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Quantifying Racial Discrimination in the 1944 G.I. Bill

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Abstract

Did the G.I. bill discriminate against Black World War II veterans? Using a variety of historical sources, I estimate the average amounts of G.I. benefits received by Black and white World War II veterans, as well as their cash-equivalents. These estimates suggest that Black veterans received more in benefits than white veterans, but that their cash-equivalents were lower. However, these estimates are associated with significant uncertainty.

JEL Classification: N42, H24, D63
Keywords: Segregation, equivalent variations, education, housing, unemployment

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1 Introduction

Towards the end of the Second World War, the U.S. government passed the 1944 Servicemen's Readjustment Act, commonly known as the G.I. bill.[1] The G.I. bill promised returning soldiers a variety of benefits such as education subsidies, home loan guarantees and unemployment insurance. By the end of World War II, there were over 15 million veterans who were eligible for these benefits. For many, the benefits were instrumental in clearing the path to homeownership and higher education.

Some legislators are currently in the process of proposing a bill that would extend the G.I. benefits to descendants of Black WWII veterans.[2] The stated purpose of the bill is to correct for past discrimination, echoing a popular sentiment that the 1944 G.I. bill was unfair towards Black veterans (see, for example, Blakemore [2019]). Yet, there are currently no rigorous quantitative estimates of the extent of racial discrimination in the G.I. bill. The purpose of this paper is provide such estimates.

The objective of this paper is to provide an assessment of how much the U.S. government owes the descendants of Black WWIII veterans as compensation for discrimination in the 1944 G.I. bill. The answer, of course, depends on the normative criterion used for judging racial discrimination. I consider two alternative criteria. The first is based on disparities in government spending. According to this criterion, the compensation should be related to racial differences in government spending per veteran. The second criterion is based on cash-equivalents. According to this criterion, the compensation should depend on racial disparities in the veterans' cash equivalents of the benefit package. This implies two related research questions: the first is, how much, on average, did the U.S. government spend on G.I. benefits for Black and white WWII veterans? The second is, what were the corresponding average cash-equivalents of these benefits?

The first question is conceptually straightforward. Using a variety of historical sources, such as veteran surveys and the annual reports of the Veteran's Administration (VA), I construct estimates of government spending on each of the G.I. benefits for Black and white veterans. To answer the second question, it is necessary to make some functional-from assumptions about the veterans' utility functions. Under the assumption of quasilinear preferences, it is possible to construct structural estimates of the cash-equivalents using three inputs: (a) demand elasticities (for example, how the demand for higher education is affected by the price of higher education); (b) the effective subsidy rates implied by the

[1] For a detailed overview of the law at the time of legislation, see Lashbrook [1944].

[2] The name of the bill is The Sgt. Isaac Woodard, Jr. and Sgt. Joseph H. Maddox GI Bill Restoration Act of 2021; see https://www.majoritywhip.gov/media-center/press-releases/clyburn-moulton-introduce-landmark-legislation-provide-black-wwii.

G.I. bill (for example, how much a college degree costs with and without the G.I. benefits); and (c) participation rates (i.e, the percent of veterans who used the G.I. benefits to pay for a college degree). I rely on previous literature for estimates of demand elasticities. To calibrate effective subsidy rates, I construct estimates of the subsidized and unsubsidized prices of education, housing, and job search. Participation rates are mostly based on veterans' surveys.

The estimates suggest that, if anything, the government spent *more* on G.I. benefits for Black veterans (see Table 1). This is perhaps surprising in light of the overwhelming popular sentiment that Black veterans were de-facto excluded from the G.I. bill. According to our first criterion, the government does not owe anything to descendants of Black World War II veterans as compensation for racial discrimination in the G.I. bill.

However, the findings do point at a racial gap in cash equivalents. My estimates suggest that, on average, white veterans would have preferred a cash transfer of $554 over the benefit package, while, for Black veterans, the cash equivalent was only $468. These estimates imply that the cash equivalent was 18% higher for white veterans. Judging by our second normative criterion, the government should compensate Black WWII veterans for past discrimination. As illustrated in Table 1, the amount of compensation depends on the interest rate used: for a real interest rate of 2%, the required compensation is about $6,000. For a real interest rate of 5$, the required compensation is around $60,000. An interest rate of 7% – roughly consistent with the long-run rate of return on stocks – implies that the required compensation is over $250,000.

It is worth qualifying that both the estimated government spending amounts and the estimated cash equivalents are associated with significant uncertainty. Given data limitations, we cannot conclude decisively whether there was any discrimination – regardless of the normative criterion used. The point estimates constitute the "best guess" estimates, and, as such, should be used as a starting point for policy discussions. However, the analysis demonstrates the need for additional data sources, such as VA administrative records.

This paper is related to an emerging economics literature on racial disparities in the United States (Darity et al. [2020], Boerma and Karabarbounis [2022], Brouillette et al. [2021] and Derenoncourt [2021]). Closely related are Turner and Bound [2003], Agbai [2022] and Althoff and Szerman [2022] who specifically study racial disparities resulting from the 1944 G.I. bill. Turner and Bound [2003] document that the G.I. bill led to an increase in college education for white veterans and for Black veterans who lived in the North, but had little effect on the college education of Black veterans who lived in the South. Agbai [2022] documents racial disparities in VA home loan guarantees in the 1950s. Althoff and Szerman [2022] find that the G.I. bill exacerbated the racial wealth gap. Unlike these papers, the goal

Table 1: Estimated average net-present-values of G.I. benefits by race

Benefit	Government Spending		Cash Equivalent	
	White	Black	White	Black
(1) Education and training, 1944 USD	$457	$522	$278	$227
(2) Housing loans, 1944 USD	$135	$128	$117	$103
(3) Readjustment allowances, 1944 USD	$193	$227	$160	$138
(4) Total, 1944 USD ((1)+(2)+(3))	$784	$877	$554	$468
(5) Total, 2020 dollars	$11,741	$13,126	$8,289	$7,004
(5.a) With 2% real interest (2023)	$56,118	$62,739	$39,619	$33,478
(5.b) With 5% real interest (2023)	$554,171	$619,555	$391,241	$330,596
(5.c) With 7% real interest (2023)	$2,460,000	$2,751,000	$1,737,000	$1,468,000

Note: Estimates correspond to unconditional averages across all veterans, including those who did not use the G.I. benefits. The methodology used for constructing the estimates in the first three rows is detailed in section 3. It should be noted that the numbers correspond to point estimates; the uncertainty associated with these estimates is hard to quantify, for reasons that I discuss in sections 2.1 and 3.

of the current paper is not to establish a causal relationship between the G.I. bill and racial disparities in education, homeownership or wealth. Rather, it is to estimate racial disparities in government spending and in cash-equivalents of the entire benefits package.

This paper is also related to the Katznelson-Mettler debate on racial discrimination in the G.I. bill (Katznelson and Mettler [2008]). Katznelson argues that the G.I. bill was highly discriminatory, as Black veterans were more limited in the ways in which they could utilize and access their G.I. benefits. Mettler argues that, despite the highly-segregated environment, the bill allowed Black veterans to benefit at similar rates as white veterans. Much of the debate centers around the question of whether G.I. benefits used for non-college education and training should "count". Black veterans were less likely to use their G.I. benefits for college, but more likely to use them for other types of training, which are suspected to be of lower quality. By estimating the cash-equivalents associated with the different components of the G.I. benefits, I am able to quantify differences in the values that the G.I. benefits had for the veterans.

The rest of the paper is organized as follows. Section 2 lays out the conceptual framework. It discusses the normative criteria used for the analysis, and introduces the functional form assumptions made for computing cash-equivalents. Section 3 contains analyses of each of the components of the G.I. bill. Section 4 offers concluding remarks and suggested policy implications.

2 Framework

To illustrate the measures of racial disparities that I study, consider a simple setup in which there are only two goods: higher-education (h) and consumption (c). A veteran whose income is m and faces prices p_c and p_h solves the following optimization problem:

$$V(m, p_c, p_h) = \max_{h,c} E_w[u(c, wh)] \text{ s.t. } p_c c + p_h h = m \tag{1}$$

where u is an increasing utility function, w is the returns to education (which may be unknown at the time of decision-making), and E_w is the expectation operator. The function V describes the veteran's preferences over different combinations of income and prices.

Consider a G.I. bill that subsidizes education at a rate of s. The first measure of racial disparities that I estimate is the difference in average government spending, where the government spending on each veteran is given by:

$$\text{Government spending } = sp_h h^*(p_c, p_h, s, m) \tag{2}$$

where $h^*(p_c, p_h, s, m)$ is the amount of higher education that the veteran chooses to consume given the subsidy.

The second measure that I estimate is the difference in the average cash-equivalents of the subsidy, which is defined based on the identity

$$V(m + \text{Cash equivalent}, p_c, p_h) = V(m, p_c, (1 - s)p_h) \tag{3}$$

Intuitively, the cash equivalent is related to the veteran's willingness to pay for the subsidy. If the veteran decides not to take advantage of the subsidy, then his cash-equivalent of it is 0. In the other extreme, if the veteran would have decided to go to college regardless of the subsidy, then the subsidy is a pure cash transfer: he can use the money that he would have spent on college for whatever he likes. In both of these cases, the cash-equivalent is equal to the amount of government spending.

The more interesting case is an intermediate case, in which the veteran decides to go to college only because it is subsidized. In this case, the cash equivalent of the subsidy is not zero, because the veteran chooses to take advantage of it. But it is not clear whether he would have preferred the subsidy over, say, an unconditional transfer amounting to 50% of the tuition. His cash-equivalent is the amount of an alternative unconditional cash transfer that makes him exactly indifferent with respect to taking the subsidy instead. It can be interpreted as the nominal value of the subsidy from the veteran's perspective.

It is worth emphasizing that both government spending and cash-equivalents depend on the prices p_c and p_h, which are the prevailing prices at the time in which the benefits were claimed. Neither depend on the realized returns to education, w, or on subsequent changes in the relative prices of consumption and education. The implication is that the subsequent increase in the returns to education and the increase in the relative cost of higher education have no bearing on the calculation of these two measures. Similarly, the subsequent appreciation of housing does not matter for the calculation of inequities in the housing benefit in 1944.

These observations are pertinent to the discussion because some of the critiques of the G.I. bill relate to its long-term effects on the racial wealth gap (see, for example, Agbai [2022] and Althoff and Szerman [2022]). It is possible that the G.I. bill contributed to the racial wealth gap, as white veterans disproportionately used their benefits for college education and housing, which yielded higher returns than other benefits. However, it is crucial to point out that expected returns to education are already reflected in college tuition rates, and expected appreciation in housing is already reflected in home prices. The focus on the long-run wealth gap is misleading because it over-emphasizes long-run returns over short-run benefits, and because it confuses expected returns with realized returns. For these reasons, the approach here is to quantify discrimination in terms of the value of the benefits at the time of legislation.

Before proceeding, it is worth discussing a key limitation of my normative approach: Both of my measures ignore potential inequalities in access rates. To illustrate, consider a scenario in which we have two veterans, a Black veteran and a white veteran, neither of which received any G.I. benefits. For both of these veterans, government spending on G.I. benefits is zero, and the cash equivalents of the benefits are zero. Consequently, neither measure suggests any racial disparities in benefits. However, we cannot rule out the possibility of differential access rates. It could be, for example, that the white veteran had full access to the benefits, but chose not to utilize them because he already had an advanced degree, a house, and a job to come back to, while the Black veteran had none of these things but was denied access to his benefits by a racist VA officer.

