

College Education and The Mid-Century GI Bills

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ABSTRACT

The mid-century GI bills were the largest direct scholarship program for higher education in American history. I use a comparison group created by the sharp cutoff date of the Korean War GI bill to evaluate the effects of the Korean War GI bill on post-secondary educational attainment and access to college by the disadvantaged. I then bound the likely effects of the World War II GI bill based on a combination of elasticities estimated for the Korean War GI bill and information from the Survey of Occupational Change in a Generation. I find that the combination of the Korean War and WWII GI bills probably increased total post-secondary attainment among all men born between 1921 and 1933 by about 15% to 20%, with smaller effects for surrounding cohorts. The impacts of both programs on college attainment were apparently concentrated among veterans from families in the upper half of the socio-economic distribution. A simple partial equilibrium cost-benefit analysis of the legislation shows that even allowing for substantial deadweight loss associated with government fund-raising, the GI bills produced a benefit/cost ratio of between 1.5 to 1 and 2 to 1. I estimate that roughly two-thirds to four-fifths of program expenditures for higher education were transfers, and the remainder paid for additional education induced by the subsidy offer.

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The World War II GI bill -- and its significant but less celebrated cousin, the Korean War GI bill -- have acquired the reputation of being one of the signal successes of twentieth century American domestic policy, a kind of domestic Marshall plan. Observers have credited the GI bill with playing a vital role in opening the doors of higher education to millions who would otherwise have been unable to enter college for financial reasons, and helping to set the stage for the decades of widely shared prosperity that followed World War II. The reputation of these bills is justified by their scale. Almost 70% of all men who turned 21 between 1940 and 1955 were guaranteed an essentially free college education plus a substantial stipend under one of the two GI bills. In 1960, some 18% of the total stock of college-educated males in the United States could claim that their college education had been financed by a GI bill subsidy.¹

This paper examines the effects of the two GI bills on the level and distribution of higher educational attainment. I begin by evaluating the impacts of the Korean War using a comparison group method generated by a clear natural experiment. Veterans entering the military on or before January 31, 1955 were eligible for full benefits, but veterans entering after this date were ineligible. The January 1955 cutoff date for eligibility probably did not coincide with major independent shifts in military service or education -- the cutoff was well after the actual end of hostilities in Korea, which occurred in June, 1953. For these reasons, a comparison of regression-adjusted education levels for veterans who entered the military just before January 31, 1955 to education levels for veterans who entered just after provides a good estimate of the effects of the bill on college attainment.

In contrast to the Korean War legislation, there is no clear identification strategy to determine the effects of the WWII GI bill. Since virtually all veterans during the WWII period and the Korean period that immediately followed it were eligible for extensive educational benefits, and veterans were a select group, it is not possible to find a group that is comparable to veterans but were not eligible for the GI bill. However, there are more speculative sources of

¹ The first (70%) figure is based on self-reported military service during the WWII and/or Korea period among males in the 1970 Census; almost all veterans of these wars were eligible for GI benefits. The second (18%) figure uses administrative data on benefits granted during the first five years of each GI bill as a numerator (Committee on Veterans Affairs, 1972) and the number of men reporting 1 or more years of college education in the 1960 Census as a denominator.

information on the effects of the legislation. One is the new estimate in this paper of the effects of the Korean War GI bill. As explained below, the Korean GI Bill and WWII GI Bill had similar legislative provisions, and the programs affected cohorts that were reasonably close in time. Evidence on the effects of the Korean War GI bill provides a useful guide to the likely effects of the WWII legislation. I also present direct evidence on the effects of the WWII bill. I first compare the educational outcomes of veterans with those of civilians, after controlling for extensive background variables included in the Occupational Changes in a Generation (OCG) data set. Then I examine the time pattern in educational attainment around the WWII period. These methods are somewhat more speculative than the comparison group design used to examine the Korean War GI bill and require stronger assumptions to derive a direct impact for the WWII GI bill subsidy.

I find that the GI bills did have substantial effects, probably increasing total years of post-secondary attainment among men born between 1921 and 1933 by about 15% to 20%. There was little effect for men born before 1921, probably because they were older at the time of military entry. Most of the effects of the legislation on higher education were concentrated among men from families in the upper half of the distribution of socio-economic status. A partial equilibrium analysis of costs and benefits gives a benefit/cost ratio of between 1.5 to 1 and 2 to 1 for the bills (although partial equilibrium analysis may be deceptive for a program of this size). I find that about two-thirds to four-fifths of government spending on higher education in these programs was a transfer to veterans who would have undertaken education in any case, while the remainder went to fund additional education induced by the subsidy offer.

