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Time to First Homeownership: Racial Differences, and the Impact of 1986 Tax Reform Act

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Abstract

The rate of transition of young adults from living with parents or renting to homeownership affects the national homeownership rate. There are substantial racial and ethnic differences in the length of time that it takes for this transition to occur, contributing to the well-known racial gaps in ownership rates. These differences are important because they affect the length of time that households enjoy the economic and social benefits of homeownership. This study uses a national longitudinal data from 1979 to 2000 to analyze the reasons for observed differences in the time to first ownership. Hypotheses are derived from two perspectives: the demand for homeownership and the supply of dwelling suitable for owner-occupancy. From the demand side, factors influencing the timing of first ownership are derived from the user cost model and the consumption-investment models of homeownership. From the supply side, consideration of geographic location and the mortgage market provides additional hypotheses. A relative risk Cox model is used in the estimation.

We find that minorities achieve first-time homeownership more slowly than Whites. Even after accounting for a variety of individual, geographic, and macroeconomic characteristics, we find that significant differences among the races remain that cannot be attributed to any observed economic differences. As a secondary focus of the study, we look at the effect of 1986 Tax Act Reform (TRA) and find that it adversely affected the low income households in terms of achieving first-time homeownership.

1. INTRODUCTION

There continues to be a high level of interest in the nation's homeownership rate, especially differences in the rate by race and ethnicity. An important determinant of the ownership rate is the length of time that households spend in spells of non-homeownership; that is, renting or living with parents or others. Differences in ownership rates between Whites, Blacks, Hispanics, and Asians could be due, in part, to differences in their durations in these non-ownership spells. In this study we focus on the duration of time that individuals take to become first-time homeowners.

Homeownership impacts the economic and social outcomes of households. Dietz and Haurin (2003) review this literature and they note that there is good evidence to support claims that homeownership has a positive effect on the level of household wealth, in part due to the well known tax advantage of ownership in the U.S. (Rosen 1979).[1] Another positive effect is on the quality of home environment (Menaghan and Parcel 1991), where a contributing factor is a greater rate of home maintenance for properties that are owner-occupied (Galster 1983; Gatzlaff, Green, and Ling 1998). There is an increasing amount of evidence that the children of parents who are owner-occupiers achieve higher levels of cognition, have fewer social problems, and are more likely later in life to become homeowners (Green and White 1997; Boehm and Schlottmann 1999; Haurin, Parcel, and Haurin 2002).[2] The likely mechanisms are the improved home environment, the greater geographic stability associated with homeownership (Aaronson 2000), and the improved level of owners' self-esteem (Rohe and Stegman 1994).

The duration of time to first ownership affects how long it takes for a household to begin receiving these benefits. Public policy often seems focused on helping individuals achieve ownership at *some* time during their lifetimes, not early in their lifetimes. Early ownership provides more time for children to receive the benefits of geographic stability and an improved home environment. It permits the household more time to benefit from the tax advantages of ownership compared to renting.

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[1] When real house value rises, real wealth tends to increase. The long term evidence about the prevalence and distribution of increases in real house values is quite mixed (Dietz and Haurin 2003). Wealth also may rise through gains in home equity as the mortgage is repaid, but renters also could participate in this type of "forced savings". Haurin and Rosenthal (2004) find that the economic gains resulting from house price appreciation are predominantly saved.

[2] These studies include numerous economic and demographic control variables for parental and family background and the neighborhood. They also address the problem of unobserved heterogeneity that could lead to sample selection issues when comparing renters with owners.

It also is important to view homeownership from a lifetime perspective. The few studies on this topic suggest that early spells of homeownership increase the probability of later spells of ownership (Boehm and Schlottman 2004; Haurin and Rosenthal 2003). This outcome is sensible because wealth accumulation during a first spell of ownership makes it easier to overcome mortgage lender imposed down payment constraints later in life. Thus, the time until the first spell of ownership begins affects a household's lifetime profile of tenure choice.

The differences in this paper's approach compared with other studies of racial differences in homeownership rates are numerous. We adopt an intertemporal approach while most studies of racial gaps in homeownership are based on cross-sectional data sets. We focus on when households achieve their first homeownership experience, while most other studies of racial differences combine all spells of ownership. Figure 1 sheds some light on the timing of first ownership among the individuals in our sample. Whites achieve ownership the earliest with Blacks trailing by a substantial amount of time. One goal of this paper is to determine which economic and social factors explain these differences in time to first homeownership.

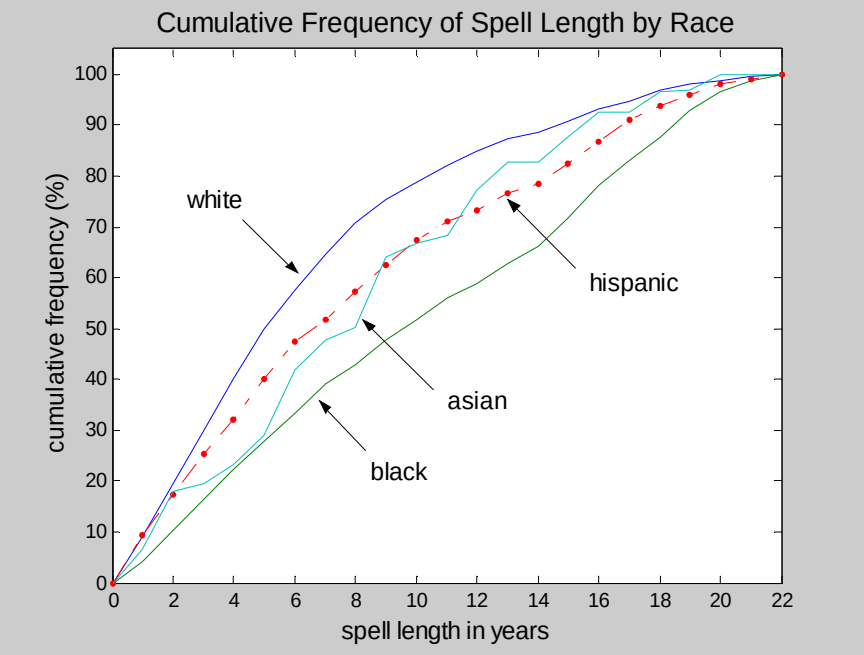


Figure 1: Cumulative Distribution of Time to First Homeownership

Source: Authors' calculation based on weighted NLSY data.

A secondary focus of this study is an evaluation of the impact of the 1986 Tax Reform Act (TRA) on the time to first homeownership. The TRA substantially reduced the tax benefits of homeownership for low income households. This effect was documented by Follain and Ling (1991) in their study of tenure choice where they found the deductibility of mortgage interest payments was worthless for many households with incomes below $42,500 ($1991). Our data set reports the tenure choices of a cohort of respondents during the period 1979-2000 and thus the impact of the TRA on the time to first ownership can be estimated. A low income household that did not purchase a home by 1986 found that its tax benefits of owning diminished post-TRA. This change in tax laws should have the effect of further lengthening the duration of renting or living with parents. We present the first test of this hypothesis.

The sequence of the paper is the following. We first briefly review the literature on tenure choice then discuss the relatively small literature on the time to first homeownership. Next, a theoretical framework is outlined that guides our choice of empirical model and variables. We then present the econometric model and describe the data. Following the presentation of the results, we discuss the implications for public policy.

2. REVIEW OF LITERATURE

Static Models of Homeownership

The literature on tenure choice is vast and the subset that studies racial differences also is large. A comprehensive review of the racial gap literature is contained in Haurin, Rosenthal, Herbert, and Duda (Haurin et al. 2003). They show that large racial and ethnic differences in homeownership rates persisted throughout the 20th century. Their review concludes that most studies in the 1970s through the 1990s found that the differences in ownership rates (typically 25 percentage points) between Whites, Blacks, and Hispanics were primarily explained by differences in the economic and social attributes of households (about 15 percentage points) with the other 10 percentage points unexplained. Often this residual is attributed to unmeasured discrimination in the housing and mortgage markets; however, Haurin et al. (2003) note that it also may be attributed to other omitted variables.

Static models of tenure choice often adopt the framework that tenure choice is explained by demographic variables and the relative cost of housing, household income and wealth and their

interactions with mortgage lender constraints. In these studies, the relative cost of housing is influenced by the user cost of housing and by spatial differences in the constant-quality cost of owned housing relative to rental units. User costs of housing reflect the after tax cost of mortgage interest rates and foregone earnings on home equity, depreciation and maintenance, and expected house price inflation (Rosen 1979; Follain and Ling 1991). The key lender constraint that affects achieving homeownership is the required down payment, this documented by Linneman and Wachter (1989) and Haurin, Hendershott, and Wachter (1997) among many others. The impact of racial differences in the amount of wealth on the likelihood of homeownership is amplified through this constraint. Demographic variables found to be particularly important include marital status and age.

