes. In 2000, they were statistically more likely to travel without a car than white and other respondents. By 2012, however, there was no behavioral difference after controlling for other factors. This change occurred both inside and outside of Philadelphia, though suburban black respondents remained statistically more likely to travel without a car than suburban white respondents in 2012. The difference between low-income residents' and wealthier residents' travel behavior also shrank over time, though it remained substantial and statistically significant in 2012. Low-income residents were nearly three times as likely as wealthier residents to travel without cars in 2000, but only twice as likely in 2012.

Third, the local built environment appears to be more strongly correlated with car-free travel routines in 2012 than in 2000. As shown in Table 2 and Figure 5, population density and Walk Scores were weakly and statistically insignificantly associated with car-free travel routines in 2000. By 2012, however, living in a denser, more walkable neighborhood was a much better predictor of car-free travel. It was also a relatively important one. Since the built environment's

direct relationship on how easy or hard it is to travel with or without a car probably has not changed much, this finding suggests that either the relative importance of socioeconomic predictors has decreased or that more people are better able to match their travel and locational preferences in 2012 than in 2000. That is, someone who prefers car-free travel finds it easier to select into a dense, walkable neighborhood in 2012 than in 2000. The shift could, however, also reflect people priced out of dense and walkable neighborhoods who are responding to more car-friendly environments by driving more. In any case, the built environment matters relatively more in 2012 than in 2000.

These three trends are interrelated. Although our model suggests that youth itself is not associated with more car-free travel in 2012 versus 2000, more young people have moved to the kinds of walkable and transit-accessible neighborhoods where car-free lifestyles are easiest in 2012 than in 2000, and these built-environment variables have become more important over time. In terms of age and income, young newcomers tend to be substantially wealthier than those born in Philadelphia, where 37% of children live in poverty (ACS 2014 5-Year Estimates). In this respect, Millennials moving to urban areas may be more likely to travel without cars than Millennials in the suburbs, but more likely to use cars than Millennials who were born and raised in Philadelphia. Race, of course, is also strongly correlated with income and geography. In both 2000 and 2012, black respondents were substantially more likely to live in dense, urban areas and to live in poverty than white respondents. The number and share of both black and white residents increased outside of Philadelphia at roughly the same rates, though the proportion of blacks living in poverty is two to four times higher in each suburban county (Census 2000, ACS 2014 5-Year Estimates). Across the two-time periods, the travel behavior and residential location of white and black respondents have begun to converge, but black residents remain substantially more likely to live in poverty than whites (31.3% versus 18.5%) (ACS 2014 5-Year Estimates). Income and race, moreover, have become less associated with car-free travel over time.

Taken together, these three conclusions fit an overall narrative about how urban gentrification and the suburbanization of poverty have led to dramatic changes in urban travel patterns in Philadelphia. Research into changing travel patterns in other metropolitan areas will likely also reveal specific geographic and socioeconomic trends that may not fit national narratives about changing preferences or economic recession. Gentrification and the suburbanization of poverty are

particularly likely to affect large cities with rapidly changing socioeconomic profiles, such as New York, Boston, and San Francisco.

Notes

1. This results in an overestimate of the proportion of people who did not travel on the survey day. In 2012, for example, 19.7% of the full sample reported no travel as opposed to 22.6% in our sample. Those who did not travel in the region on the survey day reported the following most common reasons: no reason to leave the house (37%); illness (9%); working around the house (9%); homebound or disabled (8%); the weather (6%); worked from home (6%); not scheduled to work (5%); or taking a vacation or personal day (5%). For reasons of potential inconsistency across surveys, we focus our findings and discussion on the subset of people who traveled on the survey day.
2. We used the same accessibility data in 2000 and 2012, data from the University of Minnesota Accessibility Observatory (Owen and Levinson, 2014). This database summarizes the number of jobs accessible within 30 minutes including access and egress time on foot. Because our accessibility data do not vary across the two periods, the changes are reflective of changes in residential location rather than changes in transit service. Public transit services did not change meaningfully during this period, although the distribution of jobs within the metropolitan area may have.
3. Since the size of parameter estimates increases with the variance of the error terms in choice models, combining data from two survey years requires additional procedures make the parameter estimates comparable. We tested a scalar parameter (Ben-Akiva

et al., 1994; Train, 2009, chap. 3.2) and a mixed logit model with a random coefficient (Hensher et al., 2008) to account for differences in error terms for the 2000 and 2012 data. Both tests indicated that any differences in variance were not statistically significant and correcting for differences produced worse model fits. The final reported models (Table 2) pool both datasets and provides an estimate of the for the 2012 predictor when it is statistically significant. To prevent the larger 2012 sample from exerting more influence than the smaller 2000 sample, we take an equivalently sized random sample of the 2012 data. We also estimated separate models that cut the sample by race, county (Philadelphia vs. suburbs), and car ownership. These confirmed the substantive findings discussed in the next two sections and are available upon request.

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