Unfortunately, data limitations prevent me from documenting any inequalities in access rates. While disbursement amounts are available from veteran surveys and other sources, the surveys did not ask about claims that were denied. Consequently, it is not straightforward to assess whether there were racial disparities in access to benefits, although there are some anecdotal evidence suggesting that this was the case (Onkst [1998]).

The two measures that I consider here correspond to two different normative criteria. The idea of evaluating fairness based on government spending captures Dworkin's approach,

according to which fairness should be judged according to the amount that society *spends* on each individual (Dworkin [1981]). According to Dworkin's approach, what matters is that the tax payer sacrifices the same amount of money in recognition of each veteran's service. This normative criterion can be interpreted as measuring fairness from the perspective of government spending.

The cash-equivalent measure is an instance of the money-metric utility approach (see Fleurbaey [2009]). In this context, it is broadly in line with Sen's capability approach (Sen [1980]). According to this approach, fairness should be evaluated based on the extents to which the G.I. bill expanded veterans' consumption and investment possibilities. This depends on the degree to which the veterans' circumstances allowed them to take advantage of the G.I. benefits, as well as on the opportunities that they had for doing so. For example, the G.I. bill made it possible for white veterans to obtain a degree from the University of Mississippi, but it did not make this possible for Black veterans (because of segregationist policy). To express the value of the consumption and investment possibilities embedded in the G.I. bill, I calibrate the cash equivalents of the benefits. Racial disparities in cash equivalents capture racial inequality in the value of the benefits from the veterans' perspectives.

2.1 Cash-equivalents

To calibrate the cash-equivalents, it is convenient to make some functional-form assumptions about the utility function. For each expenditure category, x, (housing, education or unemployment), assume that the utility function over x and other consumption expenditure, c, takes the quasilinear form:

$$U(c, x) = c + \Psi x^{\sigma} \tag{4}$$

where $\sigma < 1$.

This functional form assumes that there exists some good, c, which has no diminishing marginal utility. Furthermore, it is assumed that Black and white veterans face the same price of that good.

Given this functional form, the cash-equivalent depends on the parameters σ and Ψ. I assume that the parameter σ, which captures the technological substitutability with other forms of consumption, was the same for white and Black veterans. However, I allow for the possibility that Black and white veterans had different values for Ψ. This can capture, for example, racial differences in the returns to schooling, or racial differences in the quality of schooling or housing that could be obtained given segregation and redlining policies. Racial differences in Ψ capture both racial differences in the quality of x (for example, differences in the quality of higher education opportunities), and racial differences in background con-

ditions that affect the "usefulness" of x. For example, the college subsidy was less useful for veterans who were not college-ready.

Calibrating preference parameters. Assuming this functional form, the preference parameters Ψ and σ can be calibrated based on how changes in the subsidy rate affect the demand for x. To simplify the analysis, it is useful to normalize the prices of c and x to equal 1 (this is a normalization of the units in which c and x are measured). The consumer's indirect preferences over income, m, and a subsidy on x, s, are represented by the indirect utility function:

$$V(m,s) = \max_{c,x} U(c,x) \text{ s.t. } c + (1-s)x = m \tag{5}$$

The first order conditions yield:

$$\sigma\Psi x^{\sigma-1} = 1 - s \Rightarrow x = \left(\frac{1-s}{\sigma\Psi}\right)^{\frac{1}{\sigma-1}} \tag{6}$$

Applying the log transformation, this optimality condition can be rewritten as

$$\ln(x) = \frac{1}{\sigma-1}\ln(1-s) - \frac{1}{\sigma-1}\ln(\sigma\Psi) \tag{7}$$

Then, we can infer the elasticity parameter, σ, based on the equation

$$\Delta\ln(x) = \frac{1}{\sigma-1}(\ln(1-s) - \ln(1)) = \frac{1}{\sigma-1}\ln(1-s) \Rightarrow \sigma = \frac{\ln(1-s)}{\Delta\ln(x)} + 1 \tag{8}$$

where $\Delta\ln(x)$ is the change in $\log x$ caused by raising the subsidy from 0 to s. This formula is useful because it allows us to use causal estimates from previous literature to calibrate the preference parameter σ.

The parameter Ψ can then be inferred based on the equilibrium expenditure on x, using equation 7:

$$(\sigma-1)\ln(x) = \ln(1-s) - \ln(\sigma\Psi) \Rightarrow \ln(\Psi\sigma) = \ln(1-s) - (\sigma-1)\ln(x) \tag{9}$$

$$\Rightarrow \Psi = \left(\frac{1-s}{\sigma}\right)x^{1-\sigma}$$

Note that the sign of Ψ is the same as the sign of σ: when $\sigma > 0$, then $\Psi > 0$, and a larger Ψ represents a stronger preference for good x. In contrast, when $\sigma < 0$, then $\Psi < 0$, and a *smaller* Ψ represents a stronger preference for x. In both cases, the sensitivity of utility to the consumption of x is higher when the absolute value of Ψ is higher.

For a given expenditure amount, x, a higher subsidy rate is indicative of a lower absolute value of Ψ. Intuitively, a higher s means that more of the expenditure on x is driven by the high subsidy rate – and not by a strong preference for consuming x.

Cash equivalents. This functional form yields a simple formula for the cash-equivalents of the subsidies. Let EV (equivalent variation) denote the cash-equivalent of the subsidy.

Proposition 1. *The cash-equivalent is given by*

$$EV = \underbrace{\left(1-(1-s)^{\frac{\sigma}{\sigma-1}}\right)}_{s\text{-}term} \underbrace{\left(\frac{1}{(\sigma\Psi)^{\frac{1}{\sigma-1}}} - \frac{\Psi}{(\sigma\Psi)^{\frac{\sigma}{\sigma-1}}}\right)}_{\Psi\text{-}term} \tag{10}$$

The proof of this proposition is contained in the appendix, together with other omitted proofs. This expression illustrates that the cash equivalent can be decomposed into two terms: one that depends on the subsidy rate, s, and another that depends on the preference parameter Ψ. Intuitively, the cash-equivalent is increasing in the subsidy rate, because a higher subsidy rate implies a larger price reduction for x.

However, note that the preference parameter, Ψ, is calibrated based on (9), and that, for a given x, a higher s is indicative of a lower absolute value of Ψ. Furthermore, note that the government spending on x, which is denoted g, is given by $g = sx$. Substituting in these expressions, we obtain the following result.

Proposition 2. *1. The cash-equivalent satisfies the following identity:*

$$EV = \underbrace{\left(\frac{1}{s}\left(1-(1-s)^{\frac{1}{1-\sigma}}\right)-1\right)\left(\frac{1-\sigma}{\sigma}\right)}_{\sigma\text{-}term} g \tag{11}$$

2. The right hand side of (28) is decreasing in s.

This results illustrates that, although increasing the subsidy always increases the cash-equivalent, for a given amount of government spending, there is a negative relationship between the estimated cash equivalent and the subsidy rate. In the context of the G.I. bill, I find that g was somewhat higher for Black veterans, but that s was higher as well. The higher subsidy rates are responsible for the finding that Black veterans had lower cash equivalents.

3 Benefit amounts

This section discusses the methodology for estimating the G.I. benefit amounts and their associated cash equivalents. In what follows, I focus on the net-present-value of G.I. benefits, at the time of legislation (1944). G.I. benefits were claimed over several years: veterans were eligible for unemployment and self-employment benefits until 1953, for education and training benefits until 1956, and for home loan guarantees for many decades.[3] Consequently, computing the net-present value of the benefits requires inflation adjustments, and taking a stance on the real interest rate. Inflation adjustments are made based on the Consumer Price Index (CPI).[4] I set the real interest at 5%.[5]

Replication code for all of the calculations in this section can be found at Eden [2023].

Uncertainty and caveats. The calculations here are based on a 5% real discount rate. The "right" discount rate in the context of government spending is the rate at which the government could borrow and save, while the "right" discount rate in the context of cash equivalents is the rate at which veterans could borrow and save. These rates may be different, and changing the discount rates may affect the calculations.

3.1 Education and training

The G.I. bill included provisions for education and training benefits. The benefits could be used for a variety of education and training programs, including college, high school completion, trade schools and on-the-job training. The benefits had two components: tuition subsidies and stipends.

The rates at which veterans took advantage of the education and training benefits can be estimated based on the 1979 Survey of Veterans (SOV), and are summarized in Appendix

[3]The original legislation included an expiration of the home loan benefits, but it was extended several times: see Fetter [2013].

[4]Unfortunately, Federal Reserve Bank of St. Louis (FRED) reports the CPI only starting from 1947. I therefore use the CPI reported in: Robert J. Shiller, Stock Market Data Used in "Irrational Exuberance" Princeton University Press, 2000, 2005, 2015, updated; available at http://www.econ.yale.edu/ shiller/data.htm.

[5]Interest rates vary based on the asset's underlying liquidity and risk. For example, in 1955, the 10-year annualized real stock return was around 10%, while the 10-year annualized real bond return was around 1% (see Robert J. Shiller, Stock Market Data Used in "Irrational Exuberance" Princeton University Press, 2000, 2005, 2015, updated; available at http://www.econ.yale.edu/ shiller/data.htm). I choose 5% as an intermediate value.

Table C1.[67] As pointed out by Turner and Bound [2003] and Katznelson and Mettler [2008], the survey suggests that Black veterans were at least as likely to take advantage of the education and training benefits. However, white veterans were more likely to use their benefits for college, while Black veterans were more likely to use their benefits for other types of education and training.

The 1950 Census confirms that Black and white veterans used the education benefits at similar rates (see Appendix Table C2). In 1950, about 20% of WWII veterans, both Black and white, report being "in school". The difference between Black and white veterans is not statistically or economically significant, which is consistent with the SOV.

I assume that there was no tuition for apprenticeships, on-the-job training, or farm training. To estimate tuition costs for other education and training programs, I distinguish between three categories: high school, technical schools (which group the categories "flight school", "other school" and "correspondence" in the 1979 SOV), and college.

Tuition rates for each of these categories can be estimated based on the Study of Consumer Purchases in the United States, 1935-1936.[8] The survey documents the expenditure patterns of households during 1935-1936, including education expenditures. It asks about annual expenditures on tuition and on books and school supplies. It also asks how many household members attend school, which can be used to convert household expenditures to measures of expenditures per student. The survey distinguishes between high school, business or technical school, and college. The survey also classifies households by race. This allows me to create a measure of tuition cost by institution type and by race.

To convert the 1935-1936 measures to 1944 dollars, I inflate estimates using category-specific price indexes from the Bureau of Economic Analysis.[9] To adjust college prices, I use the price index for Higher Education; to adjust high school prices, I use the price index for Nursery, elementary, and secondary schools; and, to adjust the tuition of the "other schools" category, I use the price index for Commercial and vocational schools.[10] To adjust the price of books and supplies, I use the price index for "Educational books".

Appendix Table C3 presents estimates of the inflation-adjusted costs of tuition and books for the different education and training categories by race. Because the VA paid only up to

[6] I am grateful to the National Bureau of Economic Research for giving me access to the microdata and the codebook.

[7] The estimated participation rates similar (but not identical) to those reported in the of the Veterans Administration [1950] (1950 SOV), which were 43% for whites and 49% for "non-whites".

[8] Published by The Inter-University Consortium for Political and Social Research (ICPSR 8908): see https://www.icpsr.umich.edu/web/ICPSR/series/171.

[9] Table 2.5.4. Price Indexes for Personal Consumption Expenditures by Function.

