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Housing Demand, Housing Wealth, and Public Policy

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Abstract

This dissertation comprises three papers on housing demand, housing wealth, and public policy. The first two papers make use of veteran access to the VA Loan Guaranty Program during the post-war housing boom during the 1940s and 1950s. The findings show that, for both World War II and Korean War veterans, access to the VA loan program promoted household formation. Specifically, access to the program increased an individual's probability of both marriage and homeownership relative to comparable individuals who did not have access to the program. The third paper analyzes the impact of the Deficit Reduction Act of 2005's change in the status of housing equity as a protected asset in determining Medicaid long-term care payment eligibility. The impact of the policy on the housing equity holdings of individuals likely to require long-term care is estimated across three dimensions: before versus after the policy change, above versus below the eligibility cutoff, and a variety of self-reported health measures. The findings show that the policy induced individuals above the policy cutoff who were likely to require long-term care to hold less housing equity than comparable individuals who were either below the eligibility cutoff or did not report a health measure.

HOUSING DEMAND, HOUSING WEALTH, AND PUBLIC POLICY

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DISSERTATION

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Chapter 1

Housing Demand, Housing Wealth, and Public Policy

The overarching theme of this dissertation is how public policy affects housing demand and housing wealth, both directly and indirectly. Chapters 2 and 3 analyze how mortgage subsidy programs promote household formation. Both chapters make use of the Veteran's Administration (VA) Loan Guaranty Program, which provided mortgage subsidies to returning veterans during the post-war housing boom. Chapter 2 analyzes this relationship among veterans of World War II, and Chapter 3 analyzes this relationship among veterans of the Korean War. Chapter 4 considers the implicit tax imposed by Medicaid means-testing to test whether households likely to require long-term care reduce housing equity.

Public policy related to homeownership has largely focused on expanding ownership through government intervention in mortgage markets since the 1940s. The impact of mortgage subsidies on household formation has been largely understudied in economics, even though household formation is a key determinant of housing demand. Chapters 2 and 3 analyze the relationship between mortgage subsidies and marriage for World War II and Korean War veterans, respectively. Access to the VA Loan Guaranty Program among veterans provides exogenous variation to identify this relationship. Given that the probability of military service fell dramatically at the termination of each war, this paper makes use of birth cohort variation to identify the relationship between mortgage subsidies and marriage rates.

Among World War II veterans in Chapter 2, cohort differences are associated with an increase in marriage rates of 1.4 percentage points. Instrumental variables analysis suggests that veteran status is associated with an 11 percentage point increase in marriage rates. In addition, cohort differences are associated with an increase in homeownership of 7.7 percentage points.

Using instrumental variables, the transition from renter to owner is associated with an increase in the probability of marriage of 18 percentage points. Lastly, analysis of cohort differences at different ages suggests that these effects attenuate as individuals get older.

Qualitatively similar results are found for the Korean War cohorts in Chapter 3. Cohort differences are associated with an increase in marriage rates of 6 percentage points. Instrumental variables analysis suggests that veteran status is associated with an 38 percentage point increase in marriage rates. In addition, cohort differences are associated with an increase in homeownership of 10 percentage points. Using instrumental variables, the transition from renter to owner is associated with an increase in the probability of marriage of 63 percentage points.

Chapter 4 analyzes the impact of the Deficit Reduction Act of 2005's change in the status of housing equity as a protected asset in determining Medicaid long-term care payment eligibility. Prior to this change, individuals could use the housing asset as a shelter in order to qualify for Medicaid long-term care payments. I use a variety of self-reported health measures and employ a differencing methodology to estimate the impact of the policy on the housing equity holdings of individuals likely to require long-term care. Using a panel of unmarried homeowners from 2004 and 2006, I estimate that the policy induced individuals above the policy cutoff who were likely to require long-term care to hold less housing equity by values of between $82,000 and $220,000. This equates to reductions of 23-62% for this group relative to comparable homeowners during this period. These estimates are substantially larger than earlier estimates of housing equity reductions in the context of Medicaid policy and confirm the importance of the housing asset as a shelter for Medicaid eligibility.

Chapter 2
Do Mortgage Subsidies Promote Household Formation? Evidence from World War II Cohorts

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2.1. Introduction

Federal housing policy in the United States has advocated for increases in home ownership since the post-war housing boom in the 1940s and 1950s. Much of the focus of policy has been on expanding ownership through government intervention in mortgage markets. A long literature exists in urban and housing economics that has studied the role of mortgage subsidies on home ownership (e.g., Dietz and Haurin, 2003; Fetter, 2013). One relationship, which has been largely overlooked in the economics literature, is the impact of these policies on household formation—a key determinant of housing demand (Haurin and Rosenthal, 2007). This paper makes use of veteran access to the Veteran's Administration (VA) Loan Guaranty Program during the post-war housing boom to analyze the impact of mortgage subsidies on marriage rates.

The loan program was initiated through the passage of the Serviceman's Readjustment Act (GI Bill) on June 22, 1944—approximately one year prior to the end of war—and represented a major government intervention in the mortgage market during the post-war period. First, the VA loans transformed mortgage markets. Prior to the late 1940s, residential mortgages were non-amortizing with short terms of 5-10 years, variable interest rates, and loan-to-value ratios of 50% or less. Entering the 1940s and the post-war period, mortgage product terms changed significantly. Mortgages were fully amortized and featured longer terms of 30 years, fixed interest rates over the life of the loan, and loan-to-value ratios of up to 95% (Green and Wachter, 2005). Second, VA loans were available for an extended period, well into the late 1950s. [1] Veterans who may not have been able or willing to enter into homeownership directly following their return from service, particularly younger cohorts of veterans, could make use of

[1] Initially, the VA loan program was designed to be a short-term readjustment benefit available for two years after the termination of war. In 1945, the program was changed to a longer-term benefit, whereby eligible veterans were given until 1955 (ten years after the termination of war) to make use of the program.

the program at a later point in time. Third, the loan program was large in scope as it was available to almost all of the 16 million World War II (WWII) veterans. This was approximately 31 percent of the adult male population in 1950.

The purpose of program was to increase access to mortgage credit among returning servicemen. Veterans were offered relatively favorable loan terms to promote home buying. Meanwhile, mortgage lenders received a guaranty of repayment on at least a portion of the home mortgage. In principle, loans were available for home purchases, farm purchases, opening a small business or other business investments. However, in practice, loans were taken out almost exclusively for the purpose of non-farm home purchases.

Fetter (2013) used the VA loan program to explain changes in the age distribution of homeownership between 1940 and 1960. Using a regression discontinuity approach based on differences in the probability of veteran status across birth cohorts, he estimated the probability of homeownership among veterans coming of age before and after the termination of war. He found that GI Bill benefits shifted the distribution of homeownership to younger ages between 1940 and 1960. Those coming of age prior to the termination of the war had a homeownership rate that was 13 percentage points higher in 1960 than otherwise similar men who came of age after the war ended. What remains an open question is the extent to which these mortgage subsidies may have affected the rate of marriage, independent of and in combination with homeownership.

The current paper makes use of Census microdata (Ruggles et al., 2015) to analyze the relationship between mortgage subsidies, homeownership, and marriage. Time-series analysis of the period 1900-1960 shows a strong, positive correlation between mortgages, homeownership, and marriage rates. Most of this growth occurred from 1940 to 1960, at the same time the VA

loan program was expanding. Unfortunately, simple time-series analysis is not sufficient to establish a causal relationship: other confounding factors may have driven the trends observed in the data.

This paper attempts to identify the causal relationship between mortgage subsidies and marital status using plausibly exogenous variation in access to the VA loan program that varied by an individual's year and quarter of birth. In particular, from March, 1942, through June, 1947, military service in WWII was determined by an individual's date of birth (Angrist and Kruger, 1994), and the probability of military service decreased substantially at the termination of WWII. In combination, cohorts who came of age after the termination of war were significantly less likely to be eligible for the VA loan program. Moreover, among those coming of age prior to the termination of WWII, individuals born earlier in any calendar year were more likely to be drafted than those born later in the same year. This allows for a between-cohort comparison of veterans and non-veterans, as has been used in earlier studies, such as Bound and Turner (2002) and Fetter (2013).

There are three primary findings. First, cohorts coming of age prior to the termination of war experienced increases in marriage rates by between 1-2 percentage points in 1960 for 30-35 year old men. For men of similar ages in the 1940 Census, the mean marriage rate was approximately 81%. By dividing the parameter estimate by the 1940 baseline mean (i.e., 0.01/0.81), being in the pre-end-of-war cohort raised marriage rates by 1-2%. Instrumental variables estimates show that eligibility for the VA loan program as proxied by veteran status was associated with an 11 percentage point increase in marriage rates. By dividing the parameter estimate by the mean marriage rate in 1940, being a veteran increased the probability of marriage by approximately 14 percentage points. Second, coming of age prior to the termination of war

increased the probability of homeownership by 8 percentage points in 1960 for 30-35 year old men. The mean marriage rate for men of similar ages in the 1940 Census was approximately 21%. By dividing the parameter estimate by the 1940 baseline mean, this is an increase in homeownership of approximately 33%. Instrumental variables analysis implies that the transition from renter to owner is associated with an increase in the probability of marriage of up to 18 percentage points. Finally, using multiple Census cross-sections from 1950-1980, estimation of the relationship between cohort differences and marriage for the same group of individuals at different ages implies that coming of age prior to the termination of war had a larger impact on marriage rates at earlier ages. Over calendar time, as these individuals age, the effects attenuate.

An area of concern is whether there exists other service related factors that may have also been correlated with marriage. If the exclusion restriction holds, then the estimate captures the true effect of the VA loan program on marriage. One possibility is whether being a veteran, in general, influences an individual's probability of being married. In order to test this, the analysis includes two robustness checks to pick up this veteran effect. The first re-estimates the effect for World War I cohorts. These men did not have access to GI Bill-equivalent benefits. The second uses automobile ownership as a placebo test. Automobile ownership is tied to credit markets, but not mortgage markets. Thus, if the VA loan program serves as a mortgage market intervention, then it should not affect credit markets more generally. Neither of these tests shows evidence of a veteran effect being associated with the probability of marriage.

The remainder of the paper is outlined as follows: Section II provides time series evidence; Section III provides an overview of the size and details of the VA home loan program; Section IV reviews identification and the empirical methodology; Section V provides a discussion of the results; Section VI performs various robustness checks; Section VII performs

analysis on effects over time; Section VIII provides additional evidence from the Survey of Consumer Finance; and Section IX concludes.

2.2. Time Series Evidence

2.2.1. Marriage and Homeownership

Figures 2.1.a-c display aggregate rates of owner-occupancy and marriage among the adult male population in the United States taken from 1900-1960 decennial Censuses.[2] Figure 2.1.a is the sample of all adult males; figure 2.1.b is for adult males age 35 and under; and figure 2.1.c is for adult males over age 35. Among all adult males, owner-occupancy rates remained fairly steady in the period prior to the 1930s. From 1940 to 1960, there was a major movement toward homeownership. Rates of owner-occupancy increased approximately 25 percentage points among adult men. For males 35 and under, as well as those over 35, there is a large increase in homeownership between 1940-1960. This indicates that increases in ownership are not being driven by a particular age group.[3]

Figure 2.1.a shows that marriage and owner-occupancy rates track one another closely. Among all males, marriage rates were trending slightly upward prior to 1940, then experienced a large increase from 1940-1960. In the latter period, marriage rates increased approximately 10 percentage points. Among males 35 and under, marriage rates display a similar pattern. Importantly, the jump in marriage is much sharper for this group over the period 1940-1960. Among males over 35, rates of marriage show no such pattern, and the trend is only slightly upward-sloping. This suggests that the increase in marriage rates is being driven by the younger group of individuals over the period of analysis.

[2] The 1950 Census does not include information owner-occupancy and living arrangements.
[3] The post-war growth in homeownership has been widely studied in urban and housing economics (Fetter, 2013; White, Snowden, and Fishback, 2014), as well as real estate economics (Klaman, 1961; Green and Wachter, 2003).

2.2.2. Household Formation

In order to better understand living arrangements among individuals, it is useful to look at household formation defined as being the head of household, Figures 2.2.a and 2.2.b show the rate of headship among married and non-married men in 1940 and 1960, respectively. For unmarried men, at younger ages the rate of headship is low. Unmarried men begin establishing headship around age 20. By age 35, 15% of unmarried men are heads of household. By age 50, 40% of unmarried men are heads of household. A different picture is seen for married men. At age 20, 45% of married men are heads of household. By age 50, 95% of married men are heads of household. This suggests a strong, positive correlation between marriage and headship in the period prior to WWII. Unmarried individuals are significantly more likely to be in shared living arrangements. In 1960, headship becomes more concave at earlier ages. This suggests the relationship between marriage and headship strengthened for younger men between 1940 and 1960.

Figures 2.3.a and 2.3.b, decompose headship into owner versus renter status for 1940 and 1960, respectively. In 1940, the figure shows that among married men, establishing a household is largely associated with renting between the ages of 18-44. After age 44, married households are more likely to own homes. In 1960, the shift from renter to owner happens between the age of 27 and 28. Furthermore, rates of ownership among married households are higher at all ages. For unmarried men under age 50, the probability of renting is slightly larger than that of owning. After age 50, unmarried men are more likely to own. In 1960, increases in rates of headship for unmarried men under age 50 are driven by renters. While the gap between renting and owning widens for this group, unmarried men remain significantly less likely to establish a household

than married men at all ages. After age 50, ownership becomes more likely among unmarried men.

2.2.3. Marriage Markets

Another consideration is potential changes in the market for marriage between 1940 and 1960. Figure 2.4 shows the distribution of spousal age differences among married households where the husband is between 18-35 years old. Spousal age difference is calculated by taking the husband's age in years minus the wife's age in years. The left panel corresponds to 1940, and the right panel corresponds to 1960. In 1940, the mean spousal age difference is approximately 3 years. This means that ,on average, the husband was three years older than their wife. A large portion of married men also married women who were the same age (0), one year younger (1), and two years younger (2). In 1960, the distribution in spousal age differences becomes more narrow. A larger proportion of men are marrying women of the same age or within three years younger. The mean spousal age difference decreases to approximately 2.

Figures 2.5.a and 2.5.b decompose the wife's academic achievement by husband's academic achievement for married couples where the husband is between ages 18-35 in 1940 and 1960, respectively. The x-axis corresponds to the husband's education level and the y-axis corresponds to the wife's education level. In 1940, 78% of men with less than a high school diploma were married to women with less than a high school diploma, 16% were married to women with a high school diploma, 2% were married to women with some college, and less than 1% were married to women with a college degree. For men who completed high school, 36% were married to women with less than a high school diploma, 50% were married to women who completed high school, 10% were married to women with some college, and 2% were married to women who completed college. Among men with some college, 21% were married to women

with less than a high school diploma, 40% were married to women who completed high school, 28% were married to women with some college, and 10% were married to women who completed college. For men who completed college, 11% were married to women with less than a high school diploma, 30% were married to women who completed high school, 24% were married to women with some college, and 14% were married to women who completed college.

In 1960, more than 62% of men who earn less than a high school diploma are married to women with less than a high school diploma. Approximately 30% are married to women who completed high school, and few of these men are married to women with any college schooling. For men who complete high school, 29% are married to women who have less than a high school diploma, 60% are married to women who completed high school, 8% are married to women with some college, and few are married to women who completed college. Among men with some college, 18% are married to women with less than a high school diploma, 50% are married to women who completed high school, 23% are married to women with some college, and about 7% are married to women who completed college. Among men who completed college, 5% are married to women with less than a high school diploma, 30% are married to women who completed high school, 25% are married to women with some college, and close to 30% are married to women who completed college. This is evidence of a strong, positive correlation between the husband's educational attainment and the wife's educational attainment. Furthermore, this relationship appears stronger in 1960 than in 1940.

2.3. The VA Loan Guaranty Program

Eligibility for GI Bill benefits was widespread in order to ease the transition of military personnel back into civilian life. The initial legislation deemed individuals eligible if they served

in the armed forces of the United States at any point between September 16, 1940, and July 25, 1947. Eligibility further required that individuals maintained active service for at least ninety days and were not dishonorably discharged, or were discharged due to an injury or disability incurred during military service. The VA estimated there were close to 16 million WWII veterans in 1947 who were eligible for the VA loan program (Department of Veteran's Affairs, 1947).

Within the GI Bill, two popular programs among younger veterans were educational subsidies and loan guaranties. The former provided an annual allowance for education and job training for up to four years, along with a small monthly stipend that varied based on whether an individual had dependents. The latter was known as the VA Loan Guaranty Program. For borrowers, the program offered access to favorable credit, enabling veterans to purchase a home, perform home improvement, or invest in business capital. For lenders, any loans taken out were guaranteed or insured by the VA up to a pre-approved amount.

2.3.1. Loan Terms and Trends

There were three primary phases of legislation relating to VA loan terms. In the initial legislation, terms included a maximum interest rate of 4% and maximum loan maturity of 20 years. The guaranty was set at the lesser of 50% of the cost or $2000 for home loans.[4] Furthermore, all eligible veterans were able to apply for a loan within two years from separation of service or two years after the war ended, whichever was later. Next, the GI Bill was amended in 1945. [5] Maximum interest rates remained unchanged, but maximum loan maturities were

[4] Using the 1940 Census microdata and the Shiller House Price Index, the median home value in 1945 was approximately $3,231.

[5] According to the VA, the primary reason for amending the initial legislation was that the $2000 guarantee limit was not large enough to support homeownership among recently discharged veterans. Another issue was that of the 20-year maturity period. Given that the average veteran income was small, this duration left monthly payments high relative to the income earned by veterans. Thus, under the initial program, the average veteran was not able to make use of the program (*Department of Veteran's Affairs*, 2006).

increased to 25 years. The guaranty amount was increased to the lesser of 50% of the cost or $4000. More importantly, veterans were given ten years after the termination of war to apply for the program—pushing the eligibility window back to 1955.[6] Finally, the VA Loan Guaranty Program was amended in 1950, whereby loan maturities were increased to 30 years and the maximum loan guaranty limit was increased to the lesser of 60% of the cost or $7500.[7]

As a whole, for borrowers, the consumption-saving tradeoff encountered by first-time home buyers for a down payment was largely eliminated for eligible veterans. The GI Bill relaxed the down payment constraint making entry into homeownership easier for these households. This is particularly important for younger households who were less likely to have accrued sufficient savings for a down payment outside of the VA loan program. For lenders, the guaranty provided protection against potential default, which incentivized the offering of mortgage loans to these veterans.

Figure 2.6 shows total VA loan applications and those for home purchases from 1946-1957. There are three spikes in loan applications. The first occurs in 1946, shortly after the termination of war. The second occurs in the middle of the Korean War in 1951. The last is in 1955, approaching the expected termination of the benefit program.[8] Additionally, the majority of loan applications were for the purchase of a new or existing home. The length of the program was such that takeup occurred well into the 1950s.

Figure 2.7 shows a time series of the dollar value of outstanding mortgage debt from 1936-1952 using data from Grebler, Blank, and Winnick (1956). The solid line represents all

[6] Maximum interest rates on VA home loans remained unchanged over this period and until 1953 when they were increased to 4.5%.
[7] In 1957, the GI Bill would once again be amended to allow WWII veterans until July of 1958 to apply for a VA loan. And, again, in 1958, extending eligibility to July of 1960.
[8] The program benefit was expected to end in 1957 although in that same year the benefit would be extended indefinitely.

mortgage debt, and the long-dashed line represents all non-VA mortgage debt. The blue vertical line at 1945 indicates the start of the VA Loan Guaranty program. The dotted line represents outstanding debt held through VA mortgages. The value of VA mortgage debt grew from the start of the program through 1952. At the same time, non-VA mortgage lending was increasing.

2.3.2. Program Take-up

Table 2.1 shows estimates of VA home loan take-up by calendar year from 1945-1957.[9] These estimates align well with the temporal variation in homeownership and marriage rates observed in Figure 2.1. Approximately 12% of WWII veterans had made use of the VA loan program for the purchase of housing by 1950; by the end of 1957, one-quarter of living WWII veterans had made use of the program.[10]

Tables 2.2.a and 2.2.b show tabulations of VA home loan take-up among veterans by age group for 1950 and 1960, respectively. Among younger cohorts, the loan program experienced substantial growth between 1950 and 1960. Take-up is relatively low, at approximately 5.5%, for individuals under age 35 in 1950. Between 1950 and 1960, this group experienced substantial gains of over 15 percentage points. Individuals between the ages of 35-44 experienced similar gains, with approximately 7 percent takeup in 1950 and 18 percent takeup in 1960. In comparison, for individuals between the ages of 45-64, combined takeup was approximately 16% in 1950, and this proportion decreased 2 percentage points in 1960. Table 2.3 shows similar tabulations over the population of all men.

[9] These estimates likely underestimate actual program take-up as they do not account for veterans who may have been ineligible for the program for various reasons.

[10] After 1957, the Department of Veteran's Affairs no longer provided a breakdown of the annual loan applications.

2.4. Identification

While time-series analysis shows a strong, positive correlation between mortgages, homeownership, and marriage rates, the potential for omitted factors makes establishing a causal relationship difficult based on this evidence alone. For example, growth in earnings, productivity, and non-VA mortgages may have generated increases in homeownership and marriage. Fetter (2013, 2014) also shows that a substantial amount of growth in owner-occupancy occurred from 1940-1945. This may suggest that homeownership was trending upward prior to the VA loan programs existence.

In an attempt to circumvent these potential confounders, this paper uses a comparison of marriage and homeownership among veterans relative to non-veterans, with identification relying on variation in veteran status by year and quarter of birth. A large proportion of men coming of age between 1941 and 1945 were veterans and had access to the VA home loan program. Men coming of age after the war ended in 1945 experienced a much lower probability of having access to these benefits because they were less likely to have served in the armed forces.

In Figure 2.8, the solid line shows the proportion of veterans in WWII by year and quarter of birth in the 1960 Census. The dashed line includes veterans who served in the Korean War.

Starting with the cohort of men born in the first quarter of 1913 (1913Q1), the probability of military service in WWII was approximately 40%. Among men born in 1913Q1-1919Q4, the probability of military service increases significantly and almost doubles to 80%. For cohorts born in 1920Q1-1926Q4, the probability of military service is relatively flat near 80%. For individuals serving in WWII only and born in 1928Q1 or later, the probability of military service

in WWII falls to zero. Including service in the Korean War follows a similar pattern, although, for those born in 1928Q1 or later, the probability of military service falls to roughly 60%. The sharp decrease in military service occurs within the 1927 birth cohort. These individuals came of age near the end of WWII in 1945, with some turning 18 before the end of war and some after the end of war. The termination of war in Figure 2.8 is marked by the solid vertical line. This paper follows Fetter (2013) in designating the end of war as falling between 1927Q4-1928Q1.[11]

Figure 2.9.a shows the proportion of veterans among all men, along with aggregate homeownership and marriage rates for veterans relative to non-veterans in 1960 by year and quarter of birth, starting in 1913Q1 and ending in 1932Q4. The solid vertical line drawn between 1927Q4 and 1928Q1 indicates the approximate termination of World War II. For the earliest cohorts, the ratio of homeownership and marriage for veterans relative to non-veterans lies at one (parity). In other words, for birth cohorts unaffected by the run-up in military service, the rate of homeownership and marriage for veterans and non-veterans was the same. As the demand for military service increased by year of birth, a large run-up occurred for all three measures in the figure. That is, veterans were more likely to own a home and be married compared to non-veterans born in the same year. After the end of war, the graph shows sharp decreases in all three measures, whereby marriage returns to parity. The manner in which marriage rates track homeownership and veteran status is striking.[12]

The sharp decrease in veteran status at the termination of war (approximately 1945Q4) exemplifies the between-cohort variation used in this study. Individuals born prior to the

[11] Fetter (2013) determines these cutoffs using structural break estimation techniques based on the probability of veteran status (see Chay, McEwan, and Urquiola, 2005; Card, Mas, and Rothstein, 2008).

[12] Another consideration is the quality of marriages among veterans compared to non-veterans. Figures 1.A1-1.A3 in the appendix show aggregate rates of veteran status and divorce by quarter-and-year of birth for 1960-1980, respectively. No evidence is seen of a relationship between veteran status and the probability of divorce relative to nonveterans in any year.

termination of war had a substantially larger probability of military service than those born after the war ended. There are two subsamples of interest used in this paper, which include men born between 1925Q1-1930Q4 and 1923Q1-1932Q4.[13] These subsamples are chosen following earlier studies in the literature on GI Bill benefits, specifically Bound and Turner (2003) and Fetter (2013). The second sample is restricted to individuals born before 1932Q4 in order to avoid potential confounding effects from changes in the demand for military manpower observed during the Korean War. These cohorts are denoted by the yellow and green pairs of lines, respectively. Cohorts of men born prior to 1923Q1 are not included in the analysis because, among this group, a large proportion selected into military service.[14] Figure 2.9.b is similar to Figure 2.9.a, but restricts the variables to the subsamples of interest.

The reduced-form estimating equation, indexed by individual i, is the following:

$$Marriage_i = \beta_0 + \beta_1 Pre\_EOW_i + \boldsymbol{X}'\boldsymbol{\delta} + \varepsilon_i \qquad (1)$$

where $Marriage$ is an indicator equal to 1 if individual i is married, Pre_EOW is an indicator equal to 1 if individual i came of age prior to the WWII break, $\boldsymbol{X}$ is a matrix of controls, including a state of birth fixed effect, and ε is an error term. The coefficient of interest is β_1, which represents the impact of military service on the probability of marriage.

Time-series evidence from Figure 2.6 shows that program takeup occurred well into the 1950s and points to using the 1960 Census microdata for the primary analysis in this paper. The 1960 data is a 1% representative sample of the U.S. population. The sample is restricted to white men born in the United States who are non-institutionalized. The primary analysis makes use of the subsample of men born (coming of age) over the period 1925-1930 (1943-1948). For

[13] The analysis has also been performed for the sample of individuals born between 1919Q1-1932Q4, following Almond (2006). In general, the results are quantitatively similar for subsamples falling between 1919Q1-1932Q4.
[14] Angrist and Krueger (1994) show that positive selection into military service resulted in improved outcomes for these veterans relative to nonveterans.

robustness, the subsample is extended to men born (coming of age) between 1923-1932 (1941-1950). Summary statistics are reported in Table 2.4 for the primary sample group (born 1925-1930). .

2.5. Results

2.5.1. Reduced-Form Estimates for Marriage

Table 2.5 reports reduced-form estimates of equation (1) for the primary sample in the 1960 Census.[15] Reported standard errors are heteroscedasticity-robust and clustered at the year-by-quarter of birth level.[16] Column (1) reports unconditional estimates of marriage on the pre-end-of-war indicator. Birth cohorts coming of age prior to the end of war experienced an increase in marriage rates of approximately 3 percentage points. The inclusion of state-of-birth fixed effects in column (2) and quarter-of-birth fixed effects in column (3) has almost no effect on these estimates. These are modest increases in the probability of marriage, given an average of over 80% for men of similar ages in the 1940 Census microdata.

The GI Bill also included education and training benefits available to eligible veterans. These were largely taken up for postsecondary education. Figure 2.10 displays aggregate rates of veteran status and educational attainment by year of birth in 1960 for birth years 1923-1932. Educational attainment of less than high school, high school completion, or some college does not seem to be correlated with the demand for military service. The relative rates of attainment for these groups are flat. Among individuals who completed college, there is evidence of a relationship with the demand for service. For this group, a large drop in the relative rate of

[15] Probit estimates for marriage and homeownership are qualitatively the same. Marginal effects from the probit model are reported in appendix Table 1.A1.
[16] Earlier studies rely on traditional heteroskedasticity-robust standard errors. These standard errors are typically larger, but do not affect the level of statistical significance for estimates in the primary analysis of equation (1).

attainment is seen at the termination of WWII, similar to the sharp decrease observed for homeownership.

Although the GI Bill affected the educational attainment of male veterans of WWII, education and income are highly correlated with the decision to marry. Thus, including income and education controls reduces the potential for omitted-variable bias, independent of any relationship with the GI Bill. The inclusion of a linear income control in column (3) reduces the estimated effect on marriage substantially. Columns (4)-(8) report conditional estimates of equation (1) using an extensive combination of income and education controls, including up to a quartic in income, and education interacted with income. Overall, the estimates are robust to the various sets of income and education controls. The effect of coming of age prior to the termination of WWII on marriage rates is between 1-3 percentage points. In the preferred specification, reported in column (8), the estimated effect is 1.4 percentage points. Given a mean rate of marriage of 80.1% for men of comparable ages in 1940, this estimate represents a modest increase in the rate of marriage of approximately 1.7%.

2.5.2. Veteran Status and Instrumental Variable Estimates

To estimate the impact of eligibility for the VA loan program on marriage rates, the following estimating equation, indexed by individual *i*, can be used:

$$Marriage_i = \tau_0 + \tau_1 Veteran_i + \boldsymbol{X}'\boldsymbol{\omega} + \varepsilon_i \qquad (2)$$

where the coefficient of interest is τ_1. This parameter describes the effect of being a veteran on the probability of marriage. A long literature exists in labor economics that addresses the potential for positive selection into military service (e.g., Angrist, 1989; Angrist, 1990; Angrist and Krueger, 1994), making OLS estimation of τ_1 in equation (2) biased. The pre-end-of-war

indicator can be used as an instrument for veteran status as has been done in prior studies (Bound and Turner, 2002; Fetter, 2013).

Using the preferred specification, reduced-form and instrumental variable estimates are reported in Table 2.6. Column (1) reports the first-stage estimate of veteran status on the pre-end of war indicator. Coming of age prior to the termination of WWII increases an individual's probability of being a veteran by approximately 13 percentage points compared to individuals who came of age after the end of war. Column (2) repeats reduced-form estimates of marriage on the pre-end-of-war indicator, similar to those reported in column (8) of Table 2.5. Column (3) reports the instrumental variables estimate of τ_1. Eligibility for the VA loan program as proxied by being a veteran increases the probability of marriage by approximately 11 percentage points. Furthermore, from Table 2.2, the takeup rate among men 30-35 years old is 17%. This gives an approximate treatment-on-the-treated of 65%.

2.5.3. Homeownership and Instrumental Variable Estimates

Given that the VA loan program was expected to increase the rate of homeownership, the relationship between year of birth and the probability of homeownership can also be estimated, similar to Fetter (2013). This relationship is described by the following equation, indexed by individual *i*,

$$Own_i = \rho_0 + \rho_1 Pre\_EOW_i + \boldsymbol{X}'\boldsymbol{\mu} + \varepsilon_i \qquad (3)$$

where the coefficient of interest is ρ_1. Estimates of ρ_1 are reported in column (1) of Table 2.7. Individuals coming of age prior to the end of war experienced an increase in homeownership of approximately 7.7 percentage points. This estimate is slightly smaller than in Fetter (2013).[17]

[17] The difference is small in economic terms, but may be attributed, to the inclusion of income and education controls.

Given a mean homeownership rate of 24% for men of comparable ages in 1940, this is equivalent to an increase in homeownership of about 30%.

The VA loan program also can be used to estimate the effect of mortgage subsidies on marriage rates through the homeownership channel. This relationship is described by the following estimating equation, indexed by individual *i*,

$$Marriage_i = \alpha_0 + \alpha_1 Own_i + \boldsymbol{X}'\boldsymbol{\theta} + \varepsilon_i \qquad (4)$$

where the parameter of interest is α_1, which describes the effect of transitioning from renter to owner on the probability of marriage. This assumes that the expectation of homeownership is followed by the joint decision to marry and own a home, regardless of which event occurred first. Given that mortgage subsidies improved both the expectation and realization of homeownership, instrumental variables can be used to estimate the relationship between marriage and homeownership. Column (3) of Table 2.7 reports instrumental variables estimates of α_1 in equation (4). Homeownership increases the probability of marriage by 18 percentage points.[18]

2.6. Robustness Checks

2.6.1. Sample Selection

Column (1) of Table 2.8 reports estimates of equation (1) using the sample of men born (coming of age) between 1923-1932 (1941-1950). This increases the window of analysis to five years before and after the termination of WWII, respectively. The lower bound of 1923 follows Bound and Turner (2003); the upper bound of 1932 is meant to reduce the potential for confounding effects due to service in the Korean War. For this sample of individuals, coming of

[18] Eriksen (2010) estimates a similar relationship using a randomized control trial of Individual Development Accounts. He estimates that homeownership is associated with an increase in the probability of marriage of between 37-47 percentage points.[18] While these estimates are in a slightly different context, they provide at least some comparison of the relationship between homeownership and marriage.

age prior to the termination of WWII increases marriage rates by approximately 2.4 percentage points. This is an increase of approximately 3% based on men of comparable age ranges in 1940. The difference between the larger and smaller sample is economically small in magnitude.

Another potential concern is that some men may have been married prior to or during the war. For these men, it is difficult to establish a causal relationship between the VA mortgage subsidy and marriage. This is important because if the expectation of homeownership promotes marriage, then the effect should be observed, particularly, for men not married prior to or during service. Figure 2.11.a shows the relationship between veteran status, homeownership, and marriage for the subsample of men married after the passage of the GI Bill. The cohort effects seen in Figure 2.9 also exist among this subsample of men. The estimate of equation (1) restricted to the subsample of men married after the GI Bill's passage is reported in column (2) of Table 2.8. The estimated effect on marriage of coming of age prior to the termination of war is 1 percentage point. Figure 2.11.b performs a similar exercise for the subsample of men married after the end of war (VJ Day). The estimate of equation (1) restricted to this subsample of men is reported in column (3) of Table 2.8. The estimated effect on marriage of coming of age prior to the termination of war is approximately 0.7 percentage point.