Empirical Studies of the Time to First Homeownership

There is a small literature that focuses on the time to first ownership, but none of the articles highlight racial differences or the impact of household wealth. Henretta (1986) studies the transition of young households from renting to homeownership using data on White households from the Panel Study of Income Dynamics (PSID). His method is discrete time event history analysis, but he uses an ad hoc procedure to correct for the presence of multiple observations of every household. He finds a few variables are significant (wife's and husband's earnings, number of children), but many are not and some have unexpected signs. Also, he finds no evidence that household level variables interacted with measures of housing cost have a significant effect on the probability of first time ownership.

Morrow-Jones (1988) uses the American Housing Survey to study moves of young adults from renting to owning (not necessarily first time ownership). She used a method that attempts to model the set of age specific transition rates for young adults. The selection of explanatory variables was not guided by particular theories and the curve fitting exercise produced a number of counter-intuitive results.

Boehm (1993) hypothesizes that there are direct as well as indirect effects of transitory and expected income on the time to first ownership. He uses PSID data and finds that both types of income not only have a direct effect on the probability of transitioning to homeownership, but also an indirect effect through the effect of income on wealth accumulation. One of the limitations of Boehm's study is that he assumes an exponential duration model. This model requires the hazard

rate of becoming a homeowner to be constant; however, this claim is contradicted by our data. Boehm also assumes that spells begins when an individual leaves the parental home. However, the length of time that individuals remain with parents depends on many of the same socio-demographic and economic factors that influence the time to first ownership. Thus, Boehm's results conflate individual's decisions about remaining with parents and time to first ownership. The alternative, used by us and other studies of first-time ownership is to measure the time to first ownership from a particular age.

Clark, Deurloo, and Dieleman (1997) focused on the transition to first time homeownership in Germany. Mulder and Wagner (1998) compared the German experience to that of the Dutch in attaining first time ownership. Both studies argue that economic, demographic, and geographic variables should be important to the explanation of the timing of the transition. Clark, Deurloo, and Dieleman's findings were quite limited (only income and the number of earners were significant in a Cox proportional hazard estimation). Mulder and Wagner's study was limited because of the use of retrospective data and thus they do not include income or wealth in their analysis. Using a logistic regression they find that marriage, education, number of years worked, socio-economic status, and parental homeownership speed the transition from renting to owning while living in a large urban area (likely a proxy for housing costs) and unemployment slows it.

Guiso and Jappelli (2002) use Italian data and a proportional hazard model to study the duration of time that an individual saves until they purchase a house. They highlight the effect of transfers (gifts and inheritances) on saving time, finding that the effect is small on spell lengths, but the households purchase larger houses after receiving a transfer. Their data are retrospective, not longitudinal as in our data set. A major problem with their dependent variable is that their data do not allow them to distinguish between first and later ownership spells; they can only measure the time from age 25 until the time a household begins its current spell of ownership. A third important limitation of their data is that they must assume that some variables (e.g., education and family size) are time invariant because of data limitations. This limitation is a significant problem because young households' attributes change rapidly over time. Variables that shorten the savings time include education, permanent income, and transfers. Ones that lengthen the savings time include the price of housing, larger city size, and being single.

Boehm and Schlottmann (2004) use nine years of PSID data to study the duration of stay in owned and rented dwellings. Their focus is on understanding multiple spells of ownership, but

they also study the transition from renting to first ownership. They find that White households are more likely to transition to ownership than minorities. Household characteristics that increase the probability of a transition are higher permanent income and education beyond high school. Slowing the transition are being single, a larger family size, and living in a large metro area (a proxy for omitted housing prices). No effect of wealth was found, this surprising because of the expected importance of the down payment constraint. One criticism of this interesting study is that all minority households were combined into one category; Hispanics, Blacks, and Asians were not separated. Also, wealth was measured only in three waves of the panel; other years' values had to be imputed.

This review of the literature suggests that the optimal data set is one with panel data, not retrospective data. The data should focus on households who are relatively young and are making their first transition to ownership. The econometric model should allow for a flexibly specified baseline hazard function. While many explanatory variables have been used, the theoretical guidance for their choice has been lacking or loose. We address these problems by using a panel data set of length 21 years. The respondents are young and pass through the prime transition to ownership years during the survey period. Our econometric model allows a very flexible baseline hazard function and a large set of explanatory variables are available. Our choice of these variables is guided by two models of the demand for homeownership and consideration of the supply side of the market. Our particular focus is on explaining racial and ethnic differences in attaining first time homeownership.

3. MODELS AND HYPOTHESES

This section discusses two models of the demand side of tenure choice, the consumption-investment demand model and the so-called user cost model. Both models generate hypotheses about the effect of household characteristics on the demand for first-time homeownership.[3] The section concludes with a discussion of ways that the supply of dwellings might influence tenure choice.

[3] Haurin et al. (2003) reviews these models in substantially more detail than the discussion in this paper.

The "Consumption-Investment Demand" Model of Tenure Choice

Developed by Henderson and Ioannides (1983, 1987), this model highlights a household's portfolio choice problem, with owner-occupied housing being one possible asset in the portfolio. Household have a consumption demand for housing, this being a function of factors such as the price of housing family size, income, and wealth. They also have an investment demand for housing derived from portfolio size and balance considerations. In general, if investment demand exceeds consumption demand, the model predicts that the household will be an owner-occupier. In contrast, if consumption demand exceeds investment demand then the household should rent and perhaps purchase housing assets (e.g. purchase a small dwelling and become a landlord).[4]

The primary determinant of investment demand should be household wealth, but household income and the risk characteristics of housing also are important. As wealth rises, investment demand grows more rapidly than consumption demand, and ownership becomes more likely. Also, if a low wealth household purchases a home, it would be exposed to relatively high risk because its portfolio would not be diversified (Flavin and Yamashita 2000). This additional risk should lower investment demand by this group. Higher wealth households should invest in housing because of the benefits of diversification (Yao and Zhang 2001). Overall, there are multiple forces that tend to raise the demand for homeownership as household wealth rises.

The expected length of stay in a dwelling affects its rate of return as an investment because of the high transactions costs associated with terminating a spell of homeownership. Haurin and Gill (2002) show the substantial influence of planned mobility on the annualized transaction cost of owning and thus on the probability of a household becoming a homeowner. The transaction cost of selling a home does not affect consumption demand other than through the impact of the small reduction in lifetime net income. Thus, households with high expected mobility rates are predicted to be much less likely to own a home. Observed mobility rates are greater for the young and for singles, and are somewhat greater for low income households (Haurin and Gill 2002).[5]

The investment-consumption model suggests that the greater is expected house price appreciation, the greater is the investment demand for housing. Consumption demand will be little affected and thus the likelihood of homeownership is greater. Thus, spatial differences in expected

[4] There are a few complicating details not addressed in this brief summary, but they are discussed in Ioannides and Rosenthal (1994).

[5] The latter finding may be due to reverse causality as low income households have lower ownership rates and thus a lower cost of relocating (Boehm 1981).

house price appreciation could cause systematic differences in the demand for ownership. The Conventional Mortgage Home Price Index shows substantial variation among census regions (Freddie Mac 2003). The ratio of 2000 to 1979 prices ranged from a high of 3.8 in New England, to 3.5 in the Pacific region, 3.3 Middle Atlantic, 2.7 South Atlantic, 2.6 East North Central, 2.5 Mountain, 2.3 West North Central and East South Central, and finally to a low of 1.9 in the West South Central region. We include a variable measuring house price appreciation, but regional dummy variables may capture additional effects.

A somewhat different issue is the *level* of house prices on the consumption and investment demand for housing. Higher house price levels should reduce the consumption demand for housing. The total dollar value of investment demand for housing is not likely affected by the price of housing; however, the investment demand for the quantity of housing is affected. In high house price areas, less quantity of housing can be purchased for a given dollar investment. Thus, in high house price areas, the consumption and investment quantity demanded will fall, and the net effect on the demand for homeownership is unclear. There is a relationship of house price levels with the down payment constraint (discussed later), but this relationship is not part of the standard consumption-investment model.

A related effect is created by the volatility of house prices. Belsky and Duda (2000) found that the standard deviation of appreciation rates for low-priced homes is about 2.5 times greater than for high-priced homes in a study of four cities. Thus, their study suggests that low-price homes may be a particularly risky investment. The consumption-investment model predicts that low income households will avoid investing in housing because of the price risk; hence, they will be more likely to remain a renter compared to higher income households.