Contrary to the "legend" of the GI bill, the effects of the legislation are best conceived of as evolutionary rather than revolutionary. Because of the independent negative impact of WWII on education, much of the effect of the WWII GI bill was probably compensatory; it maintained the pre-war trend of rapid growth in higher education and moderately accelerated it. Although the effects of the GI bills were substantial, they are not strikingly large compared to the consistently rapid growth that has characterized higher education in the U.S. through most of this century. Any equalizing effect of the GI bills on the distribution of college attainment probably occurred mainly among veterans from families in the upper half of the income distribution.

Literature Review

There have been surprisingly few attempts to measure the effects of the mid-century GI bills on the level and distribution of post-secondary educational attainment. The limited efforts to date have produced conflicting results. Contemporary observers using survey evidence found that about a fifth to a quarter of those attending college on a WWII GI bill subsidy would not have done so otherwise (Frederickson and Schrader, 1951). Some later scholars concluded that the effects of the WWII GI bill did not even make up for the shortfall in degrees caused by WWII (Olson, 1974).

A recent paper that directly examines the effect of the WWII GI bill on educational attainment is by Bound and Turner (1999), who use the dip in military service at the close of WWII as a source of exogenous variation in WWII GI bill eligibility. Since most non-WWII veterans during this period served in Korea, and because the end of WWII caused many changes in education not directly related to the GI bill, their method requires strong assumptions. For example, it is necessary to make assumptions about the effect of the Korean GI bill on education and the counterfactual trend in education over the period in the absence of the GI bill. The findings in this paper fit within the range of possible impacts estimated by Bound and Turner for the WWII GI bill in all cases.

Several economists have examined the education effects of later, post-Korean GI bills (O'Neill, 1977, Angrist, 1993) and non-U.S. WWII era GI bills (Lemieux and Card, 1998). The O'Neill and Angrist papers focus on a period (1966 and after) after the period studied here. Both papers find strong effects due to GI educational benefits. Angrist's preferred estimate is that use of veterans' benefits resulted in a schooling increment of .75 to 1.5 years, which is an impact quite comparable with what I find here.² The Lemieux and Card paper focuses on earnings effects of the Canadian GI bill, and does not estimate an educational effect for the

² Angrist reports gains in total education associated GI bill use during the late 1960s and 1970s, whereas I focus on figures for the gain in post-secondary education associated with GI bill eligibility during the 1940s and 1950s. These are not directly comparable figures; Angrist's is the average gain among veterans who actually use GI bill benefits, whereas mine is the average gain across all eligible veterans. However, when my results are adjusted to reflect average impacts among GI bill users they are surprisingly close to Angrist's.

legislation.

Historical Background

As Figure 1 shows, levels of military service were very high for men in their late teens and early twenties during the peak period of WWII and the Korean War. Especially during the WWII period, the great majority of men under age 26 who could pass the mental and physical tests necessary for induction were drafted and served in the military. Men older than 25 years of age, and especially those older than 30, were often able to obtain deferments or exemptions from service. Since mental and physical tests were required for induction during both WWII and the Korean War, men who served in the military were a highly select group who differed from civilians in many ways. Self-selection through volunteering also occurred during the periods when volunteering was allowed, as it was throughout the Korean War and during the early years of WWII. Appendix A has an extensive discussion of military selection procedures during both WWII and Korea.

In addition to trends in military service, Figure 1 also shows the trend in average years of post-secondary education for all cohorts of males born in the United States between 1905 and 1940, drawn retrospectively from the 1970 census. The trend in levels of post-secondary education across the period is compatible with an effect for the GI bills. Educational growth was rapid for men born from 1910 to 1927, a period that coincides with the growth and peak in WWII service. There was then a brief pause in educational growth for men born 1927 to 1929, which coincides with the "notch" between service in WWII and the Korean War. Growth resumes for men born 1930 to 1933, the peak cohorts for Korean War service. Finally, growth in education ceases during the Korean drawdown period.

This trend is difficult to interpret. There was very rapid pre-existing growth in higher education before WWII. We know from contemporary administrative data that college enrollment increased three-fold from 1910 to 1940 (Goldin and Katz, 1999), and that growth was especially rapid just prior to the outbreak of WWII. Bachelor degrees granted to males as a fraction of the relevant population increased 5.1% annually during the years 1936 to 1940 (see Table 15 and the related discussion). This is primarily due to very rapid growth in high school

graduation rates during the Depression years (Goldin, 1998), as well as the wide availability of affordable higher education institutions before WWII (Goldin and Katz, 1999). It is this pre-war growth, and not the GI bill, that probably accounts for the rapid increases in education for cohorts born early in the century, many of whom were in their late twenties by the time they entered WWII.