2.6.2. Automobile Usage

Between 1940 and 1960, automobile ownership was increasing substantially. According to the U.S. Census bureau, in 1940, real consumer expenditure on automobiles was approximately $4.7 million; in 1950, expenditures increased to $14.1 million; and, in 1960, expenditures increased to 17.7 million.[19] The GI Bill did not provide direct subsidies to automobile markets. Thus, the observed time-series increases should not be directly related to GI Bill benefits. Automobile ownership can be used to test whether the VA home loan program is

[19] Reported dollar values are in 1960 real dollars.

truly a mortgage market intervention, rather than this effect being generated through credit markets as a whole. In addition, automobile ownership can be used to test for effects from service. If veterans are different than nonveterans, then cohort differences in automobile ownership might be observed.

It is possible that automobile ownership was indirectly affected by the GI Bill mortgage subsidies. First, if individuals are moving to areas farther from the central city, then automobile ownership may complement homeownership. Second, because VA mortgage subsidies functioned through a relaxation of the budget constraint for eligible individuals, this may have made more money available for the purchase of automobiles. Therefore, if cohort differences are not found for automobile ownership, then it provides a strong test of the hypothesis that the GI Bill affected credit markets more generally.

Figure 2.12 shows the rate of ownership of any automobile for veterans relative to non-veterans. The graph also includes the relative rate of marriage and overall proportion of veterans. For automobile ownership, there appears to be a small decrease at the war break. However, this decrease is substantially smaller than the drop in marriage rates. There is similar evidence of a downward trend beginning in 1925, so this decrease may be reflecting the observed downward trend.

According to the 1949 Survey of Consumer Finances, only 3% of households owned more than one automobile. Thus, it is appropriate to estimate potential cohort differences along the margin of whether a household owns any automobile. In order to estimate this relationship, the marriage indicator is substituted with an indicator for whether the individual owns an automobile on the left-hand side of equation (1). The automobile indicator is equal to 1 if the household owns at least one automobile and equal to zero if they do not own an automobile. The

reduced-form estimate of any automobile ownership on the pre-end-of-war indicator for the primary sample is reported in column (3) of Table 2.8. The estimate is close to zero and statistically insignificant. This suggests that there is no difference in automobile ownership among individuals coming of age prior to the termination of war versus those who came of age after the war. Thus, eligibility for the VA home loan program is likely responsible for the observed increases in homeownership and marriage.

2.6.3. Cohort Effects in World War I

Estimation of cohort effects for men serving in World War I (WWI) can be used to test whether cohort differences in marriage rates arise strictly due to military service. A GI Bill equivalent did not exist for veterans of WWI. Therefore, cohort differences are unlikely to be attributed to veterans' benefits. Given that WWI ended in November of 1918, cohort differences can be observed for individuals turning 21 years old three years before and after the end of WWI.[20]

Using the 1930 Census data, the sample of analysis is the 1894-1899 birth cohorts. This makes individuals comparable in age to the WWII birth cohorts observed in 1960. Due to data limitations, equation (1) is estimated controlling only for state-of-birth fixed effects. Column (3) of table 2.9 reports a cohort difference of 3.1 percentage points for men coming of age prior to the end of WWI compared to men coming of age after the war. Column (1) reports the comparable estimate for WWII in 1960, which is 2.6 percentage points. Thus, service in WWI has a larger impact on marriage rates across cohorts. Upon closer examination, the cohort difference from service in WWI seems to be driven by men who were married prior to the termination of war. Column (4) shows that the cohort difference is -1.9 percentage points when the sample is restricted to men who were married after the end of war. In contrast, for individuals

[20] For almost all of WWI conscription, individuals had to be at least 21 years old to serve.

who were married after the end of WWII, the cohort difference falls to 1.8 percentage points (column (2)). This makes it difficult to attribute the cohort difference observed in the WWI sample to service effects. A more likely explanation is selection into military service.

2.6.4. Estimation using Quarterly Variation in the Demand for Military Service

After March of 1942, service in the armed forces was determined based on an individual's date of birth, where individuals born earlier in the year had a higher probability of being drafted. Therefore, access to GI Bill benefits was also a function of an individual's month of birth for cohorts born (coming of age) in 1924 (1942) or later. While the primary estimates rely on between-cohort variation, it is important to account for potential variation by quarter-of-birth.

An alternative to estimating equation (1), indexed by individual *i*, is

$$Marriage_i = \gamma_0 + \gamma_1 Pre\_EOW_i + \gamma_2 PreEOW * QOB1_i + \boldsymbol{X}'\boldsymbol{\varphi} + \varepsilon_i \qquad (5)$$

where $\gamma_1$respresents the marginal effect for individuals coming of age prior to the end of WWII who were not born in the first quarter of a calendar year; and the coefficient of interest, γ_2, is the additional marginal response for similar individuals who were born in the first quarter of the calendar year. In order to identify off of quarter of birth, year-of-birth fixed effects are included in equation (5) and quarter-of-birth fixed effects are not included.[21]

Table 2.10 reports the reduced-form estimates of equation (5) for the primary sample. The estimate of $\gamma_1$is approximately 1 percentage point. Individuals coming of age prior to the end of WWII who were not born in the first quarter of a calendar year were 1 percentage point more likely to be married than individuals not born prior to the termination of war. The estimate

[21] . More specifically, this allows for quarterly variation in the demand for military service among cohorts serving in WWII, but restricts this variation in the post-period. The first quarter within the calendar year is used due to the fact that individuals born in the first quarter have the highest probability of being drafted into service than all other quarters.

of γ_2 is 0.5 percentage point. Individuals who were born in the first quarter of the calendar year and prior to the termination had an additional increase in the probability of marriage of 0.5 percentage points. Therefore, a higher probability of military service, as proxied by being born in the first quarter of the calendar year, generates a total increase in marriage rates of approximately 1.5 percentage points. Column (2) re-estimates equation (5) with an independent effect from being born in the first quarter of the calendar year. The estimates show that inclusion of this control reduces the estimate of $\gamma_2$from equation (5) to zero.

2.7. Extensions

The final portion of this study analyzes the relationship between mortgage subsidies and marriage at different points in the lifecycle. This analysis follows from the tenure transition literature (Artle and Varaiya, 1978), which investigates the household decision to enter into homeownership using a lifecycle model. For households entering into homeownership, the timing of entry is determined by the household's asset accumulation relative to the down payment constraint. One prediction of this model is that, all else equal, a smaller down payment should reduce the time to initial home purchase. In the context of this paper, mortgage subsidy programs, such as the VA home loan program, function largely through reductions in the down payment constraint. Consequently, the VA loan program is expected to promote larger increases in homeownership at younger ages. Fetter (2013) calibrates a variant of the tenure choice model based on housing market characteristics in 1960. He shows that the age profile of homeownership becomes more concave at younger ages as the down payment constraint is reduced. This affirms that a reduction in the down payment constraint will be greater at earlier

points in the lifecycle than at later points. A similar effect should be anticipated for the marriage decision.

Equation (1) is re-estimated for the primary sample using decennial Census data for 1960-1980 in order to analyze the impact of cohort differences on household formation at different ages for the same birth years. These estimates are reported in Table 2.11. In 1970, the sample is between the ages of 40-45, and the estimated effect decreases to almost zero. In 1980, individuals are between the ages of 50-55. For this Census year, the estimate becomes negative and, again, is very close to zero. The attenuated effect of mortgage subsidies on marriage rates provides suggestive evidence that mortgage subsidy programs have larger impacts on household formation at earlier points in the lifecycle.

2.8. Evidence from the Survey of Consumer Finances

Data from the Survey of Consumer Finances (SCF) from 1950-58 provides information on marriage, homeownership, and VA loan takeup. The SCF is a nationally representative sample of dwelling units, reported annually.[22] Sample units are reported using information for the head of household.[23] The sample includes demographic information and housing information, such as previous and present homeownership, mortgage characteristics, and duration of tenure. This section makes use of the SCF data to analyze the relationship between VA loan takeup, veteran status, and marriage and homeownership. Not all variables are available in each year, limiting the number of years for some portions of the analysis. Summary statistics for SCF homeowners in 1955 and 1956 are reported in Table 1.A2 in the appendix.

[22] The SCF was reported annually from 1948-1983.
[23] The head of household is most likely to be the husband, main earner, or owner of the home.

2.8.1. VA Loan Takeup and Veteran Status

In order to assess the differential probability of VA loan takeup among veterans, the following estimating equation is considered, indexed by individual,i, and time, t:

$$VA\ Loan_i = \beta_0 + \beta_1 Veteran_i + X'\delta + \varepsilon_{it} \qquad (6)$$

where VA Loan is an indicator equal to 1 if the individual reported using a VA loan and zero otherwise; veteran is an indicator equal to 1 if the individual is a veteran and zero otherwise; X is a vector of controls, including education groups and a year fixed effect; and ε is a random error term.

Due to the potential for selection into military service, equation (1) is estimated by instrumenting for veteran status based on an individual's age. The SCF provides age information in five year groups for 1955-58. The data are restricted to the 25-29 and 30-34 age groups.[24] The latter is defined as the pre-WWII cohort and considered more likely to have served in the war. The former is defined as the post-WWII cohort and considered less likely to have served in the war. Thus, the instrument is defined by an indicator equal to 1 if the individual is in the 30-34 age group and equal to zero if the individual is in the 25-29 age group.

Instrumental variables estimates for equation (1) are reported in Table 2.12. Column (1) reports the first-stage regression of veteran status on the pre-war indicator. Individuals in the high probability of service cohort were 10 percentage points more likely to be veterans than individuals in the low probability of service cohort. Column (2) reports the reduced form regression of VA loan takeup on the pre-WWII indicator. Individuals with a high probability of military service were 4 percentage points more likely to use a VA loan than individuals in the low probability of service cohort. Column (3) reports the instrumental variables estimate, which

[24] These age groups are consistent across the four years. The SCF does not provide individual level information on year of birth.

is equivalent to dividing the estimate in column (2) by the estimate in column (1). As proxied by the pre-WWII indicator, veterans were 46 percentage points more likely to take up a VA loan than non-veterans. [25]

2.8.2. VA Loan Takeup and Marriage

In order to assess the differential probability of marriage based on VA loan takeup, the following estimating equation is considered, indexed by individual,i, and time, t:

$$Marriage_i = \alpha_0 + \alpha_1 VA\ Loan_i + X'\pi\ + \vartheta_{it} \qquad (7)$$

where Marriage is an indicator equal to 1 if the individual is married and equal to zero otherwise; VA Loan is an indicator equal to 1 if the individual reported using a VA loan and zero otherwise; X is a vector of controls, including education groups and a year fixed effect; and ϑ is a random error term. Equation (2) is estimated by instrumenting for VA Loan takeup based on the pre-WWII indicator as described in the prior subsection.

Instrumental variables estimates for equation (2) are reported in Table 2.13. Column (1) reports the first-stage regression of VA loan takeup on the pre-war indicator. Individuals in the high probability of service cohort were 5 percentage points more likely to use a VA loan than individuals in the low probability of service cohort. Column (2) reports the reduced form estimates of marriage on the pre-WWII indicator. Individuals in the high probability of service cohort were 1 percentage point more likely to be married than individuals in the low probability of service cohort. Column (3) reports the instrumental variables estimate, which is equivalent to dividing the estimate in column (2) by the estimate in column (1). As proxied by the pre-WWII indicator, individuals who reported using a VA loan were 16 percentage points more likely to be

[25] Given a first-stage F-statistic of 6.92, the pre-WWII indicator appears to be a weak instrument. This is likely due to the age groups not aligning exactly with the WWII break based on year of birth, which occurs between 1927Q4 and 1928Q1. For example, in 1955, individuals in the high probability group were born in 1921-1925 and in the low probability group were born in 1926-1930.

married than those who did not use a VA loan. However, the first-stage F-statistic of 0.89 indicates that the pre-WWII indicator is a weak instrument for VA loan takeup.

2.8.3. Homeownership and Marriage

Using the SCF data, the relationship between homeownership and marriage is re-estimated to confirm earlier findings in the decennial Census data. Instrumental variables estimates for the relationship between marriage and homeownership, as proxied by the pre-WWII indicator are reported in Table 2.14. Column (1) reports the first-stage regression of homeownership on the pre-WWII indicator. Individuals in the high probability of service cohort were 18 percentage points more likely to be homeowners than individuals in the low probability of service cohort. Column (2) reports the reduced form estimates of marriage on the pre-WWII indicator. Individuals in the high probability of service cohort were 6 percentage points more likely to be married than individuals in the low probability of service cohort. Column (3) reports the instrumental variables estimate, which is equivalent to dividing the estimate in column (2) by the estimate in column (1). The transition from renter to homeowner is associated with a 34 percentage point increase in the probability of marriage. This estimate is larger than that found in the decennial Census data and may be due to differences in how the pre-WWII indicator is defined.[26]

2.8.4. Timing of Homeownership and Marriage

Using information on the timing of marriage and homeownership, SCF data can also be used to better understand the mechanism by which VA loans promoted marriage. If access to the VA program affected the expectation of homeownership, then the program may have promoted marriage directly. This is true if veterans married knowing they could enter into homeownership

[26] Year of birth and single-year age are not available in the SCF. High probability versus low probability are based on the assigned SCF age groups. The proportion of individuals born before and after the 1927Q4 break varies by data year.

shortly after. On the other hand, the VA program may have indirectly promoted marriage through the homeownership channel. This is true if veterans used the program to enter into homeownership then decided to marry.

The SCF provides information on the number of years the individual has been married and the approximate year of home purchase. These variables are used to determine whether individuals entered into marriage or homeownership first.[27] The following estimating equations, indexed by individual, i, and time, t, are used to analyze these relationships:

$$Marry\ Before\ Own_{it} = \alpha_0 + \alpha_1 High\ Probability_{it} + X'\theta + \vartheta_{it} \quad (8)$$

$$Marry\ After\ Own_{it} = \beta_0 + \beta_1 High\ Probability_{it} + X'\delta + \varepsilon_{it} \quad (9)$$

where $Marry\ Before\ Own$ in (3) is a dummy variable equal to 1 if the individual was determined to have entered married before entering into homeownership and zero otherwise; $Marry\ After\ Own$ in (4) is a dummy variable equal to 1 if the individual was determined to have entered into marriage after homeownership and zero otherwise;[28] $High\ Probability$ is a dummy variable equal to 1 if the individual has a high probability of military service and zero otherwise; X is a matrix of controls, including education and a year fixed effect; ϑ and ε are random error components. The probability of military service is determined for each year-by-age-group cell using data from the 1950 decennial Census. High probability is defined as being above the median service probability. Data from the 1950-1958 SCF cross-sections are used to analyze these relationships.

[27] For marriage timing, year ranges are consistent across data years. For homeownership timing, year ranges are not consistent across data years. This inconsistency creates a number of indeterminate cases, which cannot be used in the empirical analysis.

[28] A third case is where individuals married in the same year they entered into homeownership. The number of cases in which this occurs is small.

Estimates of equations (3) and (4) are reported in columns (1) and (2) of Table 2.15, respectively. The estimate of α_1 in equation (3) is 0.038. Individuals in the high probability group were 4 percentage points more likely than low probability individuals to marry before owning. The estimate of β_1 in equation (4) is 0.003. There is no statistical difference between individuals in the high probability and low probability group in terms of marrying after owning. Column (3) in Table 2.15 includes a third group where individuals marry and own in the same year. For this group, the estimated effect is -0.041, meaning that high probability individuals were less likely than low probability individuals to marry and own in the same year. Overall, these results point to the mechanism being a direct effect of VA loans on marriage rates.

Next, equations (3) and (4) are re-estimated for each of 1952 and 1957. For both of these years the SCF age groups align with the sharp decrease in the demand for service that occurs between 1927Q4 and 1928Q1. In 1952, individuals are grouped into 10 year age groups so the analysis makes use of the 18-24 and 25-34 age groups. These groups correspond to birth years 1928-1934 and 1918-1927, respectively. In 1957, individuals are grouped into 5-year age groups so the analysis makes use of the 25-29 and 30-34 age groups. These groups correspond to birth years 1928-1932 and 1923-1927, respectively. High probability is equal to 1 if the individual was born in 1927 or earlier and zero if they were born after 1927.

Results for 1952 are reported in panel a of Table 2.16. The estimate of α_1 is 0.053, indicating that the high probability group was 5 percentage points more likely to marry before owning than the low probability group. The estimate of β_1 is -0.077, indicating that the high probability group was 8 percentage points less likely than the low probability group to marry after owning. Column (3) shows that the high probability group was 2.3 percentage points more likely to marry and own in the same year than the low probability group.

Results for 1957 are reported in panel b of Table 2.16. The estimate of α_1 is 0.368, indicating that the high probability group was 37 percentage points more likely to marry before owning than the low probability group. The estimate of β_1 is -0.178, indicating that the high probability group was 8 percentage points less likely than the low probability group to marry after owning. Column (3) shows that the high probability group was 19 percentage points less likely to marry and own in the same year than the low probability group.

Overall, the results from 1952 and 1957 appear to support the findings from the pooled year regressions, whereby the high probability group is more likely to be marry prior to entering into homeownership. Furthermore, comparing the 1952 and 1957 yearly estimates, differences in the magnitude of the effects are likely to arise from two factors. First, the narrower age groups in 1957 provide a closer comparison with respect to identifying these relationships. Second, by 1957, more veterans will have been able to make use of the VA loan benefit than were able in 1952.

2.9. Conclusion

This paper presents estimates of the relationship between mortgage subsidies and household formation. Using veteran access to the VA Loan Guaranty Program, cohorts with a higher probability of VA loan eligibility (i.e., came of age prior to the end of WWII) had a higher probability of marriage by 1.4 percentage points compared to those less likely to be eligible for the VA loan program. Instrumental variable analysis shows that differences in program eligibility, proxied by veteran status, increase the probability of marriage by 1 percentage point. Given an approximate program takeup rate of 17 percent among veterans under

age 35 in 1960, the estimates imply a treatment-on-the-treated impact of 65%. A second finding is that coming of age prior to the termination of war is associated with increases in homeownership of 7.7 percentage points. Given a homeownership rate of 24% among men of similar ages in 1940, this is equivalent to an increase of approximately 33% at the mean. Instrumental variable analysis implies that becoming a homeowner is associated with an 18 percentage point increase in the probability of marriage. Lastly, analysis of cohort differences at different ages for the same birth cohorts suggests that these effects attenuate with age.

This study provides evidence that exogenous household formation may not be an appropriate assumption in the context of tenure choice (Bourassa, 1995; Hendershott et al., 2009; Painter and Lee, 2009). Accounting for these decisions jointly may be a more practical approach (Borsch-Supan, 1986; Hendershott, 1987; Haurin et al., 1993,1994). A more recent literature has analyzed economic impacts on household formation (Lee and Painter, 2013; Choi and Painter, 2014). A better understanding of the relationship between homeownership and household formation is useful.

Another consideration is how mortgage subsidy programs affect the household portfolio. By entering into homeownership earlier, households may hold more housing than is mean-variance efficient (Brueckner, 1997; Flavin and Yamashita, 2001). They may also hold fewer investments in stocks (Fratantoni, 1998; Yamashita, 1998; Chetty and Szeidl, 2007). The short-term and long-term impact of mortgage subsidy programs on the household portfolio remains an open question. Similarly, considerations for the private and social welfare consequences of mortgage subsidy programs merit further investigation. Changes in the consumption and investment demand for housing may enhance private welfare. At the same time, homeownership

has been shown to provide positive externalities (Dietz and Haurin, 2003). Thus, mortgage subsidy programs may enhance both private and social welfare.

There are three major caveats to the analysis in this paper. First, household formation defined through marriage may not be useful in understanding the dynamics of household formation today. Further research should be performed in this area using more recent data and with consideration for other aspects of household formation (e.g., cohabitation among non-married partners). Second, the empirical analysis contains limited information on VA loan takeup. The Census data does not include detailed questions on loan type. Using the SCF some insight is gained, however, the data is limited in size and only available for a few years. Thus, pinpointing the exact mechanism through which household formation is affected is difficult. Use of individual data on VA loan takeup would enhance this analysis and provide a clearer picture of the relationship between household formation and mortgage subsidies. Third, given that education benefits available to veterans may have also affected marriage rates, endogenous education may bias results. Including an instrument for education attainment would be useful to improve estimates of the effect of the VA loan program on marriage. Estimates reported in this paper may be considered an upper bound if increases in educational attainment are associated with higher rates of marriage.

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Figure 2.1.a

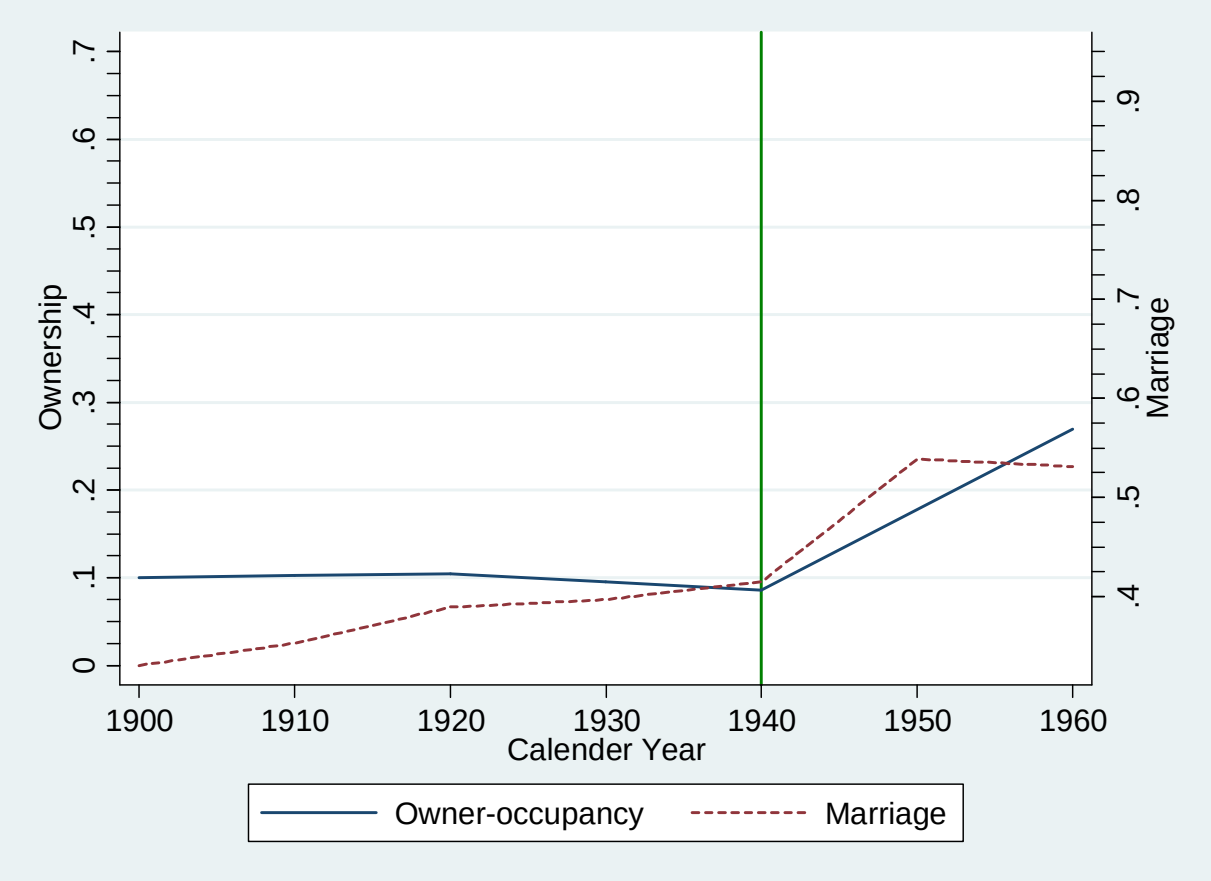
Rate of Owner Occupancy and Marriage Among Adult Males, 1900-1960

Source: IPUMS USA 1900-1960

Note: The rate of owner-occupancy is defined as male heads of household who report living in an owner-occupied dwelling. Marriage is defined as being currently married and does not include individuals who report being divorced, separated, or widowed.

Figure 2.1.b

Rate of Owner Occupancy and Marriage Among Males Age 35 and Under, 1900-1960



Source: IPUMS USA 1900-1960

Note: The rate of owner-occupancy is defined as male heads of household who report living in an owner-occupied dwelling. Marriage is defined as being currently married and does not include individuals who report being divorced, separated, or widowed.

Figure 2.1.c

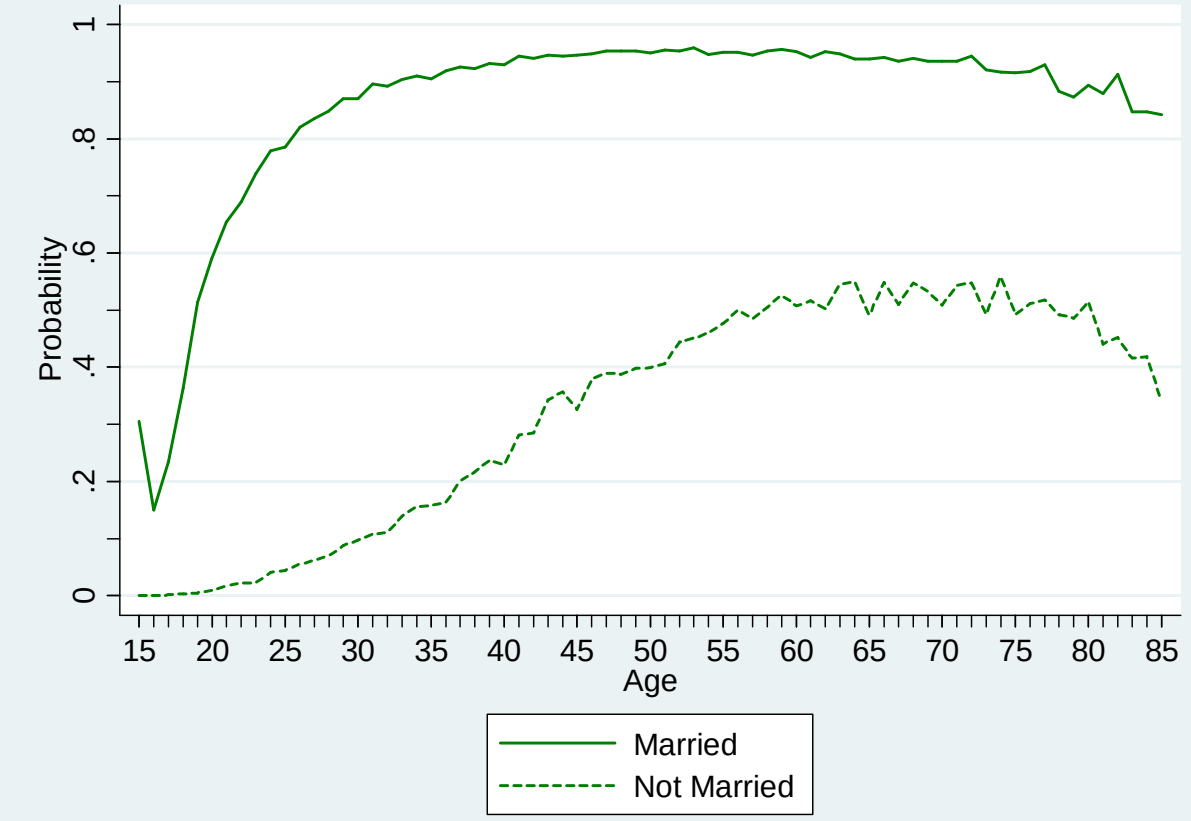
Rate of Owner Occupancy and Marriage Among Males Over 35 Years of Age, 1900-1960

Source: IPUMS USA 1900-1960

Note: The rate of owner-occupancy is defined as male heads of household who report living in an owner-occupied dwelling. Marriage is defined as being currently married and does not include individuals who report being divorced, separated, or widowed.

Figure 2.2.a

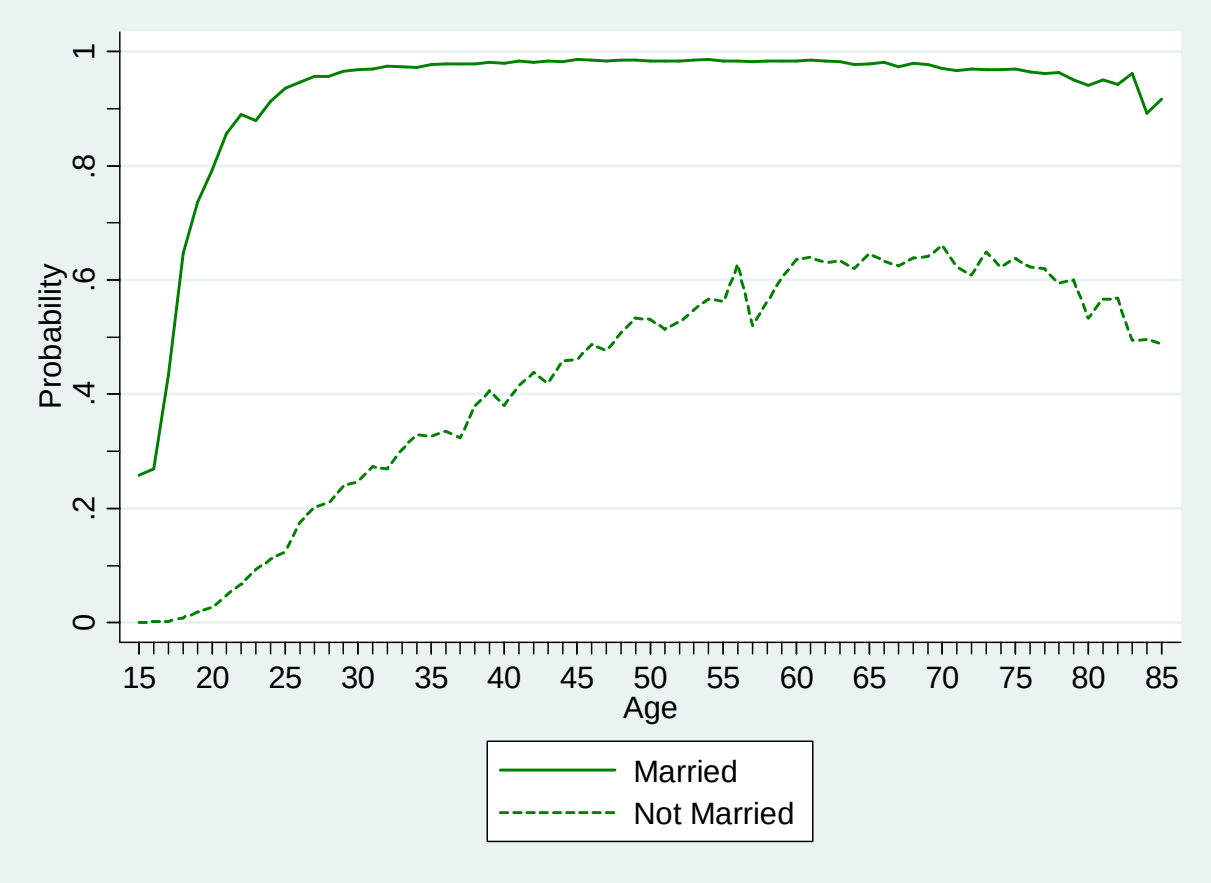
Rate of Headship among Married and Non-Married Men by Age, 1940