An important cost variable is the mortgage interest rate. A higher rate raises the cost of consumption and investment in housing. The net effect on the likelihood of ownership is unclear.

The rate of return on investments in housing may depend on the rate of depreciation of the dwelling. Emrath (1995, 1997) used American Housing Survey data and showed that maintenance expenses per square foot of housing increase as a percentage of house value as houses age. However, if the depreciation rate of older housing is known to be higher, then this attribute should be capitalized in the market price, and the net of maintenance rate of return will not be affected. It is likely that the risk of needing a major repair (water or natural gas line breaks, failure of a furnace in winter) is much greater for old dwellings. Thus, investment demand will be lower for risk

averse households and those who cannot afford the cost of a major repair (i.e. those with low income and low wealth). Older properties are located in central cities, thus investment demand and the likelihood of homeownership should be lower in these areas. Also, Black and Hispanic households tend to reside in older housing and there is good evidence that their choice set is limited by discrimination (Ross and Yinger 2002); thus, the depreciation argument suggests that minorities will have lower homeownership rates. Also, singles have less time to undertake do-it-yourself home maintenance and are thus less likely to own.

We expect greater job security and income stability should increase investment demand more than consumption demand. Information about job security is difficult to obtain, but greater tenure in the current job suggests greater security. From a more aggregate perspective, Black and Hispanic households' rate of unemployment has greater variance than that of Whites, and thus it is reasonable to argue they have less job security. Also, job security falls when the local unemployment rate rises and thus a household's investment demand should fall when unemployment rates (and uncertainty) are high. The level of the local unemployment rate likely has little effect on a household's consumption demand for housing. The result is that a higher unemployment rate should lead to a lower probability of homeownership, holding constant an individual's employment status.

The rate of return to housing that influences consumption and investment demand is the after-tax rate. The U.S. tax code subsidizes homeownership compared with renting (see Follain and Ling (1991) for a thorough analysis). Imputed rents (the market value of renting the dwelling) of owner-occupiers are not taxed and mortgage interest and property tax payments are deductible if a household chooses to itemize deductions on its Federal taxes. Also, Federal tax codes have generous rules regarding the treatment of capital gains. Even prior to the 1997 tax reform that further reduced capital gains taxation of owner-occupied housing, capital gains taxes were easily avoided by continuously purchasing a higher priced home. For example, in 1995, only five percent of all have sellers reported to the IRS capital gains on owner-occupied housing.[6]

The reduction in the after-tax cost of housing for higher income groups tends to raise their consumption and investment demands for owner-occupied housing. Thus, for high mid and high income households, the investment demand for owner-occupied housing is boosted substantially

[6] See Hoyt and Rosenthal (1992) for further discussion of these effects.

relative to other assets. Thus, the impact of the tax code is that homeownership should be more likely as income rises.

The 1986 Tax Reform Act further reduced the tax benefits of homeownership for low and moderate income households (Follain and Ling 1991).[7] Thus, both the consumption and investment demand for owner-occupied housing should fall, with the net effect being unclear.

Both the investment and consumption demand for housing depends on the number and ages of children. An increased number of children should raise the demand for residential space, but it also reduces disposable income. As noted above, one way to invest in child outcomes is to purchase a home. Thus, a greater number of children should raise the investment demand for ownership. The conflicting forces lead to an ambiguous prediction about the effect of children on the likelihood of a young household transitioning to homeownership.

The "User Cost" Model of Tenure Choice

The most frequently used model in empirical work on tenure choice is one that highlights the role of the relative price of owning compared with renting. The relative cost is typically defined to equal the product of the user cost of owning (the annual cost of $1 of owner occupied housing) and the ratio of house prices to rental prices (holding quality constant). The user cost is a function of income tax rates, depreciation rates, expected length of stay in the home, mortgage interest rates, property tax rates, and the expected appreciation of the home's value (Rosen 1979). Many of the predictions of this model are the same as the consumption-investment model, even though the justification sometimes differs.

Job security, house price volatility, local unemployment rates, and household wealth do not play a role in the standard user cost model and thus no predictions result for tenure choice regarding these variables. In an extended model (Hendershott and Won 1992), a risk premium term can be added to the model. The result is similar predictions to the consumption-investment model. The anticipated length of stay in a home is important in the user-cost model. The longer the expected stay, the lower are the annualized transaction costs and the user cost, and thus the

[7] The act reduced the number of marginal rate brackets and compressed the marginal rate structure so that the sharpest decline in marginal tax rates was experienced by high-income individuals. However, the reform also raised the levels of the standard deduction and personal exemption. Prior to the reform, in 1986, these values were $3,670 and $1,080, respectively. The reform established a standard deduction of $5,000 in 1988 and phased in a personal exemption level of $2,000 by 1989, each of which was indexed to inflation in succeeding years.

more likely is a transition to homeownership. Rosenthal (1988) formally incorporates transaction costs into a user cost measure of owner-occupied housing and finds evidence consistent with the idea that transaction costs affect tenure choice. From the user cost perspective, higher expected house price appreciation reduces the relative cost of owning compared with renting. Thus, higher expected price appreciation encourages ownership similar to the consumption-investment model.

Critical to the tenure choice decision is the price of constant-quality owner-occupied housing relative to renting. The greater the price of housing, ceteris paribus, the less likely is ownership. The user cost of homeownership is positively related to the mortgage interest rate. Thus, a higher mortgage rate should lower the likelihood of ownership. Passage of the TRA raised the user cost for low and moderate income households and the unambiguous prediction is that ownership should be less likely.

Supply Side Factors and Constraints

Supply side factors and constraints could affect the timing of the transition to homeownership. One important constraint is the mortgage lender imposed down payment requirement. Studies by Zorn (1989), Linneman and Wachter (1989), and Haurin, Hendershott, and Wachter (1997) confirm that a large percentage of households' tenure choices are affected because they have insufficient wealth to buy their desired houses. The percentage of house value required for a down payment typically was 20 percent in the 1970s, this value continuing to into the early 1980s. In 1990, only eight percent of loan originations had a loan-to-value ratio greater than 90 percent. The minimal required down payment fell thereafter and throughout the 1990s. Our sample period is 1979 to 2000 and thus the minimal down payment ranged from 20% to about 5%. Overall, the existence of binding down payment constraints suggests that low wealth households are likely to remain renters longer. Another observation is that the greater the price of constant quality housing in a locality, the greater the needed down payment. Thus, spatial and intertemporal variations in house prices should affect the likelihood of exiting to ownership through this mechanism.

Black and Hispanic households are more likely to be affected by the down payment constraint. Data from the 1998 Survey of Consumer Finances (SCF), weighted to be representative of the United States, confirms that typical Black and Hispanic renters have very little wealth (Haurin et al. 2003). For example, the level of wealth at the 25th percentile of the wealth

distribution is basically zero and that at the 50th percentile is just $1,523 and $2,556, respectively. In contrast, among White renters the 50th percentile level of wealth is $9,908.

Kain and Quigley (1975) argued that supply side factors are important to tenure choice; specifically that single-family detached housing stock is more conducive to homeownership. Haurin et al. (2003) argue that this occurs because the administrative costs associated with the organization of multi-family buildings into condominiums are high. These higher costs may occur in low income areas because of the negative externalities (e.g. high crime rates) often associated with these areas. Property owners in multi-family units have limited ability to monitor disruptive behavior within the building. Because central city areas have relatively high levels of multi-family housing, renters living in central cities will have a lower rate of transition to homeownership unless they move to suburban or rural areas.

Another aspect of the supply side of the market is the restriction of choice due to discrimination. One prediction is that minorities facing discrimination in the housing market face restricted access to suburban neighborhoods, these suburban areas containing a higher proportion of single family detached dwellings. The implication is that minorities will take longer to become owners. Racial steering in the housing market has been documented and appears to have persisted throughout the 1980s and 1990s (Ross and Yinger 2003). A large literature also exists regarding the prevalence of discrimination in mortgage lending (Munnell et al. 1996). They found that Black mortgage applicants in Boston in the late 1980s were eight percentage points more likely to have their loan applications rejected relative to comparable White loan applicants. This study's conclusions have been criticized, but there remains substantial evidence of discrimination against minorities in the housing market, resulting in less ability to relocate from the central city to the suburbs.

The conclusions drawn from the supply side of the housing market are that first-time homeownership will occur more slowly for minorities, for those with low wealth, and for those young adults living in central cities where there are relatively few single family dwelling.