Growth in schooling was interrupted by the outbreak of WWII. The war drew existing students out of universities and led prospective ones to delay their education. It also had a sharp negative effect on high school graduation rates by drawing young men away from high school to work in war industries or volunteer for the military (Goldin, 1998). With the close of WWII, these factors lessened in importance. High school graduation rates rose once again, and veterans who had delayed their education to serve in the military flooded back into the colleges.

It is easy to see in Figure 1 that the cohorts most affected by WWII do not actually show a decline in post-secondary education. Given the reasons to believe that WWII had an independent negative effect on educational growth, this feature is surprising and points to an effect of the WWII GI bill that was at least large enough to compensate for any negative effects of WWII on education. But the magnitude of the GI bill effect inferred from a time trend will depend completely on assumptions about the extent to which pre-war educational growth would have continued in the absence of the GI bill. It is thus difficult to infer an actual magnitude for the GI bill's effects from observing educational trends.

Data Sources

This paper uses several data sources that have not previously been used to examine the impact of the WWII GI bill. The most important is the Occupational Changes in a Generation (OCG) survey (Blau et al., 1994). The OCG was administered in 1962 and 1973, each time as a supplement to the March CPS. Each male between 18 and 65 selected for the CPS sample was given a supplemental questionnaire concerning family background and their personal work and marital history. The 1973 questionnaire includes a range of questions on military background, such as dates of entry and exit, and years of education prior to military entry. The 1962 questionnaire was more limited than the 1973 one, and contains no questions concerning Korean

veteran status (men were only asked if they fought in World War II). It also does not contain questions about age or education at the time of military entry.

It is worth noting that about 11% of the CPS sample gave no response to the key family background questions on OCG survey. The non-responders appear to be less educated than the full responders. I have eliminated these persons from the sample.³ My OCG sample therefore has slightly (5-10%) higher education levels than the corresponding census year.

A second data source is the Survey of Veterans, or SOV (Hammond, 1980, Department of Veterans Affairs, 1994). The SOV was undertaken in 1978 and in 1987 as an adjunct to the March CPS and in 1992 as a stand-alone survey. The SOV does not include family background data, but it does include a question on education at the time of military entry. For veterans serving after 1955 the SOV surveys also include useful background information on the military service record. I present results only from the 1978 SOV here.⁴

In addition to these data sources, I use the 1950 to 1980 U.S. Federal population Census IPUMS samples.

The GI Bill Legislation

The WWII GI bill was passed in 1944. The education portion of the bill was originally envisaged as a limited program to allow veterans whose education had been interrupted by the war to continue their education. The eventual legislation that was passed was much broader, and the response to it was strong. Out of about 15.3 million WWII veterans, some 7.8 million eventually drew on educational benefits (President's Commission, 1956), although only a

³ I only eliminated persons who did not respond to any of the key family background questions; I used a missing value dummy for persons who did not respond to a subset of them.

⁴ I have analyzed all three SOVs, although only the 1978 results are shown in this paper. Results from all generally support the impacts found here. Results from the 1987 SOV on the impact of the Korean GI bill on education are somewhat smaller than the impacts shown here, although the difference is not statistically significant, and results from the 1992 SOV are considerably larger, but again not significantly different. The later SOVs have more limited background variables, and probably contain more recall error. The 1992 SOV asks only about degrees completed, not total years of education.

minority of them used their benefits for higher education.⁵

The Korean War GI bill was passed in July 1952, and was consciously modeled after the WWII GI bill. As discussed below, the generosity of the bill was similar to but somewhat less than that of the WWII GI bill. Again, response was strong: out of around 5.3 million Korean conflict veterans about 2 million drew on educational benefits under the bill within five years of passage, and more than a million used it for college (Committee on Veterans Affairs, 1972).

The eligibility rules for the use of these bills were quite generous (President's Commission, 1956). For the WWII bill, all individuals who had served in the U.S. armed forces during the World War II period (September, 1940 through July, 1947) were covered for a minimum of one year of training plus one additional month for each month of active duty, up to a maximum of 48 months.⁶ All active duty service was covered, as long as the individual had served during WWII. Note that for higher education students summers would generally not be counted as supported periods, so 9 months of GI bill eligibility would generally suffice to cover one year of full-time college.