[10] In principle, it is necessary to account for the fact that not all veterans used their education benefits in 1944, but rather they used it over the period 1944-1956. However, according to Table 2.5.4, the relative prices of higher education and commercial and vocational schools remained stable throughout this period.

$500 for tuition and books, I censor the data at 500. However, the uncensored estimates are similar, as tuition rates of over $500 were rare at the time.

The estimates suggest that, in 1935-1936, white people attended slightly more expensive high schools and colleges. However, technical training was almost twice as expensive for Black people. I am not sure why that is. The sample size is small: there are only 11 observations of Black households enrolled in technical schools. However, the data for these 11 households consistently shows tuition rates that are higher than the tuition rates for white students. The higher estimate is not driven by outliers (this is also reflected by the confidence interval). The data suggest that similar proportions of Black and white students enrolled in technical training enroll in private institutions (about half). Within public technical training institutions, tuition rates are similar for Black and white households. The difference in tuition rates comes from private institutions.[11] While interesting, these racial differences in tuition rates turn out not to have much effect on the results (see Table 3, row (2)).

In addition to subsidizing tuition, the G.I. bill paid stipends. Stipend amounts varied with the number of dependents. According to Table B1 in Bound and Turner [2002], stipends depended on whether the veteran was single, had one dependent, or two or more dependents. I use the 1950 Census to estimate the share of veterans in school which fall into each of these categories (no dependents, one dependent, or more than one dependent). The results are reported in Appendix Table C2. The VA Annual Reports[12] document the number of veterans who claimed education and training benefits in each year. Table B1 in Bound and Turner [2002] describes the stipend amounts in each year, as a function of the number of dependents. Based on this information, I estimate the average inflation-adjusted monthly stipend to be slightly higher for Black veterans (because of racial differences in the number of dependents).[13]

Overall, these estimates suggest that government spending on college was higher for white veterans than for Black veterans, but that this difference was offset by the difference

[11] The survey includes 6 Black households with students enrolled in private technical institutions, and 19 white households with students enrolled in private technical institutions. The tuition rates for all 6 Black households is above the median tuition rate for the white households.

[12] Available at https://www.va.gov/vetdata/Report.asp.

[13] The stipends are computed as follows. Table B1 in Bound and Turner [2002] describes the stipend amounts in each year of the program (1944-1956), as a function of the number of dependents. I first adjust these numbers for inflation using the CPI deflator. The VA Annual Reports contain information on how many people used the education and training benefits in each year of the program, which allows me to estimate the proportion of benefits claim in each of the years 1944-1956. I then estimate the average annual stipend as the $12 \sum$(Inflation-adjusted monthly stipend for veterans with x dependents) $\times$ (Share of veterans with x dependents) $\times$ (Share of benefits claimed that year), where the sum is taken over years.

in spending on other schools, which was higher for Black veterans.[14] Table 2 summarizes the calculation of the government spending amounts. It is worth highlighting that the racial differences in estimated government spending are largely insensitive to estimated differences in tuition rates and in the number of dependents (see rows (6.a) and (6.b)). Because stipends constitute the bulk of government spending on the education and training benefits (see rows (5.c) and (5.d)), the racial gap is driven primarily by the racial gap in participation rates: because Black veterans utilized the education and training benefit at higher rates, government spending was higher.

Cash-equivalents. To compute the cash-equivalents, it is necessary to estimate the implied subsidy rates. The cost of attending school has two components: tuition and opportunity costs. Appendix Table C4 details the subsidies on each of these, for the different education and training types. The table suggests that opportunity costs, or forgone market wages, represented the bulk of the costs of pursuing education and training. Consequently, differences across tuition rates for the different types of education and training programs had little effect on the total subsidy rates. White veterans faced subsidy rates of around 60%, while Black veterans faced subsidy rates of around 90%. This difference reflects the lower market wages of Black veterans.

The high implicit subsidy rates raise the question of why *only* 46.2% of Black veterans took advantage of the education and training benefit. Since it was subsidized at close to 100%, we would have expected the vast majority to take advantage of the benefit *if* there were education and training opportunities that could benefit them. The fact that the uptake was far from 100% is indicative of a low Ψ: many veterans did not take advantage of this program because it did not provide education and training opportunities that could meaningfully advance their goals.

To calibrate σ, it is necessary to know how the G.I. education benefits affected educational attainment. Bound and Turner [2002] estimate that the G.I. benefits increased years of college for white veterans by between 32%-38%. This suggests that

$$0.28 \approx \ln(1.32) \leq \Delta \ln(x) \leq \ln(1.38) \approx 0.32$$

Using these estimates of $\Delta \ln(x)$ as well as the subsidy rate for white veterans reported

[14] To calculate the net present value of the benefits, it is necessary to account for the fact that benefits were claimed between 1944 and 1956. I apply a real discount rate of 5% and calculate the average discounting applied to school benefits and on-the-job training benefits, based on data from the VA Annual Reports for fiscal years 1946-1956. The reports list the number of veterans receiving training benefits by quarter. The results suggest that, to account for the time pattern of benefits, it is necessary to multiply the average real benefit amounts by 0.83 (both for school benefits and for on-the-job benefits).

Table 2: Estimates of government spending on education and training (NPV, 1944 dollars)

	White	Black
(0) Stipends		
(0.a) Share with no dependents	0.6	0.53
(0.b) Share with one dependent	0.24	0.34
(0.c) Share with more than one dependent	0.16	0.13
(0.d) Average annual stipend (see footnote 13)	\$786	\$803
(1) College		
(1.a) Participation rate	0.17	0.11
(1.b) Benefit months (conditional on participation)	23.3	26
(1.c) Tuition	\$202	\$173
(1.d) Cost per vet: $((0.d)+(1.c))\times\left(\frac{(1.b)}{12}\right)\times(1.a)$	**\$334**	**\$221**
(2) High school		
(2.a) Participation rate	0.01	0.05
(2.b) Benefit months (conditional on participation)	13.2	17
(2.c) Tuition	\$18	\$12
(2.d) Cost per vet: $((0.d)+(2.c))\times\left(\frac{(2.b)}{12}\right)\times(2.a)$	**\$6**	**\$60**
(3) Other school		
(3.a) Participation rate	0.12	0.21
(3.b) Benefit months (conditional on participation)	12.7	14.5
(3.c) Tuition	\$81	\$169
(3.d) Cost per vet: $((0.d)+(3.c))\times\left(\frac{(3.b)}{12}\right)\times(3.a)$	**\$109**	**\$245**
(4) On the job training		
(4.a) Participation rate	0.1	0.1
(4.b) Benefit months (conditional on participation)	16.3	14
(4.c) Tuition	\$0	\$0
(4.d) Cost per vet: $((0.d)+(4.c))\times\left(\frac{(4.b)}{12}\right)\times(4.a)$	**\$105**	**\$95**
Total		
(5.a) Total cost per vet: (1.d)+(2.d)+(3.d)+(4.d)	\$551	\$630
(5.b) Time discount: (5.a)×0.83 (see footnote 14)	**\$457**	**\$522**
(5.c) Total stipend costs, discounted	\$392	\$452
(5.d) Total tuition costs, discounted	\$65	\$69
(6.a) Robustness: (5.b) with no racial differences in tuition	\$457	\$509
(6.b) Robustness: (5.b) with no racial differences in number of dependents	\$457	\$512

Note: (0): Number of dependents are from Appendix Table C2. (1,2,3,4): Participation rates and average benefit months are from Appendix Table C1. Tuition rates are from Appendix Table C3. For (6.a), I assume that Black veterans paid the same tuition rates as white veterans. For (6.b), I ignore racial differences in the number of dependents, which determine stipend amounts).

Table 3: Cash equivalents for the education and training benefit: alternative specifications

	White	Black
(1) Benchmark	**$278**	**$227**
(2) No racial differences in tuition rates	$278	$217
(3) No racial differences in dependents	$278	$227
(4) No racial differences in wages	$278	$326
(5) $\sigma = -2.36$ (see expression (12))	$281	$236
(6) $\sigma = -1.94$ (see expression (12))	$274	$219

Note: In specification (2), I assume that the tuition rates paid by whites applied to Black veterans as well, and in specification (3) I assume that the distribution of dependents among Black veterans was the same as the distribution among white veterans. In specification (4), I assume that there were no racial differences in wages (conditional on number of dependents).

in Appendix Table C4, by equation 8, we have that

$$\sigma = \frac{\ln(1-s)}{\Delta \ln(x)} + 1 = \frac{\ln(1-0.61)}{\Delta \ln(x)} + 1 = \frac{(-0.94)}{\Delta \ln(x)} + 1 \Rightarrow$$

$$-2.36 = \frac{(-0.94)}{0.28} + 1 \leq \sigma \leq \frac{(-0.94)}{0.32} + 1 = -1.94 \tag{12}$$

As a benchmark, I use the point estimate in Bound and Turner [2002], according to which the G.I. benefits increased years of college by 35%. This implies that $\Delta \ln(x) = 0.3$, and hence

$$\sigma = \frac{(-0.94)}{0.3} + 1 = -2.17$$

Using equation 28, these estimates of σ can be combined with estimates of s and g in Appendix Table C4 to produce estimates for the cash equivalents by type of program and number of dependents. These estimates are summarized in rows (2.f), (3.f), (4.f) and (5.f), with the estimate $\sigma = -2.17$ used for the benchmark calculations. The average cash equivalents (and government spending amounts) for the entire veteran populations are lower, as there is a significant proportion of veterans who did not use the education and training benefits. For these veterans, government spending and cash equivalents are both zero. The numbers reported in Table 1 take this into account.

Table 3 presents alternative estimates of the cash equivalents. The benchmark estimate is not very sensitive to racial differences in tuition rates or in the distribution of dependents. What is driving the racial difference in cash equivalents is the racial gap in market wages. In addition, the estimated cash equivalents do not appear to be very sensitive to σ.

It may also be useful to decompose the cash equivalents based on Propositions 1 and 2. Given that cash equivalents are estimated separately by education type and number of dependents, there are $3 \times 4 = 12$ different cash equivalents. For the purpose of this illustration, I focus on the cash equivalents of the college subsidy among single veterans (the results are qualitatively similar for other specifications). These decompositions are illustrated in Table 4. The decomposition based on Proposition 1 illustrates that the racial gap in cash equivalents is driven by the racial gap in the preference parameter, Ψ (note that the absolute value of this parameter is higher for white veterans, and it is what matters for the size of the cash equivalent). If there were no racial differences in Ψ, then Black veterans would have benefited from the G.I. bill nearly twice (0.78/0.5) as much as white veterans, as they faced higher subsidy rates. The racial difference in Ψ can be interpreted in several ways. First, discrimination in the labor market may have resulted in lower returns to education for Black men. This would show up as a racial gap in Ψ, as it would have affected veterans' willingness to pay for obtaining an education. Second, the racial gap in Ψ may be indicative of segregation that limited the opportunities that Black veterans had for taking advantage of the education and training benefit, and reduced the average quality of the programs that they could access. Finally, the lower Ψ may be indicative of racial differences in educational background (or "college readiness"), which may have resulted in a racial gap in the benefits from additional education and training.

The decomposition based on Proposition 2 offers a complementary perspective. Among veterans who used the G.I. benefits to attend college, there was no significant difference in government spending per veteran. However, the subsidy rates were higher for Black veterans. This implies in a lower σ-term, and lower cash-equivalents.

Uncertainty and caveats. As illustrated in the above calculations, there is substantial quantifiable statistical uncertainty with respect to the government spending amounts and the cash equivalents. There is also some unquantifiable uncertainty which is worth mentioning. First, I have assumed throughout that there was no tuition paid for apprenticeships, farm training and on-the-job training, and that these training opportunities did not pay any wages (aside from the government-provided stipends). These assumptions may be wrong.