Summary of Hypotheses

The demand for homeownership models predict that the transition from living with parents or renting to homeownership is more likely the greater is a household's income and wealth. The probability of transition also should rise with increased age and job tenure, and it should be higher

for married couples. It will be faster in areas with high rates of house price appreciation but slower for households living in central cities, in areas with high local unemployment rates, and for minority households. The transition should be slower when mortgage interest rates are high. Factors related to predicting greater permanent income such as increased education and mental ability also should cause a faster transition to homeownership. The higher is house price, the slower will be the transition to ownership. Finally, transitions to owning should be slower after passage of the TRA.

4. DATA SET AND DESCRIPTIVE STATISTICS

Data Set

Our study uses data from the National Longitudinal Survey of Youth (Center for Human Resource Research 2003). The survey began in 1979 when its respondents were ages 14 to 22. The initial survey included about 12,000 youths and the attrition rate has remained relatively low with 8,033 responses received in 2000.[8] The survey was annual through 1994, then biannual. However, in 1991 information about homeownership was not collected. In 2000, respondents were ages 35 to 42, having passed through the primary first-time home purchasing years.[9] The Hispanic sample represents Hispanic youths present in the U.S. in 1979 and is unchanged thereafter, thus Hispanics immigrating to the U.S. after 1979 are not represented in these data.

Duration of Time to First Homeownership

We begin the analysis of respondents when they become 21 years old, this occurring between 1979 and 1986. We explain the length of time it takes for a respondent to transition to

[8] The 1979 NLSY contained a sample of military members that was dropped in 1982. These respondents are not included in our analysis.

[9] The optimal data set would be one where continuous observations are available for every variable. No longitudinal data set contains this quality and quantity of information. The NLSY contains three types of variable: those reporting values at all points in time (e.g., continuous work histories), those aggregated over a particular time period (e.g., income earned in the last calendar year), and those that are a snapshot at the time of the survey. Because tenure status is reported only on survey dates, the dating of the first purchase of a home is inaccurate to an extent. Further, it is possible that the first home was purchased and sold between surveys, this spell not recorded in the data. The longer the time between surveys, the more likely is an intra-survey event to occur, this more likely post 1994. However, 1994 is 15 years into the survey and most of the respondents had already become first-time homeowners.

ownership, or until the spell is censored. Our sample includes 4,010 individuals and 3,372 of them became homeowners within the observed period of 21 years. Percentiles of the survival time are the following: 25% of the sample became homeownerships by the third year, 50% by the sixth year, and 75% by the twelfth year. The total number of person-years is 29,397.

Covariates

There are four broad categories of covariates: time invariant, time varying individual characteristics, time varying macroeconomic variables, and residential location (which also is time varying). Among the time invariant variables are race/ethnicity (White, Black, Hispanic and Asian) and gender. Three variables are included because they are related to permanent income: the respondent's Armed Forces Qualification Test (AFQT) score,[10] health condition,[11] and highest grade completed. We use indicators of whether the respondent is part of a first or second generation family to control for the respondent's familiarity with the U.S. housing and mortgage market. We also include the highest grade completed by either parent as a proxy for parental wealth. Time varying variables include the number of respondent's children and marital status. Also included are weeks unemployed and weeks employed, and three kinds of income sources: wages and salaries, inheritances, and the amount from all other income sources.

To capture location effects we use two kinds of variables: intra-MSA location and census region. Regarding MSA location, we record whether the respondent resides in the central city or suburb (rural is the reference category). The nine census regions are New England, Middle Atlantic, East North Central, West North Central, South Atlantic, East South Central, West South Central, and Mountain (East North Central is the reference category). County population is also included to control for the size of the location.

A number of time-varying macro level variables are included in the estimation. One is a time varying regional constant-quality house price index. The first step in its creation is to measure regional differences in constant-quality house prices in a particular year. We use the Mills-Simenauer index for 1986 (Mills and Simenauer 1996). We then expand the index to span the sample period by using the Freddie Mac repeat sales regional house price index for the period

[10] The AFQT is a general measure of trainability on a scale of 1 to 99. Normed scores (adjusted for age differences) are reported in the survey. The test includes as components: arithmetic reasoning, word knowledge, paragraph comprehension, and numerical operations.
[11] An indicator of whether health limits the amount or type of work.

1979-2000 (Freddie Mac 2003). A second variable is the national average interest rate on fixed rate 30 year mortgages (Office of Policy Development and Research 2003).[12] Other components of the user cost include the rate of maintenance and depreciation (assumed to be time and spatially invariant), and the expected rate of house price inflation. The latter is assumed to equal the rate of inflation in house prices as measured by the Freddie Mac index. We include an indicator variable for the 1986 Tax Reform Act that takes the value of 1 in 1986 and thereafter for household earnings $50,000 or less (in 2000 dollars) and 0 otherwise. The unemployment rate is measured at the regional level.

In the NLSY, detailed wealth questions were asked beginning in 1985, six years after the initiation of the study and thus we cannot include wealth in our analysis of the full sample. However, because the cohort spanned ages 14 to 21 in 1979, there are two groups that are age 21 or less in 1985. We separately examine the time to ownership of these groups, focusing on the importance of wealth. The existence of down payment constraints suggests there may be substantial nonlinearities in the response to different wealth levels. In past studies, the nonlinearities were addressed by creating a variable that indicates when the constraint was binding. This method requires the assumption of a critical minimum down payment (often 10% or 20% of house value) and the estimation of the price of a house that a household with particular characteristics would buy. Clearly the minimum down payment percentage has fallen over time, making the calculation of a constraint variable more difficult and somewhat arbitrary. We simply include net wealth and test for differential impacts between samples.

Descriptive statistics

Appendix B contains descriptive statistics, all of which are weighted. After weighting, whites represent 82% of the sample while blacks represent 12%. Hispanic and Asian percentages are 5% and 1% respectively. Other time invariant characteristics are presented in table B1. There are substantial racial differences in AFQT scores and immigration status.

Time varying characteristics are in table B2 while the location characteristics are in table B3 (which are also time varying). For a time varying variable, a sample mean doesn't have any

[12] Formally, there may be a different interest rate applicable to the foregone benefit of home equity. Because we are measuring the cost of ownership for current renters, we simplify by assuming this rate equals the mortgage interest rate. We also assume that, at a point in time the mortgage interest rate is constant across individuals and space.

obvious interpretation in this kind of a sample. Table B3 and B4 present mean values of time varying variables during the time that the respondents lived with parents or rented. For example, in table B3 the first row is the mean regional unemployment rate and it says that an individual of any race faces an average regional unemployment rate of 7.275% over the spell of time to first ownership.

Number of children is higher among Blacks. Black respondents spend less time working and Black households earned, on average, $6,000 less, per year, than Whites. Blacks also were married for smaller percentage of time than other groups. Whites spent less time as divorced, widowed, and separated than minorities. Hispanics and Asians faced higher regional house prices because they are more heavily located in the Pacific and Mountain regions (see Table B3). Table B3 presents the percentage of time that an average individual spent in various locations during their time spent as a renter or living with parents. Black and Hispanic respondents spent much more time in central cities and less time in suburbs and in rural areas compared to Whites.

5. ESTIMATION

Testing the above hypotheses is accomplished by estimating a relative risk Cox model.[13] We first present the Kaplan-Meier estimates by race and then present a log-rank test.

Kaplan-Meier Estimates

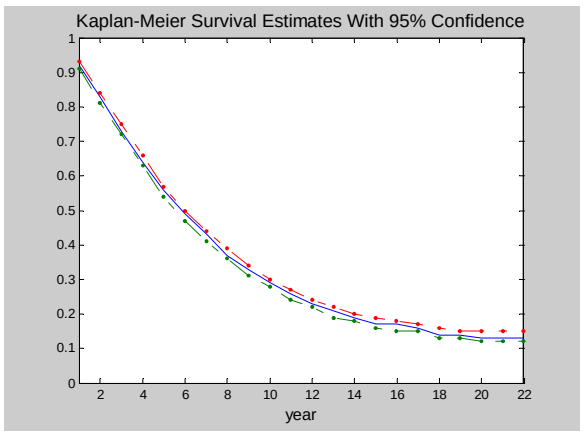
Let $t_1 < t_2 < \cdots < t_k$, $j = 1,...,k$, denote the set of observed failure times in the sample. Let n_j be the number at risk of failure just before the time t_j and d_j equals the number of failures at time t_j. Then the Kaplan-Meier or *product limit estimate* of the survivor function is,

$$(1) \qquad \hat{S}(t) = \prod_{j|t_j \le t} \left(\frac{n_j - d_j}{n_j} \right).$$

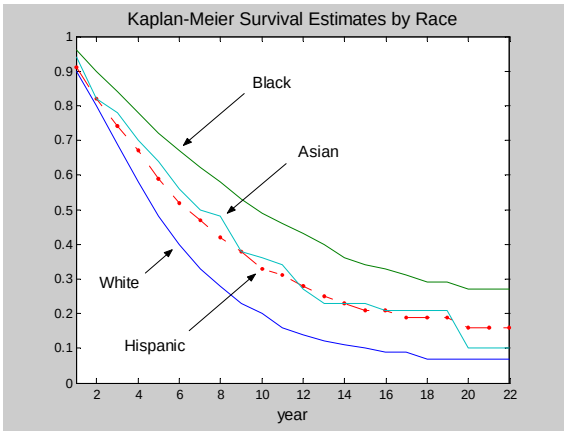
The confidence bounds are, $\hat{S}(t)^{\exp(\pm z_{\alpha/2}\hat{\sigma}(t))}$, where $z_{\alpha/2}$ is the $(1-\alpha/2)$ quantile of the normal distribution, $\hat{\sigma}^2(t) = \hat{\text{var}}[\log \hat{S}(t)] / [\log \hat{S}(t)]^2$ and,

[13] For a detail description of these models see Kalbfleisch and Prentice (2002).