Source: IPUMS USA 1940

Figure 2.2.b

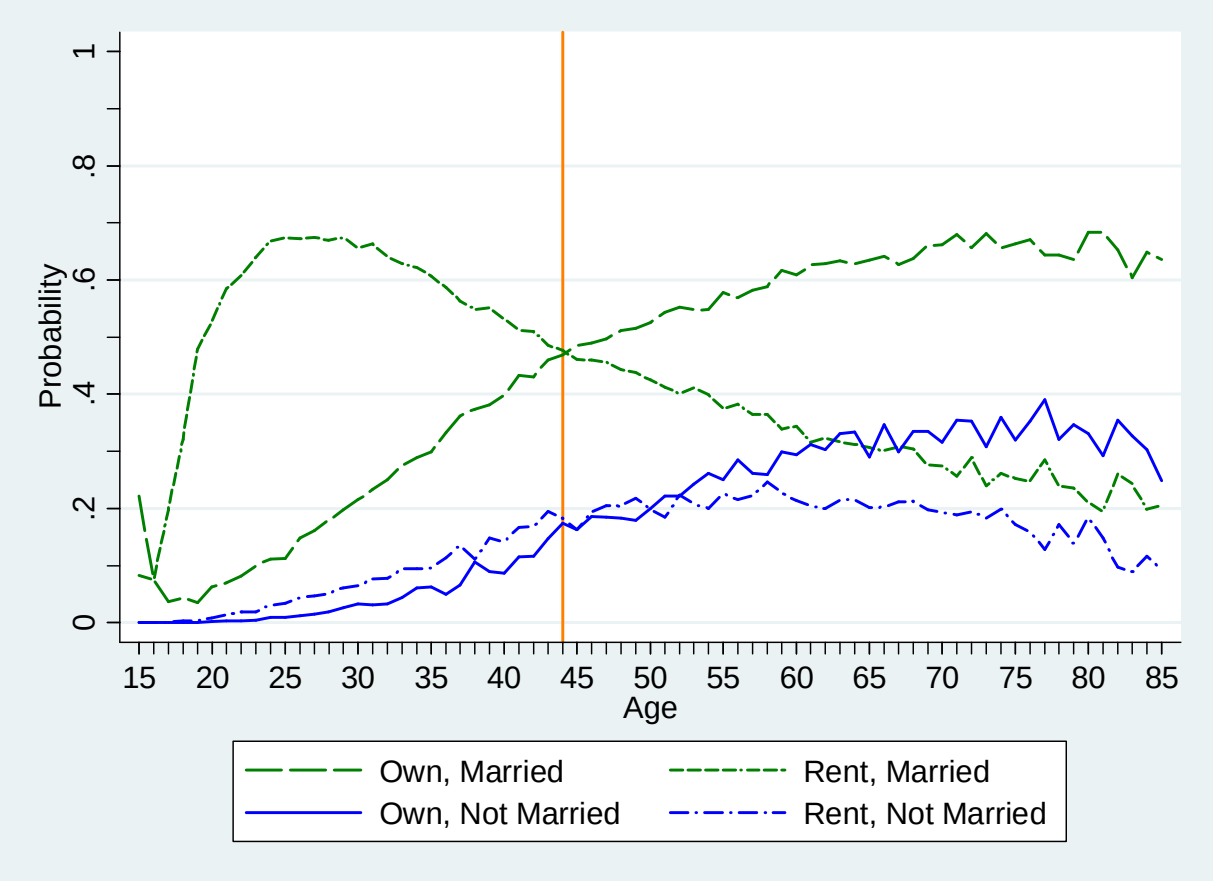
Rate of Headship among Married and Non-Married Men by Age, 1960



Source: IPUMS USA 1960

Figure 2.3.a

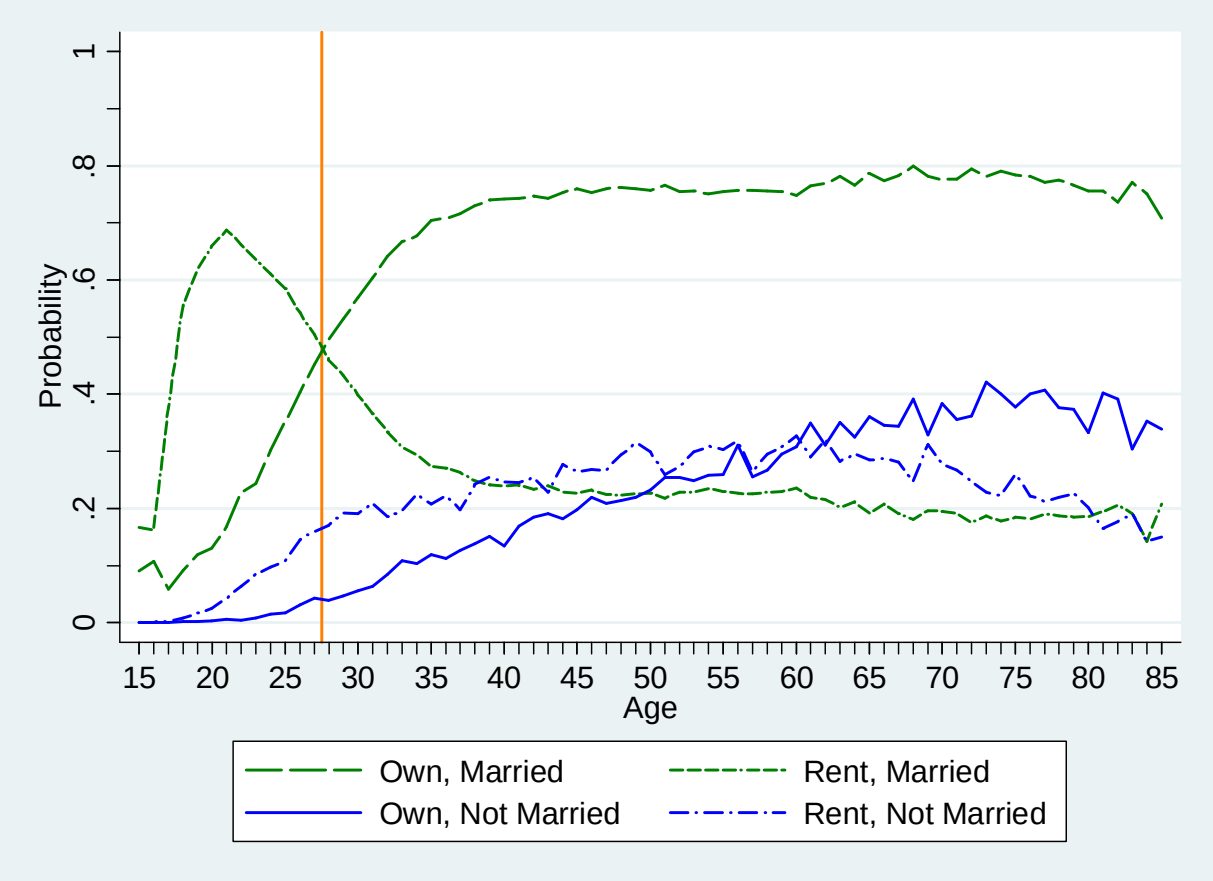
Rate of Ownership and Rental among Married and Non-Married Men by Age, 1940



Source: IPUMS USA 1940

Figure 2.3.b

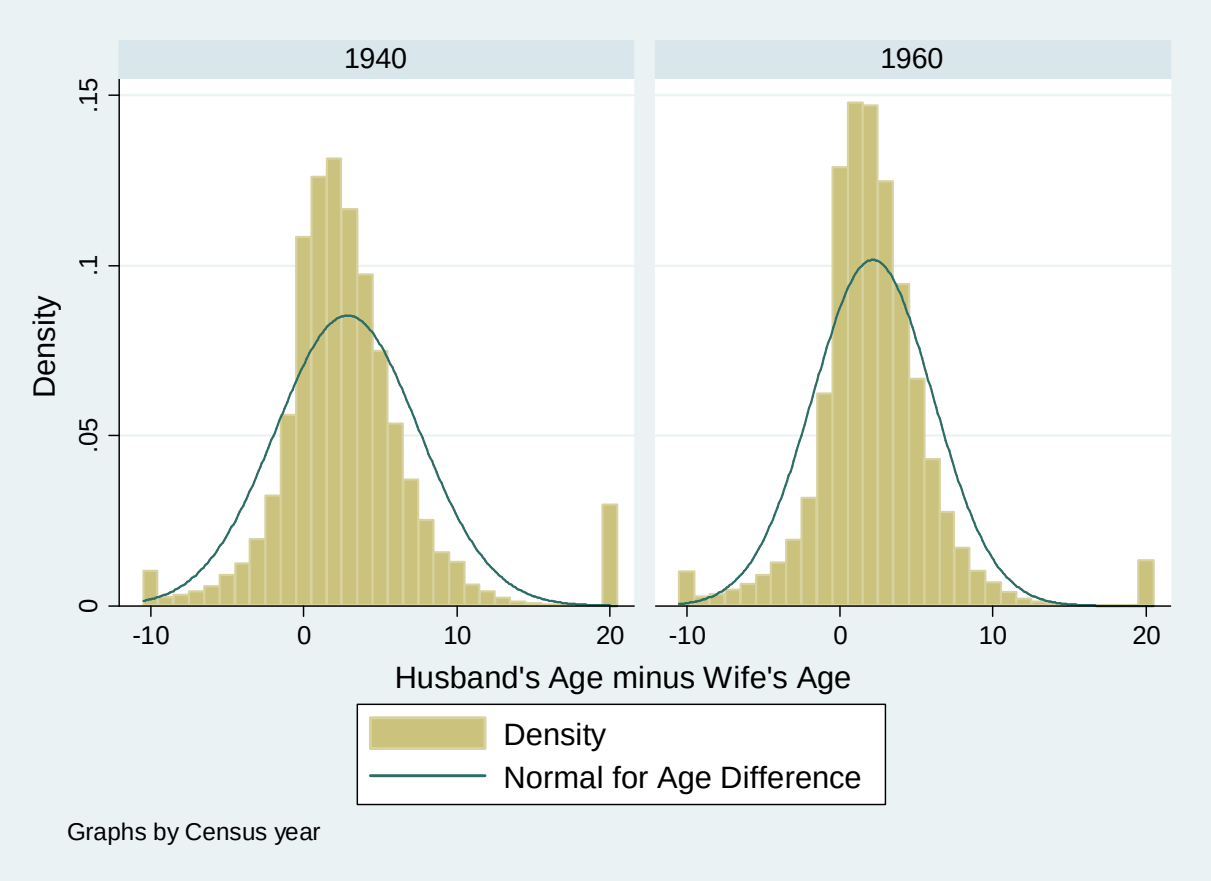
Rate of Ownership and Rental among Married and Non-Married Men by Age, 1960



Source: IPUMS USA 1960

Figure 2.4

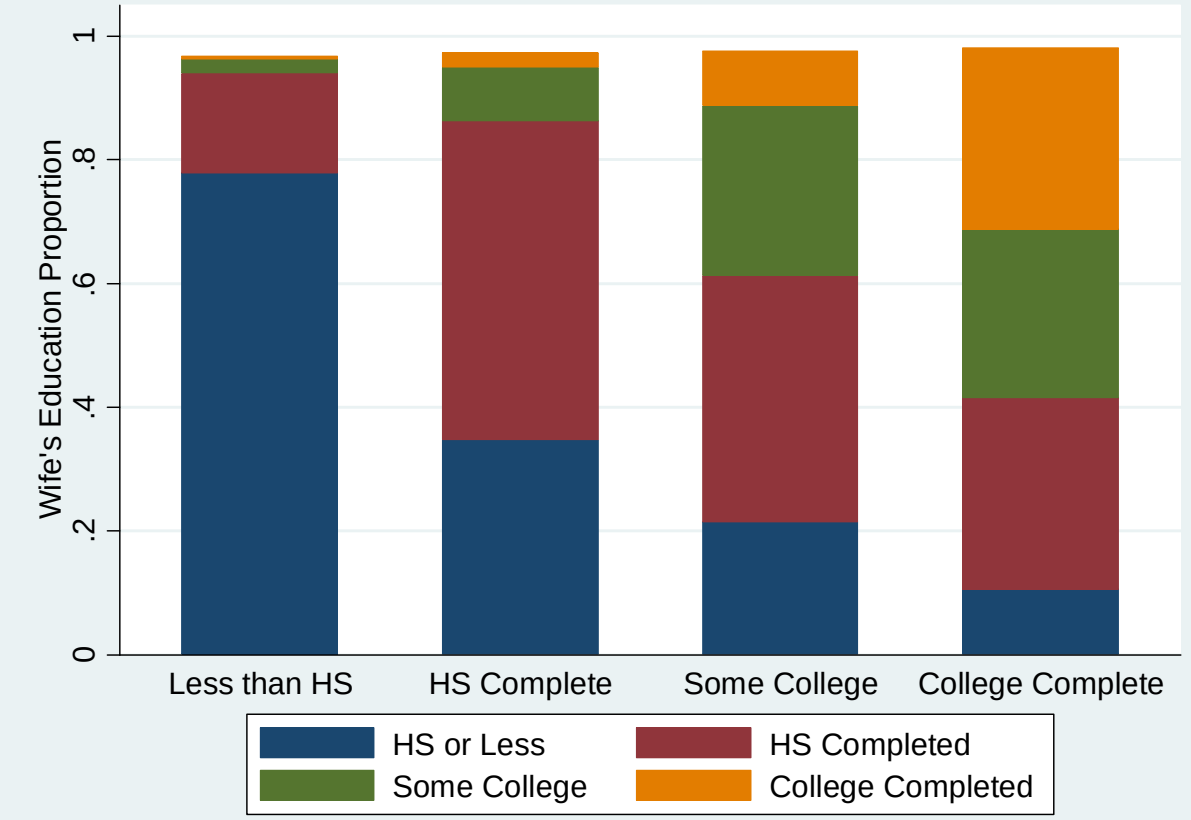
Distribution of Spousal Age Difference among Married Couples for Men ages 18-35 in 1940 and 1960



Source: IPUMS USA 1960

Figure 2.5.a

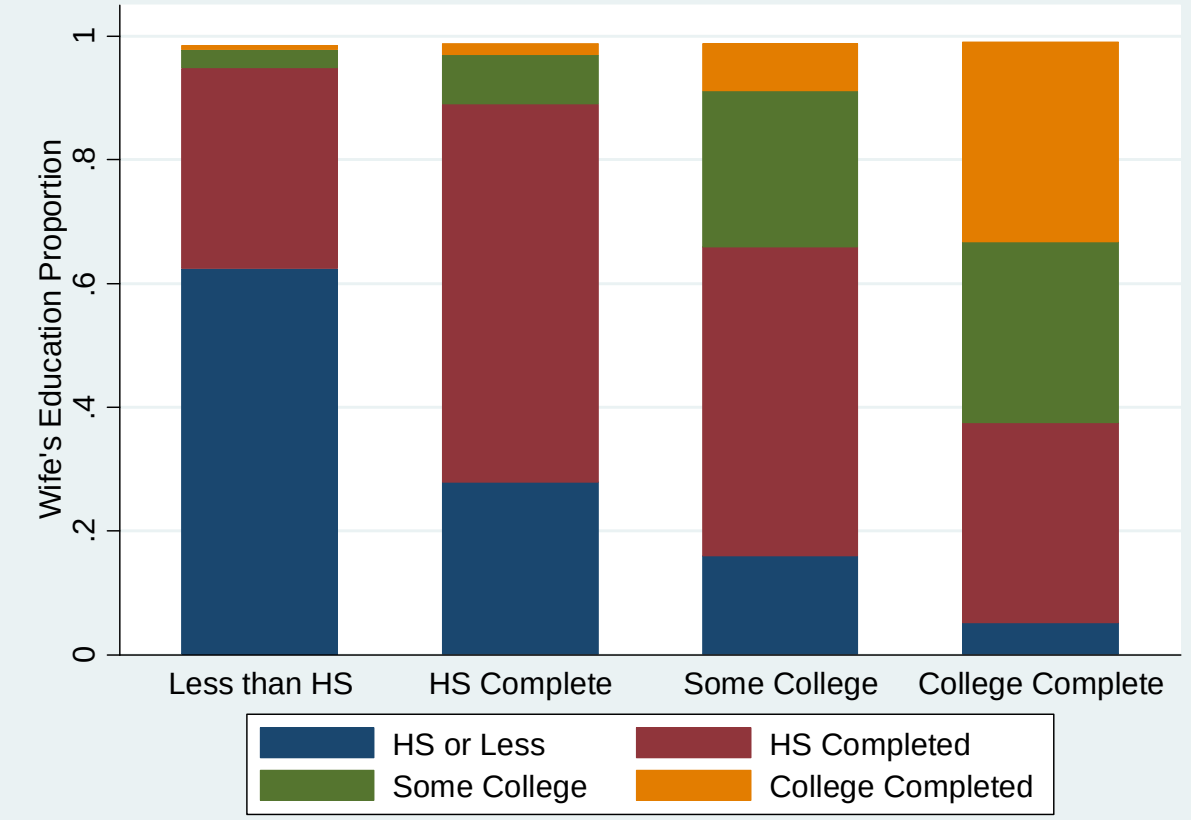
Wife's Education by Husband's Education for Men ages 18-35 in 1940



Source: IPUMS USA 1960

Figure 2.5.b

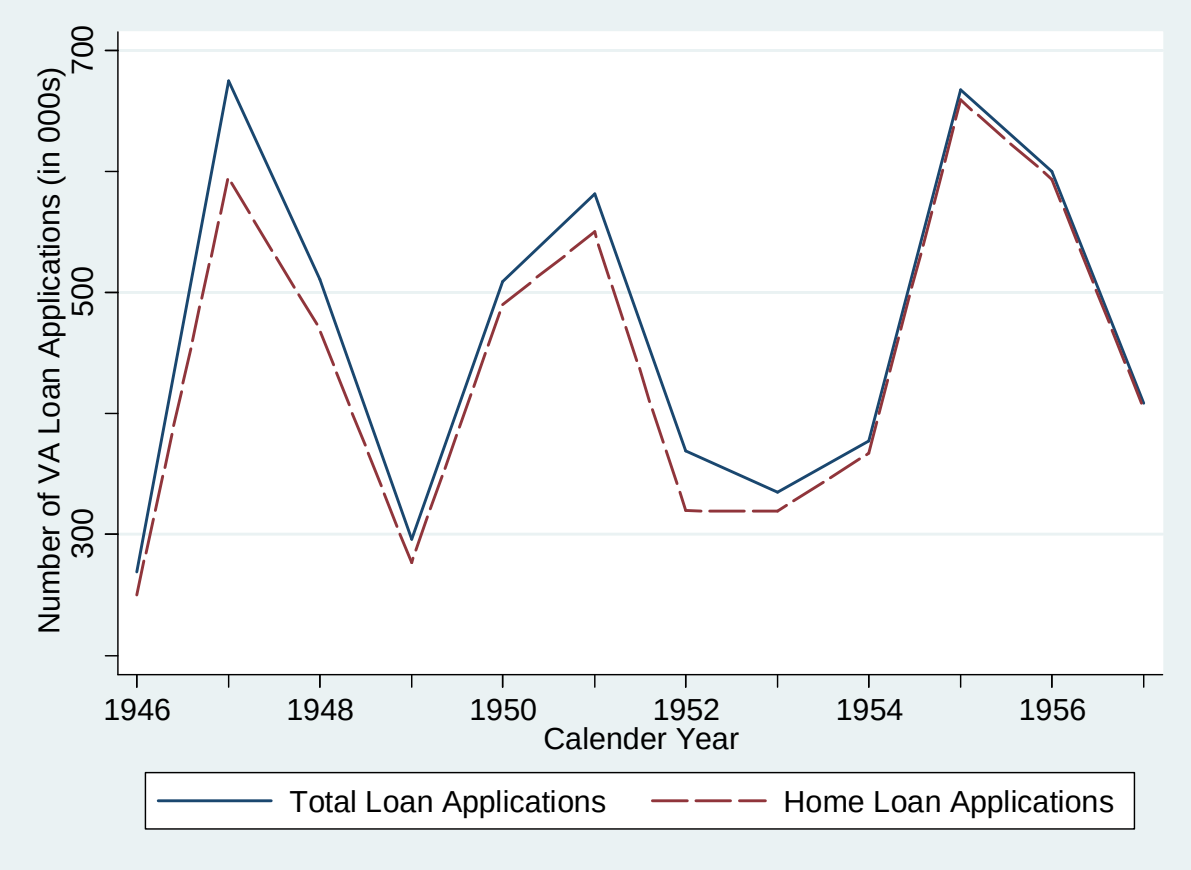
Wife's Education by Husband's Education for Men ages 18-35 in 1960



Source: IPUMS USA 1960

Figure 2.6

Total VA Loan Applications and VA Loan Applications for Home Purchase, 1946-1957

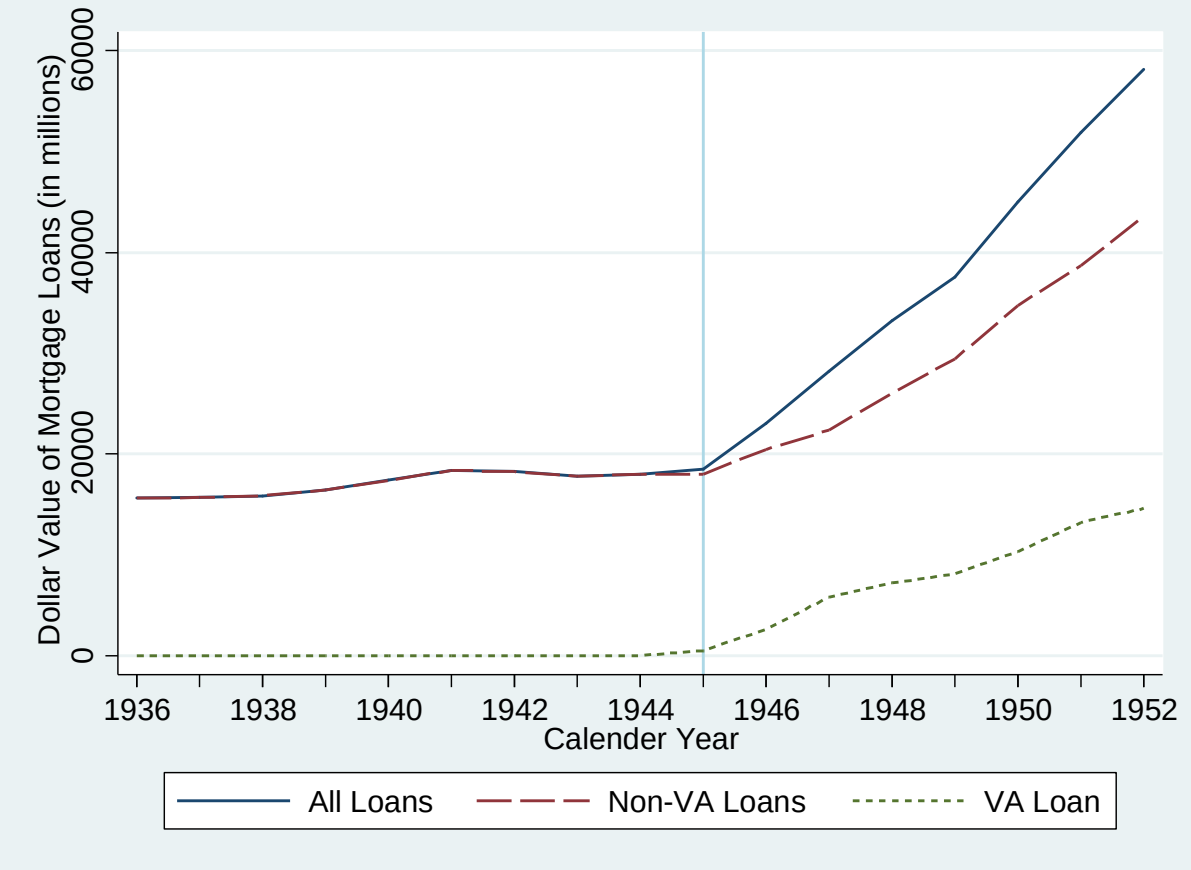


Source: VA Annual Reports (1946-1957)

Note: The Administration on Veterans Affairs follows a fiscal year ending in June of each calendar year.

Figure 2.7

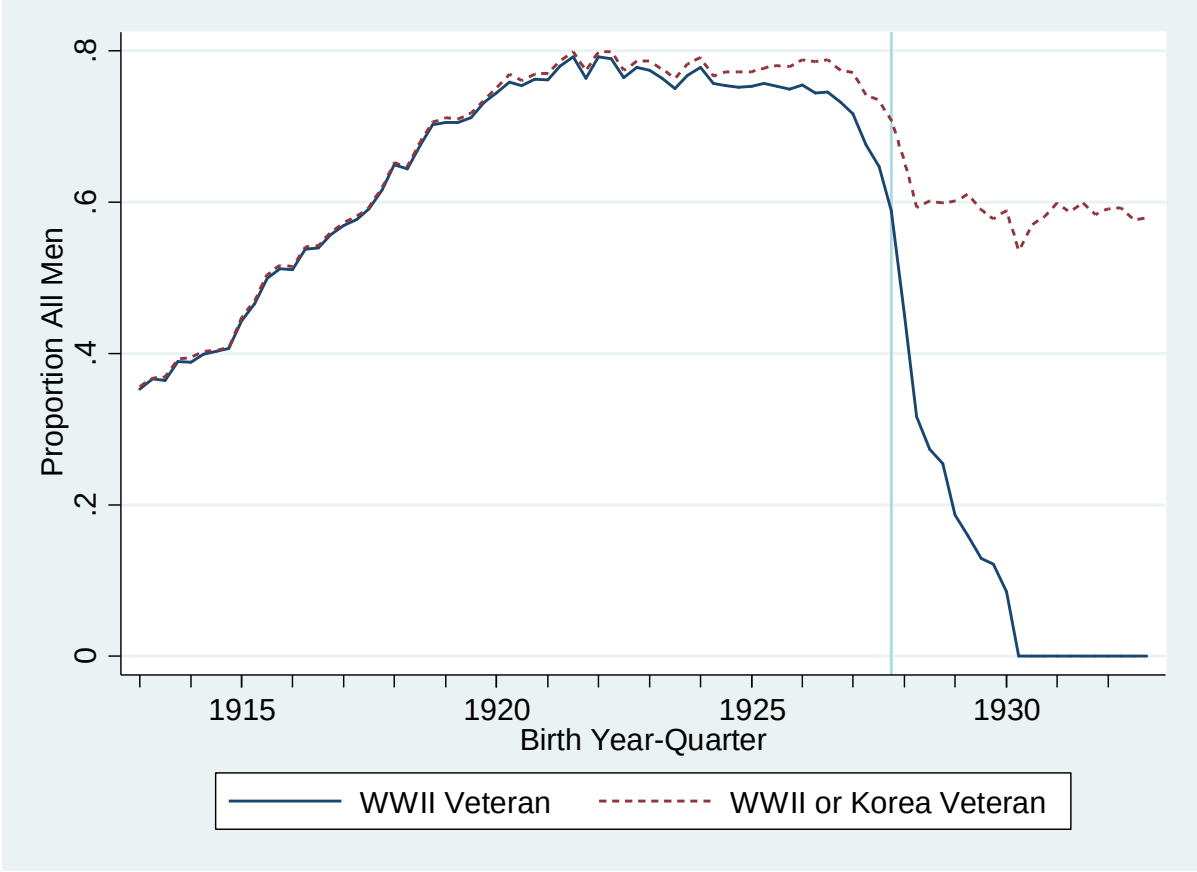
Dollar Value of Outstanding Mortgage Loans, 1936-1952



Source: Grebler, Blank, and Winnick (1956)

Figure 2.8

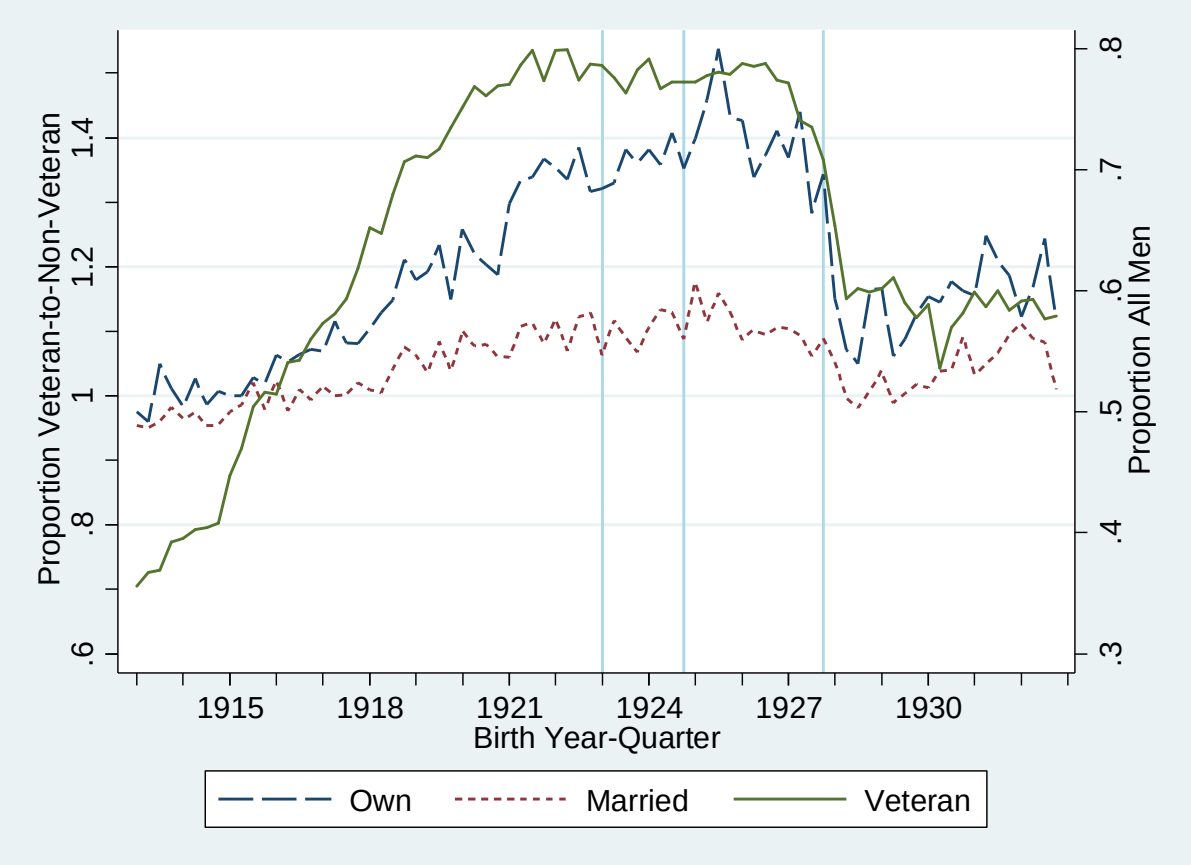
Aggregate Rate of Veteran Status in WWII and Korean War by Year-and-Quarter of Birth in 1960 for Birth Years 1913-1932.



Source: IPUMS USA 1960

Figure 2.9.a

Aggregate Rates of Veteran Status, Homeownership and Marriage by Quarter-and-Year of Birth in 1960 for birth years 1913-1932.

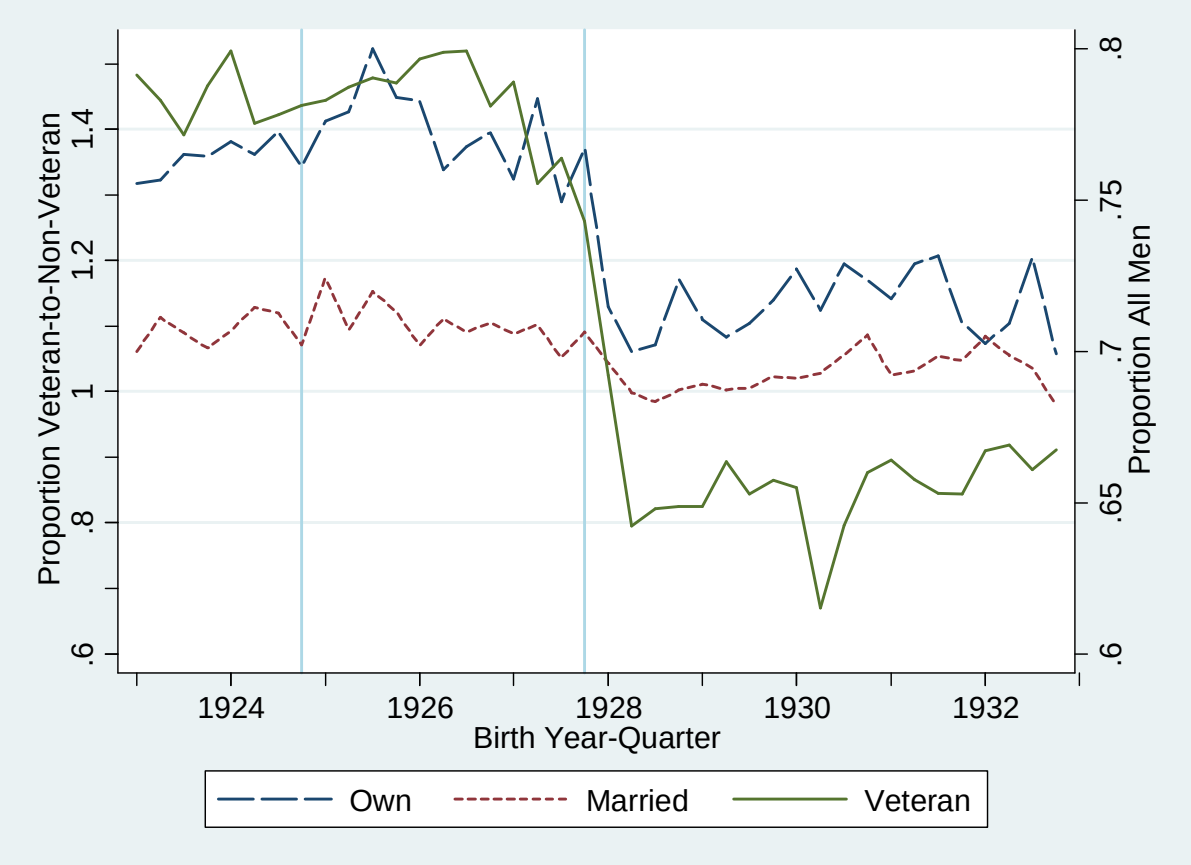


Source: IPUMS USA 1960

Note: The figure above uses a sample of white men, born between 1913Q1-1932Q4, in the 1960 Census microdata. The left axis corresponds to ownership and marriage rates among veterans relative to non-veterans. Individual data points are generated by dividing the rate of homeownership or marriage of veterans by the same rate for nonveterans in each year-quarter cell. Thus, individual data points represent a ratio of veterans relative to nonveterans for each quarter-by-year birth cohort. The right axis corresponds to the aggregate rate of veteran status among all men in the sample.