The duration of benefits for the Korean War GI bill was defined as one and one-half times any active duty term that included any service during the officially defined Korean War period (June, 1950 to January 31, 1955). That is, any veteran who had even one day of service during this period qualified for benefits based on his entire term of military duty, even if most of it was not during the Korean War period. Benefits were limited to 36 months of eligibility.

As can readily be seen from Table 1, the vast majority of veterans in both wars had enough GI bill eligibility to qualify for at least three years of post-secondary education.⁷ It is likely that the few who did not were not comparable to those who did; major causes of short

⁵ According to a contemporary survey of veterans, only 35% of those in training in November 1949 were enrolled at the university level, with the remainder enrolled in proprietary or vocational schools below the university level or some form of on-the-job training (Dept. of Veterans Affairs, 1950). The fraction of students enrolled at the university level went down even further among post-1949 users of the legislation (President's Commission, 1956).

⁶ The major exception was veterans receiving a dishonorable discharge.

⁷ It is likely that the great majority of those with 1-2 years of service in Korea in fact had closer to 2 years, since this was the standard service period by law.

service length were dishonorable discharges and serious war wounds. As a practical matter, I assume that GI bill eligibility is effectively identical to veterans status during the relevant war, and I do not take into account differences in length of GI bill eligibility.

The financial provisions of the bills were generous. The WWII bill provided full payment for tuition, books, and supplies at essentially any higher education institution in the country, as well as a substantial living stipend that varied based on the family size of the veteran. The Korean legislation offered a generous flat fee (that varied based on family size) from which the veteran was expected to pay both tuition and living expenses.

Table 2 summarizes the payment provisions of the two GI bills, and the reductions they created in the total cost (tuition plus opportunity cost) of college attendance for the typical veteran. Both the tuition benefit and the living stipend are included. The figures assume that veterans do not work for pay during the school year, but are able to earn the median wage for a 20 to 24 year old male during the three summer months. The total cost of schooling is thus estimated as the average tuition rate for a public or private college, plus 75% of the median wage for a 20-24 year old male during the relevant year (since nine months of earnings are foregone).⁸ The costs of books and supplies are not counted.⁹ The assumption that veterans do not work during the school year is a conservative one. According to the 1950 census, one-third of college students aged 18 to 24 worked during the census week (in April).

As the table shows, the GI bill subsidies reduced total college costs substantially, with the WWII GI bill being somewhat more generous than the Korean one. Cost reductions for veterans receiving the benefit were at least 40-50% and often more (especially since two-thirds of Korean veterans attended public universities). According to the 1950 Census, in 1948 about 20% of veterans in their twenties had one child, and 15% had two or more children. Thus the majority of veterans had no children, but about a third did qualify for the more generous subsidies offered to families. In determining elasticities for this paper, I will be using the rough figure of 60% for the cut in total college costs created by the WWII GI bill and 50% for the Korean War GI bill.

⁸ The table uses 1956 as a baseline year for Korean veterans, since this is the year when most of the Korean veterans in my analysis sample exited the military.

⁹ Counting these makes the WWII GI bill slightly more generous, and the Korean GI bill slightly less so.

EVIDENCE ON THE KOREAN GI BILL AND POST-SECONDARY SCHOOLING

Effects on Mean Post-Secondary Schooling Levels

The rules for Korean War GI bill eligibility create a natural comparison group for evaluating the effects of the legislation. The timeline in Table 3 gives the basic chronology of this "natural experiment". The original 1952 legislation simply stated that veterans qualified for education benefits based on active duty service during an (undefined) Korean War period. Combat on the Korean peninsula ended when a cease-fire was signed in June 1953. However, the official eligibility period for Korean War GI bill educational benefits did not end until January 1955. On this date an amendment to the original 1952 legislation was passed stating that all veterans serving in the military at any point from June 1950 to January 1955 were eligible for Korean War GI bill benefits based on their full term of active duty service (even that period after January 1955). Veterans joining even a day after January 31 1955 were not eligible for any Korean War GI bill benefits. However, post-Korean veterans were later retroactively covered by the post-Korean War GI bill, passed in mid-1966. The post-Korean GI bill was quite similar to the Korean War GI bill, but slightly less generous.¹⁰

The provision of full benefits to those entering the military at any time up to January 1955 was likely not anticipated by military entrants after the June 1953 cease fire. After this cease fire the close of the "official" Korean War period could have occurred at any date, and according to the original 1952 legislation no benefits would be provided for service after the close of the Korean period. Therefore, it does not seem likely that awareness of the Korean GI bill benefits led to selection into the military due to interest in education. Based on this framework, I assume that veterans joining the military "just after" the benefit cutoff date will provide a good comparison group for veterans joining "just before" the cutoff date, especially since it is possible to control for extensive background variables using the OCG.