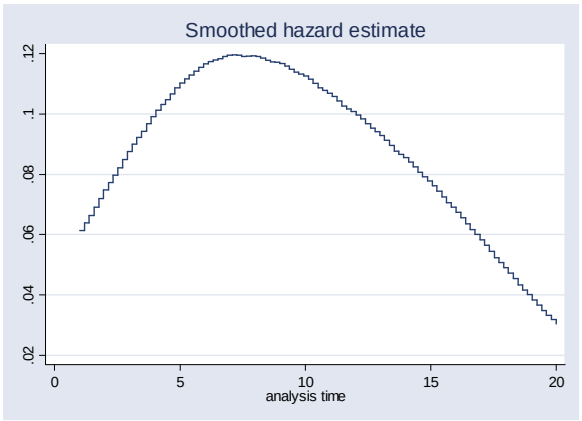
(2) $$\hat{\text{var}}[\log \hat{S}(t)] = \sum_{j|t_j \le t} \left(\frac{d_j}{n_j(n_j - d_j)} \right).$$



Panel A



Panel B



Panel C

Figure 2: Kaplan-Meier Survival Estimates

In Figure 2, panel A, we show the estimated survival function for all race and ethnic groups combined. The 95% confidence interval is shown in the dotted lines. A 50% chance of survival occurs at 5.8 years. In panel B we present the estimates by race/ethnicity. As expected from the descriptive data, the survival of whites as non-owners is substantially different from that of minorities. Among minorities, Blacks become first-time homeowners at a substantially slower rate than Asians and Hispanics. Panel C presents smoothed empirical hazard rate for the full sample (all races combined), which is defined as the probability of a household exiting to homeownership conditional on survival to that point in time. It rises rapidly through year 7 (age 28), then falls fairly rapidly. This result suggests that an estimation model that allows for only constant or

monotonic hazard rates is inappropriate (e.g. parametric models with exponential or Weibull distributions). In our econometric estimation, we use the relative risk Cox model to allow for a flexible specification.

Log Rank Test by Race and Ethnicity

Here we test whether the survivor functions $S_1(t), \ldots, S_p(t)$ are equal on the basis of samples from each of p population groups. We have four racial groups, White, Black, Hispanic and Asian and thus $p = 4$. Let $t_1 < t_2 < \cdots < t_k$ denote the failure times for the sample formed by pooling the p groups. As in Kaplan-Meier estimates, n_j denotes the number at risk of failure just before time t_j, and d_j is the number of failures at time t_j. Let d_{ij} and n_{ij} be the corresponding numbers in sample i where $i = 1, \ldots, p$. We test the null hypothesis, $H_0 : \lambda_1(t) = \ldots = \lambda_p(t)$, against the alternative that at least one of the $\lambda_i(t)$ is different for some t_j, where $\lambda_i(t)$ is the hazard of group i at time t.[14] The results are summarized in Table 1.

Table 1: Log rank test for equality of survival function

Race	Events observed	Events expected
White	2212	1733
Black	686	1108
Hispanic	434	485
Asian	40	47
Total	3372	3372

[14] The conditional distribution for $d_{1j}, \ldots, d_{pj}$ given d_j is a multivariate hypergeometric distribution which gives the conditional mean and variance of d_{ij} to be, respectively, $e_{ij} = n_{ij} d_j n_j^{-1}$ and $(W_j)_{ij} = n_{ij}(n_j - n_{ij}) d_j (n_j - d_j) n_j^{-2} (n_j - 1)^{-1}$. The conditional covariance of d_{ij} and d_{lj} is, $(W_j)_{il} = n_{ij} n_{lj} d_j (n_j - d_j) n_j^{-2} (n_j - 1)^{-1}$. The log-rank statistic is, $w = \sum_{j=1}^{k} w_j = O - E$, where, $O = (O_1, \ldots, O_p)'$ is the vector of observed number of failures, $E = (E_1, \ldots, E_p)'$ can be informally thought of as a vector of 'expected' failures, $O_i = \sum_{j=1}^{k} d_{ij}$, and $E_i = \sum_{j=1}^{k} e_{ij}$. The statistic $w_j' = (d_{1j} - e_{1j}, \ldots, d_{pj} - e_{pj})$ has conditional mean 0 and $p \times p$ variance matrix W_j. An approximate test of equality of the p survivor distributions is based on the asymptotic χ^2_{p-1} distribution for $w' W^{-1} w$, where $W = W_1 + \ldots + W_k$.

The test statistic, χ^2_{p-1} = 346.56 (where $p = 4$) has a p-value = 0.000. Thus, we reject H_0 that the survivor functions are the same among the four groups of individuals, confirming the visual inspection based on panel B of Figure 2.

Relative Risk Cox Model

We use a relative risk Cox model to analyze duration of time to first ownership. Because some of our covariates are time varying, this method differs from the simple proportional hazard analysis. We also account for right censoring.[15] Three forms of the model were tested: one where we impose the same underlying hazard rate on all respondents and include dummy variables for race/ethnicity and thus allow for a proportional shift in the hazard rate, one where we allow the hazard rate to differ by race/ethnicity, and a model where the error term is treated as a random effect (cite??). The coefficients of our explanatory variables changed little among these specifications, thus we present the results for the model with a single hazard rate.

Let $X_i(t) = \{x_i(u);\ 0 \le u < t\}$ be the covariate history of the individual *i* up to time *t*. All the covariates are assumed to be exogenous and time varying. Thus,

(3) $$P[X(t) \mid X(u), t \ge u] = P[X(t) \mid X(u), t = u], \qquad 0 < u \le t.$$

That is, the covariate may influence the rate of failure over time. Its path up to any time $t > u$ is not affected by the occurrence of a failure at time *u*. Let $Z(t)$ be derived covariates that are functions of $X(t)$ and *t*. The hazard process is given by,

(4) $$\lambda[t; X(t)]dt = P\{T \in [t, t+dt) \mid X(t), T \ge t\} = \lambda_0(t)\exp[Z(t)'\beta]dt,$$

where, $\lambda_0(t)$ is an arbitrary, unspecified baseline hazard, β is the vector of coefficients of interest and *Z* are the covariates.

The sample consists of *k* failure times $t_1 < t_2 < \cdots < t_k$ with no ties, so that the remaining $n-k$ observations are right censored. Let $R(t)$ denote the set of items at risk of failure at time just before *t*. Then, the *j*-th term in the partial likelihood is,

[15] Left censoring is not a concern because of our use of an exogenous criterion to begin each spell. However, some of the respondents already own by age 21 (?? %), and thus sample selection may be a small problem.

$$(5) \qquad L_j(\beta) = \frac{\lambda[t_j; X_j(t_j)]}{\sum_{l \in R(t_j)} \lambda[t_j; X_l(t_j)]}$$

This gives rise to the partial likelihood[16],

$$(6) \qquad L(\beta) = \prod_{j=1}^{k} \frac{\exp[Z_j(t_j)'\beta]}{\sum_{l \in R(t_j)} \exp[Z_l(t_j)'\beta]}.$$

The variance of $\hat{\beta}$ is estimated by the conventional inverse matrix of the negative second derivative of the log likelihood. We report the robust standard errors produced by STATA that is calculated by the method of Lin and Wei (1989). The estimated coefficients β measure how the logarithm of relative hazard $\lambda(t, \cdot)/\lambda_0(t)$ is affected by a unit change in the covariate. Alternatively, $\exp(\beta)$, the hazard ratio, equals the relative hazard $\lambda(t, \cdot)/\lambda_0(t)$ and not its logarithm, which yields an easier interpretation. We, therefore, present and interpret our results in terms of hazard ratios. When $\beta = 0$, the hazard ratio is 1 and for $\beta > 0$ (< 0) hazard ratio is greater (less) than 1.