Second, I have assumed that the distribution of veterans across training programs, as well as the distribution of their number of dependents, remained constant across time. This is almost surely wrong, as the average number of dependents likely increased over time (as veterans aged). These trends may affect the calculations in ways that are hard to anticipate.

Table 4: Cash equivalents for college, singles: decompositions

	White	Black
Cash equivalents	\$599	\$445
Subsidy rate	0.64	0.89
Preference parameter, Ψ	$-0.81 * 10^9$	$-0.77 * 10^8$
(1) Proposition 1		
s-term	0.5	0.78
Ψ-term	$1.2 * 10^3$	572
(1) Proposition 2		
σ-term	0.83	0.64
g	\$1,225	\$1,196

Note: The parameter Ψ is calculated based on equation 9, using the identity $x = g/s$ (where x is quantity, s is the subsidy rate and g is the government spending on the subsidy).

3.2 Home loan guarantees

One of the G.I. benefits was access to home loan guarantees. VA-guaranteed loans were regulated to have low interest rates, low down-payments and long maturities.[15]

The home loan guarantee program constituted a subsidy on housing. To see this, let H denote the price of a home, and consider the net-present value of the cost of purchasing this home, given a fixed-rate mortgage with an interest rate of r_m and monthly payments of m, to be repaid in T periods.

In the first period, the owner takes out a loan of $H - d$, where d is the downpayment. In the next period, the owner pays the monthly payment, m, but his debt increases at the interest rate, r_m. His debt becomes:

$$(1 + r_m)(H - d - m) = (1 + r_m)(H - d) - (1 + r_m)m \tag{13}$$

In the following period, he pays an additional m, so his debt is:

$$(1+r_m)((1+r_m)(H-d)-(1+r_m)m-m) = (1+r_m)^2(H-d)-(1+r_m)^2m-(1+r_m)m \tag{14}$$

[15]The 1960 Residential Finance Survey confirms that VA loans had less variable terms than conventional loans. For example, virtually 100% of VA loans had interest rates of between 4% and 5.5%, with a median of 4.5%. For conventional mortgages, there was much more variation: 62% of loans had interest rates of over 6%, and about 10% had interest rates of below 4.5 percent, with a median of 5.6%.

So, in each period, t, the remaining debt is

$$(1+r_m)^t(H-d) - m\sum_{\tau=1}^{t}(1+r_m)^\tau \tag{15}$$

In period T, the loan is paid off. This means that

$$(1+r_m)^T(H-d) = m\sum_{t=1}^{T}(1+r_m)^t$$

Hence, the monthly payment, m, is given by

$$m = \frac{(1+r_m)^T(H-d)}{\sum_{t=1}^{T}(1+r_m)^t} = \frac{(H-d)}{\sum_{t=1}^{T}(1+r_m)^{t-T}} \tag{16}$$

Given the market interest rate, r^*, the net present value of the amount that the owner pays for the home is:

$$d + \sum_{t=0}^{T-1}\frac{m}{(1+r^*)^t} = H - (H-d) + m\sum_{t=0}^{T-1}\frac{1}{(1+r^*)^t} = \tag{17}$$

$$H - (H-d) + \left(\frac{(1+r_m)^T(H-d)}{\sum_{t=1}^{T}(1+r_m)^t}\right)\left(\sum_{t=0}^{T-1}\frac{1}{(1+r^*)^t}\right) =$$

$$H + (H-d)\left(\left(\frac{(1+r_m)^T}{\sum_{t=1}^{T}(1+r_m)^t}\right)\left(\sum_{t=0}^{T-1}\frac{1}{(1+r^*)^t}\right) - 1\right)$$

This formula illustrates that the net-present-value of the cost of the home is increasing in r_m. A home-loan guarantee that lowers r_m therefore constitutes a subsidy on homeownership. In fact, the VA loan guarantee program subsidized homes in three ways: first, by offering below-market mortgage rates. Second, by increasing the loan-to-value ratios. And, third, by offering significantly longer maturities than what was customary at the time.

I calculate government spending on home-loan guarantees based on the difference between the unsubsidized cost of the home and the subsidized cost of the home. In particular, government spending, g, is given by

$$g = H + (H-d^c)\left(\left(\frac{(1+r_m^c)^{T^c}}{\sum_{t=1}^{T^c}(1+r_m^c)^t}\right)\left(\sum_{t=0}^{T^c-1}\frac{1}{(1+r^*)^t}\right) - 1\right)$$

$$-\left(H+(H-d)\left(\left(\frac{(1+r_m)^T}{\sum_{t=1}^{T}(1+r_m)^t}\right)\left(\sum_{t=0}^{T-1}\frac{1}{(1+r^*)^t}\right)-1\right)\right)$$

where d^c is the counterfactual down payment, r_m^c is the counterfactual mortgage rate, and T^c is the counterfactual maturity of the mortgage loan. Similarly, I calibrate the subsidy rate, s, based on the identity

$$1-s=\frac{H+(H-d)\left(\left(\frac{(1+r_m)^T}{\sum_{t=1}^{T}(1+r_m)^t}\right)\left(\sum_{t=0}^{T-1}\frac{1}{(1+r^*)^t}\right)-1\right)}{H+(H-d^c)\left(\left(\frac{(1+r_m^c)^{T^c}}{\sum_{t=1}^{T^c}(1+r_m^c)^t}\right)\left(\sum_{t=0}^{T^c-1}\frac{1}{(1+r^*)^t}\right)-1\right)}= \tag{18}$$

$$\frac{1+\frac{H-d}{H}\left(\left(\frac{(1+r_m)^T}{\sum_{t=1}^{T}(1+r_m)^t}\right)\left(\sum_{t=0}^{T-1}\frac{1}{(1+r^*)^t}\right)-1\right)}{1+\frac{H-d^c}{H}\left(\left(\frac{(1+r_m^c)^{T^c}}{\sum_{t=1}^{T^c}(1+r_m^c)^t}\right)\left(\sum_{t=0}^{T^c-1}\frac{1}{(1+r^*)^t}\right)-1\right)}$$

(note that the ratio on the right-hand-side corresponds to the ratio of the subsidized cost and the unsubsidized cost of a home).

Note that the ratio $LTV=(H-d)/H$ is the loan-to-value ratio. Loan-to-value ratios may, in principle, vary with the size of the loan; however, for the purpose of this calculation, I will assume that loan to value ratios depend only on the mortgage type, and not on the size of the loan. This implies a constant subsidy rate that does not depend on the price of the house, and is given by

$$1-s=\frac{1+LTV\left(\left(\frac{(1+r_m)^T}{\sum_{t=1}^{T}(1+r_m)^t}\right)\left(\sum_{t=0}^{T-1}\frac{1}{(1+r^*)^t}\right)-1\right)}{1+LTV^c\left(\left(\frac{(1+r_m^c)^{T^c}}{\sum_{t=1}^{T^c}(1+r^c)^t}\right)\left(\sum_{t=0}^{T^c-1}\frac{1}{(1+r^*)^t}\right)-1\right)} \tag{19}$$

where LTV^c is the counterfactual loan-to-value ratio.

Calibration of the home price, H. I estimate the purchase price of the home, H, based on the 1979 SOV. The survey asks veterans whether or not they used a VA loan guarantee to purchase their first home. For those who did, the survey asks about the price of the first home and the year in which the home was purchased. I compute the discounted value of the price of the home from the perspective of 1944, using the nominal interest rate (which is the sum of the inflation rate and an assumed 5% real rate of return).

To illustrate this procedure, consider, for example, a veteran who buys a \$500,000 house in the year 2000 (of course, this will not be recorded in the 1979 survey; but it is useful for illustrating the procedure using more-familiar prices). Inflation adjustment makes this roughly \$60,000. We then discount the \$60,000 to reflect that this house is to be delivered 56 years later (2000-1944=56). So the discounted house price is $\$60,000/(1+r)^{56}$, where

r is the real interest rate. For $r = 0.05$, which is what I assume here, we have that the discounted house price is \$3,900. Note that \$3,900 is the amount the the veteran must save in 1944 in order to finance the purchase of the \$500,000 house in the year 2000.

Following this procedure, I estimate that the average discounted value of white veterans' VA-financed first homes was $H_{White} = \$4,217$, and the discounted value of Black veterans' VA-financed first homes was $H_{Black} = \$2,878$ (see Appendix Table C5). This differential reflects both differences in home prices and differences in the timing of home purchases. According to the 1979 survey, first-home purchases of Black veterans happened, on average, 4 years later than first-home purchases of white veterans. In addition, the average purchase price of their first homes (after adjusting for inflation) was 19.4% lower.

Calibration of the home-to-value ratio. Median loan-to-value ratios on different types of mortgages are available from the 1960 Residential Finance Survey (1960 RFS). The median loan-to-value ratio on VA loans was $LTV = 0.91$ (which I assume did not vary by race).

Calibration of the loan maturity, T. According to the 1960 RFS, the median maturity of VA-guaranteed loans was 25 years. I therefore set $T = 25$ for both Black and white veterans.

Calibration of the interest rates, r_m and r^*. I set the real interest rate at $r^* = 0.05$ (consistent with other net-present-value calculations in this paper).

According to the 1960 RFS, the median nominal interest rate on VA loans was 4.5%. In the 1960s, inflation was around 1%.[16] This suggests that, in real terms,

$$r_m = 0.045 - 0.01 = 0.035$$

Calibration of the counterfactual loan terms: r_m^c, T^c and LTV^c. Because I do not have direct information on mortgage terms by race, I calibrate counterfactual mortgage terms based on the following assumptions. First, I assume that the shares of veterans that would have qualified for Federal Housing Administration (FHA) loans are the same as in the non-veteran population of people with mortgage loans (24% for whites and 13% for nonwhites, according to the 1960 RFS). Concretely, I assume that for 24% of white veterans and 13% of Black veterans, the counterfactual mortgage terms are given by the terms of FHA loans, while for the remaining veterans, counterfactual mortgage terms correspond to the terms of conventional mortgage loans.

[16] See Inflation, consumer prices for the United States (FPCPITOTLZGUSA): FRED economic data. Available at https://fred.stlouisfed.org/series/FPCPITOTLZGUSA.

Second, I assume that FHA loan terms were the same for Black and white borrowers. According to the 1960 RFS, the terms of FHA loans were only slightly less favorable than the terms of VA loans: the median interest rate was 4.6% (as opposed to 4.5%), the median loan-to-value ratio was 0.84 (as opposed to 0.91), and the median maturity was 24 years (as opposed to 25 years). For counterfactual FHA borrowers, I set $T^c = 24$, $r^c = 0.046 - 0.01$ (to convert the nominal interest rate to a real interest rate by subtracting 1% inflation), and $LTV^c = 0.84$.

For conventional loans, the median loan to value ratio was 0.68, while the median maturity was 15 years (1960 RFS). I assume that these aspects of the loans did not vary by race: for counterfactual-conventional borrowers, I set $T^c = 15$ and $LTV^c = 0.68$.