¹⁰ The typical veteran qualified for about 24 months of funding under the post-Korean GI bill, as opposed to about 36 under the Korean War GI bill. Real benefit levels under the 1966 legislation were about 90-95% of benefit levels under the Korean War GI bill (Udell, 1968; author's inflation adjustments using CPI-U).

Slightly more formally, I can represent an individual's level of post-secondary schooling in the absence of the Korean War GI bill subsidy as S_{0i} , and their education given eligibility for the Korean War GI bill subsidy as S_{1i} . The average impact of subsidy eligibility on post-secondary education can be represented as $E[S_{1i} - S_{0i}]$. I cannot observe this statistic in a population of veterans who joined at exactly the same time, but the sharp benefits cutoff allows me to observe the following statistic:

$$(1) \ E[S_{1i} | V_i = 1, K_i = 1, X_i] - E[S_{0i} | V_i = 1, K_i = 0, X_i]$$

Here, V_i indicates veteran status, K_i is an indicator for service during the officially defined Korean War period, and X_i is a vector of covariates. The fact that both groups were veterans allows me to hold constant the effects of military service on education, although the exact period of military service differs slightly.

There are potentially two problems with this method. The first is that because of changes in military selection, veterans entering during the post-Korean period may differ from veterans entering during the Korean period in unobservable ways that affect schooling. I attempt to address this problem by limiting my sample, whenever possible, to veterans who entered the military at a time quite close to the January 1955 deadline. I also control for extensive background variables, including education prior to military entry.

A second issue is that even post-Korean veterans eventually became eligible for education benefits through the 1966 post-Korean GI bill. Thus, the simple difference in (1) estimates the effect of becoming eligible for veterans benefits immediately upon military release compared with the effect of becoming eligible in 1966. I address this problem both by limiting my sample to veterans who exited well before 1966 and by the use of various assumptions to put bounds on the effects of the later eligibility of the comparison group for the post-Korean GI bill.

Tables 4 and 5 show descriptive statistics and results from estimating the difference in equation (1), using two different data sources. The first sample is from the 1973 OCG, and consists of veterans who joined the military between February 1954 and January 1956 who served one to five years on active duty. The five year limit ensures that veterans in this sample were

released from the military no later than January 1961, over five years before the post-Korean GI bill was passed.

The second sample is from the 1978 SOV. Because this survey contains only the date of military release, and not the date of entry, I cannot recreate the 1973 OCG sample. I have instead selected all veterans discharged between February 1955 and January 1961, and eliminated those with service prior to the beginning of the Korean War in 1950 or with less than one year of completed service before discharge. Unlike the OCG sample, the SOV sample thus includes Korean War veterans entering the military in 1950 through 1953 and with greater than one year of service, and non-Korean veterans entering the military in 1956 through 1960.¹¹

The point estimates of the Korean GI bill's impact in Table 5 are consistently significant, and also quite consistent across the two samples. They are also similar to the simple differences in post-secondary education shown in Table 4. The point estimates show that entrance into the military prior to the expiration of the Korean War GI bill is associated with a roughly 20% increase in educational levels. Based on the rough reduction of 50% in higher education costs calculated for the Korean War GI bill in Table 2, this implies an elasticity of post-secondary educational attainment to the GI bill subsidy of about .4. The regressions include controls for individual year of education upon military entry, as well as other covariates.

As Table 4 shows, in the OCG sample there do appear to be some differences between the Korean and post-Korean samples in education prior to military entry. The post-Korean sample is significantly less likely to have a high school degree at military entry, but have higher levels of post-secondary education at military entry. This difference underscores the necessity of controlling carefully for pre-service education and other background variables, as well as performing robustness checks. Due to the length of the paper, I have not shown the detailed results of alternative specifications and sample definitions here. However, the point estimates are

¹¹ The SOV sample obviously has a greater variance in time of entry to the military and cohort of birth, with an average age difference of 2½ years. For these reasons, I consider it less reliable than the OCG sample, even though the results are quite similar. Another issue is that the sample includes veterans joining the military between the passage of the Korean War GI bill in July, 1952 and the close of hostilities in June, 1953; these veterans might have anticipated educational benefits for their service. However, during this period over half of entrants entered through the draft, and many who volunteered did so to avoid the draft. In any case, interest in education benefits seems an unlikely reason for entering the military during a shooting war.