Figure 2.9.b

Aggregate Rates of Veteran Status, Homeownership and Marriage by Quarter-and-Year of Birth in 1960 for birth years 1923-1932.

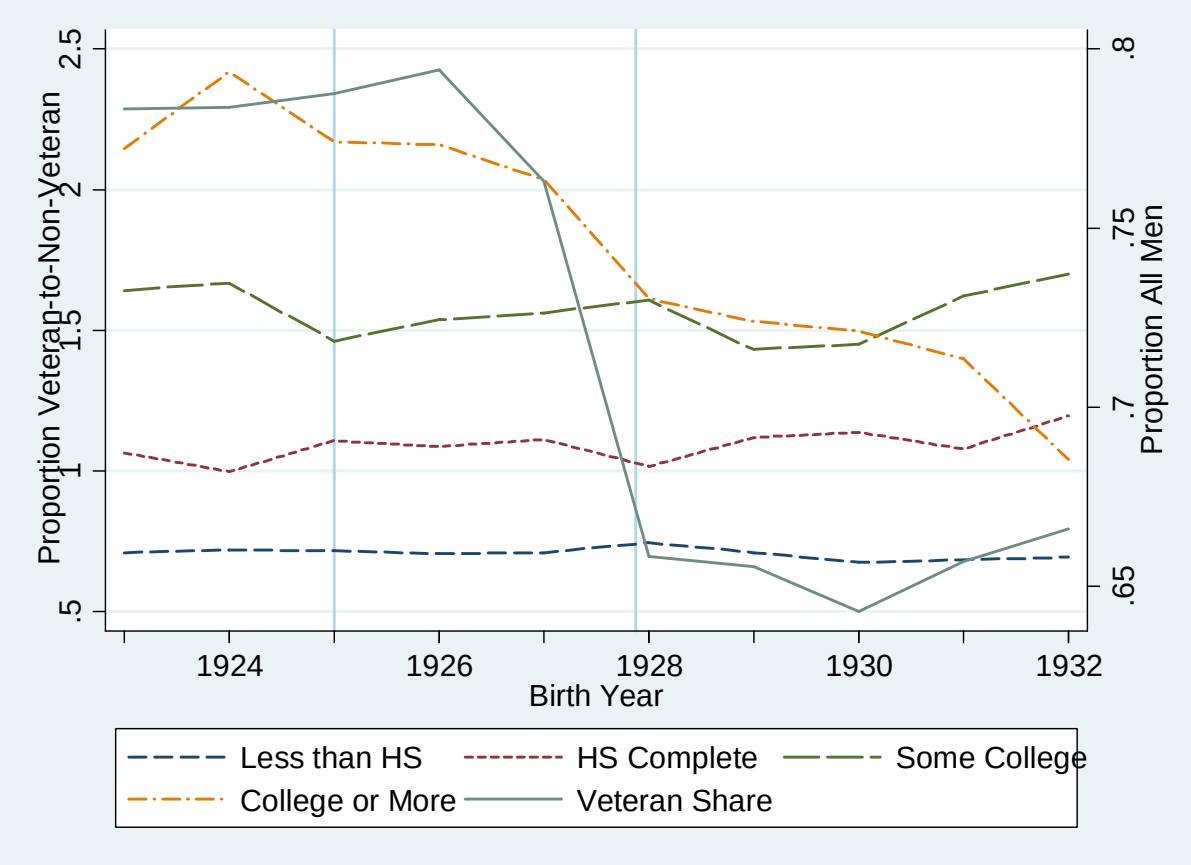


Source: IPUMS USA 1960

Note: The figure above uses a sample of white men, born between 1923Q1-1932Q4, in the 1960 Census microdata. The left axis corresponds to ownership and marriage rates among veterans relative to non-veterans. Individual data points are generated by dividing the rate of homeownership or marriage of veterans by the same rate for nonveterans in each year-quarter cell. Thus, individual data points represent a ratio of veterans relative to nonveterans for each quarter-by-year birth cohort. The right axis corresponds to the aggregate rate of veteran status among all men in the sample.

Figure 2.10

Aggregate Rates of Veteran Status and Educational Attainment by Year of Birth in 1960 for birth years 1923-1932.

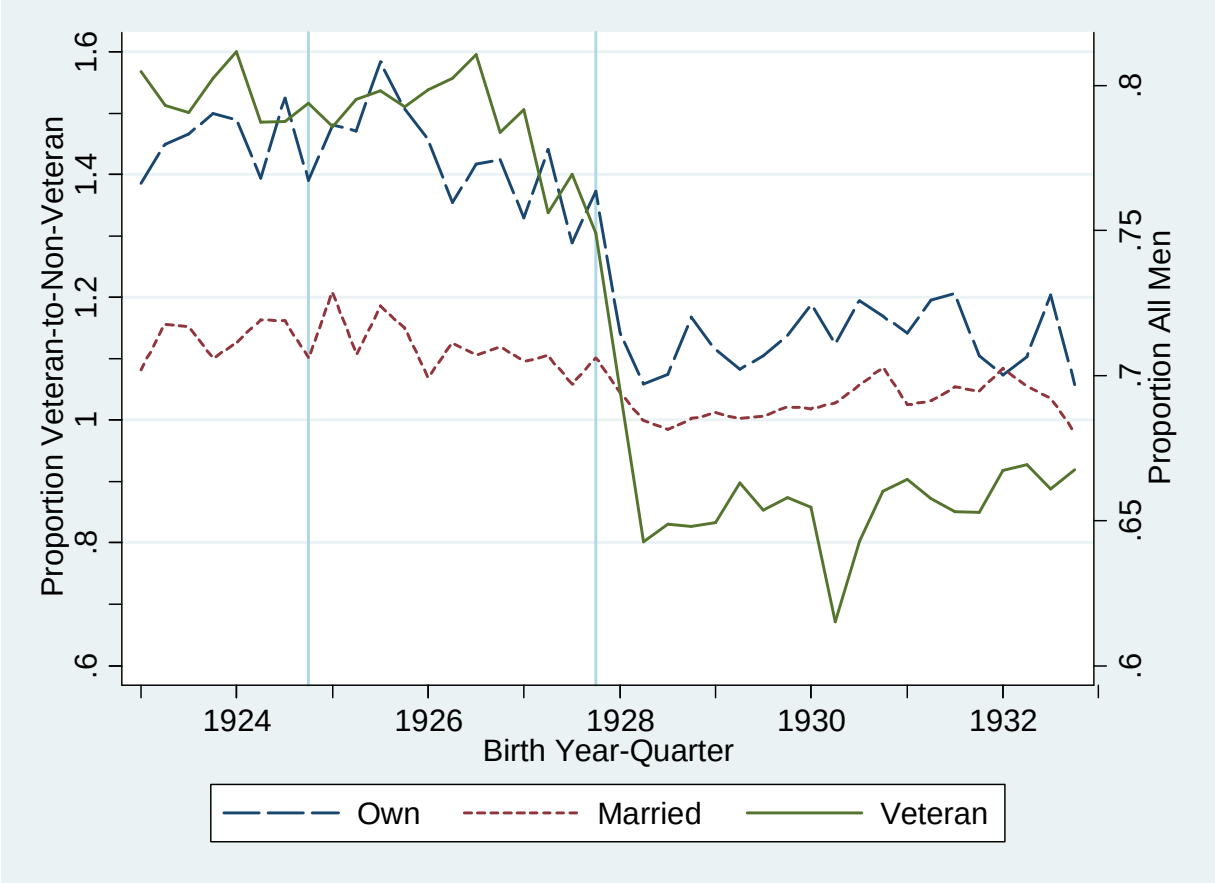


Source: IPUMS USA 1960

Note: The figure above uses a sample of white men, born between 1923Q1-1932Q4, in the 1960 Census microdata. The left axis corresponds to rates of educational attainment among veterans relative to non-veterans. Individual data points are generated by dividing the rate of educational attainment of veterans by the same rate for nonveterans in each birth year cell. Thus, individual data points represent a ratio of veterans relative to nonveterans for each year of birth cohort. The right axis corresponds to the aggregate rate of veteran status among all men in the sample.

Figure 2.11.a

Aggregate Rates of Veteran Status, Homeownership and Marriage by Quarter-and-Year of Birth in 1960 for birth years 1923-1932 among men who were married after the GI Bill passage.

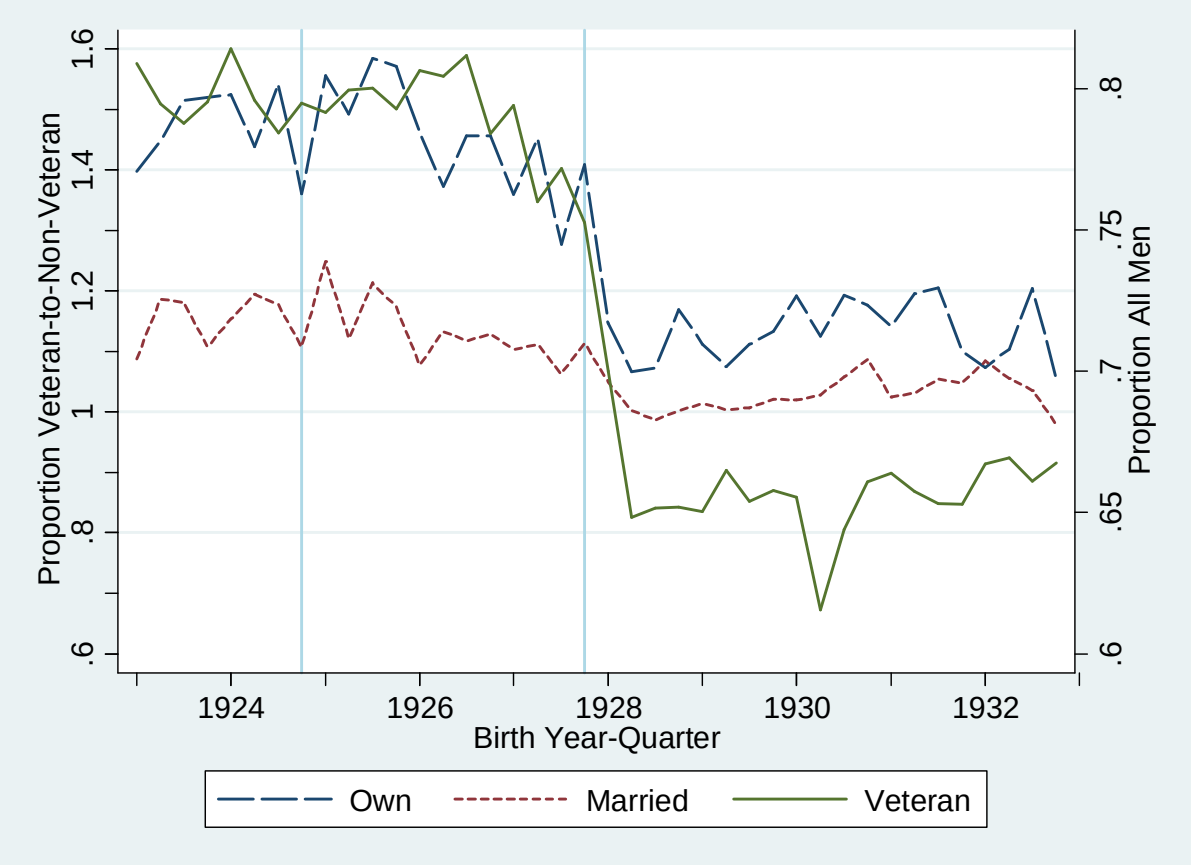


Source: IPUMS USA 1960

Note: The figure above uses a sample of white men, born between 1923Q1-1932Q4, in the 1960 Census microdata. Compared to Figure 3a, this graph is restricted to men married after the GI Bill was passed. The left axis corresponds to ownership and marriage rates among veterans relative to non-veterans. Individual data points are generated by dividing the rate of homeownership or marriage of veterans by the same rate for nonveterans in each year-quarter cell. Thus, individual data points represent a ratio of veterans relative to nonveterans for each quarter-by-year birth cohort. The right axis corresponds to the aggregate rate of veteran status among all men in the sample.

Figure 2.11.b

Aggregate Rates of Veteran Status, Homeownership and Marriage by Quarter-and-Year of Birth in 1960 for birth years 1923-1932 among men who were married after VJ Day.

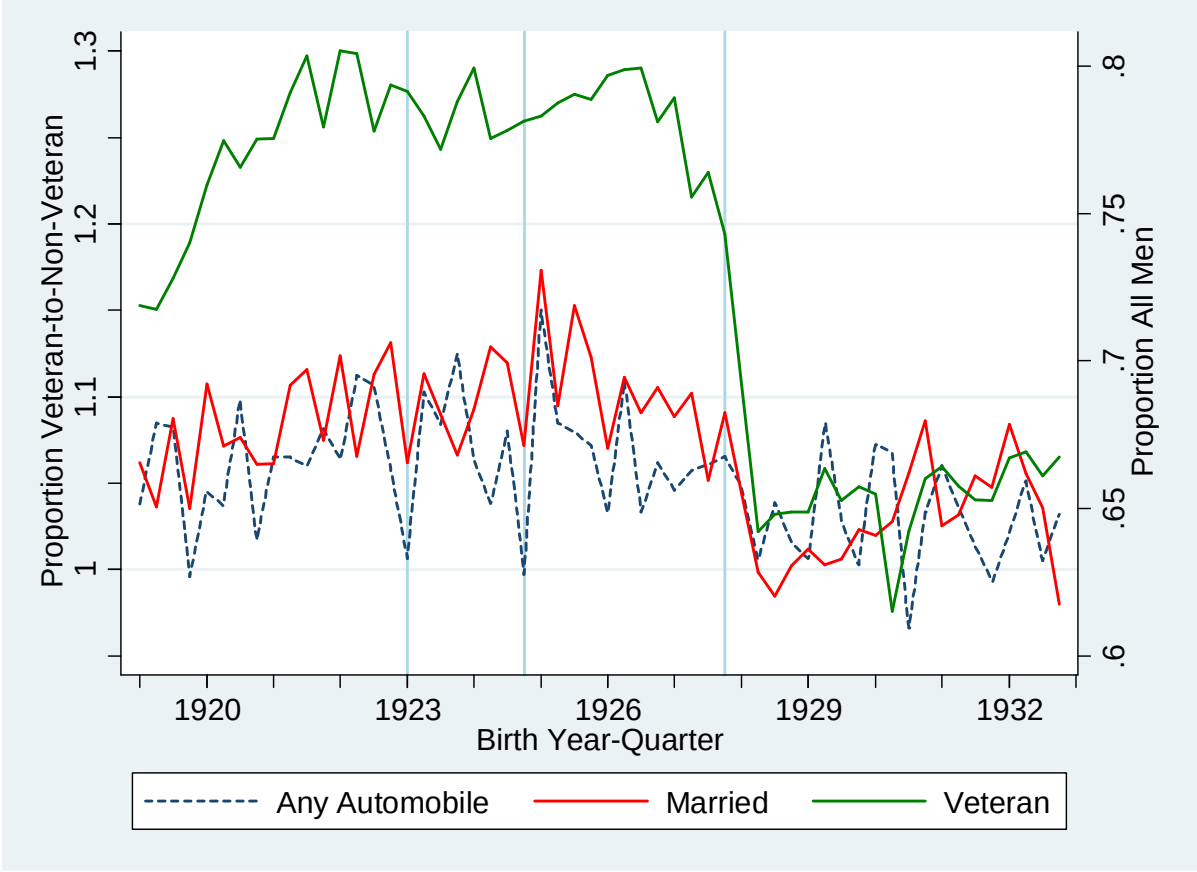


Source: IPUMS USA 1960

Note: The figure above uses a sample of white men, born between 1923Q1-1932Q4, in the 1960 Census microdata. Compared to Figure 3a, this graph is restricted to men married after VJ Day (the end of war). The left axis corresponds to ownership and marriage rates among veterans relative to non-veterans. Individual data points are generated by dividing the rate of homeownership or marriage of veterans by the same rate for nonveterans in each year-quarter cell. Thus, individual data points represent a ratio of veterans relative to nonveterans for each quarter-by-year birth cohort. The right axis corresponds to the aggregate rate of veteran status among all men in the sample.

Figure 2.12

Aggregate Rates of Veteran Status, Ownership of Any Automobile and Marriage by Quarter-and-Year of Birth in 1960 for birth years 1919-1932



Source: IPUMS USA 1960

Note: The figure above uses a sample of nonwhite men, born between 1919Q1-1932Q4, in the 1960 Census microdata. The left axis corresponds to the rate of any automobile ownership and marriage rates among veterans relative to non-veterans. Individual data points are generated by dividing the rate of any automobile or marriage of veterans by the same rate for nonveterans in each year-quarter cell. Thus, individual data points represent a ratio of veterans relative to nonveterans for each quarter-by-year birth cohort. The right axis corresponds to the aggregate rate of veteran status among all men in the sample.

Table 2.1

Annual Potential Takeup of VA Home Loans Among WWII Veterans, 1945-1957

Year	Number of Living WWII Veterans	Number of Applications Closed	Cumulative Applications Closed	Eligible Veterans per Annum	Annual Takeup (%)	Cumulative Takeup (%)
1945	12807000	11220	11220	12807000	0.09	0.09
1946	12807000	154500	165720	12795780	1.21	1.29
1947	14361000	558653	724373	14195280	3.94	5.04
1948	14900000	479709	1204082	14175627	3.38	8.08
1949	15182000	260699	1464781	13977918	1.87	9.65
1950	15386000	380360	1845141	13921219	2.73	11.99
1951	15200000	516938	2362079	13354859	3.87	15.54
1952	14827000	367961	2730040	12464921	2.95	18.41
1953	14712000	300480	3030520	11981960	2.51	20.60
1954	14574000	273936	3304456	11543480	2.37	22.67
1955	14578000	442745	3747201	11273544	3.93	25.70
1956	14510000	441451	4188652	10762799	4.10	28.87
1957	14429000	287742	4476394	10240348	2.81	31.02

Note: The estimated take-up rate is based on the total number of veterans surviving WWII and the Korean War as reported in the Veteran's Administration Annual Reports for 1945-1957. Home loan application information for Korean War veterans are not distinguished by the VA until 1954. In 1952, the number of WWII Veterans falls by almost 400,000- a much larger decrease than in any other year and not likely attributable to post-service deaths. This may be due to a change in reporting by the VA since some WWII veterans re-entered service in the Korean War period. After 1952, the VA clearly distinguishes between veterans serving in only WWII or only the Korean War versus those veterans serving in both wars. The Administration on Veterans Affairs follows a fiscal year ending in June of each calendar year.

Table 2.2

Estimated Takeup of Among Veterans by Age Group (Males, 18+)

Age	Veteran Composition (%) (1)	Estimate Total Veterans (2)	Total VA First Mortgage (3)	Veterans with First Mortgage (%) (4)
a. WWII Veterans in 1950				
Under 35	73.0	11227164	615301	5.5
35-44	21.1	3249523	234139	7.2
45-64	5.4	823151	65181	7.9
65+	0.6	86162	4518	5.2
b. WWII & Korean War Veterans in 1960				
Under 35	36.8	7253752	1227050	16.9
35-44	43.4	8551459	1544396	18.1
45-64	19.2	3790568	543671	14.3
65+	0.7	128193	65543	51.1

Note: Veteran composition is determined based off of Census microdata for 1950 and 1960 (Ruggles et al, 2015). The Census of Housing Residential Finance information provides tabulations of VA mortgage holdings by age groups. Age groups vary from 1950 to 1960 based on how the information is reported by the Census of Housing. The total number of living veterans in 1950 and 1960 is taken from the Veteran's Administration Annual Reports for each year.

Table 2.3

Estimated Takeup of VA Home Loans Among US Population by Age Group (Males, 18+)

Age	US Composition (%) (1)	Estimate Total Population (2)	Total VA First Mortgage (3)	Total VA First Mortgage (%) (4)
a. Takeup Among US Population in 1950				
Under 35	40.30	18130631	615301	3.39
35-44	22.97	10334010	234139	2.27
45-64	27.87	12538479	65181	0.52
65+	8.86	3986040	4518	0.11
b. Takeup Among US Population in 1960				
Under 35	33.82	18721759	1227050	6.55
35-44	21.17	11719090	1544396	13.18
45-64	31.95	17686582	543671	3.07
65+	13.07	7235168	65543	0.91

Note: US Population of males, 18 years of age and over, along with the age composition is determined based off of Census microdata for 1950 and 1960 (Ruggles et al., 2015). The total US population is taken from the US Census Bureau's Fast Facts for 1950 and 1960. The Census of Housing Residential Finance provides tabulations of VA mortgage holdings by age groups. Age groups vary from 1950 to 1960 based on how the information is reported by the Census of Housing. The total number of living veterans in 1950 and 1960 is taken from the Veteran's Administration Annual Reports for each fiscal year.

Table 2.4

Summary Statistics in 1960 for Sample of Men Born Between 1925-1930

Sample Selection:	Full Sample	Pre End of War Cohort=1	Pre End of War Cohort=0
	(1)	(2)	(3)
Veteran of WWII	0.45	0.72	0.17
Veteran of WWII or Korea	0.68	0.77	0.59
Owns home	0.55	0.59	0.50
Married	0.86	0.87	0.84
Age	31.78	33.25	30.25
Less than High School	0.42	0.44	0.39
High School Completed	0.30	0.28	0.33
Some College	0.11	0.11	0.12
College or More Completed	0.16	0.16	0.17
Personal Income (000,000s of 1990$)	0.25	0.26	0.24
Observations	57,337	29,155	28,182

Table 2.5

Reduced Form Regressions of Marriage on Pre- End of World War II Indicator in 1960 for men born between 1925Q1:1930Q4.

Dependent Variable:	1 = Married						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Pre End of War Cohort	0.026	0.026	0.016	0.013	0.012	0.015	0.014
	(0.005)	(0.005)	(0.003)	(0.004)	(0.003)	(0.004)	(0.004)
Income			0.479	0.546	1.445	2.608	1.63
			(0.019)	(0.021)	(0.040)	(0.277)	(0.303)
Income^2					-1.107	-4.987	-4.297
					(0.041)	(1.301)	(1.243)
Income^3						3.637	3.057
						(2.091)	(1.908)
Income ^4						-0.797	-2.925
						(1.032)	(1.705)
Completed High School				-0.006	-0.021	-0.023	0.064
				(0.003)	(0.003)	(0.003)	(0.026)
Some College Completed				-0.048	-0.064	-0.06	0.016
				(0.006)	(0.005)	(0.005)	(0.036)
College Completed				-0.079	-0.092	-0.079	-0.058
				(0.005)	(0.005)	(0.006)	(0.027)
Constant	0.843	0.907	0.808	0.809	0.695	0.607	0.561
	(0.004)	(0.010)	(0.009)	(0.009)	(0.009)	(0.014)	(0.018)
Birth State FE	NO	YES	YES	YES	YES	YES	YES
Income x Educ	NO	NO	NO	NO	NO	NO	YES

Note: Total number of observations is 57,337 for all regressions. Heteroskedasticity-robust clustered standard errors are reported. Clustering is done at the year-by-quarter of birth level. The baseline comparison mean taken from the 1940 IPUMS census for men between 30-35 years of age is 0.808.

Table 2.6

Instrumental Variables Estimates of Marriage on Veteran Status in 1960 for men born between 1925Q1:1930Q4.

Dependent Variable:	First Stage 1 = Veteran	Reduced Form 1 = Married	IV
	(1)	(2)	(3)
Pre End of War Cohort	0.127	0.014	
	(0.007)	(0.004)	
Veteran			0.110
			(0.025)

Note: Total number of observations is 57,337 for all regressions. Heteroskedasticity-robust clustered standard errors are reported. Clustering is done at the year-by-quarter of birth level. First-stage F-statistic is 399.43. Controls include Birth State FE, Income (through quartic), Education, and Income x Education. The baseline comparison mean taken from the 1940 IPUMS census for men between 30-35 years of age is 0.808 for marriage and 0.024 for veteran status.

Table 2.7

Instrumental Variables Estimates of Marriage on Homeownership in 1960 for men born between 1925Q1:1930Q4.

	First Stage	Reduced Form	IV
Dependent Variable:	1 = Own	1 = Married	
	(1)	(2)	(3)
Pre End of War Cohort	0.077	0.014	
	(0.008)	(0.004)	
Own			0.183
			(0.035)

Note: Total number of observations is 57,337 for all regressions. Heteroskedasticity-robust clustered standard errors are reported. Clustering is done at the year-by-quarter of birth level. First-stage F-statistic is 96.88. Controls include Birth State FE, Income (through quartic), Education, and Income x Education. The baseline comparison mean taken from the 1940 IPUMS census for men between 30-35 years of age is 0.808 for marriage and 0.243 for homeownership.

Table 2.8

Robustness Checks

Dependent Variable	1 = Married			1 = Own Auto
	(1)	(2)	(3)	(4)
Pre End of War Cohort	0.024	0.010	0.007	0.003
	(0.003)	(0.004)	(0.004)	(0.003)
Observations	94,704	55,453	53,765	57,337
Primary Sample		X	X	X
Extended Sample	X			
Married After GI Bill		X		
Married After EOW			X	
Mean	0.818	0.808	0.808	0.900

Note: Heteroskedasticity-robust clustered standard errors are reported. Clustering is done at the year-by-quarter of birth level. Controls include Birth State FE, Income (4), Education, and Income x Education. For columns (1)-(3), means are based off of the 1940 Census data for men of comparable ages. For column (4), means are based off of 1960 sample of men who came of age after the termination of WWII.

Table 2.9

Robustness Checks: WWI and WWII Cohort Analysis

Census Year:	1960 (WWII)		1930 (WWI)	
Dependent Variable:	1 = Married			
	(1)	(2)	(3)	(4)
Pre End of War Cohort	0.026	0.018	0.031	-0.019
	(0.005)	(0.005)	(0.004)	(0.005)
Observations	57,337	53,765	39,009	32,356
Primary Sample	X		X	
Married After EOW		X		X

Note: Heteroskedasticity-robust standard errors are reported. Controls include Birth State FE.

Table 2.10

Reduced Form Regressions of Marriage on Pre- End of World War II Indicator Interacted with First Quarter Indicator in 1960 for men born between 1925Q1:1930Q4.

Dependent Variable:	1 = Married	
	(1)	(2)
Pre End of War Cohort*Born First Quarter	0.010	0.0002
	(0.004)	(0.0059)
Pre End of War Cohort	0.005	0.0076
	(0.002)	(0.0026)
Born First Quarter		0.0098
		(0.0048)

Note: Total number of observations is 57,337 for all regressions. Heteroskedasticity-robust clustered standard errors are reported. Clustering is done at the year-by-quarter of birth level. Controls include Birth State FE, YOB FE, Income (4), Education, and Income x Education. The baseline comparison mean for marriage rates is 0.808 and is taken from the 1940 IPUMS census.

Table 2.11
Reduced Form Regressions of Marriage on Pre- End of World War II Indicator for men born between 1925Q1:1930Q4

Census Year	1960	1970	1980
Dependent Variable:	1 = Married		
	(1)	(2)	(3)
Pre End of War Cohort	0.014	0.0010	-0.0003
	(0.0036)	(0.0021)	(0.0031)
Observations	57,337	51,680	51,583
Mean (in 1940)	0.808	0.808	0.808

Note: Heteroskedasticity-robust clustered standard errors are reported. Clustering is done at the year-by-quarter of birth level. Controls include Birth State FE, Income (4), Education, and Income x Education. The baseline comparison mean is taken from the 1940 IPUMS census. Data for 1950 includes institutionalized individuals due to differences in data availability.

Table 2.12

Instrumental Variables Estimates of VA Loan Takeup on Veteran Status

	First Stage	Reduced Form	IV
Dependent Variable:	1 = Veteran	1 = Used VA Loan	
	(1)	(2)	(3)
Pre-War Age Group	0.103	0.038	
	(0.039)	(0.041)	
Veteran			0.460
			(0.473)
First Stage F-Statistic	6.92		
Observations			422

Note: Estimates are reported for SCF data years 1955-56. Veteran status is not available in 1958. VA Loan status is not available in 1957 or 1958.

Table 2.13

Instrumental Variables Estimates of Marriage on VA Loan Takeup

	First Stage	Reduced Form	IV
Dependent Variable:	1 = Used VA Loan	1 = Married	
	(1)	(2)	(3)
Pre-War Age Group	0.047	0.008	
	(0.050)	(0.020)	
VA Loan			0.159
			(0.424)
First Stage F-Statistic	0.89		
Observations			422

Note: Estimates are reported for SCF data years 1955-56. VA Loan status is not available in 1957 or 1958.

Table 2.14

Instrumental Variables Estimates of Marriage on Ownership

	First Stage	Reduced Form	IV
Dependent Variable:	1 = Own	1 = Married	
	(1)	(2)	(3)
Pre-War Age Group	0.176	0.060	
	(0.021)	(0.014)	
Own			0.341
			(0.081)
First Stage F-Statistic	67.45		
Observations			2128

Note: Estimates are reported for SCF data years 1955-58.

Table 2.15

Timing of Marriage and Homeownership, 1950-1958

Dependent Variable:	1 = Marriage before Homeownership	1 = Marriage after Homeownership	1 = Marriage and Homeownership in Same Year
	(1)	(2)	(3)
High Probability Group	0.038	0.003	-0.041
	(0.019)	(0.016)	(0.011)
At least Some High School	-0.006	-0.002	0.008
	(0.016)	(0.014)	(0.010)
At least Some College	-0.022	0.003	0.019
	(0.018)	(0.015)	(0.011)
Constant	0.871	0.043	0.086
	(0.032)	(0.027)	(0.019)
Observations	3,868	3,868	3,868

Note: Estimates are reported for SCF data years 1950-58. Probability of service in each year-by-age group is defined using Census data on the proportion of veterans in each SCF age group. High probability is equal to one if the year-age group is above the median service probability.

Table 2.16

Timing of Marriage and Homeownership by Year

a. 1952

Dependent Variable:	1 = Marriage before Homeownership	1 = Marriage after Homeownership	1 = Marriage and Homeownership in Same Year
	(1)	(2)	(3)
High Probability Group	0.053	-0.077	0.023
	(0.041)	(0.036)	(0.020)
At least Some High School	-0.032	0.027	0.005
	(0.038)	(0.033)	(0.019)
At least Some College	-0.048	0.029	0.019
	(0.042)	(0.037)	(0.021)
Constant	0.893	0.114	-0.007
	(0.047)	(0.042)	(0.023)
Observations	424	424	424

b. 1957

Dependent Variable:	1 = Marriage before Homeownership	1 = Marriage after Homeownership	1 = Marriage and Homeownership in Same Year
	(1)	(2)	(3)
High Probability Group	0.368	-0.178	-0.190
	(0.045)	(0.033)	(0.038)
At least Some High School	0.102	-0.110	0.008
	(0.062)	(0.046)	(0.052)
At least Some College	-0.064	-0.005	0.069
	(0.064)	(0.048)	(0.054)
Constant	0.437	0.308	0.255
	(0.067)	(0.050)	(0.056)
Observations	487	487	487

Note: Estimates are reported for the individual SCF data years, 1952 and 1957. High probability is defined based on the SCF age group. For 1952, high probability is equal to 1 if the individual is in the age group (born) defined as 25-34 (1918-1927) and equal to 0 the individual is in the age group (born) defined as 18-24 (1928-1934). For 1957, high probability is equal to 1 if the individual is in the age group (born) defined as 30-34 (1923-1927) and equal to 0 if the individual is in the age group (born) defined as 25-29 (1928-1932).

Table 1.A1

Probit Marginal Effects for Marriage and Homeownership in 1960 for men born between 1925Q1:1930Q4.

Dependent Variable:	1 = Own	1 = Married
	(1)	(2)
Pre End of War Cohort	0.085	0.014
	(0.011)	(0.004)
Birth State FE	YES	YES
Income (Exp)	YES (4)	YES (4)
Education	YES	YES
Income x Educ	YES	YES
QOB FE	NO	NO
YOB FE	NO	NO

Table 1.A2

Summary Statistics for SCF homeowners in 1955 and 1956

Sample:	Nonveterans	Veterans without VA Loan	Veterans with VA Loan
	(1)	(2)	(3)
Married	0.895	0.970	0.987
Age 18-24	0.026	0.141	0.157
Age 25-34	0.025	0.272	0.358
Less than HS	0.595	0.349	0.283
HS Completed	0.209	0.283	0.336
Some College	0.089	0.148	0.182
College Completed	0.101	0.220	0.198
Observations	1918	427	318

Figure 1.A1

Aggregate Rates of Veteran Status and Divorce by Quarter-and-Year of Birth in 1960 for birth years 1913-1932.