I calibrate race-specific counterfactual mortgage rates, r_m^c, based on racial differences in delinquency rates. Among all homeowners, the delinquency rate in 1950 was 5.8%. Among nonwhites, the rate was 13.2%.[17] In part, this difference is explained by the lower average income of nonwhite borrowers. Regardless of the source, differences in delinquency rates likely translated into differences in mortgage terms.[18] We can calibrate the conventional mortgage rates as the sum of the risk-free nominal interest rate and the risk premiums that are consistent with the probabilities of default. Using p to denote the probability of default, the nominal interest rate on mortgage loans, i, is given by

$$i = i_{safe} + p$$

where i_{safe} is the nominal interest rate associated with a risk-free borrower. In 1960, the nominal rate of return on a 10-year treasury bond was 4.12%.[19] Note that, given 1% inflation, the real rate of return on treasuries was around 3% – somewhat below the long-run average of the real interest rate assumed here, which is $r^* = 5\%$. While the short-term nominal interest is not appropriate for long-run net-present value calculations, it can be used for inferring the risk premium associated with mortgage loans. For the purpose of this calculation, I set $i_{safe} = 0.0412$.

According to the 1960 RFS, the median conventional mortgage rate for all borrowers in 1960 was $i = 5.6\%$. Since white borrowers constituted the majority of borrowers, this suggests that

$$0.056 = i_{White} = 0.0412 + p_{White} \Rightarrow p_{White} = 0.0148 \tag{20}$$

[17] See page 71 and Table 62 in Ratcliff et al. [1957].

[18] Direct evidence of racial differences in mortgage costs is available for more-recent time periods. See, for example,Bayer et al. [2018].

[19] See Market Yield on U.S. Treasury Securities at 10-Year Constant Maturity, Quoted on an Investment Basis, FRED Economic Data. Available at https://fred.stlouisfed.org/series/GS10#0.

In 1950, the delinquency rate of Blacks was roughly twice as high as the delinquency rates for whites. Assuming that the relative risk of delinquency of Black and white borrowers remained roughly the same throughout the period, the risk premium for Black borrowers can be calibrated as

$$p_{Black} = 2 * p_{White} = 0.0296 \Rightarrow i_{Black} = 0.0412 + p_{Black} = 0.0412 + 0.0296 = 0.0708 \quad (21)$$

To convert these nominal interest rates into real interest rate, I subtract 1% for inflation. This results in estimates of $r^c_{m,White} = 0.056$ and $r^c_{m,Black} = 0.0608$.

Participation rates. Average government spending on home loan guarantees depends on the share of veterans who participated in the home-loan guarantee program. For each veteran who did not purchase a home with a VA loan guarantee, government spending is set to 0.

I estimate participation rates based on the 1987 survey of veterans. The home loan guarantee program was extended several times, so veterans remained eligible for VA-guaranteed loans throughout their adulthoods. Consequently, the share of veterans who had ever used VA loans increased over time (see Table 5). In 1950, few veterans took advantage of VA loan guarantees. Furthermore, at the time, white veterans were three times more likely than Black veterans to have VA-guaranteed home loans.

However, this racial disparity substantially decreased over the years. In 1987 (when most veterans were in their 60s), about 37% of white WWII veterans had used a VA loan at some point, and the corresponding number for Black WWII veterans was 32%. The difference between these rates is not statistically significant.

Table 6 details the calibration parameters used for calculating the government spending amounts, g, and the subsidy rates, s.

The implied subsidy rates can be calculated based on the ratio of the net present value of the mortgage payments guaranteed by the VA, and the net present value of the mortgage payments for the same home if it were financed through a conventional or FHA loan. This calculation implies that the VA loan guarantee subsidized housing for Black veterans at a higher rate than for white veterans, reflecting the assumption that Black veterans had less favorable terms on conventional loans, and more limited access to FHA loans.

To calibrate the parameter σ, I rely on the findings of Fetter [2013]. Fetter [2013] estimates that, as a result of the G.I. bill, veterans purchased their homes about 5 years earlier. He finds no strong effects on selection into homeownership. Using his methodology, I find

Table 5: Percent of veterans who had used a VA loan guarantee

	1950 SOV	1950 RFS	1979 SOV	1987 SOV
White	13%	6%	39%	37%
			(38%, 41%)	(36%,39%)
Black	5%	2%	29%	32%
			(24%, 34%)	(26%,38%)

Note: Estimates correspond to unconditional averages across all veterans, including those who did not take advantage of the G.I. benefits. The 1979 SOV estimates are based on a sample of 4,428 white WWII veterans and 323 Black WWII veterans who served for at least 90 days. The 1987 SOV estimates are based on a sample of 3,336 white WWII veterans and 262 Black WWII veterans. Estimates are based on sample weights, and brackets correspond to 95% confidence intervals. The estimates from the 1950 RFS were constructed based on Table 68 in Ratcliff et al. [1957], which allows for the construction of estimates of VA-backed mortgages per white and Nonwhite veteran (assuming 14 million white WWII veterans and 1 million nonwhite WWII veterans). The estimates from the 1950 SOV correspond to participation rates in all VA loan guarantee programs, which include also business loan guarantees.

no statistically-significant effect on home values conditional on homeownership.[20] I therefore assume that the counterfactual net-present value of spending on homes is given by the same value, discounted by 5 years using a real interest rate of 5% (I consider some alternative specifications in Table 7, rows (6.a) and (6.b) – they do not appear to significantly change the results). The implied estimates of the structural parameters are summarized in Tables 7 and 8.

Perhaps surprisingly, the results suggest that there were no significant racial differences in government spending per veteran or in cash-equivalents. The reasoning can be understood from Table 7, rows (6.c)-(6.f). Rows (6.c) and (6.d) illustrate that higher home prices and higher participation rates among whites contribute to a racial gap in cash equivalents: if there were no differences in the average home prices for Black veterans who used the home loan guarantee, or if Black veterans used the G.I. benefit at the same rate as white veterans, then they would have had higher estimated cash equivalents. At the same time, even though they used the loan guarantees to purchase cheaper houses than white veterans, they benefited more from the loan guarantee program because they had worse outside options. This is illustrated in rows (6.e) and (6.f): if we set the counterfactual terms for Black veterans to be more similar to those of white veterans, the government spending amounts and the cash

[20]I use the 1960, 1970 and 1980 Census, which report home values. I instrument veteran status with birth cohort cutoffs (as in Fetter [2013]) and regress the long of home values on (instrumented) veteran status, including year fixed-effects, birth-quarter fixed effects, and a continuous birth cohort control. I find that veteran status was associated with home values that are about 3% higher, but the effects are not statistically significant from 0. The confidence interval is (-5%,11%).

Table 6: Calibration of housing benefits: government spending

Parameter	Value	Target
(1.a) Share of whites who used VA financing	0.37	1987 SOV
(1.b) Share of Blacks who used VA financing	0.32	1987 SOV
(2.a) Interest on VA loans	4.5%	Median rate, 1960 RFS
(2.b) Loan to value ratio, VA loans	0.91	Median, 1960 RFS
(2.c) Term, VA loans	25 years	Median, 1960 RFS
(3.a) Interest on FHA loans	4.6%	Median rate, 1960 RFS
(3.b) Loan to value ratio, FHA loans	0.84	Median, 1960 RFS
(3.c) Term, FHA loans	24 years	Median, 1960 RFS
(4.a.White) Interest on conventional loans, whites	5.6%	Median rate, 1960 RFS
(4.a.Black) Interest on conventional loans, Blacks	7%	Equation (21)
(4.b) Loan to value ratio, conventional loans	0.68	Median, 1960 RFS
(4.c) Term, conventional loans	15 years	Median, 1960 RFS
(5.a) FHA qualified: White	24%	(FHA loans)/(non-VA loans), 1960 RFS
(5.b) Conventional: White	76%	100% minus (5.a)
(5.c) FHA qualified: Black	13%	(FHA loans)/(non-VA loans), 1960 RFS
(5.d) Conventional: Black	87%	100% minus (5.c)
(6) Subsidy rates, s		
(6.a) FHA-qualified borrowers	2.2%	Equation (19), inputs rows 2 and 3
(6.b) White conventional borrowers	10.7%	Equation (19), inputs rows 2 and 4
(6.c) Black conventional borrowers	15.7%	Equation (19), inputs rows 2 and 5
(7.a) Home value, White (1944 dollars)	\$4,217	NPV of first home price, 1979 SOV
(7.b) Home value, Black (1944 dollars)	\$2,878	NPV of first home price, 1979 SOV
(8) Government spending by type		$s * H$
(8.a) Government spending: FHA, white	\$93	(6.a)×(7.a)
(8.b) Government spending: conventional, white	\$449	(6.b)×(7.a)
(8.c) Government spending: FHA, Black	\$63	(6.a)×(7.b)
(8.d) Government spending: conventional, Black	\$452	(6.c)×(7.b)
(9.a) Share of whites who used VA financing	0.37	1987 SOV
(9.b) Share of Blacks who used VA financing	0.32	1987 SOV
(10.a) Average government spending: white	**\$135**	(9.a)×((5.a)×(8.a)+(5.b)×(8.b))
(10.b) Average government spending: Black	**\$128**	(9.b)×((5.c)×(8.c)+(5.d)×(8.d))

Table 7: Calibration of housing benefits: cash equivalents

Parameter	Value	Target
(1) Subsidy effects on:		
(1.a) timing of homeownership	5 years	Fetter [2013]
(1.b) lifetime homeownership	0	Fetter [2013]
(1.c) home price	0	See footnote 20
(1.d) housing NPV ($\Delta \ln(H)$)	0.244	$\ln(H) - \ln(H/(1+r^*)^5)$ (see (11.a))
(2.a) s: whites	8.6%	Rows (5) and (6) in Table 6
(2.b) Elasticity parameter, σ	0.63	Equation 8, with (1.d) and (2.a)
(3) Proposition 2, σ-term		
(3.a) FHA-qualified	0.97	Using (Table 6 (6.a)) and (2.b)
(3.b) White conventional	0.86	Using (Table 6 (6.b)) and (2.b)
(3.c) Black conventional	0.8	Using (Table 6 (6.c)) and (2.b)
(4) Cash equivalents		(σ-term)$\times$ g (using Proposition 2)
(4.a) FHA-qualified: White	\$90	(3.a)$\times$(Table 6 (8.a))
(4.b) Conventional: White	\$386	(3.b)$\times$(Table 6 (8.b))
(4.c) FHA-qualified: Black	\$62	(3.a)$\times$(Table 6 (8.c))
(4.d) Conventional: Black	\$359	(3.c)$\times$(Table 6 (8.d))
(5) Average cash equivalents		
(5.a) White	**\$117**	(See table note)
(5.b) Black	**\$103**	(See table note)
(6) Alternative specifications: cash equivalents		
(6.a) Replace (1.c) with 11%		
- White	\$110	
- Black	\$94	
(6.b) Replace (1.c) with -5%		
- White	\$120	
- Black	\$107	
(6.c) No racial difference in home price		
- White	\$117	
- Black	\$150	
(6.d) No racial difference in participation		
- White	\$117	
- Black	\$119	
(6.e) No racial difference in conventional rates		
- White	\$117	
- Black	\$76	
(6.f) No racial difference in FHA eligibility		
- White	\$117	
- Black	\$92	

Note: Row 5.a is calculated as (Table 6: 9.a)$\times$((Table 6: 5.a)$\times$(4.a)+(Table 6: 5.b)$\times$(4.b)), and row (5.b) is calculated as (Table 6: 9.b)$\times$((Table 6: 5.c)$\times$(4.c)+(Table 6: 5.d)$\times$(4.d)).