not particularly sensitive to the choice of control variables. The impact of the Korean GI bill also remains similar when the sample is limited to veterans with a high school degree on military entry.¹²

The difference in pre-service education levels in the OCG sample in Table 4 may be due partially to random variation. According to the OCG, military entrants in 1956 show an educational pattern that is more similar to 1954 entrants than to 1955 entrants. In addition, based on data from the Selective Service, manpower demands and standards appear to be reasonably similar in 1954 and 1955. For example, rejection rates for draftees on physical and mental exams were 48.7% for 1955, and 47.3% for 1954. There were some 560,000 total inductions into the military in 1953, but this dropped to 270,000 in 1954 and 214,000 in 1955.¹³ Finally, there are no significant differences in education at military entry between Korean and post-Korean veterans in the 1978 SOV sample, although this may be due to the fact that the two samples do not represent exactly the same population.

The results in Table 5 do not adjust for the potential effect of eligibility for the 1966 post-Korean GI bill on education among post-Korean veterans. Table 6 gives some estimates of later use of the 1966 post-Korean GI bill. The figures are from the 1979 SOV, which asks directly about the use and timing of veterans' benefits to pay for education. I have shown estimated use of GI bill funding by 1973, to correspond to the 1973 OCG results.

The results in Table 6 show that veterans with Korean service were over ten times more likely than those without Korean service to report the use of VA benefits to pay for higher education within four years of military release. A greater percentage of non-Korean veterans report funding college education with VA benefits 5 or more years after release, which probably

¹² I tested for differences in the Korean GI bill effect by initial education by interacting the dummy for Korean service with a dummy for high school degree on military entry (in the OCG sample) or military release (in the SOV sample). In the OCG sample, veterans with a high school degree at military entry showed a slightly larger impact from GI bill eligibility than those without a high school degree, but both groups showed a substantial positive effect and the difference was not statistically significant. In the SOV sample, veterans with a high school degree at military release showed a much larger impact from GI bill eligibility, while less educated veterans showed an effect only slightly greater than zero. The difference was statistically significant.

¹³ See Report of the Selective Service, 1955, U.S. GPO, 1956, pp. 35-40.

reflects greater use of the post-Korean GI bill.¹⁴ By 1973, the average number of months of post-secondary funding reported by Korean veterans is over three and one-half times greater than the figure for post-Korean veterans. Despite these genuine differences, the fact that the comparison group did use substantial amounts of GI bill funding means that the Table 5 results may underestimate the treatment effect of the Korean War GI bill.

Ideally, this problem could be solved by subtracting the causal effects of the post-Korean GI bill funding on education from the education level of the comparison group. It would then be possible to compare the treatment group education level to this adjusted comparison group level to determine the full effects of GI bill funding for Korean veterans when compared to a baseline of no funding at all. The adjusted impact produced by this method would be:

$$(2) \text{ Impact} = \beta_1 + \beta_2 M_{GI}^C$$

Here, β_1 is the simple regression-adjusted estimate of the difference in post-secondary education between the treatment and comparison group, as estimated in Table 5. M_{GI}^C refers to the average months of GI bill funded post-secondary education received by the comparison group under the post-Korean GI bill, as estimated in Table 6. Finally, β_2 is an assumption for the average causal effect of each month of GI bill funding received under the post-Korean legislation on post-secondary education levels.¹⁵

Unfortunately, there is no clearly correct way to estimate the effects of the post-Korean GI bill on education. In Table 7, I set bounds for various possible impacts of eligibility for the Korean War GI bill using three different assumptions for the value of β_2 . The lower bound assumption is that β_2 is zero; the use of the post-Korean GI bill was completely a transfer that did not causally affect education levels received at all. The lower bound impact is thus the simple regression-adjusted impact estimate from Table 5.

¹⁴ Furthermore, almost 3% of non-Korean veterans report GI bill use within 4 years of military release, which should not be possible under the law. This may be due to recall errors of various sorts.

¹⁵ Note that since β_2 is likely correlated with M_{GI} on an individual level, the use of averages as I do here is not exactly correct if the causal effect differs across individuals. I use it only as an approximation of bounds.