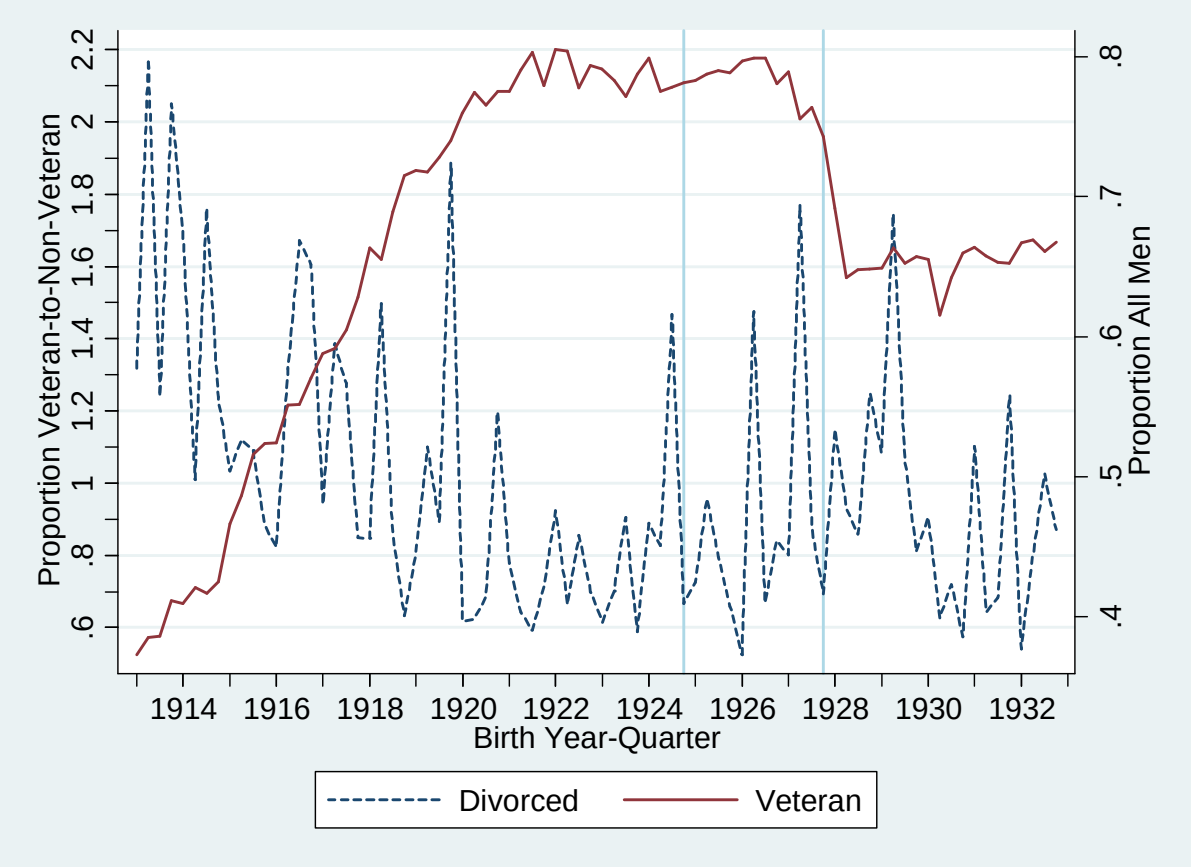


Figure 1.A2

Aggregate Rates of Veteran Status and Divorce by Quarter-and-Year of Birth in 1970 for birth years 1913-1932.

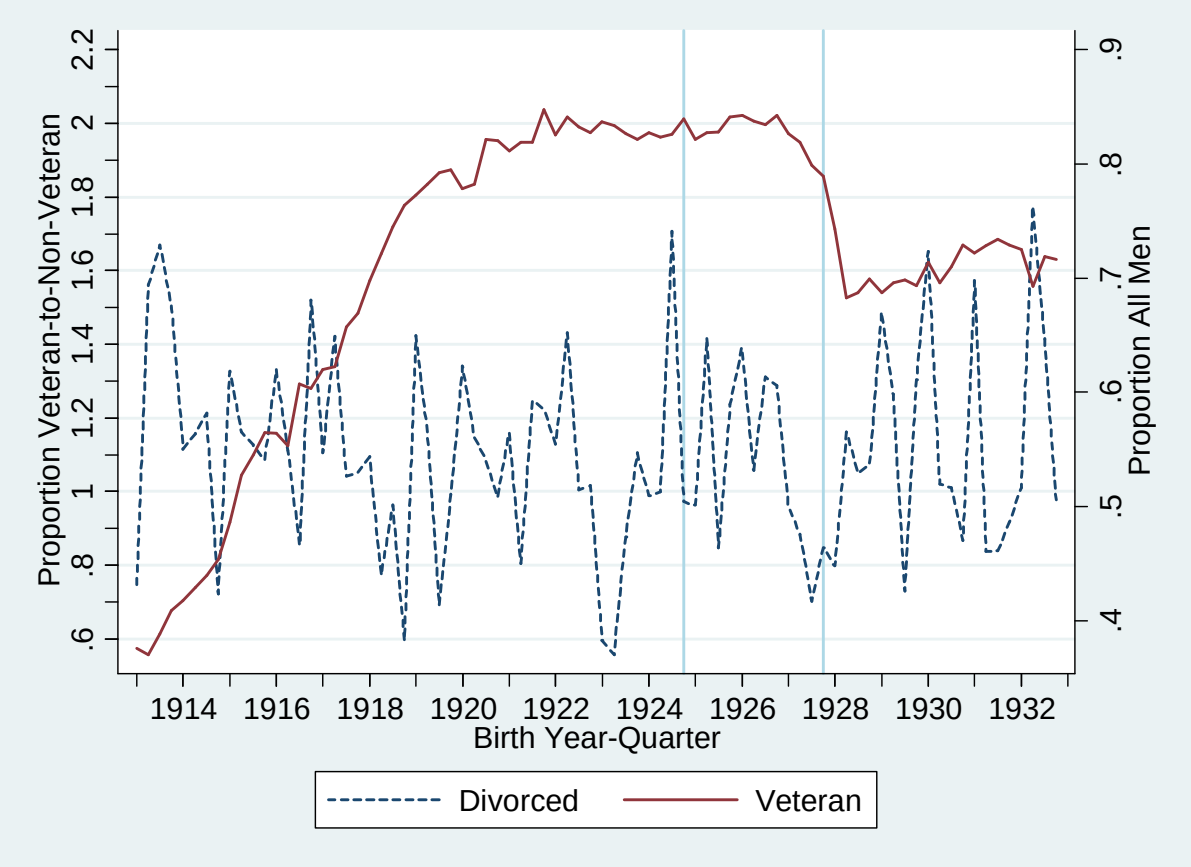
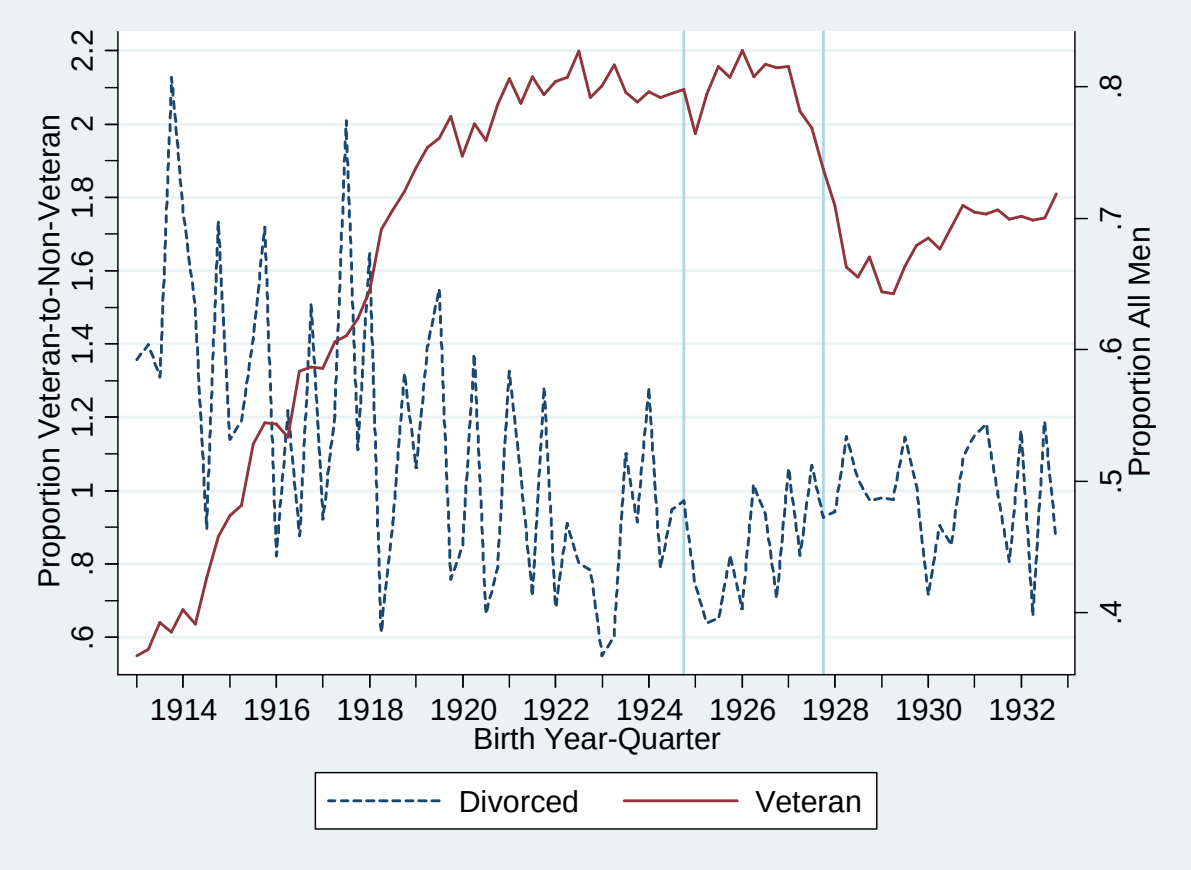


Figure 1.A3

Aggregate Rates of Veteran Status and Divorce by Quarter-and-Year of Birth in 1980 for birth years 1913-1932.



Chapter 3
Do Mortgage Subsidies Promote Household Formation? Evidence from Korean War Cohorts

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3.1. Introduction

To further analyze the impact of mortgage subsidy programs on household formation, this paper makes use of veteran access to the Veteran's Administration (VA) Loan Guaranty Program among Korean War cohorts. Veterans of the Korean War were granted access to the program during the post-war housing boom in the United States. Thus, these cohorts provide a good quasi-experiment in which to analyze the impact of mortgage subsidy programs on marriage rates.

The Korean conflict began on June 27, 1950. At the start of the war, servicemen were not immediately eligible for benefits passed under the Serviceman's Readjustment Act in June 1944. The Veteran's Adjustment Act of 1952, also known as the Korean War GI Bill, was signed into law on July 16, 1952, providing access to readjustment benefits for Korean War veterans. These benefits included both education and home loan benefits similar to those offered to veterans of World War II (WWII). According to VA estimates, by the end of fiscal year 1999, more than 1.8 million Korean War veterans had used a VA loan to purchase a home.[29]

This paper makes use of Census microdata (Ruggles et al., 2015) to analyze the relationship between mortgage subsidies, homeownership, and marriage among Korean War cohorts. Identification of the causal relationship between mortgage subsidies and marital status relies on plausibly exogenous year of birth variation in access to the VA loan program. The probability of military service decreased substantially at the termination of Korean War hostilities, meaning that cohorts who came of age after this point in time were substantially less likely to be eligible for the VA loan program. This paper uses a between-cohort comparison of veterans and non-veterans, similar to that used in Ricks (2016) for WWII cohorts.

[29] U.S. Department of Veterans Affairs (2000)

The primary findings in this study are threefold. First, cohorts coming of age prior to the termination of Korean War hostilities experienced increases in marriage rates of 6 percentage points in 1960 for men between 24-29 years of age. A baseline comparison of men of similar ages in the 1940 Census provides a mean marriage rate of approximately 59%. By dividing the parameter estimate by the 1940 baseline mean (i.e., 0.06/0.59), being in the pre-end-of-war cohort raised marriage rates by 10%. Using instrumental variables, the estimates imply that eligibility for the VA loan program as proxied by veteran status was associated with a 17 percentage point increase in marriage rates. The implicit IV indicates that being a veteran increased the probability of marriage by approximately 38 percentage points. Second, coming of age prior to the termination of Korean war hostilities increased the probability of homeownership by 10 percentage points in 1960 for men 24-29 years of age. A baseline comparison of men of similar ages in the 1940 Census shows a mean homeownership rate of approximately 10%. This equates to a doubling of the homeownership rate among this age group. Using instrumental variables analysis, the estimates imply that the transition from renter to owner is associated with an increase in the probability of marriage of up to 63 percentage points. Finally, using multiple Census cross-sections from 1960-1980, estimation of these cohort differences for the same group of individuals at different ages shows that these differences were larger at earlier ages. Over calendar time, the increased effect of coming of age prior to the termination of war attenuates.

The remainder of this paper is outlined as follows: Section II provides an overview of the size and details of the VA home loan program for Korean War veterans; Section III reviews identification and the empirical methodology; Section IV provides a discussion of the results; Section V performs various robustness checks; Section VI performs analysis on effects over

time; and Section VII concludes. The exposition in sections III-VI follow very closely with Ricks (2016), which performs similar analysis on veterans of WWII.

3.2. The Korean War GI Bill

3.2.1. Background and Eligibility

After WWII, there were two primary goals of readjustment benefits granted to eligible servicemen. First, Congress wanted to avoid issues related to readjustment as occurred in the post-World War I period. Second, Congress wanted to promote broad participation among and generosity towards all returning servicemen as occurred in the post-WWII period.[30] Goals under the Korean War GI Bill differed due to the setting under which the new legislation was passed. By the early 1950s, most younger, age-eligible men had already served in the Armed Forces, along with many older, able-bodied men. The number of servicemen returning from the Korean War was much smaller. Furthermore, the proportion of those men who were heads of household was smaller, and the proportion of those men who served without completing their education or entering the workforce was higher.[31]

The Korean War GI Bill extended the principal benefits of the Servicemen's Readjustment Act of 1944 to cover veterans of the Korean War, which included educational subsidies and home loan guaranties. Both of these programs remained popular benefits among younger cohorts of veterans. Provisions under the former benefit were rewritten to better reflect the goal of readjustment; while provisions of the latter benefit were relatively unchanged. The latter was available to veterans for ten years after the official termination of war.

[30] President's Commission Report (1956)
[31] President's Commission Report (1956)

Individuals were eligible under the Korean War GI Bill if they served in the armed forces of the United States at any point between June 27, 1950, and January 31, 1955.[32] To become eligible, returning servicemen had to have maintained active service for a minimum of ninety days and not have been dishonorably discharged, or be discharged due to an injury or disability incurred during military service. The VA estimated there were just over 5 million eligible Korean War veterans at the termination of war in 1955.[33]

3.2.2. Loan Terms and Trends

Initial loan terms available to Korean War veterans were consistent with the Housing Act of 1950. Loan maturities were increased to 30 years and the maximum loan guaranty limit was increased to the lesser of 60% of the cost or $7500. Throughout the 1950s, however, interest rates on VA loans steadily increased in order to maintain the supply of mortgage funds available to veterans from private lenders. They increased from 4.0% in 1950 to 4.5% in 1953, 4.75% in 1958, and 5.25% in 1959. These increases were necessary due to increased competition from other investment products that offered suppliers of mortgages better yields.[34]

Minimal down payments on VA loans remained the attractive feature for veteran homebuyers. The consumption-saving tradeoff encountered by first-time home buyers for a down payment was largely eliminated with many loans being offered with zero down payment. Relaxing of the down payment constraint substantially improved the probability of transitioning into homeownership for these households. Because Korean War veterans were young, this facet was particularly important as these households may have been less able to accrue sufficient

[32] Actual hostilities only occurred between June 27, 1950, and July 27, 1953. The benefit period was extended due to difficulties in peace negotiations. (U.S. Department of Veterans Affairs, 2000). For purposes of this analysis, the end of war will equate to the termination of war hostilities, rather than the official termination of war. This is the point at which the demand for military manpower fell considerably.
[33] VA Annual Report (1955)
[34] VA Annual Reports (1950-1959)

savings for a down payment outside of the VA loan program. At competitive interest rates, lenders were also willing to offer these mortgages since the guaranty provided protection against potential default.

3.2.3. Program Take-up

Table 3.1 shows estimates of VA home loan take-up among Korean War veterans by calendar year from 1953-1957.[35] Column (5) reports annual takeup, which is equal to the number of loan applications closed for the year (column (2)) divided by the number of eligible veterans (column (4)). For each of the four years, 2-4% of eligible veterans made use of the program. Column (6) reports the cumulative takeup of the program across the five years. By 1957, approximately 11% of Korean War veterans had taken out a mortgage loan through the program. This growth is similar to that seen among WWII veterans, whereby approximately 12% had made use of the VA loans within the first five years of the program.[36]

In 1960, the median age of Korean War veterans was 29. Thus, the primary focus for loan growth between 1950 and 1960 should be among younger cohorts. Tables 3.2.a and 3.2.b show tabulations of VA home loan take-up among veterans by age group for 1950 and 1960, respectively. Focusing on individuals under age 35, take-up in 1950 is 5% and in 1960 is 17%. This is an increase of approximately 12 percentage points. Census data from 1960 indicates that among those veterans under age 35, 63% were Korean War veterans. Hence, much of this growth can be attributed to the Korean War cohorts rather than the WWII cohorts. Table 3.3 shows similar tabulations over the population of all US men.

[35] These estimates likely underestimate actual program take-up as they do not account for veterans who may have been ineligible for the program for various reasons.

[36] After 1957, the Department of Veteran's Affairs no longer provided a breakdown of the annual loan applications.

3.3. Identification

As seen in Ricks (2016), time-series analysis shows evidence of a strong, positive correlation between mortgage loans, homeownership, and marriage rates. However, establishing a causal relationship is difficult due to the potential for omitted factors generating these trends in the data. In an attempt to circumvent any confounding factors, this paper uses a between cohort comparison of marriage and homeownership. Identification of the causal relationship relies on variation in veteran status by year and quarter of birth. A large proportion of men coming of age between 1950 and 1953 were veterans and had access to the loan program. Men who came of age after the termination of Korean War hostilities in 1953 experienced a much lower probability of gaining access to GI Bill benefits because they were less likely to have served in the armed forces.

In Figure 3.1, the solid line shows the proportion of veterans serving in either WWII or the Korean War by year and quarter of birth in the 1960 Census. Starting with the cohort of men born in the first quarter of 1913 (1913Q1), the probability of military service in WWII was approximately 40%. Among men born from 1913Q1-1919Q4, the probability of military service increases significantly and almost doubles to 80%. For cohorts born in 1920Q1-1926Q4, the probability of military service is relatively flat near 80%. After 1928Q1, the probability of military service falls to near 60%. This sharp decrease is due to the termination of WWII. The probability of service remains roughly constant through the 1933Q1 birth cohort, whereby much of the military service among this group is due to the Korean War. After 1933Q1 another sharp decrease in the probability of service occurs. This decrease corresponds to cohorts who came of age after the termination of Korean War hostilities. The dotted line in Figure 3.1 represents the probability of any military service by birth year and quarter. For cohorts born after 1928Q1, a

level increase of approximately 5 percentage points is apparent although the sharp decrease in service after 1933Q1 still exists. This paper follows Fetter (2013) in designating the end of war as falling between the 1933Q3-1933Q4 birth cohorts.[37]

Figure 3.2 shows the proportion of WWII and Korean War veterans among all men, along with aggregate homeownership and marriage rates for veterans relative to non-veterans in 1960 by year and quarter of birth. The data is restricted to the1928Q1-1938Q4 birth cohorts. The solid vertical line drawn between 1933Q3 and 1933Q4 indicates the approximate termination of Korean War hostilities. For the earliest cohorts, the ratio of marriage rates for veterans relative to non-veterans lies at one (parity). In other words, for birth cohorts coming of age prior to the termination of war, the rate of marriage for veterans and non-veterans was the same. As the demand for military service fell by year and quarter of birth, a sharp decrease in relative marriage rates is seen. Thus, veterans were less likely to be married than non-veterans born in the same year and quarter. For relative ownership rates, veterans who came of age prior to the termination of war were more likely to be homeowners than non-veterans. At the termination of war, a large decrease in relative ownership rates occurs. Similar patterns are found among cohorts coming of age just before and just after the termination of WWII.

The between-cohort variation used in this study follows from the sharp decrease in veteran status at the termination of war (approximately 1933Q3). Individuals who came of age prior to the termination of war had a substantially larger probability of military service than those who came of age after the war ended. The primary sample of interest in this paper is 1930Q4-1936Q3, which follows from Fetter (2013).

The reduced-form estimating equation, indexed by individual i, is the following:

[37] Fetter (2013) determines these cutoffs using structural break estimation techniques based on the probability of veteran status (see Chay, McEwan, and Urquiola, 2005; Card, Mas, and Rothstein, 2008).

$$Marriage_i = \beta_0 + \beta_1 Pre\_EOW_i + \boldsymbol{X}'\boldsymbol{\delta} + \varepsilon_i \quad (1)$$

where $Marriage$ is an indicator equal to 1 if individual i is married, Pre_EOW is an indicator equal to 1 if individual i was born prior to the Korean War break, $\boldsymbol{X}$ is a matrix of controls, including a state of birth fixed effect, and ε is an error term. The coefficient of interest is β_1, which represents the impact of military service on the probability of marriage.

For Korean War veterans, takeup would have started no earlier than the passage of the Korean War GI Bill in 1952 and continued into the first half of the 1960s. This points to using the 1960 Census microdata for the primary analysis in this paper. The 1960 data is a 1% representative sample of the U.S. population. The sample is restricted to white men born in the United States who are non-institutionalized. The primary analysis makes use of the subsample of men born (coming of age) over the period 1931Q4-1936Q3 (1949Q4-1954Q3). Summary statistics are reported in Table 3.4.

3.4. Results

3.4.1. Reduced-Form Estimates for Marriage

Table 3.5 reports reduced-form estimates of equation (1) for the primary sample in the 1960 Census. Reported standard errors are heteroscedasticity-robust and clustered at the year-by-quarter of birth level.[38] Column (1) reports the unconditional estimate of β_1. Birth cohorts coming of age prior to the termination of war experienced an increase in marriage rates of approximately 12 percentage points. The inclusion of state-of-birth fixed effects in column (2) has almost no effect on the estimate. These are large increases in the probability of marriage, given a baseline mean of 59% for men of similar ages in the 1940 Census microdata.

[38] Earlier studies rely on traditional heteroskedasticity-robust standard errors. These standard errors are typically larger, but do not affect the level of statistical significance for estimates in the primary analysis of equation (1).

The Korean War GI Bill also included education and training benefits for returning servicemen. These were largely taken up for postsecondary education. Figure 3.3 displays aggregate rates of veteran status and educational attainment by year of birth in 1960 for birth years 1928-1938. Educational attainment of less than high school and high school completion do not appear to be correlated with the demand for military service. The relative rates of attainment for these groups trend slightly upward. Among individuals with some college, there is evidence of a relationship with the demand for service. For this group, a large drop in the relative rate of attainment is seen at the termination of the Korean War similar to the sharp decrease observed for homeownership and marriage. For individuals with college or more, there is a steep and downward trend appearing across cohorts. This does not appear to be correlated with the demand for service, and the trend may be due to education disruptions among veterans relative to non-veterans.

Although these benefits affected the educational attainment of male veterans of the Korean War, education and income are highly correlated with the decision to marry. Thus, including income and education controls reduces the potential for omitted-variable bias, independent of any relationship with veterans' benefits. The inclusion of a linear income control in column (3) reduces the estimated effect on marriage to 7 percentage points. Columns (4)-(8) report conditional estimates of equation (1) using an extensive combination of income and education controls, including up to a quartic in income, and education interacted with income. The estimates fall by up to 1 percentage point, but, overall, appear robust to the inclusion of these controls. The effect of coming of age prior to the termination of the Korean War on marriage rates is between 6-12 percentage points. In the preferred specification, reported in column (8), the estimated effect is 6 percentage points. Given a mean rate of marriage of 59% for

men of comparable ages in 1940, this estimate represents a large increase in the rate of marriage of approximately 10%.

3.4.2. Veteran Status and Instrumental Variable Estimates

Following Ricks (2016), to estimate the impact of eligibility for the VA loan program on marriage rates, the following estimating equation, indexed by individual *i*, can be used:

$$Marriage_i = \tau_0 + \tau_1 Veteran_i + \boldsymbol{X}'\boldsymbol{\omega} + \varepsilon_i \qquad (2)$$

where the coefficient of interest is τ_1. This parameter describes the effect of being a veteran on the probability of marriage. OLS estimation of τ_1 in equation (2) is biased due to positive selection into military service (e.g., Angrist, 1989; Angrist, 1990; Angrist and Krueger, 1994), making. Hence, the pre-end-of-war indicator can be used as an instrument for veteran status (Bound and Turner, 2002; Fetter, 2013).

Using the preferred specification, reduced-form and instrumental variable estimates are reported in Table 3.6. Column (1) reports the first-stage estimate of veteran status on the pre-end of war indicator. Coming of age prior to the termination of the Korean War increases an individual's probability of being a veteran by approximately 17 percentage points compared to individuals who came of age after the termination of war. Column (2) reports the reduced-form estimate of marriage on the pre-end-of-war indicator from column (8) of Table 3.5. Column (3) reports the instrumental variables estimate of τ_1. Eligibility for the VA loan program as proxied by being a veteran increases the probability of marriage by approximately 38 percentage points.

3.4.3. Homeownership and Instrumental Variable Estimates

Given that the VA loan program was expected to increase the rate of homeownership, the relationship between year of birth and the probability of homeownership can also be estimated. This relationship is described by the following equation, indexed by individual *i*,

$$Own_i = \rho_0 + \rho_1 Pre\_EOW_i + \boldsymbol{X}'\boldsymbol{\mu} + \varepsilon_i \qquad (3)$$

where the coefficient of interest is ρ_1. Estimates of ρ_1 are reported in column (1) of Table 3.7. Individuals coming of age prior to the end of war experienced an increase in homeownership of approximately 10 percentage points. This estimate is slightly smaller than in Fetter (2013).[39] Given a mean homeownership rate of 10% for men of comparable ages in 1940, this is equivalent to a doubling of homeownership rates for this group of individuals.

Using the VA loan program, the effect of mortgage subsidies on marriage rates through the homeownership channel can also be estimated. This relationship is described by the following estimating equation, indexed by individual *i*,

$$Marriage_i = \alpha_0 + \alpha_1 Own_i + \boldsymbol{X}'\boldsymbol{\theta} + \varepsilon_i \qquad (4)$$

where the parameter of interest is α_1, which describes the effect of transitioning from renter to owner on the probability of marriage. As described in Ricks (2016), this relationship assumes that the expectation of homeownership is followed by the joint decision to marry and own a home, regardless of which event occurred first. Given that mortgage subsidies improved both the expectation and realization of homeownership, equation (4) is estimated using instrumental variables. Column (3) of Table 3.7 reports the instrumental variables estimates of α_1 in equation (4). Homeownership increases the probability of marriage by 63 percentage points.

3.5. Robustness Checks

3.5.1. Sample Selection

Column (1) of Table 3.8 reports estimates of equation (1) using the sample of men born (coming of age) between 1928Q4-1938Q3 (1946Q4-1956Q3). This increases the window of

[39] The difference is small in economic terms, but may be attributed, to the inclusion of income and education controls.

analysis to five years before and after the termination of the Korean War, respectively. For this sample of individuals, coming of age prior to the termination of Korean War hostilities increases marriage rates by approximately 12 percentage points. This is an increase of approximately 21% given a baseline mean of 56% for men of comparable ages in 1940. The difference between the primary and extended samples is economically small in magnitude.

Another potential concern is that some men may have been married prior to entering service or during their time in service. In such cases, it is difficult to establish a causal relationship between the VA loan program and marriage. The effect should be observed for men not married prior to or during service because, for this group, changes in the expectation of homeownership are more likely to promote marriage. Figure 3.4.a shows the relationship between veteran status, homeownership, and marriage for the subsample of men married after the passage of the Korean War GI Bill. The cohort effects seen in Figure 3.2 exist among this subsample of men as well. The estimate of equation (1) restricted to this subsample of men is reported in column (2) of Table 3.8. The estimate of β_1 for this group falls to 3.2 percentage points. Figure 3.4.b performs a similar exercise for the subsample of men married after the termination of Korean War hostilities. The estimate of equation (1) restricted to this subsample of men is reported in column (3) of Table 3.8. The estimate of β_1 for this group falls further to 1.7 percentage points. Thus, at least half of the overall estimate results from individuals not married prior to entering service.

3.5.2. Automobile Usage

Between 1940 and 1960, automobile ownership was growing among American families. . The Korean War GI Bill did not provide direct subsidies to automobile markets. Any time-series growth observed in the automobile market should not be directly related to service benefits.

Thus, automobile ownership can be used to test whether the VA home loan program is truly a mortgage market intervention, rather than an effect generated from credit markets as a whole. Automobile ownership can also test for effects from service. If veterans are different than nonveterans, then cohort differences in automobile ownership might be observed.

Figure 3.5 shows the rates of automobile ownership for veterans relative to non-veterans. The graph also includes the relative rate of marriage and overall proportion of veterans. Relative automobile ownership shows a slight downward trend. No jump appears at the war break as is the case with marriage and veteran status. In order to estimate this relationship, the marriage indicator is substituted with an indicator for whether the individual owns an automobile on the left-hand side of equation (1). The automobile indicator is equal to 1 if the household owns at least one automobile and equal to zero if they do not own an automobile.

The reduced-form estimate of any automobile ownership on the pre-end-of-war indicator for the primary sample is reported in column (4) of Table 3.8. The estimate is close to zero and statistically insignificant. This suggests that there is no difference in automobile ownership among individuals coming of age prior to the termination of war versus those who came of age after the war. This supports the notion that eligibility for the VA home loan program is likely responsible for the observed increases in homeownership and marriage.

3.5.3. Estimation using Quarterly Variation in the Demand for Military Service

Lastly, this paper attempts to account for variation by quarter of birth similar to that observed among individuals drafter into service during WWII. While the primary estimates rely on between-cohort variation, an alternative to estimating equation (1), indexed by individual *i*, is

$$Marriage_i = \gamma_0 + \gamma_1 Pre\_EOW_i + \gamma_2 PreEOW * QOB1_i + \boldsymbol{X'\varphi} + \varepsilon_i \qquad (5)$$

where $\gamma_1$respresents the marginal effect for individuals coming of age prior to the termination of the Korean War who were not born in the first quarter of a calendar year; and the coefficient of interest, γ_2, is the additional marginal response for similar individuals who were born in the first quarter of the calendar year. In order to identify off of quarter of birth, year-of-birth fixed effects are included in equation (5) and quarter-of-birth fixed effects are not included.

Table 3.9 reports the reduced-form estimates of equation (5) for the primary sample. The estimate of $\gamma_1$is approximately 1 percentage point. Individuals coming of age prior to the end of the Korean War who were not born in the first quarter of a calendar year were 1 percentage point more likely to be married than individuals not born prior to the termination of war. The estimate of γ_2 is 1 percentage point. Individuals who were born in the first quarter of the calendar year and prior to the termination had an additional increase in the probability of marriage of 1 percentage point. Therefore, a higher probability of military service, as proxied by being born in the first quarter of the calendar year, generates a total increase in marriage rates of approximately 2 percentage points. Column (2) re-estimates equation (5) with an independent effect from being born in the first quarter of the calendar year. The estimate of $\gamma_2$from equation (5) is largely unaffected by the inclusion of this intercept term.

3.6. Extensions

The final portion of this study analyzes the relationship between mortgage subsidies and marriage at different points in the lifecycle. Equation (1) is re-estimated for the primary sample using decennial Census data for 1960-1980 in order to analyze the impact of cohort differences on marriage rates at different ages for the same birth years. These estimates are reported in Table 3.10. In 1970, the sample is between the ages of 44-49, and the estimated effect decreases to

upwards of 1 percentage point. In 1980, individuals are between the ages of 54-59. The estimated effect falls to almost zero and becomes statistically insignificant. This supports the findings in Ricks (2016), whereby the effect of mortgage subsidies on marriage rates attenuate over the lifecycle. Thus, mortgage subsidy programs may have larger impacts on household formation at younger ages.

3.7. Conclusion

This paper uses access to the VA Loan Guaranty program among Korean War cohorts to present a second set of estimates of the relationship between mortgage subsidies and household formation. Cohorts who came of age prior to the termination of Korean War hostilities were 6 percentage points more likely to be married compared to those who came of age after the war. In proxying for program eligibility through veteran status, instrumental variable analysis shows that eligibility differences increase the probability of marriage by 38 percentage points. A second finding is that coming of age prior to the termination of war is associated with increases in homeownership of 10 percentage points. Given a homeownership rate of 10% among men of similar ages in 1940, this is equivalent to a doubling of homeownership. Instrumental variable analysis implies that becoming a homeowner is associated with a 63 percentage point increase in the probability of marriage. Lastly, analysis of cohort differences at different ages for the same birth cohorts suggests that these effects attenuate with age.