Table 8: Cash equivalents for the housing benefit: decompositions

	Counterfactual: FHA		Counterfactual: conventional	
	White	Black	White	Black
Cash equivalents	**$90**	**$62**	**$386**	**$359**
Subsidy rate, s	0.02	0.02	0.11	0.16
Elasticity parameter, σ	0.63	0.63	0.63	0.63
Preference parameter, Ψ	34	29	31	25
Proposition 1				
s-term	-0.04	-0.04	-0.21	-0.34
Ψ-term	-2,328	-1,589	-1,823	-1,064
Proposition 2				
σ-term	0.97	0.97	0.86	0.8
g	$93	$63	$449	$452

Note: The parameter Ψ is calculated based on equation 9.

equivalents decline. Intuitively, the subsidy mattered more for Black veterans because the terms that they faced without it were less favorable.

The decompositions in Table 8 tell a similar story. For counterfactual FHA borrowers, the home loan guarantee program implied a similar subsidy rate. For these borrowers, the estimated σ-terms are similar, and the racial gap in cash equivalents and government spending amounts reflect the fact that Black veterans used the loan guarantees to purchase cheaper homes. Because the subsidy rate for these borrowers was small, there is not a large difference between the cash equivalents and the government spending amounts.

For counterfactual conventional borrowers, the loan guarantee program implied higher subsidy rates, and hence larger differences between government spending and cash equivalents. Among these borrowers, the subsidy rate was higher for Black veterans, who faced less favorable terms on conventional loans. The estimated Ψ parameter is smaller for Black veterans, because even though they faced higher subsidy rates, they chose to purchase cheaper homes. Interestingly, there are no significant racial differences in government spending amounts among these borrowers: while Black veterans took out smaller loans, they were more heavily subsidized.

The observation that white veterans were more likely to have qualified for FHA loans means that, for many of them, the VA loan guarantee did not represent a significant improvement in terms. Moreover, the terms that they faced on conventional loans were more favorable than the terms that Black veterans faced. Putting all of this together, the es-

timates suggest similar government spending amounts and cash equivalents, even though white veterans took out larger loans.

Uncertainty and caveats. The primary source of uncertainty is the estimated market values of the home loan guarantees. This estimation requires making substantial assumptions about the mortgages that Black and white veterans would have been able to obtain without VA guarantees. The estimates are based on aggregates from the non-veteran population, which accounts neither for selection into military service nor for selection into homeownership. Better information about credit conditions would allow for more credible estimates of the market value of the loan guarantees.

3.3 Business and Farm Loans

In addition to mortgages, veterans were eligible for VA-guaranteed business and farm loans. Unfortunately, neither the 1979 SOV nor the 1987 SOV asks about these loans. However, the total value of these loans was relatively small: according to the VA Annual Reports, the proportion of guarantees for business and farm loans out of total guarantees peaked in 1946 at 7%, and dropped to 1.5% by 1956.

The value of these loan guarantees relative to the value of home loan guarantees can be gleaned from the ratio of loans to commitments. For home loans, VA commitments were, on average, 50% of the value of the loan. For farm and business loans, commitments were about 40%, suggesting that lenders assumed more of the risk.

Participation rates can be estimated by comparing the first two columns of Table 5. The first column reports the participation rates of veterans in all loan guarantee programs, including both home-loan guarantees and business and farm loan guarantees. The second column is an estimate of the participation rates in the home loan guarantees in 1950. The difference between the two is a plausible estimate of the participation rates in the business and farm loan guarantee programs. Both for white veterans and for Black veterans, the implied participation rates are in the single digits.

To get an upper-bound on the amount of government spending on farm and business loans, assume that the loan-to-value ratio on these loans was 100%. Under this assumption, the value of the loan is the value of the purchase. Assume further that the subsidy on these loans was 20% – higher than the highest subsidy rate for home purchases. These numbers imply an upper bound on the government spending on business and farm loans of $12 per veteran.

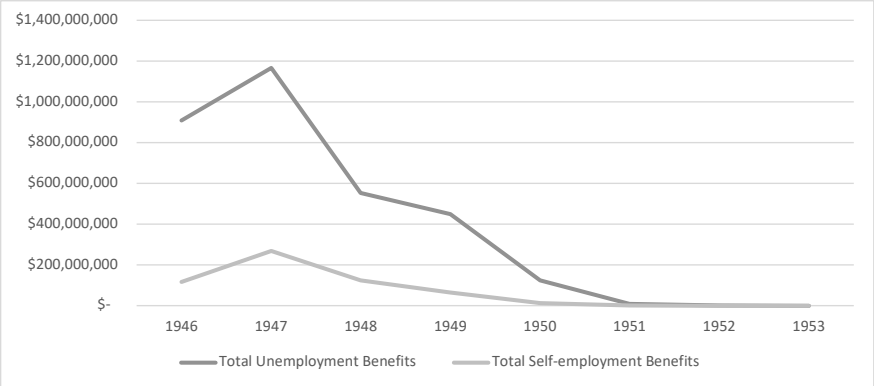
Given that the average value of these benefits was likely small, I ignore these benefits and set them to 0 for all veterans.

3.4 Unemployment and self-employment benefits

Under the G.I. bill, veterans were entitled to $20 a week in unemployment benefits, for up to 52 weeks. The G.I. bill also included some provisions for self-employment benefits. Both benefits could be claimed for 7 years after the end of the war.

The VA Annual Reports report the annual amount of unemployment and self-employment benefits paid in each year between 1946–1953 (see Figure 1).[21] Unfortunately, these benefits are not reported by race, and the 1979 and 1987 Surveys of Veterans do not ask about these benefits.[22]

Figure 1: Disbursement of Unemployment and Self-employment benefits



Source: VA Annual Reports, 1946-1953.

The 1950 SOV reports the participation rates in "readjustment allowances", which include both unemployment benefits and self-employment benefits.[23] The participation rates are reproduced in Table 9. This survey suggests that Black veterans were more likely to have received readjustment allowances than white veterans. Unfortunately, I could not obtain the estimates of the average amounts that were received by race.[24]

[21]The eligibility period for unemployment benefits was 7 years after the end of the war, so World War II veterans were not eligible for VA unemployment benefits after 1953.

[22]I have also submitted a Freedom of Information Act Request to the VA, requesting this breakdown (FOIA 22-07046-F IAD). Unfortunately they were unable to produce any records containing this information.

[23]See the 1950 Survey of Veterans, Table 12 (page 33).

[24]The report was obtained from the National Archives. Some of the sections are missing, including a section titled "Amounts".

Table 9: Calibration of readjustment allowances

Parameter	Value	Target
(1) Total discounted readjustment allowances	$\$2.9{*}10^9$	VA Annual Reports, 1946-1953
(2) Participation rate: White	52%	1950 SOV
(3) Participation rate: Black	61%	1950 SOV
(4) Number of veterans	$15{*}10^6$	VA Annual Report, 1956, p. 103
(5) Number of Black veterans	10^6	National WWII Museum[25]
(6) Number of white veterans	$14 * 10^6$	(4)-(5)
(7) Number of white recipients	$7.3 * 10^6$	(2) $\times$ (6)
(8) Number of Black recipients	$0.6 * 10^6$	(3) $\times$ (5)
(9) Readjustment allowances per white vet	**$193**	((1) $\times$ (7)/((7) + (8)))/(6)
(10) Readjustment allowances per Black vet	**$227**	((1) $\times$ (8)/((7) + (8)))/(5)
(11) Average weekly wage, white	$34	1950 Census[26]
(12) Average weekly wage, Black	$23	1950 Census[27]
(13) Subsidy rate: white	0.59	$20/(1)
(14) Subsidy rate: Black	0.87	$20/(2)
(15) Elasticity parameter, σ	-1.6	Equation 22
(16) Proposition 2, σ-term: white	0.83	Inputs $s = (3)$, $\sigma = (5)$
(17) Proposition 2, σ-term: Black	0.61	Inputs $s = (4)$, $\sigma = (5)$
(18) Cash-equivalent per white vet	**$160**	(16)$\times$ (9)
(19) Cash-equivalent per Black vet	**$138**	(17)$\times$ (10)
(20) Alternative specifications		
(20.a) Unemployment duration twice as high for white vets		
- Government spending	$201	$118
- Cash equivalent	$176	$62
(20.b) Unemployment duration twice as high for Black vets		
- Government spending	$179	$421
- Cash equivalent	$148	$257
(20.c) No racial differences in participation rates		
- Government spending	$193	$193
- Cash equivalent	$161	$119
(20.d) No racial differences in wages		
- Government spending	$193	$227
- Cash equivalent	$160	$187

The primary shortcoming of my analysis is that, in lieu of data to indicate otherwise, I calculate benefit amounts under the assumption that benefits were dispersed in proportion to participation rates, ignoring any racial differences in the benefits received conditional on unemployment. There are two reasons why unemployment benefits may not have been disbursed in proportion to participation rates. First, there may have been racial differences in average unemployment duration (conditional on unemployment), which would imply racial differences in average benefit amounts per participating veteran. I do not find evidence of this in the 1950 Census: in 1950, the average unemployment duration was about 17 weeks, both for white veterans and for Black veterans. However, it is not clear whether there were racial differences in unemployment duration in 1945-1949, which is when the bulk of unemployment benefits were disbursed.

Second, there is evidence of discrimination in the disbursement of unemployment benefits, particularly in the Deep South. Onkst [1998] reports that, often, Black veterans were denied unemployment benefits after refusing to accept menial and poorly-paid jobs, which the VA officers deemed "suitable" for them. Although there is currently no estimate of how widespread this type of discrimination was, it was apparently quite prevalent in some places. For example, Onkst [1998] reports that "only a "few" black veterans were drawing unemployment compensation in Alabama's most heavily populated black counties".[28]

In lieu of better data, I assume that unemployment and self-employment benefits were disbursed in proportion to the participation rates reported in the 1950 SOV. The estimated government expenditures on unemployment and self-employment benefits are reported in Table 9.

I turn next to the calibration of the cash equivalents. In this calculation, the good, x, is the number of unemployment days. The cost of unemployment is the forgone market wages. Table 9 (rows 11 and 12) presents the average weekly wages for employed veterans by race. Unemployment benefits subsidize unemployment. Because weekly unemployment benefits were the same for Black and white veterans and the market wage of employed white veterans was higher than the market wage of employed Black veterans, the implied subsidy was higher for Black veterans. For white veterans, the average replacement rate was 59%,

[25]See https://www.nationalww2museum.org/students-teachers/student-resources/research-starters/research-starters-us-military-numbers

[26]The estimate is based on a sample of 35,122 white employed veterans in the 1950 census. Dollar amounts are expressed in 1944 dollars (ignoring any growth in real wages between 1946 and 1950). The 95% confidence interval of the estimate is ($34, $34).

[27]The estimate is based on a sample of 2,408 Black employed veterans in the 1950 census. Dollar amounts are expressed in 1944 dollars (ignoring any growth in real wages between 1946 and 1950). The 95% confidence interval of the estimate is ($22, $23).

[28]The quote is from page 521 in Onkst [1998].

while, for Black veterans, the average replacement rate was 87%.