The mid-range estimate assumes that the average causal effect on post-secondary education of each month of post-Korean War GI bill funding is equal to the average causal effect of a month of GI bill receipt received from the Korean War GI bill. Note that the two programs differ, so this assumption is not necessarily correct. Although the financial provisions of the programs were fairly similar, the Korean War GI bill was available to veterans in my sample at a much younger age than the post-Korean War GI bill was. But even though the take up rate of the Korean legislation was greater than that of the post-Korean legislation, the educational response *per month of funding actually received* was not necessarily different.¹⁶

I implement this mid-range estimate using an approximate Wald estimator of the treatment effect of a month of GI bill funding on education, assuming that the effect of each month received is the same regardless of the program (Korean and post-Korean) that funded it and the age at which it was received. The Wald-type estimator of β_2 is produced by dividing the difference in education between treatment group and comparison group veterans produced in Table 5 by the SOV estimate of the difference in months of GI bill funding received by the treatment and comparison group:

$$(3) \beta_2 = \beta_1 / (M_{GI}^T - M_{GI}^C)$$

Here, M_{GI}^T is the mean months of GI bill funding received by the treatment (Korean service) group of veterans, while M_{GI}^C is the average number of months of GI bill funding received by the comparison group. Substituting equation (3) into equation (2) and simplifying produces the following overall impact estimator for the midrange impact:

$$(4) \text{Impact} = \beta_1 M_{GI}^T / (M_{GI}^T - M_{GI}^C)$$

The estimator in equation (3) is similar to using the date of entry into the military as an instrument for months of GI bill funding received in the following 2SLS system of regressions:

¹⁶ In fact, an argument could be made that given that funding was accepted, it is more likely to be on the margin for older veterans than for younger ones. But any bias could go in either direction.

$$(5) \quad S_i = a_1 + \gamma_1 X_i + \gamma_2 M_i + e_i$$

$$M_i = a_0 + \gamma_3 X_i + \gamma_4 D_i + u_i$$

In equation (5), M_i is the individual's number of months of GI bill funding, D_i is a 1/0 dummy for whether the individual's date of military entry was before or after January 31, 1955, and X_i is a vector of covariates. The Wald estimator shown in equation (3) will produce an approximate estimate of γ_2 , the average effect of a month of GI bill funding on education received (see Angrist and Krueger, 1999).

A number of additional caveats should be kept in mind when interpreting the mid-range estimate. One is that the OCG sample differs somewhat from the SOV sample. This means that the estimate of the difference in treatment received using the SOV sample is only an approximation of the true difference in months of GI bill funding received between the OCG treatment and comparison groups. In addition, the IV/Wald estimator approximates the Local Average Treatment Effect (LATE) of a marginal month of GI bill funding, or a month actually induced by Korean War GI bill eligibility (Angrist, Imbens, and Rubin, 1995). In this case, the marginal sample month represents a month of funding that would have been received if a veteran had been eligible for the Korean War GI bill, but would not have been received if the veteran had been ineligible for the Korean GI bill. The data in Table 6 indicates that about three-quarters of GI bill funding received in the treatment sample falls under this description, so this final caveat should not be very important.

Finally, I produce an upper bound estimate by simply doubling the mid-range estimate of β_2 . This is equivalent to assuming that the causal effect of a month of funding received from the post-Korean GI bill is twice as large as the causal effect of a month of Korean GI bill funding. I regard this estimate as less plausible than either the lower bound or mid-range estimate, since it seems unlikely that the post-Korean GI bill's causal effects were so large.

Table 7 shows impacts for the Korean War GI bill under the three assumptions. The table also shows the implied elasticity of post-secondary education to the GI bill subsidy offer, given the price reductions estimated in Table 2.

In this paper I emphasize the impacts on years of college attendance, since this seems the

best summary measure of the subsidy's effects.¹⁷ Based on the lower to mid-range estimates in Table 7 a range of .4 to .6 for the elasticity of years of college to the Korean War GI bill seems sensible. This range also fits the lower bound estimates for college graduation. The .4 to .6 range of elasticities corresponds to an increase of 20% to 30% in post-secondary education levels among eligible veterans. These point estimates, if they roughly hold for peak period Korean veterans joining a few years earlier, imply that the Korean War GI bill raised average post-secondary attainment by about 13% to 18% among all men born in the peak Korean service years of 1930 to 1933.¹⁸

Differential Effects of the Korean GI Bill by Socio-Economic Status

The family background information in the OCG allows me to directly examine the effects of the subsidy on equalizing educational attainment across social classes. Although commentators often define "social classes" with reference to race or ethnicity, I define it using family socio-economic status (SES), a measure of income, prestige and social standing that is used often in sociological research (Duncan, 1961). I have opted for this definition because the direct effect of the GI bill was simply to lower income or cost barriers to college, and I believe that SES is the best measure available for gauging the extent of income barriers to college attendance in a veteran's family.¹⁹ I define SES using the occupation of each veteran's father.