3.8. References

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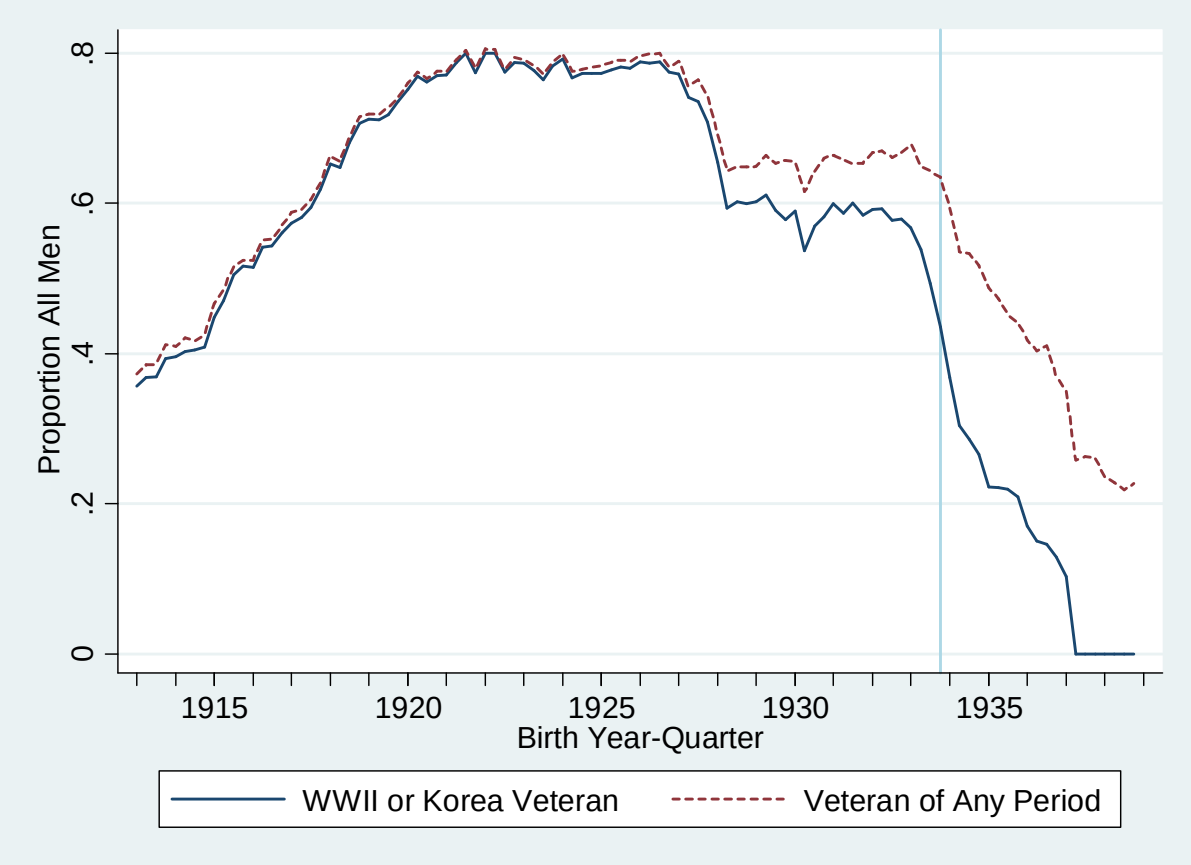
Figure 3.1

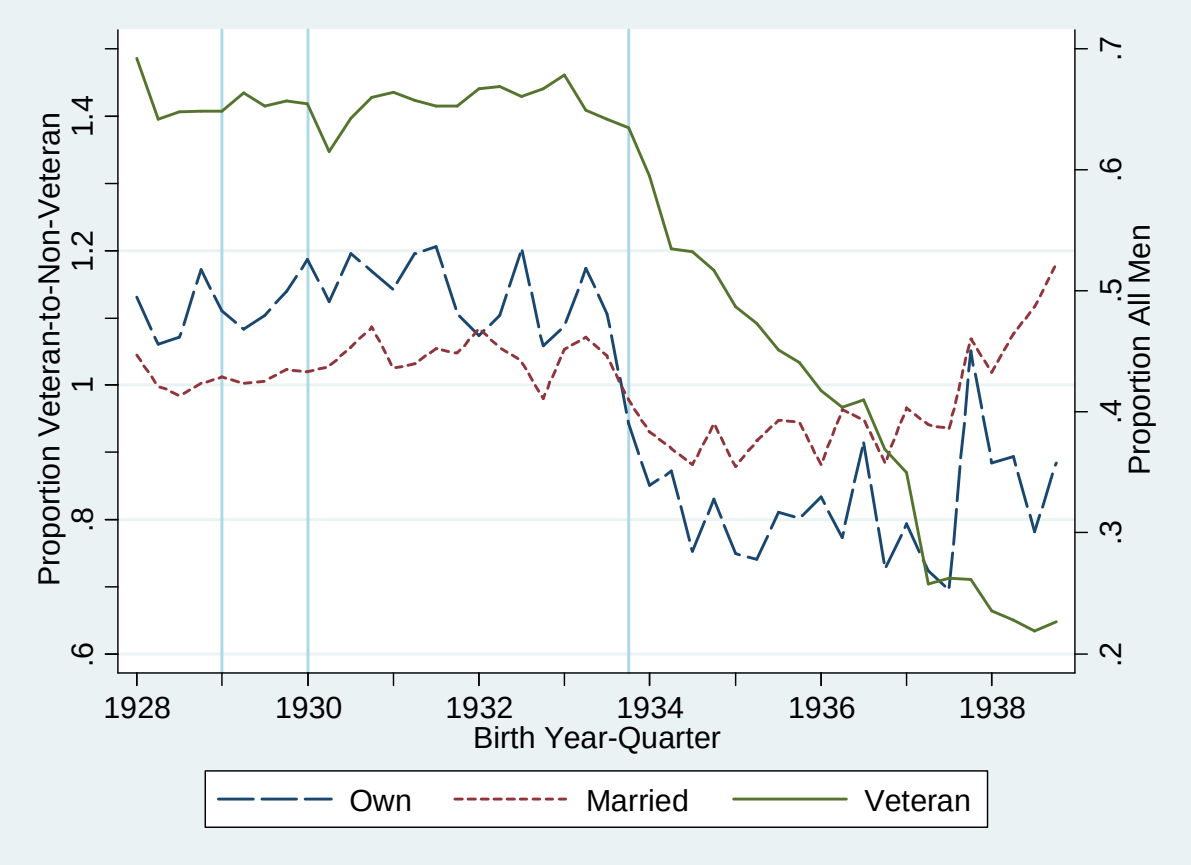
Aggregate Rate of Veteran Status by Year-and-Quarter of Birth in 1960 for Birth Years 1913-1938.



Source: IPUMS USA 1960

Figure 3.2

Aggregate Rates of Veteran Status, Homeownership and Marriage by Quarter-and-Year of Birth in 1960 for birth years 1928-1938.

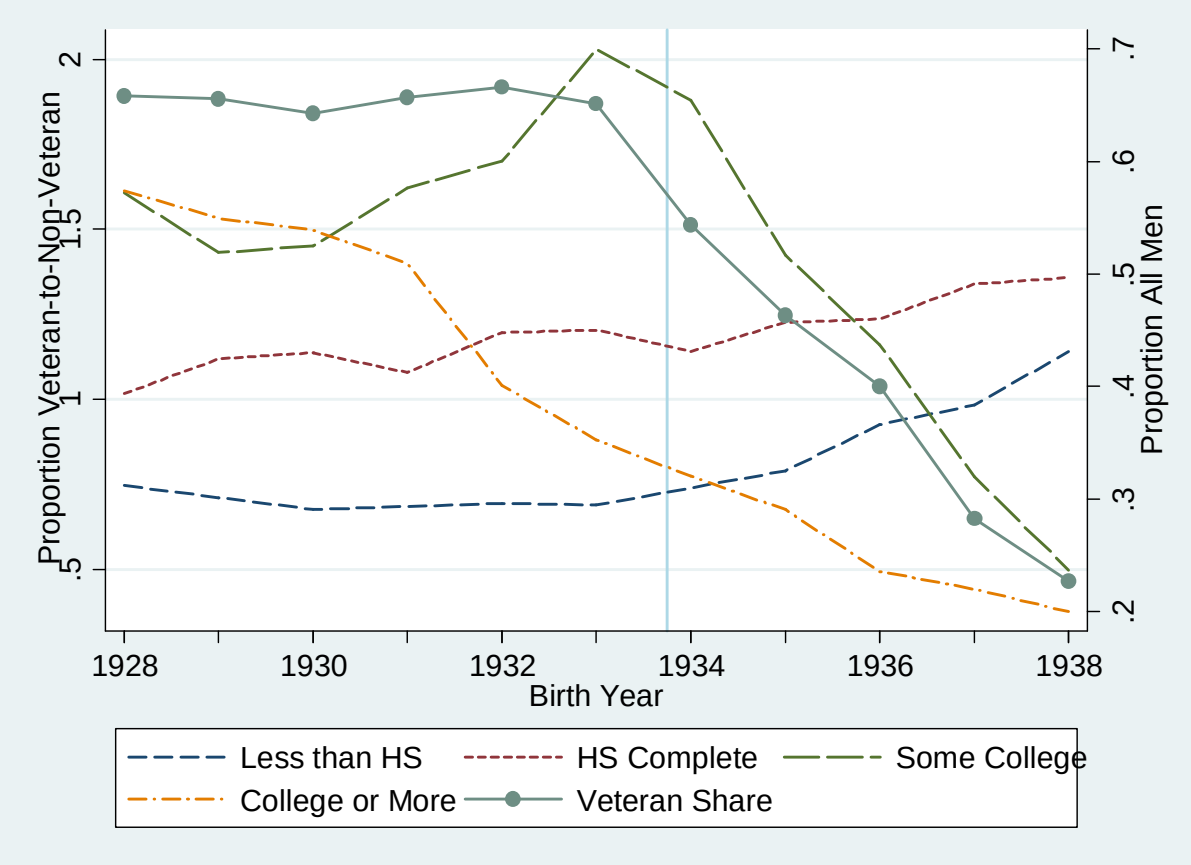


Source: IPUMS USA 1960

Note: The figure above uses a sample of white men, born between 1928Q1-1938Q4, in the 1960 Census microdata. The left axis corresponds to ownership and marriage rates among veterans relative to non-veterans. Individual data points are generated by dividing the rate of homeownership or marriage of veterans by the same rate for nonveterans in each year-quarter cell. Thus, individual data points represent a ratio of veterans relative to nonveterans for each quarter-by-year birth cohort. The right axis corresponds to the aggregate rate of veteran status among all men in the sample.

Figure 3.3

Aggregate Rates of Veteran Status and Educational Attainment by Year of Birth in 1960 for birth years 1928-1938.

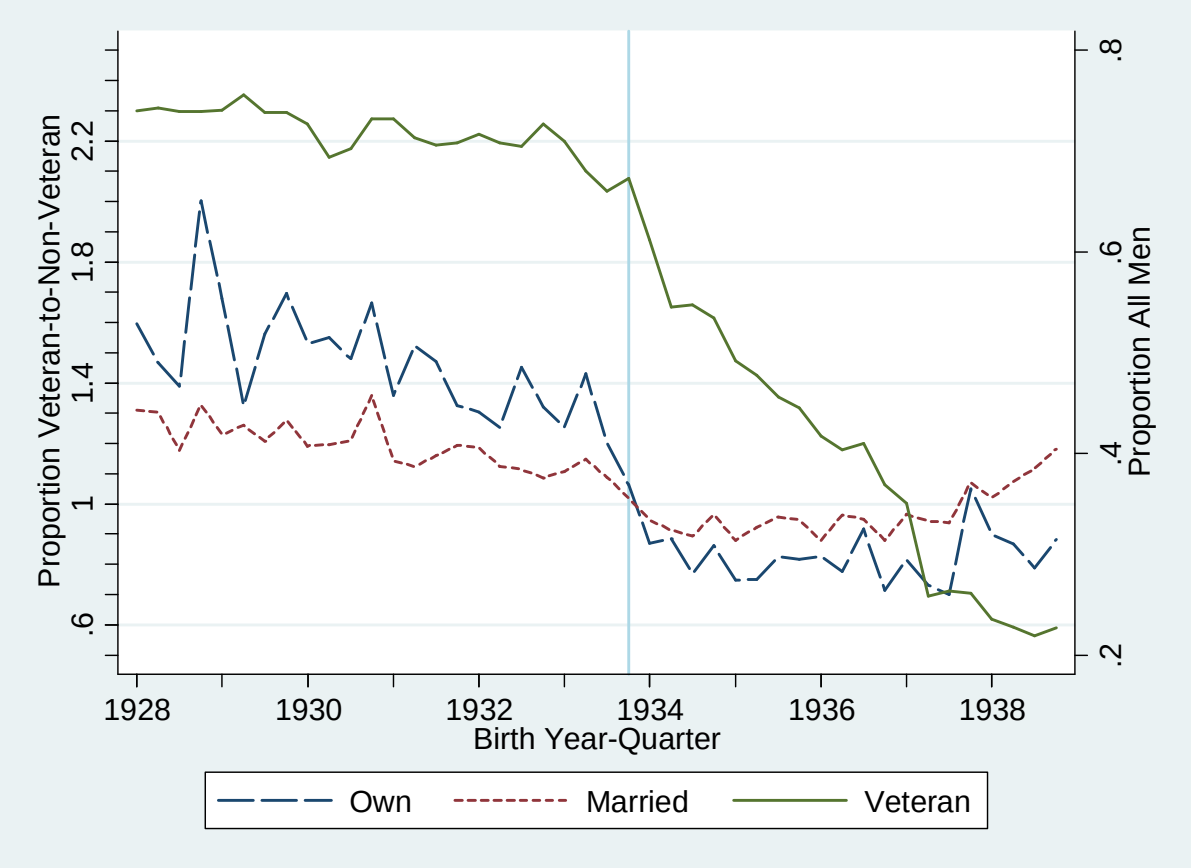


Source: IPUMS USA 1960

Note: The figure above uses a sample of white men, born between 1928-1938 in the 1960 Census microdata. The left axis corresponds to rates of educational attainment among veterans relative to non-veterans. Individual data points are generated by dividing the rate of educational attainment of veterans by the same rate for nonveterans in each birth year cell. Thus, individual data points represent a ratio of veterans relative to nonveterans for each year of birth cohort. The right axis corresponds to the aggregate rate of veteran status among all men in the sample.

Figure 3.4.a

Aggregate Rates of Veteran Status, Homeownership and Marriage by Quarter-and-Year of Birth in 1960 for birth years 1928-1938 among men who were married after the Korean GI Bill passage.

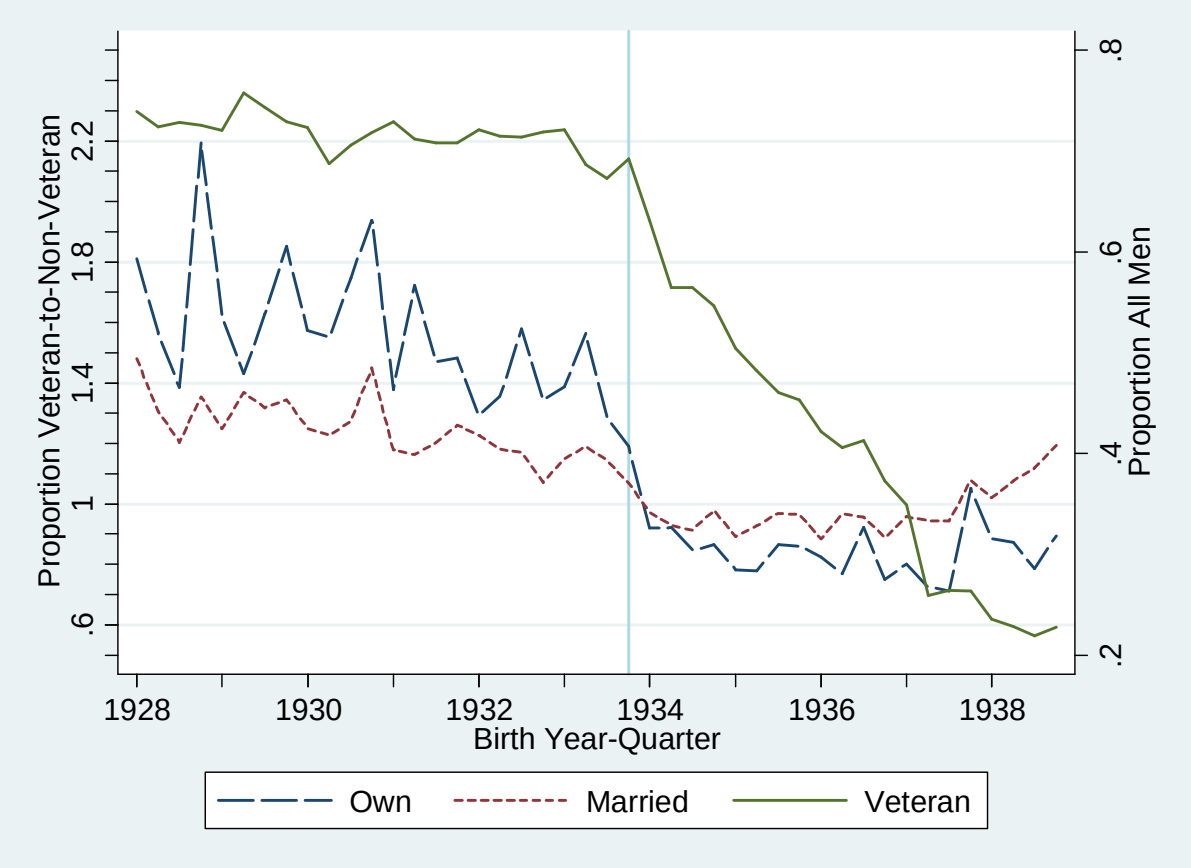


Source: IPUMS USA 1960

Note: The figure above uses a sample of white men, born between 1928Q1-1938Q4, in the 1960 Census microdata. Compared to Figure 3a, this graph is restricted to men married after the GI Bill was passed. The left axis corresponds to ownership and marriage rates among veterans relative to non-veterans. Individual data points are generated by dividing the rate of homeownership or marriage of veterans by the same rate for nonveterans in each year-quarter cell. Thus, individual data points represent a ratio of veterans relative to nonveterans for each quarter-by-year birth cohort. The right axis corresponds to the aggregate rate of veteran status among all men in the sample.

Figure 3.4.b

Aggregate Rates of Veteran Status, Homeownership and Marriage by Quarter-and-Year of Birth in 1960 for birth years 1928-1938 among men who were married after the end of Korean War hostilities.

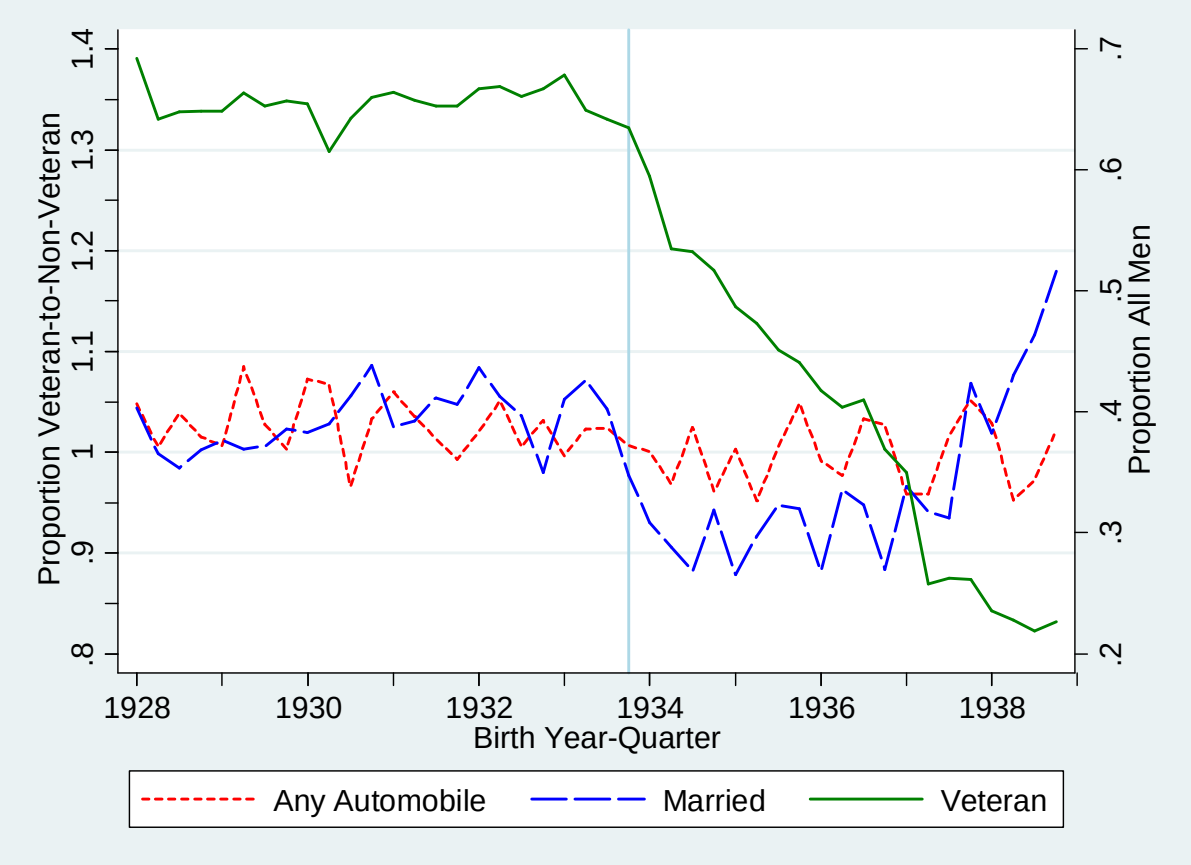


Source: IPUMS USA 1960

Note: The figure above uses a sample of white men, born between 1928Q1-1938Q4, in the 1960 Census microdata. Compared to Figure 3a, this graph is restricted to men married after VJ Day (the end of war). The left axis corresponds to ownership and marriage rates among veterans relative to non-veterans. Individual data points are generated by dividing the rate of homeownership or marriage of veterans by the same rate for nonveterans in each year-quarter cell. Thus, individual data points represent a ratio of veterans relative to nonveterans for each quarter-by-year birth cohort. The right axis corresponds to the aggregate rate of veteran status among all men in the sample.

Figure 3.5

Aggregate Rates of Veteran Status, Ownership of Any Automobile and Marriage by Quarter-and-Year of Birth in 1960 for birth years 1928-1938



Source: IPUMS USA 1960

Note: The figure above uses a sample of nonwhite men, born between 1928Q1-1938Q4, in the 1960 Census microdata. The left axis corresponds to the rate of any automobile ownership and marriage rates among veterans relative to non-veterans. Individual data points are generated by dividing the rate of any automobile or marriage of veterans by the same rate for nonveterans in each year-quarter cell. Thus, individual data points represent a ratio of veterans relative to nonveterans for each quarter-by-year birth cohort. The right axis corresponds to the aggregate rate of veteran status among all men in the sample.

Table 3.1

Annual Potential Takeup of VA Home Loans Among Korean War Veterans, 1953-1957

Year	Number of Living Korean War Veterans (1)	Number of Applications Closed (2)	Cumulative Applications Closed (3)	Eligible Veterans per Annum (4)	Annual Takeup (%) (5)	Cumulative Takeup (%) (6)
1953	1235000	.	.	1235000	.	
1954	2046000	48323	48323	2046000	2.36	2.36
1955	3188000	120241	168564	3139677	3.83	5.29
1956	3822000	159265	327829	3653436	4.36	8.58
1957	4202000	149208	477037	3874171	3.85	11.35

Note: The estimated take-up rate is based on the total number of veterans surviving the Korean War as reported in the Veteran's Administration Annual Reports for 1953-1957. Home loan application information for Korean War veterans are not distinguished by the VA until 1954. After 1952, the VA clearly distinguishes between veterans serving in only WWII or only the Korean War versus those veterans serving in both wars. The Administration on Veterans Affairs follows a fiscal year ending in June of each calendar year.

Table 3.2

Estimated Takeup of VA Home Loans Among Veterans by Age Group (Males, 18+)

Age	Veteran Composition (%) (1)	Estimate Total Veterans (2)	Total VA Mortgage (3)	Veterans with Mortgage (%) (4)
a. Takeup of WWII Veterans in 1950 by Age Group				
Under 35	72.97	11227164	615301	5.48
35-44	21.12	3249523	234139	7.21
45-64	5.35	823151	65181	7.92
65+	0.56	86162	4518	5.24
b. Takeup of WWII & Korean War Veterans in 1960 by Age Group				
Under 35	36.78	7253752	1227050	16.92
35-44	43.36	8551459	1544396	18.06
45-64	19.22	3790568	543671	14.34
65+	0.65	128193	65543	51.13

Note: Veteran composition is determined based off of Census microdata for 1950 and 1960 (Ruggles et al, 2015). The Census of Housing Residential Finance information provides tabulations of VA mortgage holdings by age groups. Age groups vary from 1950 to 1960 based on how the information is reported by the Census of Housing. The total number of living veterans in 1950 and 1960 is taken from the Veteran's Administration Annual Reports for each year.

Table 3.3

Estimated Takeup of VA Home Loans Among US Population by Age Group (Males, 18+)

Age	US Composition (%) (1)	Estimate Total Population (2)	Total VA First Mortgage (3)	Total VA First Mortgage (%) (4)
a. Takeup Among US Population in 1950				
Under 35	40.30	18130631	615301	3.39
35-44	22.97	10334010	234139	2.27
45-64	27.87	12538479	65181	0.52
65+	8.86	3986040	4518	0.11
b. Takeup Among US Population in 1960				
Under 35	33.82	18721759	1227050	6.55
35-44	21.17	11719090	1544396	13.18
45-64	31.95	17686582	543671	3.07
65+	13.07	7235168	65543	0.91

Note: US Population of males, 18 years of age and over, along with the age composition is determined based off of Census microdata for 1950 and 1960 (Ruggles et al., 2015). The total US population is taken from the US Census Bureau's Fast Facts for 1950 and 1960. The Census of Housing Residential Finance provides tabulations of VA mortgage holdings by age groups. Age groups vary from 1950 to 1960 based on how the information is reported by the Census of Housing. The total number of living veterans in 1950 and 1960 is taken from the Veteran's Administration Annual Reports for each fiscal year.

Table 3.4

Summary Statistics in 1960 for Sample of Men Born Between 1931-1936

Sample Selection:	Full Sample	Pre End of War Cohort=1	Pre End of War Cohort=0
	(1)	(2)	(3)
Veteran of WWII or Korea	0.39	0.56	0.22
Veteran of Any Period	0.56	0.66	0.47
Owns home	0.30	0.38	0.22
Married	0.73	0.80	0.67
Age	25.76	27.27	24.25
Less than High School	0.34	0.35	0.33
High School Completed	0.36	0.35	0.37
Some College	0.15	0.14	0.16
College or More Completed	0.50	0.16	0.14
Personal Income (000,000s of 1990$)	0.19	0.21	0.16
Observations	51,065	25,607	25,458

Table 3.5

Reduced Form Regressions of Marriage on Pre- End of Korean War Indicator in 1960 for men born between 1930Q4:1936Q3.

Dependent Variable:	1 = Married						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Pre End of War Cohort	0.121	0.121	0.073	0.071	0.059	0.062	0.062
	(0.015)	(0.015)	(0.010)	(0.010)	(0.008)	(0.008)	(0.008)
Income			1.041	1.098	2.31	4.184	2.93
			(0.067)	(0.063)	(0.089)	(0.205)	(0.316)
Income^2					-2.077	-10.043	-8.905
					(0.120)	(1.032)	(1.930)
Income^3						9.653	3.008
						(1.773)	(2.187)
Income ^4						-3.218	-11.086
						(0.928)	(1.540)
Completed High School				-0.028	-0.042	-0.044	0.086
				(0.005)	(0.005)	(0.004)	(0.033)
Some College Completed				-0.098	-0.103	-0.099	-0.035
				(0.009)	(0.008)	(0.007)	(0.027)
College Completed				-0.135	-0.134	-0.124	0.033
				(0.008)	(0.006)	(0.006)	(0.030)
Constant	0.681	0.761	0.605	0.629	0.514	0.409	0.334
	(0.014)	(0.017)	(0.018)	(0.017)	(0.016)	(0.016)	(0.016)
Birth State FE	NO	YES	YES	YES	YES	YES	YES
Income x Educ	NO	NO	NO	NO	NO	NO	YES

Note: Total number of observations is 51,179 for all regressions. Heteroskedasticity-robust clustered standard errors are reported. Clustering is done at the year-by-quarter of birth level. The baseline comparison mean taken from the 1940 IPUMS census for men between 24-29 years of age is 0.592.

Table 3.6

Instrumental Variables Estimates of Marriage on Veteran Status in 1960 for men born between 1930Q4:1936Q3.

	First Stage	Reduced Form	IV
Dependent Variable:	1 = Veteran	1 = Married	
	(1)	(2)	(3)
Pre End of War Cohort	0.166	0.062	
	(0.020)	(0.008)	
Veteran			0.375
			(0.040)

Note: Total number of observations is 51,179 for all regressions. Heteroskedasticity-robust clustered standard errors are reported. Clustering is done at the year-by-quarter of birth level. First-stage F-statistic is 66.64. Controls include Birth State FE, Income (through quartic), Education, and Income x Education. The baseline comparison mean taken from the 1940 IPUMS census for men between 24-29 years of age is 0.592 for marriage and 0.006 for veteran status.

Table 3.7

Instrumental Variables Estimates of Marriage on Homeownership in 1960 for men born between 1930Q4:1936Q3.

	First Stage	Reduced Form	IV
Dependent Variable:	1 = Own	1 = Married	
	(1)	(2)	(3)
Pre End of War Cohort	0.099	0.062	
	(0.011)	(0.008)	
Ownership			0.625
			(0.036)

Note: Total number of observations is 51,179 for all regressions. Heteroskedasticity-robust clustered standard errors are reported. Clustering is done at the year-by-quarter of birth level. First-stage F-statistic is 79.73. Controls include Birth State FE, Income (through quartic), Education, and Income x Education. The baseline comparison mean taken from the 1940 IPUMS census for men between 24-29 years of age is 0.592 for marriage and 0.098 for homeownership.

Table 3.8

Robustness Checks

Dependent Variable	1 = Married			1 = Own Auto
	(1)	(2)	(3)	(4)
Pre End of War Cohort	0.117	0.032	0.017	-0.003
	(0.015)	(0.008)	(0.008)	(0.005)
Observations	87,478	43,629	39,827	19,788
Primary Sample		X	X	X
Extended Sample	X			
Married After GI Bill		X		
Married After EOW			X	
Mean	0.562	0.592	0.592	0.910

Note: Heteroskedasticity-robust clustered standard errors are reported. Clustering is done at the year-by-quarter of birth level. Controls include Birth State FE, Income (4), Education, and Income x Education. For columns (1)-(3), means are based off of the 1940 Census data for men of comparable ages. For column (4), means are based off of 1960 sample of men who came of age after the termination of the Korean War.

Table 3.9

Reduced Form Regressions of Marriage on Pre- End of Korean War Indicator Interacted with First Quarter Indicator in 1960 for men born between 1930Q4:1936Q3.

Dependent Variable:	1 = Married	
	(1)	(2)
Pre End of War Cohort*Born First Quarter	0.012	-0.0161
	(0.003)	(0.0050)
Pre End of War Cohort	0.012	0.0119
	(0.005)	(0.0050)
Born First Quarter		0.028
		(0.0035)

Note: Total number of observations is 51,179 for all regressions. Heteroskedasticity-robust clustered standard errors are reported. Clustering is done at the year-by-quarter of birth level. Controls include Birth State FE, YOB FE, Income (4), Education, and Income x Education. The baseline comparison mean for marriage rates is 0.592 and is taken from the 1940 IPUMS census.

Table 3.10
Reduced Form Regressions of Marriage on Pre- End of Korean War Indicator for men born between 1930Q4:1936Q3

Census Year	1960	1970	1980
Dependent Variable:	1 = Married		
	(1)	(2)	(3)
Pre End of War Cohort	0.062	0.006	0.003
	(0.008)	(0.003)	(0.003)
Observations	51,179	47,647	47,890

Note: Heteroskedasticity-robust clustered standard errors are reported. Clustering is done at the year-by-quarter of birth level. Controls include Birth State FE, Income (4), Education, and Income x Education. The baseline comparison mean is 0.592 and is taken from the 1940 IPUMS census

Chapter 4
Homeowner Behavior, Health Status, and Medicaid Payment Eligibility: Evidence from the Deficit Reduction Act of 2005

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4.1. Introduction

Medicaid is the largest, most important payer of elderly long-term care services in the United States.[40] Eligibility for Medicaid is means-tested and requires an individual to have asset and income levels at or below their state's maximum eligibility requirement.[41] Otherwise, long-term care services must be paid for out-of-pocket. Medicaid's implicit tax, thus, creates a large incentive among elderly households to shelter or spend-down assets so as to gain eligibility. In particular, the housing asset acts as a good mechanism for sheltering assets because it has, traditionally, been considered a non-countable asset when determining eligibility.[42] This facet of Medicaid long-term care has been relatively understudied in public and urban economics.

This paper makes use of the federally mandated Deficit Reduction Act of 2005 (DRA05), which created an eligibility cap of $500,000 in non-countable housing equity on an individual basis. Consequently, individuals with housing equity over $500,000 may have become ineligible for Medicaid long-term care payments even if their non-housing assets and income met their state's eligibility criteria. This paper tests the implicit taxation of Medicaid means-testing by analyzing whether households likely to require long-term care reduce housing equity after the passage of DRA05.