The calibration of σ is based on the findings by Landais [2015], who studies the elasticity of unemployment weeks to unemployment benefits in the United States during the 1970s and 1980s. Landais [2015] finds that a 10% increase in unemployment benefits increases the duration of unemployment by 4%. These estimates are based on replacement rates of about 50%, and are conditional on unemployment. Thus, the policy increased the replacement rate to around 55%. To construct an estimate of σ based on these findings, note that, for this policy change, we have that $\Delta \ln x \approx 0.04$, and

$$\Delta \ln(1-s) = \ln(1-0.55) - \ln(1-0.5) \approx -0.105$$

Using equation 8 (and replacing $\ln(1-s)$ with the change in subsidy rates, $\Delta \ln(1-s)$), we have that

$$\sigma = \frac{\Delta \ln(1-s)}{\Delta \ln(x)} + 1 \approx -\frac{0.105}{0.04} + 1 \approx -1.6 \tag{22}$$

It is worth highlighting that, unlike the previous cases of education and training benefits and housing benefits, my estimates here are constructed based on the assumption that government spending per veteran was the same conditional on participation (that is, Black and white veterans who received readjustment allowanced received them for the same number of weeks). This is consistent with a model in which people decide whether or not to look for a job, given a fixed duration of job search. This requires a slight modification of the model in section 2.1, which assumes continuous quantities of the subsidized good (x). Instead of distinguishing between veterans who participated in the program and those who did not (and setting the cash equivalents of the latter to 0), I assume here that there is a representative household of each race who decides how much unemployment to consume collectively. This standard "trick" converts the binary decision of whether or not to search for a job into a continuous unemployment variable. Of course, this "trick" obscures heterogeneity within racial groups, and hence, especially here, the estimated cash equivalents should be taken as purely illustrative.

Rows (20.a)-(20.d) of Table 9 present the estimates of the government spending amounts and the cash equivalents under alternative specifications. Because they constitute the majority of the veteran population, the estimates relating to white veterans are not very sensitive to the assumptions about racial differences in unemployment duration. However, for Black veterans, the assumption that there is no difference in unemployment duration is highly consequential (see rows (20.a) and (20.b)).

Row (20.c) illustrates that the racial difference in government spending is driven entirely by the racial gap in participation rates (given the assumption that there is no racial difference

Table 10: Cash equivalents for the readjustment allowances: decompositions

	White	Black
Cash equivalents	**$160**	**$138**
Subsidy rate, s	0.59	0.87
Elasticity parameter, σ	-1.6	-1.6
Preference parameter, Ψ	$-8.9 * 10^5$	$-1.6 * 10^6$
Proposition 1		
s-term	0.42	0.71
Ψ-term	379	193
Proposition 2		
σ-term	0.83	0.61
g	$193	$227

Note: The parameter Ψ is calculated based on equation 9.

in unemployment duration). Row (20.d) illustrates that the racial wage gap drives the racial gap in cash equivalents.

Table 10 presents the decompositions of the cash equivalents according to Propositions 1 and 2. The pattern is by now familiar. On the one hand, my estimates of government spending per Black veteran are somewhat higher than my estimates of government spending per white veteran. On the other hand, estimated subsidy rates are higher as well. Using Proposition 2, the higher subsidy rates more-than-offset the higher government spending amounts, resulting in lower cash-equivalents. Proposition 1 tells a similar story: for Black veterans, a larger share of the cash equivalent is driven by the subsidy rate, and a smaller share is driven by the preference parameter, Ψ. Similar to the other benefits, the absolute value of Ψ is significantly higher for white veterans. Here, we might interpret this difference as reflecting higher returns to job search, consistent with anecdotal evidence that VA officers offered more job search support for white veterans (see Onkst [1998]).

Uncertainty and caveats. As highlighted above, the key uncertainty has to do with average disbursement amounts. The total amount of government spending on readjustment allowances is accurately estimated from the VA annual reports. In addition, the participation rates reported in the 1950 SOV are a reliable estimate of the shares of veterans who received *some* readjustment allowances. The key uncertainty has to do with the racial breakdown of the average amounts that veterans received conditional on claiming readjustment allowances.

4 Discussion

The estimates suggest that, on average, Black veterans received slightly less in housing benefits, but more in education and training benefits and in unemployment benefits. Taken together, the average spending per Black veteran was somewhat higher than the average spending per white veteran. This suggests that the G.I. bill was not designed with the intent of shortchanging Black veterans. Although segregation excluded Black veterans from certain benefits, the legislators provided sufficient avenues for Black veterans to take advantage of the G.I. bill, so that, in the end, average tax dollars spent on Black and white veterans were about the same.

At the same time, from the veterans' perspectives, the G.I. bill was discriminatory because it subsidized expenditures that white veterans were more likely to have made anyway. For many white veterans, the G.I. benefits were pure cash transfers, because plans of college and homeownership were already in place. In contrast, Black veterans often took advantage of the G.I. benefits only because they were heavily subsidized. Because of segregation, what the G.I. bill offered them was of lower quality. What mattered for Black veterans was not the amount of dollars that the government spent on their benefits, but rather the extent to which those benefits could be used to advance their goals. Widespread segregation meant that, for many Black veterans, the G.I. benefits were not very useful.

This analysis refocuses the policy debate on two types of questions. The first is about the relevant normative criterion for evaluating racial disparities. If racial injustice is to be judged based on government spending amounts, then, according to the point estimates in this paper, the G.I. bill was not unfair towards Black veterans. In contrast, if injustice is to be judged based on the value that the benefits had for the veterans, then the G.I. bill may have been discriminatory. Based on the point estimates, to close the gap in the net-present-value of the cash equivalents, it would be necessary to transfer between $6,000 and $270,000 to the estate of each Black World War II veteran (depending on the real interest rate used for this calculation).[29]

The second type of question is empirical. The analysis here illustrates that, based on publicly-available data, estimates of racial disparities in G.I. benefits require significant extrapolations, and are associated with substantial uncertainty. However, with administrative records, it may be possible to obtain more accurate estimates. Making such data available would significantly advance the public discussion.

[29]These estimates are based on rows (5.a) and (5.c) of Table 1 (last two columns).

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A Proof of Proposition 1

To derive an expression for cash equivalents, it is necessary to solve for equilibrium consumption of c. Substituting (6) into the budget constraint yields:

$$c = m - (1-s)x = m - (1-s) * \left(\frac{1-s}{\sigma\Psi}\right)^{\frac{1}{\sigma-1}} = m - \frac{(1-s)^{\frac{1}{\sigma-1}+1}}{(\sigma\Psi)^{\frac{1}{\sigma-1}}} = \tag{23}$$

$$m - \frac{(1-s)^{\frac{\sigma}{\sigma-1}}}{(\sigma\Psi)^{\frac{1}{\sigma-1}}}$$

Thus, the utility is given by

$$m - \frac{(1-s)^{\frac{\sigma}{\sigma-1}}}{(\sigma\Psi)^{\frac{1}{\sigma-1}}} + \Psi\left(\frac{1-s}{\sigma\Psi}\right)^{\frac{\sigma}{\sigma-1}} = m + (1-s)^{\frac{\sigma}{\sigma-1}}\left(\frac{\Psi}{(\sigma\Psi)^{\frac{\sigma}{\sigma-1}}} - \frac{1}{(\sigma\Psi)^{\frac{1}{\sigma-1}}}\right) \tag{24}$$

The cash-equivalent is given by the equivalent variation, EV, which is the solution to:

$$m + (1-s)^{\frac{\sigma}{\sigma-1}}\left(\frac{\Psi}{(\sigma\Psi)^{\frac{\sigma}{\sigma-1}}} - \frac{1}{(\sigma\Psi)^{\frac{1}{\sigma-1}}}\right) = m + EV + \left(\frac{\Psi}{(\sigma\Psi)^{\frac{\sigma}{\sigma-1}}} - \frac{1}{(\sigma\Psi)^{\frac{1}{\sigma-1}}}\right) \tag{25}$$

Yielding:

$$EV = \left((1-s)^{\frac{\sigma}{\sigma-1}} - 1\right)\left(\frac{\Psi}{(\sigma\Psi)^{\frac{\sigma}{\sigma-1}}} - \frac{1}{(\sigma\Psi)^{\frac{1}{\sigma-1}}}\right) \tag{26}$$

B Proof of Proposition 2

Substituting in expression (9) into (26), we obtain an expression for EV as a function of the elasticity parameter, σ, and the observables s and x:

$$EV = \left((1-s)^{\frac{\sigma}{\sigma-1}} - 1\right)\left(\frac{\left(\frac{1-s}{\sigma}\right)x^{1-\sigma}}{\left(\sigma\left(\frac{1-s}{\sigma}\right)x^{1-\sigma}\right)^{\frac{\sigma}{\sigma-1}}} - \frac{1}{\left(\sigma\left(\frac{1-s}{\sigma}\right)x^{1-\sigma}\right)^{\frac{1}{\sigma-1}}}\right) \tag{27}$$

$$= \left((1-s)^{\frac{\sigma}{\sigma-1}} - 1\right)\left(\frac{\left(\frac{1-s}{\sigma}\right)x^{1-\sigma}}{\left((1-s)x^{1-\sigma}\right)^{\frac{\sigma}{\sigma-1}}} - \frac{1}{\left((1-s)x^{1-\sigma}\right)^{\frac{1}{\sigma-1}}}\right)$$

$$= \left((1-s)^{\frac{\sigma}{\sigma-1}} - 1\right)\left(\frac{(1-s)^{1-\frac{\sigma}{\sigma-1}}\left(\frac{1}{\sigma}\right)x^{1-\sigma}}{\left(x^{1-\sigma}\right)^{\frac{\sigma}{\sigma-1}}} - \frac{(1-s)^{\frac{1}{1-\sigma}}}{\left(x^{1-\sigma}\right)^{\frac{1}{\sigma-1}}}\right)$$

$$= \left((1-s)^{\frac{\sigma}{\sigma-1}} - 1\right)\left(\frac{(1-s)^{\frac{\sigma-1-\sigma}{\sigma-1}}\left(\frac{1}{\sigma}\right)x^{1-\sigma}}{x^{-\sigma}} - \frac{(1-s)^{\frac{1}{1-\sigma}}}{x^{-1}}\right)$$

$$= \left((1-s)^{\frac{\sigma}{\sigma-1}} - 1\right)\left((1-s)^{\frac{1}{1-\sigma}}\left(\frac{1}{\sigma}\right)x - (1-s)^{\frac{1}{1-\sigma}}x\right)$$

$$= \left((1-s)^{\frac{\sigma}{\sigma-1}} - 1\right)\left((1-s)^{\frac{1}{1-\sigma}}\right)\left(\left(\frac{1}{\sigma}\right) - 1\right)x$$

$$= \left((1-s)^{-\frac{\sigma}{1-\sigma}} - 1\right)\left((1-s)^{\frac{1}{1-\sigma}}\right)\left(\frac{1-\sigma}{\sigma}\right)x$$

$$= \left((1-s)^{-\frac{\sigma}{1-\sigma}+\frac{1}{1-\sigma}} - (1-s)^{\frac{1}{1-\sigma}}\right)\left(\frac{1-\sigma}{\sigma}\right)x$$

$$= \left((1-s)^{\frac{1-\sigma}{1-\sigma}} - (1-s)^{\frac{1}{1-\sigma}}\right)\left(\frac{1-\sigma}{\sigma}\right)x$$

$$= \left(1-s-(1-s)^{\frac{1}{1-\sigma}}\right)\left(\frac{1-\sigma}{\sigma}\right)x$$

Note that the government spending on x, denoted g, is the subsidy amount $sx = g$. Substituting into the above expression yields the identity

$$EV = \left(\frac{1}{s}\left(1-(1-s)^{\frac{1}{1-\sigma}}\right)-1\right)\left(\frac{1-\sigma}{\sigma}\right)g \tag{28}$$