For the purpose of interpreting the impact of various covariates we carry out a comparative static type exercise by calculating expected spell lengths. Let $F(t)$ be the distribution function of the failure times where (individual subscript ignored for simplicity),

$$(7) \qquad F(t) = \int_0^t \left[\lambda[t; X(t)] \exp\left(- \int_0^t \lambda[t; X(t)] dt \right) \right] dt.$$

Using estimates of $\hat{\lambda}_0(t)$ and $\hat{\beta}$ we can calculate the predicted hazard function. Once this predicted distribution function has been obtained we identify $\tilde{t}$ such that, $\hat{F}(\tilde{t}) = 0.5$. This $\tilde{t}$ can be interpreted as the expected spell length.

As comparative static exercises, we compare expected spell lengths between two groups or between two difference levels of a continuous variable. Suppose we are calculating the expected spell lengths between the Whites and the Blacks. First we calculate predicted hazard for whites and blacks separately. To predict the black hazard function, for instance, we assume that everyone

[16] The partial likelihood arises as the product of conditional probability statements but it is not directly interpretable as a likelihood in the ordinary sense of the term. However, it can be used to estimate the β because it yields asymptotic properties. See Kalbfleisch and Prentice (2002) for a detail explanations and a formal treatment.

in the sample is black with all the other covariate values remaining the same. Similarly for all the other groups that are treated by way of dummy variables.

For continuous variables, the treatment is slightly different. Suppose we are looking at regional unemployment rate. First we predict the hazard at the mean and then at mean plus one standard deviation. This way, we obtain two expected spells and their difference indicates the impact of one standard deviation increase in regional unemployment rate. Similar explanation holds for the other continuous variables. We can also calculate the predicted homeownership rates for various groups for the age interval 21 and 42. This approximation is carried out by taking an average of $\hat{F}(t)$ over this time interval.

Relative Risk Cox Estimates

We estimate two models, with the results presented in Table 2. In the first regression we include only three race dummies. In the second, we add controls for individual characteristics, location variables and macroeconomic variables. In the first regression, we find that the hazard ratio of exiting to homeownership is 52% lower for Blacks than Whites. For Hispanics it is 31% lower while for Asians it is 34% lower. These large differences are expected based on the descriptive statistics presented above. The question is whether these racial differences can be explained by the inclusion of the other covariates. In the second regression, these differences in hazard rates fall to 38%, 22% and 26%, respectively. Thus, we conclude that some, but far from all, racial differences can be attributed to the observed differences between households.

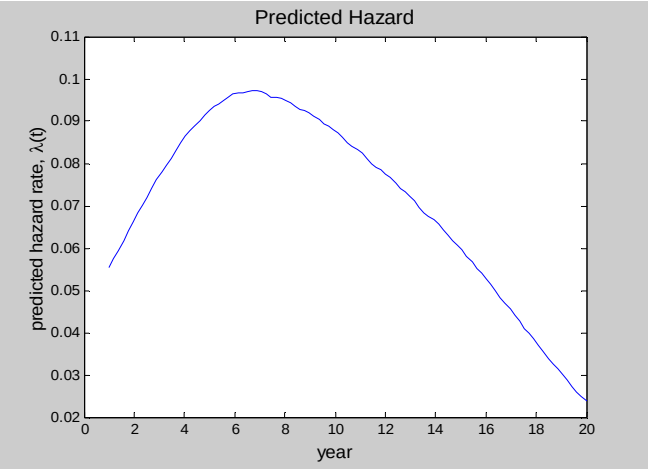


Figure 3: Predicted Hazard of Regression (2)

Table 2: Estimates of relative risk Cox model

	Regression (1)		*Regression (2)*	
	hazard ratio	P>|z|	hazard ratio	P>|z|
Black	0.4756	0.0000*	0.6247	0.0000*
Hispanic	0.6933	0.0000*	0.7826	0.0000*
Asian	0.6659	0.0070*	0.7341	0.0540*
Male	-	-	0.9365	0.0500*
First Generation	-	-	1.1384	0.1800
Second Generation	-	-	1.1815	0.0960
Parents' HGC	-	-	0.9957	0.4780
AFQT score of 1989	-	-	1.0063	0.0090*
Square of AFQT89	-	-	0.9999	0.0230*
Number of children	-	-	0.9684	0.1230
College drop out	-	-	0.9879	0.7770
College graduate	-	-	1.1912	0.0010*
Graduate school	-	-	1.2662	0.0030*
Married	-	-	2.2936	0.0000*
Widowed/separated/divorced	-	-	1.2417	0.0010*
Proportion of year worked	-	-	1.4499	0.0000*
Proportion of year unemployed	-	-	0.7260	0.0340*
Health condition	-	-	1.0664	0.4550
Annual earnings ($0,000)	-	-	1.0321	0.0000*
Other annual incomes, real ($0,000)	-	-	1.0203	0.0270*
Real annual inheritance ($0,000)	-	-	1.0271	0.0450*
Central city	-	-	0.8529	0.0000*
Suburb	-	-	0.9077	0.0400*
New England	-	-	1.1243	0.3380
Mid Atlantic	-	-	0.7477	0.0000*
West North Central	-	-	1.1676	0.0580*
South Atlantic	-	-	1.1662	0.0080*
East South Central	-	-	1.2910	0.0010*
West South Central	-	-	1.2247	0.0030*
Mountain	-	-	1.0635	0.4750
Pacific	-	-	0.6813	0.0000*
County population (00,000)	-	-	0.9991	0.4870
Regional unemployment rate	-	-	1.0180	0.2510
Regional CMHP index	-	-	1.0011	0.2260
Expected regional house price inflation	-	-	1.0151	0.0010*
National Mortgage rate	-	-	0.9367	0.0000*
1986 TRA low income interaction	-	-	0.8699	0.0030*

[* significant at 5% level]

Table 3: Estimates of relative risk Cox model with Wealth

	Regression (1)		*Regression (2)*	
	hazard rati	**P>|z|**	**hazard rati**	**P>|z|**
Black	0.6643	0.0000*	0.7137	0.0000*
Hispanic	0.8772	0.0160*	0.8550	0.0340*
Asian	0.6564	0.0140*	0.7240	0.0400*
Male	-	-	0.9348	0.0750
First Generation	-	-	0.9985	0.9890
Second Generation	-	-	1.2193	0.0700
Parents' HGC	-	-	0.9880	0.0840
AFQT score of 1989	-	-	1.0021	0.4590
Square of AFQT89	-	-	1.0000	0.2000
Number of children	-	-	0.9860	0.5620
College drop out	-	-	1.0522	0.2910
College graduate	-	-	1.2122	0.0010*
Graduate school	-	-	1.4116	0.0000*
Married	-	-	1.9311	0.0000*
Widowed/separated/divorced	-	-	1.2732	0.0010*
Proportion of year worked	-	-	1.2051	0.0220*
Proportion of year unemployed	-	-	0.7656	0.1910
Health condition	-	-	1.0984	0.3400
Annual earnings ($0,000)	-	-	1.0215	0.0000*
Other annual incomes, real ($0,000)	-	-	1.0064	0.6570
Real annual inheritance ($0,000)	-	-	0.9964	0.8370
Real net wealth ($0,000)	-	-	1.0226	0.0000*
Central city	-	-	0.8890	0.0310*
Suburb	-	-	0.9459	0.3260
New England	-	-	1.1338	0.4810
Mid Atlantic	-	-	0.7279	0.0040*
West North Central	-	-	1.1267	0.2880
South Atlantic	-	-	1.0283	0.7180
East South Central	-	-	1.1808	0.0790
West South Central	-	-	1.2017	0.0430*
Mountain	-	-	1.0019	0.9840
Pacific	-	-	0.6130	0.0010*
County population (00,000)	-	-	1.0019	0.1730
Regional unemployment rate	-	-	1.0031	0.9260
Regional CMHP index	-	-	1.0017	0.2400
Expected regional house price inflation	-	-	1.0087	0.2080
National Mortgage rate	-	-	0.8750	0.0470*
1986 TRA low income interaction	-	-	0.7540	0.0000*

[* significant at 5% level]

In regression (2), we find that a number of covariates influence the hazard ratio. The economic situation of a household matters. An additional $10,000 of real annual earnings raises the hazard rate by 3.2%. Additional other income of the same amount raises the rate by 2.0%, while an inheritance of $10,000 raises it by 2.7%. Greater work effort and less unemployment raise the hazard rate, even though earnings are controlled.

We ran separate regressions to study the importance of wealth the duration of time to first homeownership. The wealth information is available only from 1985 and, therefore, our dataset consists of respondents who reached the age of 21 on or after 1985.