Medicaid expenditure on long-term care services has seen significant growth since its implementation in the late 1960s. According to the Centers for Medicare and Medicaid Services (CMS), long-term care services and support totaled over $140 billion and accounted for 34.1 percent of all Medicaid spending in 2012. Elderly persons with physical disabilities accounted

[40] Long-term care services and support, generally, include nursing home services and/or home and community-based services.
[41] Medicaid eligibility requirements vary substantially by state. For details on state-level eligibility, readers are referred to the Centers for Medicare and Medicaid Services at www.cms.gov. Coe (2007) also provides an outline of Medicaid income eligibility requirements.
[42] The protected status of housing equity only applies to the individual's primary residence and requires that the individual plan to return to the home, or the presence of a spouse, disabled child, or minor dependent child in the home.

for a majority of these expenditures. Moreover, these expenditures are expected to grow exponentially with the aging of the *baby boomer* population. At both the state and federal level, there is a prevailing emphasis on cost-cutting and control measures with respect to Medicaid long-term care spending. DRA05 was one such measure, which targeted individuals considered *housing-rich and income-poor* by forcing them to spend down at least a portion of their housing wealth.

Among economists, the widespread take up of Medicaid long-term care services has led to a growing body of literature analyzing the individual welfare implications of Medicaid as a provider of long-term care insurance for the elderly.[43] However, the relationship between elderly housing behavior and Medicaid means-testing has been relatively understudied. One reason for this is the lack of policy variation with respect to the housing asset's exempt status. DRA05 provides the first across-the-board change in the status of housing as an entirely exempt asset in determining Medicaid long-term care payment eligibility.

In this paper I make use of detailed panel data from the Health and Retirement Study (HRS) to test the responsiveness of individual housing equity to a potential loss in Medicaid payment eligibility. Given that individuals who anticipate the need for nursing home care are more likely to respond to this policy, I use individual variation in health status to predict entry into long-term care and the need for Medicaid.

The paper makes three contributions to the existing literature. First, it examines an across-the-board change in Medicaid eligibility requirements on the use of Medicaid protected assets by households. Second, it combines time-variation with individual health status as a

[43] Norton (2000) provides an in depth discussion and review of the literature on long-term care and means-tested public insurance.

predictor of responsiveness to Medicaid long-term care eligibility. Third, it attempts to analyze the mechanisms by which housing equity holdings may be reduced.

There are three primary findings. First, implementation of the policy leads to reductions in housing equity of between $82,000 and $220,000, across a variety of health measures predicting entry into long-term care. Second, these effects are substantially larger than any effects found for health factors less likely to predict long-term care needs. Third, while I am unable to disentangle the mechanisms through which homeowners reduce housing equity, I provide evidence of substantial heterogeneity across the distribution of total housing debt. This indicates that some homeowners may be reducing their house value and others may be increasing housing debt.

The paper is organized as follows: section II describes the institutional details of DRA05's home equity provision and a description of relevant literature; section III discusses the data construction and empirical framework; section IV provides baseline estimates of housing equity holdings and quantile regression estimates; section V provides robustness checks; section VI provides an extension to housing transitions; and section VII concludes.

4.2. Background

Concern over an aging population has troubled policy-makers and academics alike. This stems from the fact that the aged are disproportionately at risk of incurring catastrophic long-term care expenses. According to the Administration on Aging, annualized average nursing home costs in 2010 ranged from $83,580 for a private room, $74,820 for a semi-private room, and $39,516 for an assisted living facility. Home and community-based services are generally smaller, but remain substantial. The probability of nursing home entry increases with age and is

highly correlated with assisted daily living (ADL) limitations. Such limitations include requiring help bathing, dressing, eating, etc. The probability of entering a nursing home among 65 year olds is between 35-50 percent, and, among individuals entering nursing homes, between 10-20 percent will incur stays of greater than five years (Brown and Finkelstein, 2007). Thus, long-term care generates a grossly right-skewed distribution of expenditures among the elderly.

4.2.1. The Home Equity Provision of the Deficit Reduction Act of 2005

Under section 6014 of the Deficit Reduction Act of 2005 (DRA05), the status of housing equity as a completely non-countable asset with respect to long-term care services changed.[44] This provision of DRA05 was implemented as a cost-cutting measure and intended to force individuals with high levels of housing equity to spend down the housing asset before relying on Medicaid. This is the first change in the status of housing equity with respect to Medicaid eligibility since the development of Medicaid in the 1960s. DRA05 was signed into law on February 8, 2006, and the home equity provision was effective for all payment applications filed on or after January 1, 2006.

The act does not deny a person from becoming Medicaid eligible, but requires that "states must deny payment [for nursing facility services or other long-term care services] if the individual's equity interest in his or her home exceeds $500,000" (CMS Enclosure, 2006b). Under the provision, states had the opportunity to increase the housing equity limit up to a maximum of $750,000.[45] According to the National Association of State Medicaid Directors, as of October 2007, ten states intended to increase the housing equity limit to the maximum, but only one state had actually implemented the provision.[46]

[44] The protected status of housing equity only applies to the individual's primary residence.
[45] States opting to increase the housing equity limit were not required to impose the increase in a uniform manner across the state. The limit could vary by region and/or eligibility groups.
[46] Massachusetts implemented the provision in July of 2006.

The equity value of the home is determined by taking the difference between the current market value of the home and any encumbrance, such as a mortgage, reverse mortgage, home equity loan, or other debt secured by the home. According to the Government Accountability Office, verification of primary residence valuation is commonplace and various methods are used to gather this information. Applicants are often required to self-report the information and at least 35 states conduct official property searches at some level (GAO, 2012).

Finally, the equity *interest* is determined by dividing the total equity among all homeowners. For example, a widowed homeowner with $500,000 in home equity would carry an equity *interest* of $500,000 (i.e., $500,000 divided by one owner). A married couple with $500,000 in home equity would allocate $250,000 in equity *interest* to each spouse (i.e., $500,000 divided by two owners). Thus, unmarried homeowners with at least $500,000 in home equity or married homeowners with at least $1 million in home equity would be affected by the DRA05 provision. This detail makes it unlikely that married homeowners would be affected by the DRA05 provision.[47]

4.2.2. Existing Literature

There are two primary areas of the economics literature relevant to this study. First, this paper fits in with the literature on elderly household behavior and social insurance programs. Earlier studies have shown that elderly households are responsive to Medicaid policy due to the implicit tax it imposes. Households may attempt to protect or spend down their assets in order to gain eligibility (Coe, 2007; Greenhalgh-Stanley, 2012). There is also evidence that elderly homeownership and living arrangement decisions are sensitive to Medicare policy (Engelhardt and Greenhalgh-Stanley, 2010) and Social Security benefits (Engelhardt, Gruber, and Perry, 2005; Engelhardt, 2008).

[47] Less than 1% of HRS homeowners in 2004 have home equity of $1 million or more.

A second body of literature has extensively analyzed the relationship between housing equity and elderly demand for public or private long-term care insurance. Because Medicaid acts as a substitute for private long-term care insurance, there is a potential for crowd-out (Brown et al., 2007; Brown and Finkelstein, 2008; Brown and Finkelstein, 2011). Given that housing has historically been an exempt asset, the sheltering of assets may affect crowd out of private long-term care insurance. Another hypothesis is that prudent elderly homeowners use the home as a precautionary buffer, foregoing private long-term care insurance in the short term. In the long-term, they are more likely to extract home equity. According to the literature, home equity extraction most commonly occurs due to entry into a nursing home (Venti and Wise, 2004; Walker, 2004; Davidoff, 2010) and may be preceded by limitations in activities of daily living (Davidoff, 2010; Davidoff, 2013).

4.3. Data, Econometric Framework, and Identification

This paper analyzes the behavior of elderly households to a change in Medicaid payment eligibility for long-term care services. Of particular interest in this study is how the policy change impacts elderly individuals with a greater likelihood of requiring Medicaid long-term care. I use a variety of self-reported health measures, which may predict entry into nursing home care, as a proxy for health status in order to show that changes in the distribution of housing equity may be driven by persons more likely to request Medicaid payments. Because the DRA05 eligibility cutoff is based on housing equity, I attempt to measure the extent and mechanisms through which elderly individuals may withdraw equity after the policy change.

4.3.1. Data Construction and Sample Restrictions

For the primary sample, I create a balanced panel data set for 2004-2006 from the RAND version of the Health and Retirement Study (HRS). The HRS is a rich data set covering a representative sample of U.S. elderly households where the head of household is age 55 or older. Households are surveyed every two years and individual respondents are asked detailed information on individual health and household level wealth.

Because the DRA05 provision focuses on an individual's *share* of housing equity, I restrict the primary sample to unmarried homeowners, namely, widowed, separated, and divorced individuals. The sample is further restricted to individuals age 65 or over in 2004.[48] This reduces potential confounding effects due to differences in Medicare coverage. It also allows health measures to be more comparable across the sample as health shocks are highly correlated with age. To provide a better comparison across the treatment and control groups, only individuals with house values above $200,000 are included in the analysis, although similar results are found by varying this cutoff.[49]

Table 4.1 shows summary statistics for elderly homeowners age 65 and over. The left panel is the sample of all homeowners, and the right panel is homeowners with home values of at least $200,000 in 2004. Both samples are further broken down into married versus unmarried households. Two noticeable differences exist among the sample of married and unmarried homeowners. First, the average age of unmarried households is about 3 years older than married households. Second, the proportion of the sample that is female increases by approximately 30 percentage points. Because widows are more likely to be older and female, these differences are

[48] Estimates for the sample of individuals 55+ and 60+ are similar and available upon request from the author.
[49] Estimates that restrict the sample to individuals without private long-term care insurance in the pre-period provide qualitatively similar results. Due to the small number of households who purchase private long-term care insurance these estimates are not included, but are available upon request.

attributed to a higher proportion of widows existing in the unmarried sample. With respect to differences in the value of homes, restricting the sample to homes above $200,000 affects the geographic representation of the sample. The proportion of homes in the Northeast and Western regions increases substantially.

4.3.2. Identification Strategy

Prior to DRA05 the primary residence was a protected asset with respect to Medicaid payments for long-term care services. The housing equity cap imposes an implicit tax of 100% on at least the individual *share* of home equity exceeding the cutoff. Assuming an individual meets all other state eligibility requirements, an individual could be deemed ineligible for long-term care payments unless they reduce their housing equity. To identify the effects of DRA05, I use time variation by comparing the periods before and after the policy change. Second, I compare individuals with house values above and below the DRA05 cutoff. Lastly, I make use of individual variation in health status that is likely to predict entry into long-term care. Given the narrow time frame surrounding the policy implementation, this allows me to focus on the effect from individuals more likely to be affected by the policy change.

Figure 4.1 shows nonparametric, kernel-density estimates of housing equity among unmarried HRS homeowners age 65 and over in 2004 and 2006.[50] The sample is restricted to individuals with housing equity between $275,000 and $900,000. For both years, the distribution is skewed to the left. This shows that there are few households at the right tail of the distribution. In 2004, there is a hump just past $500,000, which dissipates in 2006. This provides suggestive evidence of a potential reduction in housing equity among homeowners near the DRA05 cutoff.

[50] Samples are statistically significantly different using a two-sample Epps-Singleton test. Epps-Singleton statistic of 63.1 with a p-value of 0.000.

It is hypothesized that reductions in housing equity can occur through either a reduction in the value of housing or an increase in the value of encumbrances. There are three potential mechanisms for reducing the value of housing. First, an individual may choose to reduce their home value by transitioning into a lower valued home (Venti and Wise, 2004). A second way to reduce home value is by reducing property maintenance levels (Davidoff, 2004).[51] Third, home values may be reduced by transferring the housing asset to another individual or to a trust.[52]

Another possibility is the reduction of housing equity by increasing the value of encumbrances. The two likely scenarios are for individuals to increase mortgage debt through a second mortgage or by increasing housing debt through home equity loan products. Greenhalgh-Stanley (2012) finds evidence of this mechanism in her study of the impact of Medicaid Estate Recovery Programs on homeownership. Given that credit constraints were low over the period in question; these are two likely possibilities for reducing housing equity. In this paper, I will attempt to analyze these mechanisms as well as housing transitions into lower valued homes.

4.3.3. Econometric Specification

This paper employs a differencing strategy to analyze elderly homeowner responses to the DRA05 housing equity cutoff for Medicaid long-term care payment eligibility. The primary specification, indexed by individual, *i*, and time, *t*, is

$$Equity_{it} = \beta D_t^{Post} + \delta D_{it}^{Health*Post} + \theta D_{it}^{Above*Post} + \varphi D_{it}^{Health*Above*Post} + \gamma_i + u_{it} \quad (1)$$

[51] This is a valid explanation for home owners near the DRA05 cutoff although these changes are not likely picked up in property search valuations in the short-term.

[52] This is unlikely in the short –term because the Medicaid look-back provision imposes a penalty period on asset transfers for less than fair market value. If an individual were to transfer the asset to a child, for example, they would likely become ineligible for Medicaid payment for long-term care services. If the transfer is for less than fair market value they would be subject to a 60 month penalty period in which they are not eligible to receive Medicaid long-term care payments. Or, if they transferred the house at fair market value, they would not be eligible without spending down the newly acquired assets. (CMS Enclosure, 2006a)

where $Equity$ is the dollar value of housing equity for the respondent (in 2006 dollars), D^{Post} is an indicator equal to one if the year is 2006 or later, $D^{Health}$is an indicator equal to one if the respondent reports a specified health measure in the pre-period, D^{Above} is an indicator equal to one if the respondent's pre-period, self-reported home valuation is above the DRA05 cutoff, and γ is a set of respondent-level fixed effects. Estimates for the effect from *Health*, *Above*, and the interaction of *Health* and *Above* are excluded due to time-invariance given the individual fixed effect. Treatment status is defined as having a pre-period home valuation above the cutoff and reporting the specified health measure in the pre-period. The coefficient of interest, φ, describes the additional average dollar change in housing equity for a respondent with pre-period home value above the cutoff that also reports the health measure in the pre-period when compared to similar individuals who have either the reported health condition or a home-value above the cutoff in the pre-period. If elderly homeowners respond to the DRA05 policy through changes in housing equity, then, for the group of treated individuals, we expect reductions in housing equity sufficient to make them eligible for Medicaid long-term care payments.

Equation (1) is estimated using a variety of health measures. The first two analyze respondent level uncertainty measuring whether future out-of-pocket medical expenditure may exceed savings and the likelihood of entering a nursing home in the next five years.[53] Physical ability tends to be a strong predictor of future long-term care needs and nursing home entry (Davidoff, 2010; Gaugler et al., 2007). I use four indicators that proxy for the individual's physical ability. These include whether the respondent reports having at least 1 ADL, at least 2 ADLs, is lacking at least one gross motor skill, and is lacking at least one fine motor skill. Gross and fine motor skills are similar to ADLs. The former includes walking abilities, climbing stairs,

[53] Both indicators take on a value of one if the respondent has any uncertainty (percent probability of 1 or greater). This cutoff is used for precision. Results using different uncertainty cutoffs are available from the author upon request.

and bathing. The latter includes picking up a dime, eating, and dressing. Finally, I include two reported health measures that are highly positively correlated with nursing home entry (Gaugler et al., 2007). These are diabetes and cancer.[54]

4.4. Estimation Results

4.4.1. Unconditional DDD Estimates

The primary outcome of interest in this study is housing equity. Table 4.2 illustrates unconditional DDD estimates of the effect of DRA05 implementation on housing equity for unmarried individuals age 65 or older. Treatment and control groups are defined using the gross motor skills health measure. The top panel compares the change in housing equity for individuals who reported lacking at least one gross motor skill in the pre-period. The average difference is estimated by comparing individuals whose pre-period housing value was at-or-above the DRA05 cutoff to those that were below the cutoff in the pre-period. Each cell contains mean housing equity for the group, as well as standard errors and the number of individuals in the group. For individuals above the DRA05 cutoff, housing equity was reduced by approximately $84,000 in the post-period, compared to a reduction of $10,000 for individuals below the cutoff. The difference-in-difference (DD) estimate shows a relative reduction of $74,000 for those above the cutoff. The equivalent estimate in the bottom panel shows that individuals not lacking any gross motor skills experienced a relative increase in housing equity of $64,000 between 2004 and 2006.

[54] The HRS also includes stroke and memory disease as health indicators and information on prior nursing home entry. These measures provide effects of similar magnitude to other predictors of long-term care. However, due to the small size of the respective treatment groups, these estimates are not reported here but are available upon request from the author.

Taking the difference in the DD estimates across the two panels gives the unconditional DDD estimate. The DDD estimate shows a decrease of $139,000 for individuals both above the DRA05 cutoff and lacking at least one gross motor skill in the post-period relative to comparable individuals either below the cutoff or not lacking at least one gross motor skill. This unconditional estimate is statistically significant under a one-sided alternative hypothesis. It provides some evidence that DRA05 incentivized individuals more likely to require long-term care to maintain lower levels of housing equity.

Table 4.3 reports unconditional DD and DDD estimates, along with their standard errors, for all of the health measures. DD treatment is equivalent to panel A in Table 4.2, and DD control is equivalent to panel B in Table 4.2. Columns (1) and (2) show results for the respondent level uncertainty measures. Columns (3) through (6) show results for physical ability indicators. Columns (7) and (8) report results for individual health indicators. Across the various measures there is evidence that individuals more likely to require long-term care are also more likely to maintain less housing equity relative to individuals less likely to require long-term care.[55]

4.4.2. Conditional DDD Estimates

Table 4.4 reports fixed effects regression estimates for housing equity. Across all eight health measures, unmarried homeowners with pre-period house values above the cutoff who also report the health condition hold relatively less housing equity between 2004 and 2006. Reductions in housing equity range from $82,200 to $219,610 compared to individuals who reported only the health measure or only having a home value above the cutoff. The largest estimate comes from the group of individuals reporting uncertainty in future medical expenditures relative to savings. Based off of a sample mean of over $357,000 this estimate

[55] DDD tables similar to Table 4.2 are available for each health factor upon request from the author.

accounts for a 61% reduction in housing equity, or approximately three years of nursing home care.

While not all of the estimates are statistically significant, some patterns in the estimates are well aligned with predictions of nursing home entry. Across ADL measures, we see a monotonic increase in the magnitude of housing equity changes in response to the policy, although the estimate for 2 ADLs is not statistically significant.[56] The gross motor skills measure captures an effect similar to the ADL measures[57] and carries a similar magnitude. The fine motor skills measure has a smaller effect than gross motor skills, which is not statistically significant. This is expected because fine motor skills are relatively less likely to predict long-term care needs than gross motor skills. With respect to the reported health measures, we see that both cancer and diabetes generate large relative reductions in housing equity. This is consistent with evidence found in Gaugler et al (2007).

To understand the size of the estimates better it is useful to compare them to measures in the existing literature. Greenhalgh-Stanley (2012) measures changes in housing equity using state-by-time variation in Medicaid estate recovery programs. Reductions of housing equity are smaller in magnitude at approximately $28,000 for unmarried individuals compared to married individuals, equating to a decrease of approximately 23% for this group. Greenhalgh-Stanley does not estimate the added treatment effect from individual health, which may explain the large differences in magnitude.

[56] Estimates for indicators of at least 3 ADLs and at least 4 ADLs are not reported here but are available upon request from the author.
[57] Gross motor skills include the following four tasks: walking one block, walking across the room, climbing one flight of stairs, and bathing. (RAND HRS Data Documentation, Version N, 2014).

4.4.3. Quantile Regression Estimates

Due to the large right tail observed in the distribution of housing equity, I also estimate unconditional quantile regressions estimates of equation (1) across the eight health measures.[58] Figures 4.2.a-h show the estimate of φ from equation (1) starting at the median. The first thing to notice is that there is substantial variation across the distribution of housing equity. Of concern in this paper is whether changes in housing equity are occurring between the median and right-tail of the distribution. For the major predictors of nursing home entry, this appears to be true. ADL measures (2c-d) show that substantial decreases in housing equity are occurring throughout the distribution. This effect is less pronounced for the gross motor skills, fine motor skills, cancer, and diabetes measures (2e-h). Nevertheless, these measures show small reductions in housing equity between the 75th and 85th percentiles. For the two uncertainty measures (2a-b), it appears reductions in housing equity are being driven by the right tail of the distribution, although there are small reductions between the 70th and 80th percentiles.

Individuals may reduce housing equity through either increases in encumbrances or decreases in housing value. Given the substantial reductions in overall housing equity, I use quantile regression analysis to observe changes in the distribution of total housing debt, indexed by individual, *i*, and time, *t*:

$$Housing\ Debt_{it} = \alpha D_t^{Post} + \mu D_{it}^{Health*Post} + \tau D_{it}^{Above*Post} + \sigma D_{it}^{Health*Above*Post} + \rho_i + \omega_{it} \quad (2)$$

where housing debt measures the real dollar value of encumbrances. Figures 4.3a-h show estimates of σ from equation (2). Estimates begin at the 70th percentile due to the fact that the

[58] Recent works suggest that conditional quantile estimates cannot be interpreted as marginal effects (e.g., Firpo, Fortin, and Lemieux, 2009; Powell, 2013). For this reason, unconditional quantile estimates are used.

median homeowner does not hold housing debt so lower portions of the distribution are largely unaffected.

Patterns in the data show substantial heterogeneity in the distribution of housing debt. For both ADL measures (3c-d), small reductions in home equity occur up through around the 85th percentile and increases in housing debt occur beyond that point. A similar pattern is observed for both gross and fine motor skills (3e-f), although the effects are smaller in magnitude at each quantile. The pattern for diabetes (3g) is opposite with increases in housing debt occurring through the 85th percentile and reductions thereafter. Very small changes are observed for cancer (3h). For uncertainty in future medical expenditures (3a), the largest reduction in housing debt occurs between 81st and 91st percentiles. Lastly, uncertainty in future nursing home entry (3b) shows a sharp reduction in housing debt between the 92nd and 95th percentiles.

While it is difficult to disentangle these effects, the magnitudes of these changes are in line with the estimates provided earlier. If individuals who downsize the value of their residence do not take out a new mortgage, rather pay in cash, then Figure 4.3 suggests households use both reductions in house value (i.e., downsizing their home) and increases in encumbrances to reduce their housing equity.

4.5. Robustness

4.5.1. Alternative Health Measures

In order to test the validity of earlier results, I re-estimate equation (1) across a second set of health measures, which include arthritis, high blood pressure, heart disease, and lung disease. None of these health measures act as good predictors of entry into nursing home care (Gaugler et al., 2007). Estimates of φ are reported in Table 4.5. For arthritis (1) and heart disease (3) there is

a relative increase in housing equity among treated individuals. Neither of these are statistically significant. Estimates for high blood pressure (2) and lung disease (4) generate small reductions in housing equity. For both, the magnitude of the estimate is small compared to health measures predicting entry into long-term care. Even if these magnitudes are subtracted from earlier estimates, the relative decrease in housing equity remains large for treated individuals who are more likely to require Medicaid coverage. Furthermore, the standard errors are at least twice as large as the reported estimates.

4.5.2. Married Households

As a second robustness check, I re-estimate equation (1) for married households using similar restrictions to those in the primary sample. One difference is that the sample is restricted to households whose pre-period house value is less than $850,000.[59] Married households may be affected if their total housing equity is valued at or above $1 million. Thus, this restriction removes any confounding effects from potentially treated married households. Lastly, health indicators are defined based on the responses of the household head.

Table 4.6 shows conditional DDD estimates for the sample of married individuals across all health measures. Columns (5) through (8) report estimates for gross motor skills, fine motor skills, diabetes, and cancer, and show a small and statistically insignificant difference in housing equity between treated and untreated households. Estimates are larger for both ADL measures, columns (3) and (4). However, they remain much smaller in magnitude than the estimates for unmarried individuals. They are also statistically insignificant.

Married individuals in the treatment group appear to be slightly more responsive with respect to both uncertainty measures (columns (1) and (2)). For the probability of nursing home

[59] Similar results are found using other upper bounds between $850,000 and $1 million. These estimates are available upon request from the author.

entry in the next five years, the estimate is rather large in magnitude and statistically significant under a two-sided alternative hypothesis. One possible explanation for this is that forward-looking married households respond to DRA05 in preparation for expected long-term care expenses. A similar explanation may exist for the second uncertainty variable, which measures whether households expect their savings to exceed medical expenditure in the next five years. However, this estimate is much smaller in magnitude and not statistically significant.

4.5.3. Alternative Years of Data

As a final robustness check, I re-estimate equation (1) using data from 2002 and 2004. Individuals who experience health shocks are more likely to spend down their assets, including housing equity. This falsification test allows for a comparison of the policy effect to a time effect from a change in health status. These results are reported in Table 4.7 with home equity values reported in real 2006 dollars.[60]

For the probability of nursing home entry (1) and diabetes (6), the estimate of φ is positive and not statistically significant. These individuals have higher housing equity in 2004 compared to individuals who do not report the health measure or are not above the DRA05 cutoff. All of the measures of physical ability (columns (2) through (5)) display a relative reduction in housing equity among treated individuals between 2002 and 2004 although none are statistically significant. With the exception of fine motor skills, the estimates are substantially smaller than those reported in Table 4.4. The fine motor skills measure reports a relative decrease in housing equity that is $25,000 more than the comparable estimate from Table 4.4. Finally, for cancer the estimate is negative, large, and statistically significant. Upon further

[60] The measure of the probability of medical expenditure exceeding savings in the next five years is not included due to data limitations.

investigation, this estimate may be unreliable. Only two individuals are treated over the time frame, and the estimate is largely driven by one of these individuals.

4.6. Housing Transitions

Due to the small size of the restricted HRS sample, disentangling the mechanisms through which housing equity is reduced is difficult. The final portion of this analysis uses data from the 2005 and 2007 American Community Survey (ACS) to analyze the extent to which individuals may transition into lower-valued homes. The estimating equation is similar to equation (1), indexed by individual i and time t,

$$Transition\ Rate_{it} = \beta D_t^{Post} + \pi D_{it}^{Health} + \vartheta D_{it}^{Below} + \delta D_{it}^{Health*Post} + \theta D_{it}^{Below*Post} + \varphi D_{it}^{Health*Below*Post} + \gamma_i + u_{it} \quad (3)$$

where the dependent variable measures one- and two-year transition rates, D^{Below} is an indicator equal to one if the respondent's self-reported home valuation is *below* the DRA05 cutoff, and γ is a set of either state- or metro-level fixed effects. Because the ACS is a cross-section, I cannot estimate individual changes in housing equity across the pre- and post-period. The ACS provides various self-reported health measures similar to those in the HRS. These include self-care difficulty, independent living difficulty, ambulatory difficulty, cognitive difficulty, and vision or hearing difficulty. Equation (3) is estimated using similar sample restrictions for the ACS data as was used in the HRS sample.

Table 4.8 reports DDD estimates of equation (3) for the ACS data. Columns (1) through (5) report estimates for the probability of the individual having moved in the last year. Columns (6) through (10) report estimates for the probability of the individual having moved in the last two years. Among individuals reporting independent living difficulty, a larger proportion move

into homes with values below the DRA05 cutoff in the post-period relative to individuals not reporting independent living difficult or not below the cutoff. Columns (2) and (7) show relative one- and two-year transition rates of 1.3 and 1.6 percentage points, respectively. These values are substantial and equate to an increase in the rate of transition of between 31-45% relative to comparable homeowners. An effect is also found for individuals with vision or hearing difficulty. Column (5) reports a relative increase of 1.1 percentage points for the one-year transition rate of treated individuals relative to untreated individuals. Column (10) reports a relative increase of 1.0 percentage points for the two-year transition rate, although it is not statistically significant. The remaining health measures show positive transition rates, but they are not statistically significant.

Upon restricting the data to only metro areas, the estimated effects from equation (2) increase across all health measures. This is an unsurprising result since living in a metro area is positively correlated with higher average house values. Thus, aged individuals living in metro areas have a higher probability of being affected by DRA05. These estimates are shown in Table 4.9, where columns (1) through (5) show one-year transition rates and columns (6) through (10) show two-year transition estimates. For all health measures, the coefficient estimates of φ increase in magnitude when compared to those in Table 4.8. Estimated effects for individuals reporting independent living difficulty, relative to those without independent living difficulty, increase to 1.53 and 1.84 percentage points, respectively. Relative estimates for individuals with vision or hearing difficulty increase to 1.54 and 1.43 percentage points for the one- and two-year transition measures, respectively. Lastly, estimates for individuals reporting self-care difficulty become significant and are shown in columns (1) and (6), with respective one- and two-year

transition rates of 1.1 and 1.5 percentage points. Given a 1-year mean of 2.9% and a 2-year mean of 5.1%, these estimates are substantial.

It is important to note that the ACS data does not provide causal estimates due to the fact that the decision to move is jointly decided with the value of the home purchased. Nevertheless, the estimates provide suggestive evidence of a trend toward lower-valued homes among elderly individuals likely to require long-term care following the implementation of DRA05.

4.7. Conclusions

This paper provides suggestive evidence of Medicaid's implicit tax and how individuals may use housing assets as a shelter for eligibility. I show that households who are likely to require long-term care services and above the eligibility cutoff are responsive to the implementation of DRA05 compared to individuals less likely to require long-term care services or below the cutoff. Unmarried individuals reduce housing equity by up to $220,000 relative to comparable individuals, with the effect varying by the severity of health status and expectations regarding the need for long-term care.

While the DRA05 policy change affects only a small portion of the U.S. population of homeowners, it is evident that Medicaid's treatment of the home inhibits reductions in state and federal government spending for Medicaid long-term care services. Because individuals are able to "game the system", such policy changes are unlikely to have a substantial effect on total Medicaid long-term care spending. At the same time, these behavioral responses by individual homeowners may provide further evidence of the difficulties in growing the private market for long-term care insurance.

Given the small sample used for the primary portion of this analysis, more work should be done to improve our understanding of the effect of Medicaid treatment of the home on housing asset holdings. Disentangling the mechanisms by which homeowners reduce housing equity is particularly interesting. A number of existing studies are puzzled by the low take-up of reverse mortgages among elderly homeowners, showing that annuitization of housing assets can provide major welfare benefits (Davidoff, 2009; Brown and Finkelstein, 2011). If Medicaid policy can promote the use of such home equity tools, this will have major implications for these markets and for the future of Medicaid spending.

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Figure 4.1.

Kernal Density for Unmarried Individuals with Home Value of at least $200,000

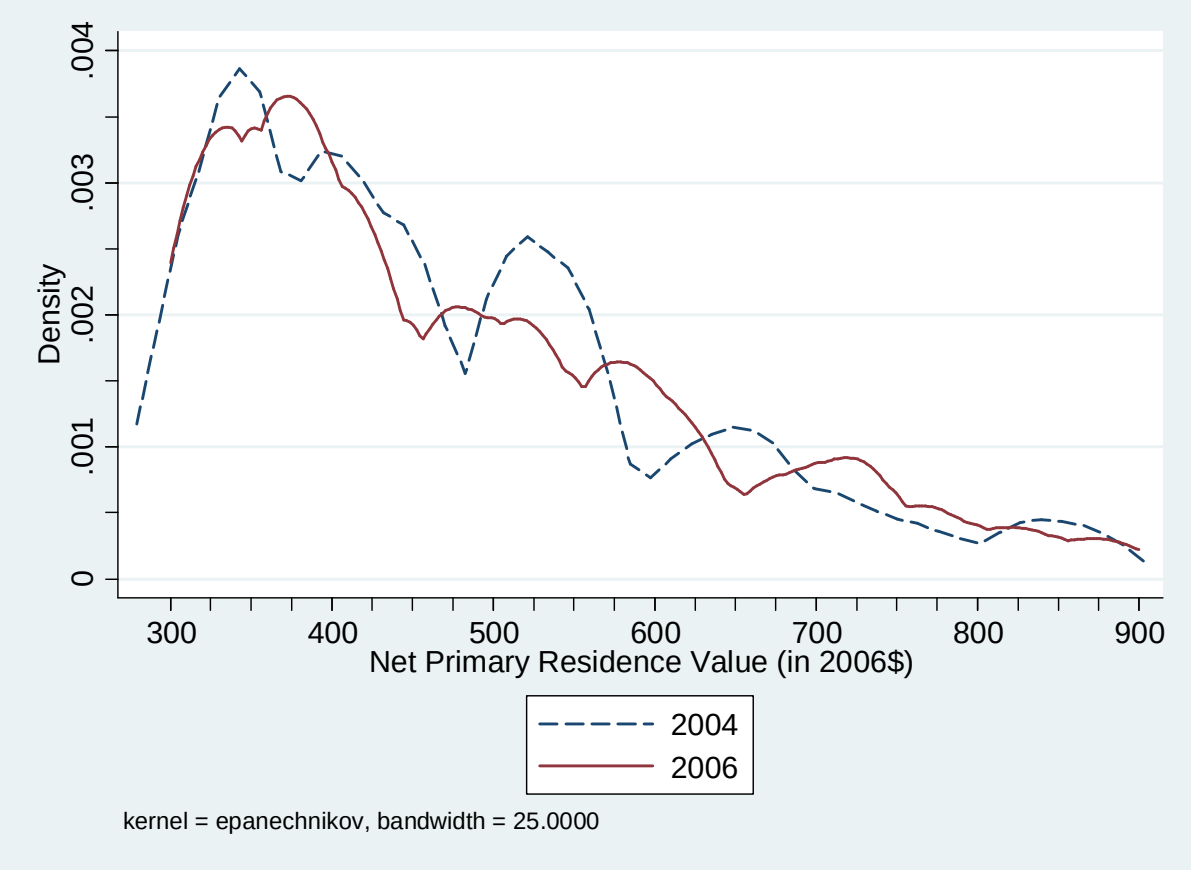

Figure 4.2.