This expression illustrates that even when government spending amounts are similar, cash equivalents may be very different. Furthermore, this expression illustrates a negative relationship between the subsidy rate and the estimated cash equivalent. To see this, note that the derivative with respect to s is given by

$$\left(-\frac{1}{s^2}\left(1-(1-s)^{\frac{1}{1-\sigma}}\right)+\frac{(1-s)^{\frac{1}{1-\sigma}}}{s(1-s)(1-\sigma)}\right)\left(\frac{1-\sigma}{\sigma}\right)g =$$

$$\frac{1}{s^2(1-s)(1-\sigma)}\left(\left((1-s)^{\frac{1}{1-\sigma}}-1\right)(1-s)(1-\sigma)+s(1-s)^{\frac{1}{1-\sigma}}\right)\left(\frac{1-\sigma}{\sigma}\right)g =$$

$$\frac{g}{s^2(1-s)\sigma}\left(\left((1-s)^{\frac{1}{1-\sigma}}-1\right)(1-s)(1-\sigma)+s(1-s)^{\frac{1}{1-\sigma}}\right) =$$

$$\frac{g}{s^2(1-s)\sigma}\left(\left((1-s)^{\frac{1}{1-\sigma}}-1\right)(1-\sigma-s+s\sigma)+s(1-s)^{\frac{1}{1-\sigma}}\right) =$$

$$\frac{g}{s^2(1-s)\sigma}\left(\left((1-s)^{\frac{1}{1-\sigma}}-1\right)(1-\sigma+s\sigma)-s(1-s)^{\frac{1}{1-\sigma}}+s+s(1-s)^{\frac{1}{1-\sigma}}\right) =$$

$$\frac{g}{s^2(1-s)\sigma}\left(\left((1-s)^{\frac{1}{1-\sigma}}-1\right)(1-\sigma+s\sigma)+s\right)$$

Note that the term $g/(s^2(1-s))$ is always positive. The sign therefore depends on the sign of

$$\left((1-s)^{\frac{1}{1-\sigma}}-1\right)(\frac{1}{\sigma}-1+s)+\frac{s}{\sigma} =$$

$$(1-s)^{\frac{1}{1-\sigma}}(\frac{1}{\sigma}-1+s)-\frac{1}{\sigma}+1-s+\frac{s}{\sigma} =$$

$$(1-s)^{\frac{1}{1-\sigma}}(\frac{1}{\sigma}-1+s)-\frac{1-s}{\sigma}+1-s =$$

$$(1-s)^{\frac{1}{1-\sigma}}(\frac{1}{\sigma}-1+s)+(1-s)(1-\frac{1}{\sigma}) =$$

$$(1-s)^{\frac{1}{1-\sigma}}(\frac{1}{\sigma}-1+s)-(1-s)(\frac{1}{\sigma}-1)<$$
$$(1-s)^{\frac{1}{1-\sigma}}(\frac{1}{\sigma}-1)-(1-s)(\frac{1}{\sigma}-1)=$$
$$\left((1-s)^{\frac{1}{1-\sigma}}-(1-s)\right)\left(\frac{1}{\sigma}-1\right) \tag{29}$$

(where the inequality follows because s and $(1-s)^{\frac{1}{1-\sigma}}$ are always positive, and hence their product is positive). To see that this expression is negative, note that:

$$\sigma>0 \Leftrightarrow -\sigma<0 \Leftrightarrow 1-\sigma<1 \Leftrightarrow 1<\frac{1}{1-\sigma}$$

$$\Leftrightarrow (1-s)^{\frac{1}{1-\sigma}}<(1-s)$$

(because $(1-s)<1$).

Furthermore,

$$1>\sigma>0 \Rightarrow \frac{1}{\sigma}>1 \Rightarrow \frac{1}{\sigma}-1>0$$

and

$$\sigma<0 \Rightarrow \frac{1}{\sigma}<1 \Rightarrow \frac{1}{\sigma}-1<0$$

Hence, we have that

$$\frac{1}{\sigma}-1>0 \Leftrightarrow \sigma>0$$

We can then distinguish between two cases:

- When $\sigma>0$, the first term in 29 is negative and the second term is positive, so the product is negative.
- When $\sigma<0$, the first term in 29 is positive and the second term is negative, so the product is negative.

It follows that, for every $\sigma<1$ (and $\sigma\neq 0$), the expression in 29 is negative, and hence the derivative of (28) is negative, establishing that it is decreasing in s.

C Additional tables

Table C1: Education and training benefits

	Participation rate		Average Months	
	White	Black	White	Black
College	17.3 %	10.6%	23.3	26
	(16.3,18.5)	(7.2,13.9)	(22.4, 24.3)	(21.8, 30.3)
High school	0.7%	5.3%	13.2	17
	(0.5,1.1)	(2.8,7.7)	(9.8, 16.6)	(11.4, 22.6)
Other school	11.8%	21.1%	12.7	14.5
	(10.8, 12.7)	(16.7, 25.6)	(11.9, 13.6)	(12.3, 16.6)
On the job	9.8%	10.3%	16.3	14
	(8.9, 10.7)	(7, 13.7)	(15.3, 17.4)	(10.4 17.6)
Any program	39.1%	46.2%	18.6	17.2
	(37.7, 40.1)	(40.8, 51.7)	(18, 19.2)	(15.5, 18.9)

Note: Estimates are based on a sample of 4,220 white WWII veterans and 309 Black WWII veterans. Average months correspond to average benefit months conditional on participation. Estimates are based on sample weights, and are conditional on having served for at least 90 days (thus being eligible for benefits). The category "other school" groups together the categories "Flight school (not correspondence)", "Other school (not correspondence)" and "Correspondence". The category "On the job" groups together the categories "Apprentice", "On-the-job" and "Farm training". Brackets correspond to 95% confidence intervals.

Table C2: Summary statistics for WWII veterans, from the 1950 Census

	White	Black
(1) In school (%)	21.2	19.2
	(20.6,21.7)	(17.3,21.1)
(2) Dependents (share)		
- Single	0.31	0.31
	(0.3,0.31)	(0.3,0.33)
- One dependent	0.34	0.48
	(0.33, 0.34)	(0.46,0.5)
- At least two dependents	0.36	0.2
	(0.35, 0.36)	(0.19, 0.22)
(2.a) Conditional on school		
- Single	0.6	0.56
	(0.59,0.62)	(0.47,0.58)
- One dependent	0.24	0.34
	(0.22,0.25)	(0.28,0.39)
- More than one dependent	0.16	0.13
	(0.15,0.17)	(0.1,0.17)
(3) Market wages (for vets not in school)		
- Unconditional average	\$128	\$78
	(\$126,\$129)	(\$75,\$82)
- Singles	\$94	\$63
	(\$92, \$96)	(\$57, \$70)
- One dependent	\$136	\$83
	(\$133, \$138)	(\$77, \$89)
- Two or more dependents	\$150	\$96
	(\$148, \$152)	(\$90, \$103)

Note: Estimates are based on a sample of 40,106 white WWII veterans and 3,133 Black WWII veterans, from the 1950 Census. Estimates are based on sample weights, and brackets correspond to 95% confidence intervals. Estimates are based on sample weights. Dependents include spouses and children.

Table C3: Average annual costs of tuition and books (1944 dollars)

	High school	Technical school	College
White	\$18	\$81	\$202
	(13, 23)	(53, 109)	(172, 233)
Black	\$12	\$169	\$173
	(7, 15)	(74, 265)	(122, 224)

Note: Estimates are based on the Study of Consumer Purchases in the United States, 1935-1936. They are adjusted to 1944 dollars using the appropriate price indexes from the BEA. Brackets correspond to 95% confidence intervals.

Table C4: Education and training benefits by type of program and number of dependents

	White			Black		
Number of dependents	0	1	>1	0	1	>1
(1.a) Market wage	\$1,128	\$1,632	\$1,800	\$756	\$996	\$1,152
(1.b) G.I. benefit: stipend	\$666	\$930	\$1,023	\$666	\$930	\$1,023
(2) College						
(2.a) Unsubsidized tuition	\$235	\$235	\$235	\$188	\$188	\$188
(2.b) Unsubsidized cost: (1.a)+(2.a)	\$1,363	\$1,867	\$2,035	\$944	\$1,184	\$1,340
(2.c) G.I. benefit: tuition	\$202	\$202	\$202	\$173	\$173	\$173
(2.d) Government spending: (1.b)+(2.c)	\$868	\$1,132	\$1,225	\$839	\$1,103	\$1,196
(2.e) Subsidy rate: (2.d)/(2.b)	0.64	0.61	0.6	0.89	0.93	0.89
(2.f) Cash equivalent	\$599	\$794	\$862	\$445	\$518	\$628
(3) High school						
(3.a) Unsubsidized tuition	\$18	\$18	\$18	\$12	\$12	\$12
(3.b) Unsubsidized cost: (1)+(3.a)	\$1,146	\$1,650	\$1,818	\$768	\$1,008	\$1,164
(3.c) G.I. benefit: tuition	\$18	\$18	\$18	\$12	\$12	\$12
(3.d) Government spending: (1.b)+(3.c)	\$684	\$948	\$1,041	\$678	\$942	\$1,035
(3.e) Subsidy rate: (3.d)/(3.b)	0.6	0.57	0.57	0.88	0.93	0.89
(3.f) Cash equivalent	\$482	\$675	\$743	\$364	\$437	\$548
(4) Other school						
(4.a) Unsubsidized tuition	\$81	\$81	\$81	\$169	\$169	\$169
(4.b) Unsubsidized cost: (1)+(4.a)	\$1,209	\$1,713	\$1,881	\$925	\$1,165	\$1,321
(4.c) G.I. benefit: tuition	\$81	\$81	\$81	\$169	\$169	\$169
(4.d) Government spending: (1.b)+(4.c)	\$747	\$1,011	\$1,104	\$835	\$1,099	\$1,192
(4.e) Subsidy rate: (4.d)/(4.b)	0.62	0.59	0.59	0.9	0.94	0.9
(4.f) Cash equivalent	\$521	\$715	\$782	\$428	\$491	\$612
(5) On-the-job						
(5.a) Unsubsidized tuition	\$0	\$0	\$0	\$0	\$0	\$0
(5.b) Unsubsidized cost: (1)+(5.a)	\$1,128	\$1,632	\$1,800	\$756	\$996	\$1,152
(5.c) G.I. benefit: tuition	\$0	\$0	\$0	\$0	\$0	\$0
(5.d) Government spending: (1.b)+(5.c)	\$666	\$930	\$1,023	\$666	\$930	\$1,023
(5.e) Subsidy rate: (5.d)/(5.b)	0.59	0.57	0.57	0.88	0.93	0.89
(5.f) Cash equivalent	\$471	\$664	\$731	\$359	\$433	\$543

Note: Tuition costs are estimated based on the 1935-1936 household expenditure survey, and converted to 1944 dollars using the appropriate BEA price indexes. G.I. benefits for tuition correspond to the average of the censured distribution of tuition costs, where the censuring reflects the VA limit of \$500 per year. Annual market wages (row 1) are estimated based on multiplying the point estimates in Table C2 by 12. Stipend amounts are estimated using the procedure laid out in footnote 13. Cash equivalents are based on equation 28, given the subsidy rates and government spending amounts.

Table C5: Price of a first home purchased with a VA loan (1944 USD, discounted)

	White	Black
(1) Average of ln(H)	8.346	7.96
(1.a) 95% confidence intervals	(8.32, 8.37)	(7.86, 8.08)
(2) Home price, H (exponent of (1))	$4,217	$2,878
(2.a) 95% confidence intervals (exponent of (1.a))	($4,120, $4,316)	($2,576, $3,216)

Note: Estimates are based on the 1979 SOV, and correspond to home prices of veterans who used a VA loan to purchase their first home. Dollar amounts correspond to discounted 1944 USD, where later home purchases are discounted at a real rate of 5%. The estimates are based on a sample of 3,639 white WWII veterans and 205 Black WWII veterans who served for at least 90 days.