The descriptive statistics results of both the full sample and the wealth sample are presented in Appendix C. If we include wealth in the estimation (Table 3), sample size is much reduced, resulting in less precise estimates. We find that an additional $10,000 of real wealth raises the hazard rate by 2.3%, but the coefficients of the other economic variables' coefficients are smaller.

The other economic measures include regional unemployment and house prices, and national mortgage interest rates and expected house price inflation. Neither of the regional variables is significant. As predicted by the models, greater expected house price inflation raises the hazard rate of becoming a homeowner (by 1.5% per percentage point of inflation). Also as expected, a greater mortgage interest rate lowers the likelihood of a transition to first-time homeownership (by 6.4% per percentage point).

We expected that the passage of the 1986 Tax Reform Act would reduce low income households' rate of movement to homeownership. This expectation is strongly confirmed in both estimations. The hazard rate is estimated to be at least 13% and up to 25% lower beginning in 1987. This result is consistent with the findings of other static studies (Follain and Ling 1991) who found the percentage of households who were homeowners fell after passage of the Act.

Among the socio-demographic variables, we find that men are 6.5% less likely to be homeowners compared with women, holding age constant. Our measure of mental ability (AFQT) has a small positive effect on the probability of becoming a homeowner. Being married has a very large influence on the hazard rate (a 130% increase in the probability of exiting to homeownership compared to those who never married). Interestingly, being divorced, separated or widowed contributes to a 24% increase in the probability of terminating a spell of living with parents or renting.

Geography and location appears to be influential determinants of transition to first-time homeownership. Central city and suburban location are less conducive compared to rural areas (by magnitude, 15% and 10%, respectively). This result for living in the central city supports the supply side argument that fewer dwellings in the central city are suitable for owner-occupancy. For regional dummies our reference group is East North Central and we see that, in comparison, Pacific and Middle Atlantic regions are at a disadvantage; they reduce the hazard ratio by 32% and 25% respectively. South Atlantic, East South Central and West South Central regions, on the other hand increase the hazard ratio by 17%, 29% and 22% respectively. These values appear to be correlated with regional house prices; however, our house price index is not significant.

Comparative Statics Exercises

Appendix D presents the predicted changes in the expected spell length based on equation (7). For changes in dummy variables, we calculate expected spell lengths and predicted homeownership rates for various groups such as racial, marital, or regional. We find that the effect of being Black, controlling for other differences between Blacks and Whites, is a 2.1 year extension of the period before first-time homeownership. This value is 41.3% greater than the average wait for Whites after age 21. Recall that this is the effect solely of the Black indicator variable; all other variables have equal values in this experiment. Other large effects on the timing of the transition are found for households in the Pacific (1.8 years) and Mid-Atlantic (1.3 years), and East South Central regions (-0.9 years). Being married speeds the time to ownership by 3.9 years compared with never having married. Living in a central city slows the transition by 0.6 years. The 1986 Tax Reform Act slowed the transition to ownership by about 0.5 years. Among the continuous variables, a one standard deviation change has a relatively small effect on the timing of the transition except for changes in the mortgage interest rate where this change slow the transition by about 8 months.

6. CONCLUSIONS AND POLICY IMPLICATIONS

We use a relative risk Cox model with flexible hazard specification to estimate the duration of time that 21 year old respondents take to become first homeowners. One focus is on explaining the large racial gap in this duration and another is measuring the effect of

Tax Act Reform of 1986 (TRA86). We use a 21 year long longitudinal data set that contains information about a large number of characteristics of the respondents' household. We append regional and national data to control for the impact of variations in macroeconomic factors that might influence the time to first ownership. Our selection of covariates in the estimation model is guided by the consumption-investment and the user cost models of tenure choice.

We find that the substantial differences in the rate that racial and ethnic groups attain first-time homeownership are only partly explained by a large number of household and macroeconomic factors. In a model that does not include a household wealth measure, only 28% of the Black-White gap in the hazard rate of exiting to ownership is explained by our covariates. The improvement in explanatory power when the covariates are included is similar for Hispanics (29%), but it is only 21% for Asians. The remaining gap is explained by omitted variables; possibilities including low wealth, discrimination, lack of knowledge of financial and real estate markets, and high mobility rates.

To include a measure of wealth, we had to use a smaller sample, but the results are fairly similar to those in the full sample. But, after adjusting for the effects on the coefficients of the race/ethnicity indicator variables, the impact of inclusion of the covariates, including wealth, is no larger than in the full sample. Just as in cross-sectional models of tenure choice, identification of the key variables that explain the racial gaps in the probability of transitioning to homeownership remain elusive. Eliminating discrimination and differences in knowledge about financial and housing markets appears to be the most likely target for public policy.

Another finding is that we confirm that the 1986 Tax Reform Act slowed the transition to homeownership by individuals who were renters prior to passage of the act. This result is consistent with other studies' findings that low income households lost their tax advantage of owning, thus lowering the probability of homeownership.

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APPENDIX A: The Data Set (1979-2000: Full Sample)

Table A1: All Race

Number of individual	4010
Number of failures	3372
Number of observations	29397
Time at risk	31459

Table A2: Unweighted Distribution By Race

Race	number	% of sample
White	2418	60
Black	996	25
Hispanic	546	14
Asian	50	1

Category	Description
Time invariant covariates	
Race	Black, Hispanic and Asian dummies (omitted: White)
Gender, *Immigration status*	One Male dummy (omitted category is female) First and second generation dummies (omitted is older generation)
Parents highest grade completed	On a scale of 0 to 20. A proxy for social background.
AFQT score of 1989	A composite score derived from an approximate and unofficial Armed Forces Qualifications Test score (AFQT) for each youth. The AFQT is a general measure of trainability on a scale of 1 to 99. Normed scores (adjusted for age differences) are reported in the survey. The test includes as components: arithmetic reasoning, word knowledge, paragraph comprehension, and numerical operations.
Individual specific covariates (Time varying)	
Family Structure	Married or divorced/separated/widowed (omitted category is never married), number of children
Education, employment	Highest grade completed, periods of employment and unemployment
Earnings etc.	Annual family earnings excluding unemployment benefits, student loans etc., other incomes from firms and businesses etc., net wealth (for 1985 onward only)
Health condition	Whether any condition that hampers work
Location (Time varying)	
MSA location	Central city and suburb (omitted category is rural)
Region *(9 divisions)*	New England, Middle Atlantic, West North Central, South Atlantic, East South Central, West South Central, Mountains, Pacific (omitted category is East North Central)
Macroeconomic variables (Time varying)	
Regional	Unemployment rate, conventional mortgage home price (CMP) index, and house price inflation
National	Mortgage rate and inflation rate of consumer price index
1986 tax reform act	Dummy variable that takes the value of 1 in 1986 and thereafter for household earnings $50,000 or less (in 2000 dollars) and 0 otherwise.

APPENDIX B: Descriptive Statistics

Table B1: Time invariant variables

	All	White	Black	Hispanic	Asian
Proportion White	0.819	1.000	0.000	0.000	0.000
Proportion Black	0.121	0.000	1.000	0.000	0.000
Proportion Hispanic	0.047	0.000	0.000	1.000	0.000
Proportion Asian	0.013	0.000	0.000	0.000	1.000
Spell length	7.424	6.889	10.518	8.438	8.557
Proportion male	0.488	0.496	0.437	0.480	0.501
Proportion 1st generation	0.020	0.008	0.011	0.220	0.195
Proportion 2nd generation	0.013	0.007	0.002	0.125	0.125
Mean parent HGC	12.699	13.097	11.452	8.921	12.828
Mean AFQT89 score	50.925	56.097	23.367	32.199	49.521
Number of observations	4010	2418	996	546	50

Note: weighted

Table B2: Time varying variables

	All	White	Black	Hispanic	Asian
Regional unemployment rate	7.275	7.332	6.954	7.147	7.163
Real Regional CMHP index	180.214	179.411	175.759	201.480	195.490
Expected regional house price inflation	5.511	5.653	4.778	4.928	5.509
County population (00,000)	7.109	6.056	9.552	18.066	11.222
Number of children	0.389	0.321	0.729	0.695	0.400
Highest grade completed (HGC)	13.120	13.229	12.702	12.261	13.241
Proportion of year worked	0.783	0.801	0.677	0.763	0.732
Proportion of year unemployed	0.056	0.049	0.101	0.059	0.060
Real annual earnings ($0,000)	2.383	2.487	1.741	2.268	2.271
Other annual incomes, real ($0,000)	0.099	0.109	0.049	0.055	0.107
Real annual Inheritance ($0,000)	0.042	0.048	0.019	0.007	0.003
Never married	0.591	0.580	0.689	0.521	0.607
Married	0.338	0.353	0.220	0.380	0.297
Widowed/divorced/separated	0.071	0.066	0.091	0.099	0.095

Note: weighted

Table B3: Regional Distribution

	All	White	Black	Hispanic	Asian
Central city	0.442	0.405	0.622	0.602	0.491
suburb	0.337	0.361	0.199	0.285	0.284
Rural	0.222	0.234	0.179	0.114	0.225
New England	0.027	0.030	0.008	0.017	0.035
Mid Atlantic	0.157	0.164	0.136	0.112	0.085
East North Central	0.234	0.258	0.148	0.046	0.205
West North Central	0.078	0.089	0.027	0.026	0.068
South Atlantic	0.202	0.186	0.371	0.067	0.128
East South Central	0.057	0.053	0.106	0.001	0.004
West South Central	0.084	0.066	0.144	0.245	0.092
Mountain	0.046	0.047	0.007	0.133	0.039
Pacific	0.115	0.106	0.053	0.352	0.344

Note: weighted

Notes:

(1) All the financial variables are CPI 2000 deflated.