Quantile Regression Estimates for Housing Equity by Health Status

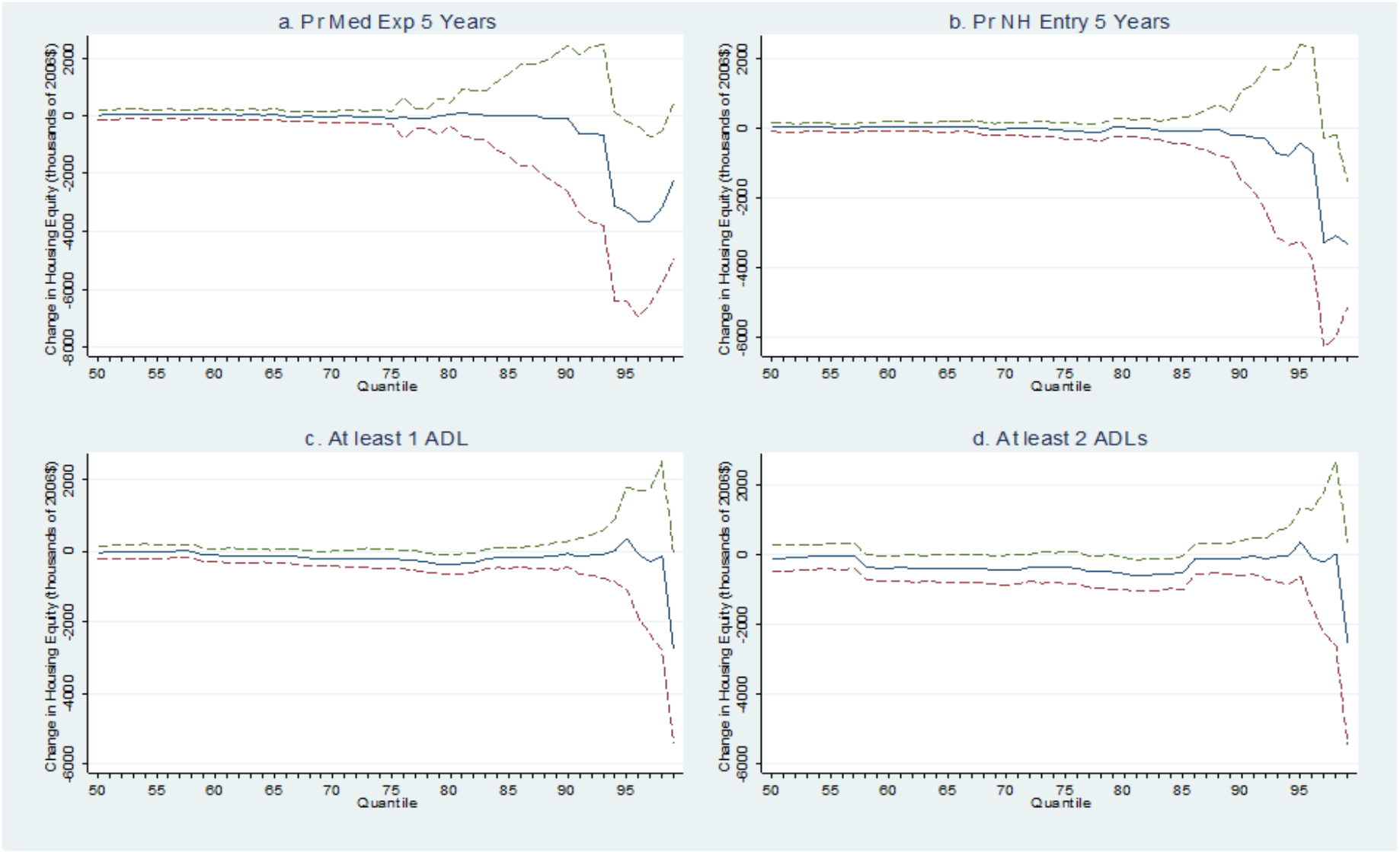

Figure 4.2. (continued)

Quantile Regression Estimates for Housing Equity by Health Status

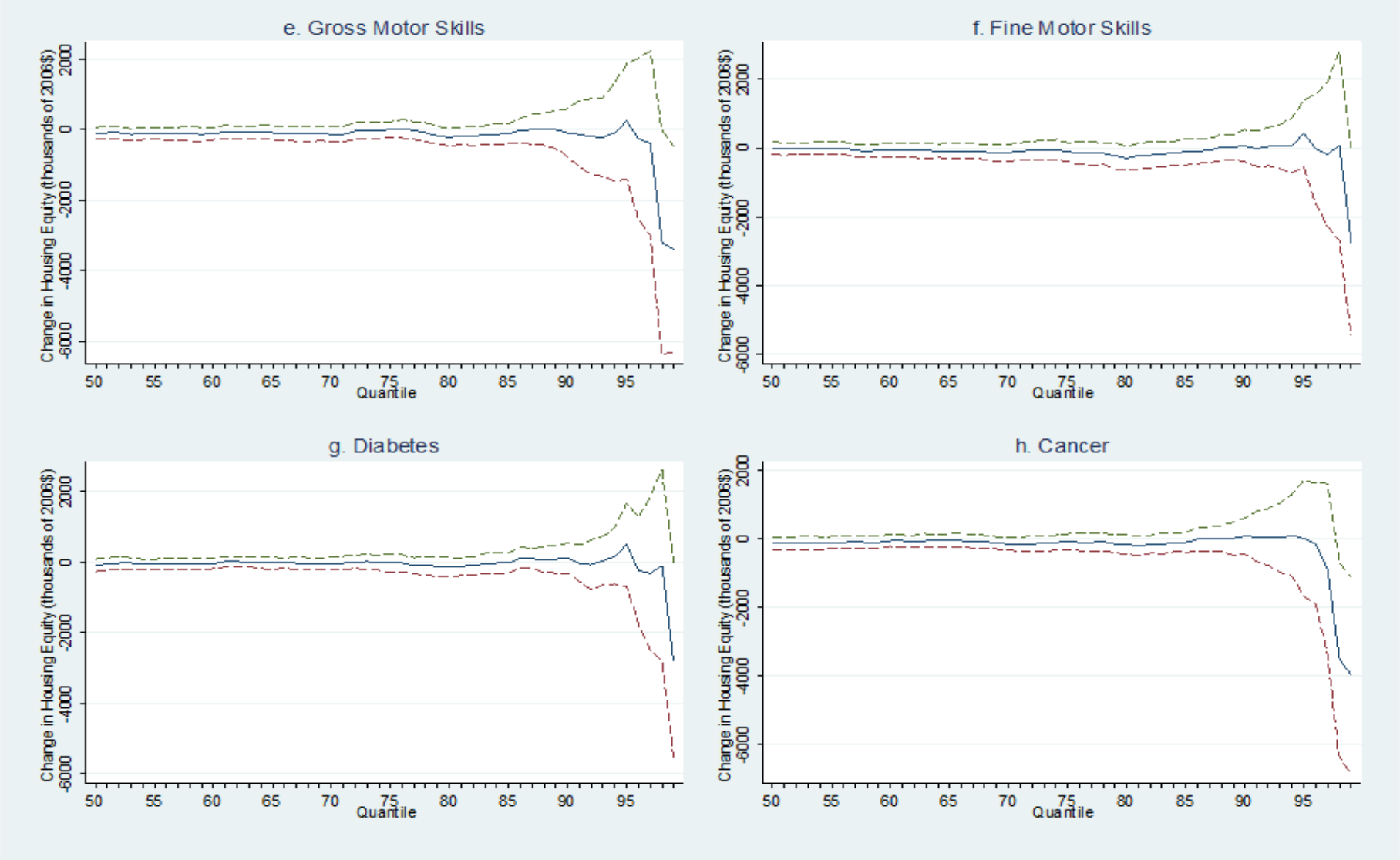

Figure 4.3.

Quantile Regression Estimates for Housing Debt by Health Status

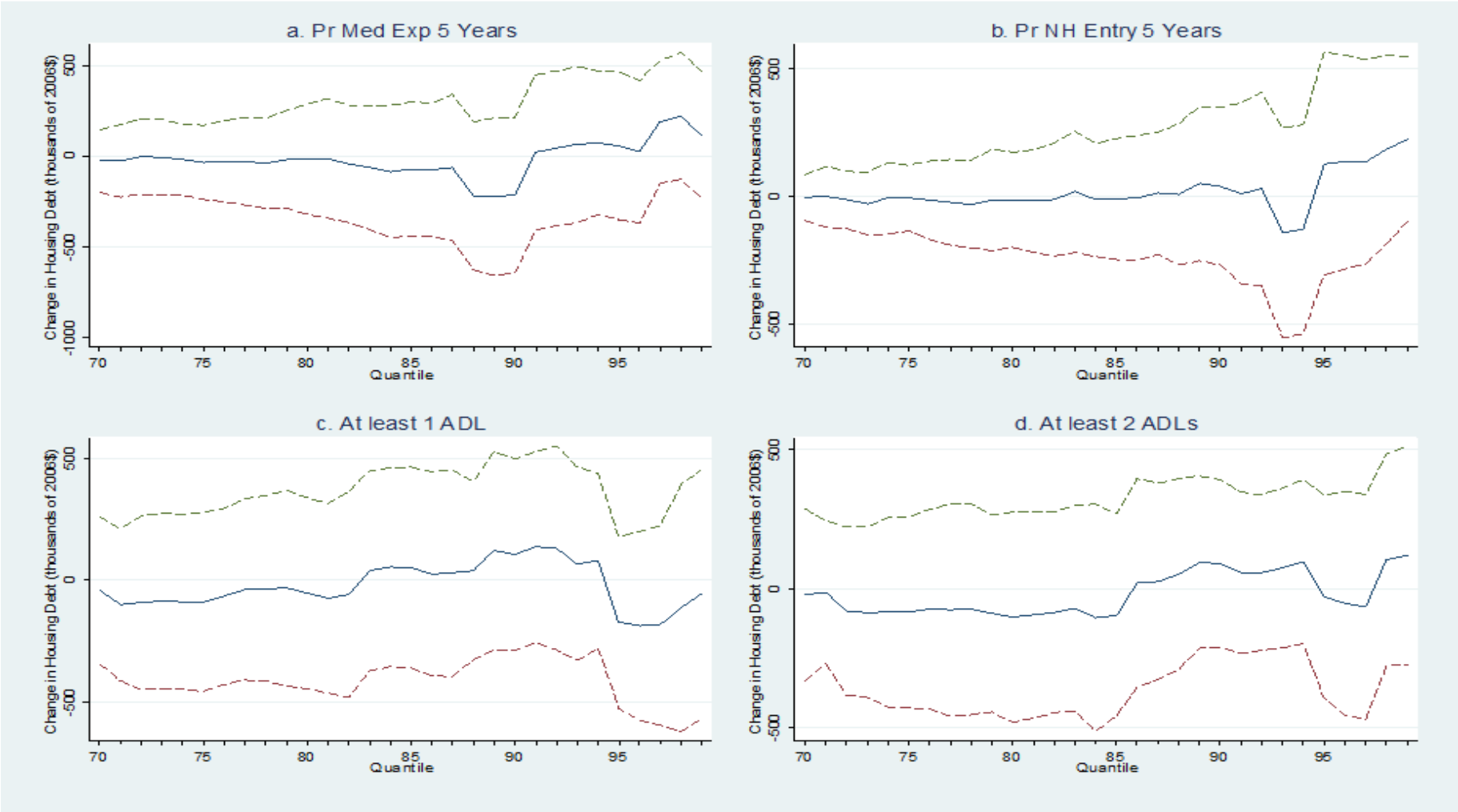

Figure 4.3. (continued)

Quantile Regression Estimates for Housing Debt by Health Status

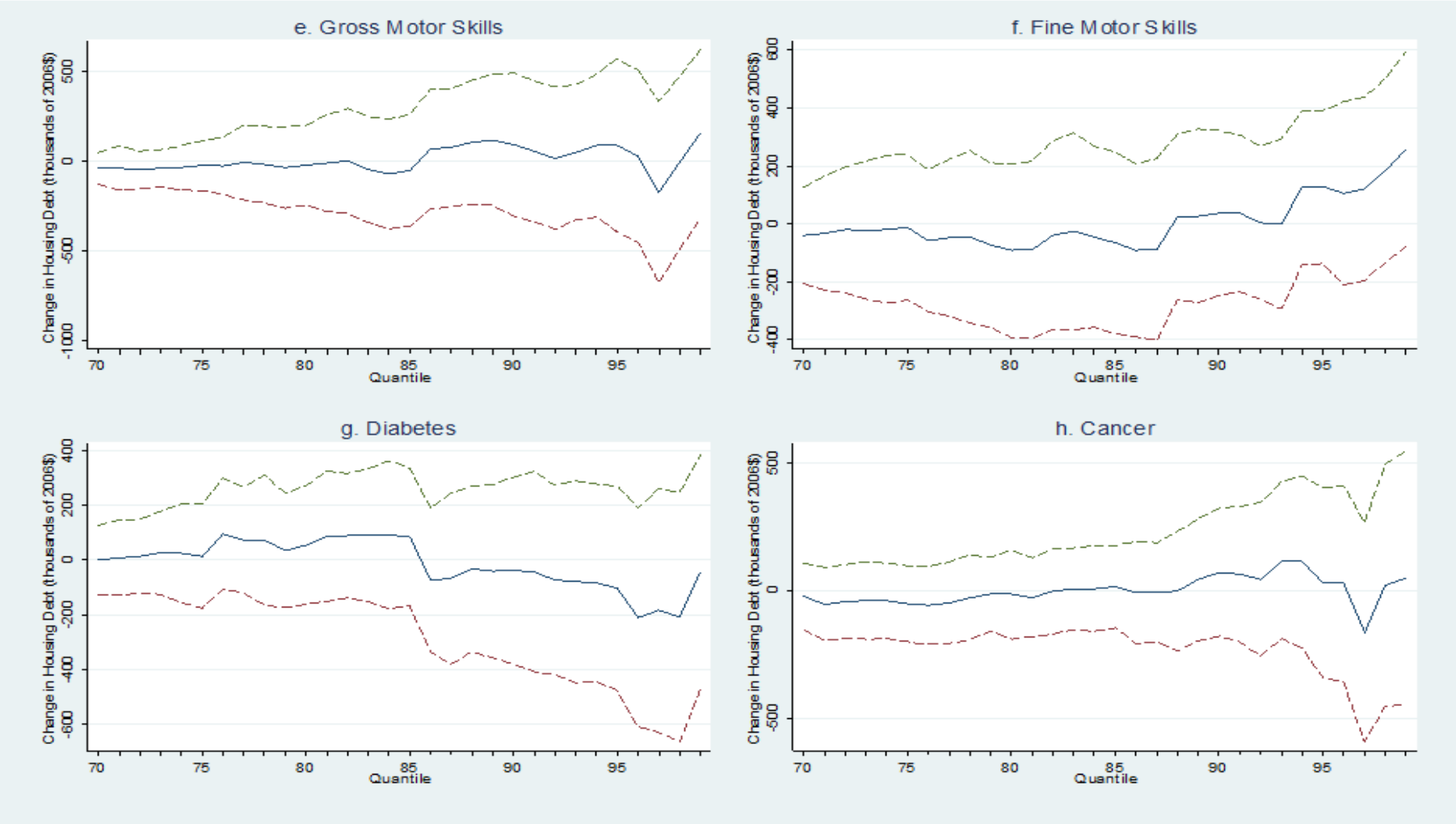

Table 4.1.
Summary Statistics for 2004 HRS sample data, age 65+.[1]

	Any pre-period home valuation		Pre-period home valuation ≥ $200k	
	(1)	(2)	(3)	(4)
Variable	Married	Wid/Sep/Div	Married	Wid/Sep/Div
Age	72.50	75.93	72.34	75.77
White	0.90	0.83	0.94	0.92
Female	0.44	0.77	0.44	0.72
Years Education	12.42	11.91	13.56	13.43
Northeast	0.14	0.14	0.19	0.24
Midwest	0.27	0.25	0.21	0.14
South	0.40	0.43	0.26	0.24
West	0.19	0.17	0.33	0.38
Home Value >= 500k	0.08	0.05	0.21	0.22
Housing Equity ($000s)	196.02	146.90	374.60	357.01
NH Ever Previously	0.01	0.04	0.02	0.03
Probability Med Exp 5 Yrs > 0	0.78	0.74	0.74	0.71
Probability NH 5 Yrs > 0	0.55	0.55	0.55	0.54
Atleast 1 ADL	0.11	0.18	0.09	0.12
Atleast 2 ADL	0.05	0.08	0.03	0.04
Stroke	0.07	0.08	0.05	0.06
Cancer	0.17	0.17	0.17	0.18
Heart Disease	0.29	0.30	0.26	0.26
Lung Disease	0.09	0.11	0.07	0.08
Psychiatric	0.10	0.15	0.08	0.13
High BP	0.59	0.62	0.53	0.58
Diabetes	0.19	0.19	0.15	0.18
Arthritis	0.65	0.69	0.60	0.63
Memory	0.02	0.02	0.01	0.02
Gross Mtr Skills	0.20	0.31	0.14	0.20
Fine Mtr Skills	0.12	0.17	0.09	0.12
No. of Households	5042	2393	1844	579

[1]All dollar values in 2006$

Table 4.2

DDD Estimates of the Impact of DRA05 on Housing Equity (in thousands of 2006$) for Unmarried Individuals, Age 65+

Cutoff/year	Before law change	After Law Change	Time difference for cutoff:
A. Treatment Individuals: Individuals Lacking At Least One Gross Motor Skill			
	705.49	620.68	
	(61.98)	(74.93)	-84.81
Above cutoff	[28]	[28]	(97.25)
	266.81	256.38	
	(10.10)	(18.16)	-10.43
Below cutoff	[90]	[90]	(20.78)
	438.68	364.30	
Cutoff difference at a point in time:	(38.76)	(52.73)	
		-74.38	
Difference-in-difference:		(65.44)	
Cutoff/year	Before law change	After Law Change	Time difference for cutoff:
B. Control Individuals: Individuals Not Lacking Any Gross Motor Skills			
	664.25	749.85	
	(31.27)	(75.16)	85.60
Above cutoff	[97]	[97]	(81.41)
	270.63	291.68	
	(5.01)	(10.95)	21.05
Below cutoff	[364]	[364]	(12.04)
	393.61		
Cutoff difference at a point in time:	(18.80)	458.17 (44.2)	
		64.55	
Difference-in-difference:		(47.96)	
		-138.94	
DDD:		**(97.61)**	

Table 4.3
Unconditional DDD estimates of the impact of DRA05 on individual housing equity across health measures predicting entry into long-term care (in thousands of 2006$).

Health Measure:	Pr Med Exp 5 Years	Pr NH Entry 5 Years	At least 1 ADL	At least 2 ADL	Gross Motor Skills	Fine Motor Skills	Diabetes	Cancer
Dependent Variable: Housing Equity	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
DD Treatment:	-20.70	-28.93	-84.08	-142.51	-74.38	-37.24	-67.66	-90.98
	(32.22)	(37.77)	(67.22)	(112.43)	(65.44)	(64.00)	(54.83)	(60.23)
DD Control:	188.26	118.36	52.69	44.08	64.55	43.4	50.86	66.45
	(117.65)	(77.60)	(44.77)	(41.87)	(47.96)	(44.93)	(47.11)	(47.88)
DDD:	**-208.96**	**-147.29**	**-136.77**	**-186.59**	**-138.94**	**-80.63**	**-118.51**	**-157.44**
	(90.68)	**(81.28)**	**(119.62)**	**(183.80)**	**(97.61)**	**(120.88)**	**(108.61)**	**(99.59)**

Standard errors in parentheses. Unconditional estimates include no controls or fixed effects. Total number of observations is 1,158.

Table 4.4

Fixed effects regressions of the impact of DRA05 on individual housing equity across health measures predicting entry into long-term care (in thousands of 2006$).

Health Measure:	Pr Med Exp 5 Years	Pr NH Entry 5 Years	At least 1 ADL	At least 2 ADL	Gross Motor Skills	Fine Motor Skills	Diabetes	Cancer
Dependent Variable: Housing Equity	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post	16.67	11.69	21.00	17.01	20.48	23.04	20.83	14.17
	(29.25)	(23.52)	(17.01)	(16.42)	(17.91)	(17.18)	(17.75)	(17.75)
Above*Post	198.18***	123.17**	54.66*	45.56	67.25**	44.96	53.18*	68.44**
	(67.58)	(53.25)	(37.12)	(35.63)	(39.18)	(37.11)	(37.91)	(38.99)
Health*Post	-2.77	5.92	-56.06	-54.65	-28.57	-66.48	-33.46	4.24
	(34.99)	(32.16)	(51.43)	(84.59)	(40.57)	(49.20)	(42.32)	(42.15)
Health*Above*Post	-219.16***	-152.33**	-139.43*	-188.07	-143.97**	-82.20	-122.21*	-159.42**
	(78.58)	(70.09)	(102.90)	(157.74)	(83.81)	(103.98)	(93.56)	(85.52)
Constant	446.02***	423.54***	407.47***	399.68***	412.19***	398.05**	419.92***	407.20***
	(162.89)	(163.12)	(162.64)	(162.92)	(162.74)	(162.87)	(164.11)	(162.93)
R-squared	0.02	0.02	0.02	0.01	0.02	0.01	0.01	0.01

Standard errors in parentheses. One sided alternative *** p<0.01, ** p<0.05, * p<0.10. All regressions include individual fixed effects and region controls. Total of 1,158 observations.

Table 4.5
Fixed effects regression of the impact of DRA05 on individual housing equity across health measures that fail to predict entry into long-term care (in thousands of 2006 dollars).

Health Measure:	Arthritis	High BP	Heart Disease	Lung Disease
Dependent Variable: Housing Equity	(1)	(2)	(3)	(4)
Post	17.66	39.83	16.94	11.52
	(26.68)	(25.42)	(18.81)	(16.96)
Above*Post	2.38	46.88	14.53	37.06
	(56.72)	(50.99)	(40.40)	(35.73)
Health*Post	-4.29	-41.52	-7.41	37.04
	(33.52)	(32.90)	(36.64)	(55.60)
Health*Above*Post	50.67	-31.58	75.16	-28.41
	(71.68)	(69.66)	(79.35)	(166.22)
Constant	401.51**	381.65**	390.41**	398.45**
	(163.55)	(163.29)	(163.47)	(163.40)
R-squared	0.01	0.01	0.01	0.01

Standard errors in parentheses. Two-sided alternative *** p<0.01, ** p<0.05, * p<0.1. All regressions include individual fixed effects and region controls. Total number of observations is 1,158.

Table 4.6
Fixed effects regressions of the impact of DRA05 on individual housing equity across health measures predicting entry into long-term care (in thousands of 2006$) for the sample of married households.

Health Measure:	Pr Med Exp 5 Years	Pr NH Entry 5 Years	At least 1 ADL	At least 2 ADL	Gross Motor Skills	Fine Motor Skills	Diabetes	Cancer
Dependent Variable: Housing Equity	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post	40.60***	28.81***	40.75***	39.45***	42.99***	41.34***	38.53***	39.42***
	(9.25)	(6.84)	(4.84)	(4.71)	(5.00)	(4.87)	(5.03)	(5.06)
Above*Post	32.39	57.30***	8.17	5.56	4.26	4.76	6.70	4.79
	(21.90)	(17.68)	(12.36)	(11.98)	(12.76)	(12.39)	(12.70)	(13.28)
Health*Post	-2.90	17.58*	-27.12	-28.36	-31.56**	-29.90**	-0.63	-6.01
	(10.69)	(9.26)	(16.50)	(24.95)	(13.14)	(15.64)	(12.90)	(12.57)
Health*Above*Post	-40.59	-95.20***	-44.57	-70.22	-1.30	-10.58	-20.65	-1.99
	(25.99)	(23.56)	(40.60)	(72.06)	(32.98)	(40.22)	(34.56)	(29.09)
Constant	228.13***	224.29***	221.03***	226.89***	225.51***	227.91***	230.32***	229.05***
	(50.80)	(50.61)	(50.84)	(50.83)	(50.77)	(50.76)	(50.83)	(50.86)
R-squared	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11

Standard errors in parentheses. One sided alternative *** p<0.01, ** p<0.05, * p<0.10. All regressions include individual fixed effects and region controls. Total number of observations is 3,446.

Table 4.7

Falsification test: Fixed effects regressions between 2002 and 2004 for individual housing equity across health measures predicting entry into long-term care (in thousands of 2006$).

Health Measure:	Pr NH Entry 5 Years	At least 1 ADL	At least 2 ADL	Gross Motor Skills	Fine Motor Skills	Diabetes	Cancer
Dependent Variable: Housing Equity	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Post	21.27	18.75	17.32	20.88*	18.92	23.49*	15.95
	(21.61)	(15.64)	(15.05)	(16.21)	(15.66)	(15.85)	(15.69)
Above*Post	-133.38***	-108.23***	-105.48***	-100.11***	-104.30***	-133.02***	-58.81*
	(49.25)	(36.46)	(35.60)	(38.93)	(36.25)	(37.58)	(35.74)
Health*Post	-4.56	0.50	27.80	-11.22	-0.90	-31.81	16.69
	(29.40)	(44.61)	(65.08)	(37.74)	(44.16)	(41.33)	(37.93)
Health*Above*Post	33.99	-63.98	-134.41	-63.58	-107.97	101.79	-471.81***
	(68.49)	(105.37)	(129.34)	(81.76)	(109.20)	(90.61)	(100.50)
Constant	260.11***	260.57***	260.87***	260.44***	259.75***	262.40***	253.14***
	(94.87)	(94.59)	(94.50)	(94.71)	(94.51)	(94.52)	(92.23)
R-squared	0.03	0.03	0.03	0.03	0.03	0.03	0.08

Standard errors in parentheses. One sided alternative *** p<0.01, ** p<0.05, * p<0.10. All regressions include individual fixed effects and region controls. Total number of observations is 922.

Table 4.8

Regression of estimating the impact of DRA05 on one- and two-year housing transition rates between 2005 and 2007.

Dependent Variable:	Moved in Last 1 Year					Moved in Last 2 Years				
Health Measure:	Self-Care Difficulty	Independent Living Difficulty	Ambulatory Difficulty	Cognitive Difficulty	Vision or Hearing Difficulty	Self-Care Difficulty	Independent Living Difficulty	Ambulatory Difficulty	Cognitive Difficulty	Vision or Hearing Difficulty
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Post	-0.0044**	-0.0038*	-0.0047*	-0.0050**	-0.0043**	-0.0049**	-0.0041*	-0.0051*	-0.0058**	-0.0048*
	(0.0024)	(0.0024)	(0.0031)	(0.0022)	(0.0024)	(0.0029)	(0.0028)	(0.0036)	(0.0028)	(0.0031)
Below	0.0052**	0.0064***	0.0059**	0.0047**	0.0066***	0.0088***	0.0102***	0.0107***	0.0078***	0.0101***
	(0.0023)	(0.0026)	(0.0029)	(0.0024)	(0.0023)	(0.0031)	(0.0033)	(0.0040)	(0.0033)	(0.0032)
Health	-0.0030	-0.0006	-0.0055	-0.0066*	0.0006	-0.0074	-0.0069	-0.0082*	-0.0148***	-0.0066*
	(0.0049)	(0.0045)	(0.0048)	(0.0050)	(0.0035)	(0.0074)	(0.0055)	(0.0062)	(0.0052)	(0.0051)
Below* Post	-0.0026	-0.0039*	-0.0026	-0.0022	-0.0035*	-0.0039	-0.0056*	-0.0050	-0.0035	-0.0046
	(0.0024)	(0.0026)	(0.0034)	(0.0023)	(0.0027)	(0.0041)	(0.0042)	(0.0050)	(0.0040)	(0.0043)
Health* Post	-0.0090*	-0.0092***	-0.0011	-0.0015	-0.0064*	-0.0144**	-0.0128***	-0.0030	-0.0019	-0.0089*
	(0.0055)	(0.0038)	(0.0059)	(0.0058)	(0.0047)	(0.0064)	(0.0046)	(0.0072)	(0.0064)	(0.0064)
Health* Below	-0.0044	-0.0104**	-0.0027	0.0024	-0.0125***	-0.0081	-0.0134**	-0.0073	0.0051	-0.0129**
	(0.0063)	(0.0057)	(0.0061)	(0.0054)	(0.0051)	(0.0091)	(0.0064)	(0.0077)	(0.0071)	(0.0065)
Health*Below*Post	0.0065	0.0133***	0.0018	0.0020	0.0113**	0.0069	0.0160**	0.0061	0.0018	0.0096
	(0.0075)	(0.0056)	(0.0078)	(0.0064)	(0.0068)	(0.0112)	(0.0071)	(0.0088)	(0.0099)	(0.0085)
Constant	0.0257***	0.0255***	0.0269***	0.0261***	0.0256***	0.0458***	0.0460***	0.0473***	0.0466***	0.0465***
	(0.0022)	(0.0024)	(0.0027)	(0.0021)	(0.0022)	(0.0026)	(0.0028)	(0.0033)	(0.0026)	(0.0027)
R-squared	0.0125	0.0126	0.0127	0.0123	0.0126	0.0185	0.0188	0.0187	0.0182	0.0188

Robust standard errors in parentheses. Two-sided alternative *** p<0.02, ** p<0.10, * p<0.20. Metro area fixed effects in all regressions. Total number of observations is 61,372.

Table 4.9

Regression of estimating the impact of DRA05 on one- and two-year housing transition rates between 2005 and 2007 for metropolitan statistical areas (MSAs).

Dependent Variable:	Moved in Last 1 Year					Moved in Last 2 Years				
Health Measure:	Self-Care Difficulty	Independent Living Difficulty	Ambulatory Difficulty	Cognitive Difficulty	Vision or Hearing Difficulty	Self-Care Difficulty	Independent Living Difficulty	Ambulatory Difficulty	Cognitive Difficulty	Vision or Hearing Difficulty
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Post	-0.0040*	-0.0035*	-0.0038	-0.0046**	-0.0040*	-0.0039*	-0.0033	-0.0039	-0.0048**	-0.0039
	(0.0026)	(0.0026)	(0.0032)	(0.0024)	(0.0026)	(0.0030)	(0.0029)	(0.0037)	(0.0029)	(0.0033)
Below	0.0048**	0.0060**	0.0064**	0.0042*	0.0064***	0.0093***	0.0104***	0.0116***	0.0080**	0.0106***
	(0.0026)	(0.0030)	(0.0032)	(0.0027)	(0.0026)	(0.0036)	(0.0038)	(0.0045)	(0.0038)	(0.0037)
Health	-0.0007	0.0006	-0.0026	-0.0048	0.0013	-0.0031	-0.0066	-0.0057	-0.0134***	-0.0038
	(0.0047)	(0.0047)	(0.0043)	(0.0051)	(0.0039)	(0.0065)	(0.0060)	(0.0063)	(0.0054)	(0.0049)
Below* Post	-0.0034	-0.0047**	-0.0045*	-0.0028	-0.0046*	-0.0066*	-0.0080**	-0.0082**	-0.0059*	-0.0073**
	(0.0027)	(0.0028)	(0.0033)	(0.0026)	(0.0029)	(0.0040)	(0.0043)	(0.0049)	(0.0041)	(0.0043)
Health* Post	-0.0108**	-0.0093**	-0.0038	-0.0019	-0.0061	-0.0173***	-0.0129***	-0.0050	-0.0049	-0.0104*
	(0.0058)	(0.0042)	(0.0059)	(0.0063)	(0.0053)	(0.0065)	(0.0051)	(0.0078)	(0.0064)	(0.0072)
Health* Below	-0.0074	-0.0125**	-0.0070*	0.0000	-0.0158***	-0.0146**	-0.0146**	-0.0110*	0.0027	-0.0173***
	(0.0065)	(0.0060)	(0.0053)	(0.0059)	(0.0051)	(0.0078)	(0.0071)	(0.0079)	(0.0079)	(0.0060)
Health*Below*Post	0.0109*	0.0153***	0.0072	0.0030	0.0154**	0.0152*	0.0184**	0.0101	0.0059	0.0143*
	(0.0076)	(0.0061)	(0.0068)	(0.0074)	(0.0070)	(0.0103)	(0.0080)	(0.0093)	(0.0109)	(0.0088)
Constant	-0.0011	-0.0020	0.0026	0.0018	0.0078**	-0.0040	-0.0047*	0.0028	0.0027	0.0140***
	(0.0027)	(0.0030)	(0.0033)	(0.0037)	(0.0037)	(0.0032)	(0.0035)	(0.0039)	(0.0042)	(0.0047)
R-squared	0.0146	0.0148	0.0148	0.0145	0.0148	0.0218	0.0222	0.0221	0.0216	0.0221

Robust standard errors in parentheses. Two-sided alternative *** p<0.02, ** p<0.10, * p<0.20. Metro area fixed effects in all regressions. Total number of observations is 51,386.

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