(2) For a time varying variable, a sample mean doesn't have any obvious interpretation in this kind of a sample. Table A3 and A4 present mean values over the spell of time to first ownership for a typical individual. For example, in table A3 the first row is the mean regional unemployment rate and it says that an individual of any rate faces an average regional unemployment rate of 7.275% over the spell of time to first ownership.

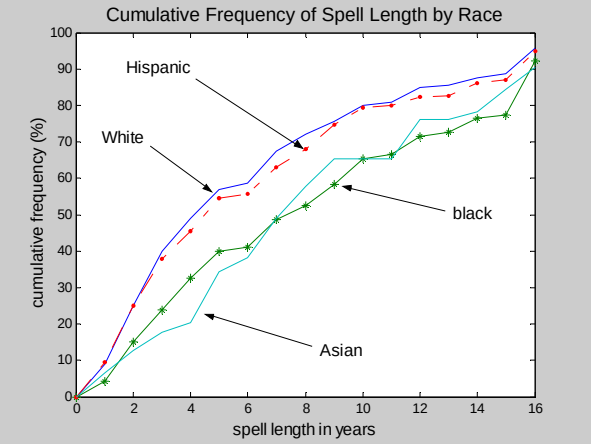
APPENDIX C: The Wealth Sample (1985-2000)

Unweighted mean spells

Race	nobs	mean spell
White	1819	5.5
Black	543	7.5
Hispanic	389	6.0
Asian	38	7.5
All race	2789	6.0

Unweighted Survival

Survival time		
25%	50%	75%
2	4	9



Note: weighted

Time invariant variables	All	White	Black	Hispanic	Asian
Proportion White	0.849	1.000	0.000	0.000	0.000
Proportion Black	0.092	0.000	1.000	0.000	0.000
Proportion Hispanic	0.045	0.000	0.000	1.000	0.000
Proportion Asian	0.014	0.000	0.000	0.000	1.000
Spell length	5.944	5.770	7.383	5.920	7.090
Proportion male	0.517	0.524	0.452	0.530	0.493
Proportion 1st generation	0.020	0.007	0.008	0.249	0.150
Proportion 2nd generation	0.017	0.010	0.002	0.118	0.176
Mean parent HGC	13.027	13.349	11.875	9.003	13.866
Mean AFQT89 score	54.897	58.695	30.226	33.390	55.476
Number of observations	2789	1819	543	389	38

Note: weighted

Time varying variables	All	White	Black	Hispanic	Asian
Regional unemployment rate	6.597	6.584	6.557	6.905	6.651
Regional CMHP index	186.046	185.846	177.644	202.423	201.039
Region house price inflation	6.530	6.752	5.075	5.067	7.276
County population (00,000)	7.695	6.827	9.373	19.671	11.158
Number of children	0.412	0.363	0.699	0.782	0.288
Highest grade completed (HGC)	13.631	13.705	13.398	12.586	13.970
Proportion of year worked	0.854	0.856	0.847	0.840	0.800
Proportion of year unemployed	0.039	0.037	0.052	0.044	0.044
Annual real earnings ($0,000)	3.074	3.112	2.743	2.919	3.449
Other annual incomes, real ($0,000)	0.147	0.157	0.086	0.075	0.191
Real inheritance per year ($0,000)	0.076	0.087	0.011	0.037	0.004
Real annual net wealth ($0,000)	1.813	1.928	0.878	1.375	2.394
Never married	0.523	0.521	0.577	0.425	0.570
Married	0.400	0.405	0.330	0.466	0.318
Widowed/divorced/separated	0.078	0.074	0.094	0.108	0.112

Note: weighted

Regional Distribution	All	White	Black	Hispanic	Asian
Central city	0.457	0.432	0.615	0.588	0.527
suburb	0.362	0.379	0.240	0.305	0.322
Rural	0.181	0.189	0.145	0.107	0.151
New England	0.026	0.029	0.008	0.012	0.006
Mid Atlantic	0.172	0.185	0.103	0.080	0.159
East North Central	0.231	0.249	0.144	0.046	0.277
West North Central	0.080	0.090	0.018	0.026	0.038
South Atlantic	0.189	0.172	0.416	0.071	0.124
East South Central	0.052	0.051	0.090	0.000	0.000
West South Central	0.080	0.065	0.144	0.239	0.041
Mountain	0.050	0.049	0.009	0.142	0.065
Pacific	0.121	0.110	0.069	0.384	0.290

Note: weighted

APPENDIX D: Comparative Statics Exercises with the full sample (without wealth)

Table D1: Comparative Statics (dummy variables)

	expected spell length	Difference with the reference category		Predicted rate of home-ownership (age 21-42)
		level	%	
Regression (2)	5.22	-	-	0.68
White (reference category)	4.95	-	-	0.71
Black	6.93	1.98	40.06	0.58
Hispanic	5.86	0.92	18.51	0.65
Asian	6.14	1.19	24.10	0.63
Female (reference)	5.16	-	-	0.69
Male	5.40	0.24	4.66	0.67
Third or older generation (reference)	5.29	-	-	0.68
First generation	4.84	-0.45	-8.51	0.71
Second generation	4.72	-0.57	-10.78	0.72
High school or less	5.39	-	-	0.67
College dropout	5.44	0.05	0.88	0.66
College graduate	4.77	-0.62	-11.58	0.71
Graduate school	4.57	-0.82	-15.21	0.73
Rural (reference)	4.70	-	-	0.72
Central city	5.24	0.55	11.70	0.68
Suburb	5.02	0.32	6.92	0.69
East north central (reference)	5.11	-	-	0.69
New England	4.72	-0.39	-7.66	0.72
Mid Atlantic	6.28	1.17	22.95	0.62
West north central	4.60	-0.51	-9.97	0.73
South Atlantic	4.60	-0.51	-9.90	0.73
East south central	4.30	-0.81	-15.78	0.75
West south central	4.46	-0.65	-12.79	0.74
Mountain	4.90	-0.21	-4.12	0.71
Pacific	6.74	1.63	31.86	0.59
Never married (reference)	7.59	-	-	0.54
Married	4.07	-3.52	-46.39	0.76
Widowed/divorced/separated	6.35	-1.24	-16.34	0.60
No health condition (reference)	5.03	-	-	0.69
Health condition	4.81	-0.22	-4.40	0.71
Without TRA86	5.12	-	-	0.68
With TRA86	5.68	0.56	10.99	0.64

Table D2: Comparative Statics (Continuous Variables)

	expected spell length	Difference with the reference category		Predicted rate of home-ownership (age 21-42)
		level	%	
Regression (2), (reference category)	5.22	-	-	0.68
Parents' HGC	5.28	0.05	1.01	0.68
AFQT89 score	5.26	0.04	0.79	0.68
Number of children	5.34	0.12	2.24	0.68
Earnings	4.97	-0.25	-4.85	0.70
Other Income	5.15	-0.07	-1.41	0.69
Inheritance	5.15	-0.07	-1.36	0.69
Proportion of year worked	4.98	-0.24	-4.59	0.70
Proportion of year unemployed	6.53	1.31	25.00	0.60
County population	5.28	0.06	1.06	0.68
Regional unemployment rate	5.11	-0.11	-2.17	0.69
Regional CMHP index	5.07	-0.16	-2.98	0.70
Expected house price inflation	4.97	-0.25	-4.77	0.70
Mortgage rate	5.87	0.65	12.36	0.64

Note: Except for proportion of year worked or unemployed, in all cases the difference is that of 1 standard deviation from the full sample statistics. In cases of proportion of year worked or unemployed, the difference is between the sample mean and full proportion. Also, all the financial variables are deflated with base year 2000.