¹⁷ The elasticities of college graduation are somewhat larger than those of years of college in both surveys. This may indicate that the subsidy had greater effects on the college graduation than the college attendance margin, but the high standard errors in the point estimates also make it possible that the finding is the result of random variation.

¹⁸ As an example of the method I used to calculate these increases, using the 1970 Census a 20% increase in years of post-secondary education for Korean War veterans born in 1931 gives roughly .2 additional years of education for these men. Assuming a zero GI bill effect for nonveterans, multiplying this educational increase by the fraction of men serving in Korea (62%) gives a roughly .12 increase in education when spread across the entire male population. Given the measured average post-secondary education among men in this cohort, this figure implies a 13% increase. I use similar calculations for the rest of the paper when giving percentage increases in overall education caused by the GI bill among an entire cohort of males.

¹⁹ There is a retrospective question on family income at age 16 in the OCG, but I feel father's SES is a better measure of permanent income. In any case, using the income measure to define social classes does not substantially change the results presented in this section, although it does increase their variance.

In this section I use two broad family SES groups. The low group includes all veterans whose father had an SES equal to or below the median SES for the veteran's year of birth, and the high group includes all others.²⁰ Veterans with no information on the father's SES are dropped.

Since a subsidy acts to reduce financial need, one might assume that the causal effects of the subsidy will be greatest among veterans from lower income groups. This assumption helps to drive the claim that the GI bill (particularly the WWII GI bill) played a critical role in the advent of "mass" higher education in the U.S (e.g. Bennett, 1996, Kerr, 1994). Lower-income veterans will indeed respond more strongly to the subsidy than higher-income veterans if persons from poor families are unable to attend college because of credit constraints, and such persons are confident in their ability to benefit from college. But if the ability to benefit from college differs between individuals then the effect is indeterminate, a point that I show formally in Appendix B.²¹ The question of the causal effects of the GI bill subsidy on education among different income groups is thus an empirical question, which I go on to examine below.

Let S_{0H} represent the level of post-secondary schooling for a high-SES individual in the absence of the Korean War GI bill subsidy, and S_{1H} represent education given the receipt of the Korean War GI bill subsidy. The L subscript indicates the equivalent for low-SES individuals. The average impact of the subsidy on post-secondary education among high-SES individuals can be represented as $E[S_{1H} - S_{0H}]$. As above, the sharp benefits cutoff allows us to observe an estimate of this difference for each SES subgroup by simply comparing Korean and post-Korean veterans within the subgroup. The difference between the effects for the two SES groups is thus:

²⁰ The low SES group generally represents about 55% to 60% of the population and the high SES group about 40% to 45% due to mass points in the SES distribution. Percentile rankings are defined by comparing the veteran's father's SES to the SES of fathers of all other persons (veteran and civilian) born in the same two-year period. Low sample sizes prevent a finer division of SES groups here, but in the WWII section I use SES quintiles.

²¹ See, for example, Becker, 1964, Card, 1999, and Cameron and Heckman, 1998. Appendix B in this paper shows a simple and general model of educational choice that rationalizes and formalizes the statement that distributional effects of an educational subsidy like the GI bill will be indeterminate in a case of differing ability to benefit from college and differing costs of college attendance based on family income. The model also includes some implications concerning which population is most likely to take advantage of the subsidy.

$$(6) \quad \{ E [S_{IH} | V_i = 1, K_i = 1, X_i] - E [S_{OH} | V_i = 1, K_i = 0, X_i] \} - \\ \{ E [S_{IL} | V_i = 1, K_i = 1, X_i] - E [S_{OL} | V_i = 1, K_i = 0, X_i] \}$$

Tables 8 and 9 provide descriptive statistics and estimates of the difference in (6) for the same OCG sample used in Tables 5 and 6. The estimates for each income group are obtained by the simple device of interacting the veterans dummy with a dummy for high and low SES (the main effects of high and low SES are also controlled for). The difference in (6) is just the difference between these coefficients, with an F-test used to test whether it is significant.

The Korean War GI bill appears to have had considerably higher causal effects on post-secondary education among higher SES veterans.²² The differences are especially striking for years of post-secondary education, where they are statistically significant and large in magnitude. The difference in college graduation rates is not as large and is statistically insignificant. In fact, due to the lower base levels of college graduation among low SES veterans, the point estimates of responses for college graduation rates imply similar elasticities of college graduation for high and low SES veterans (although the absolute effects are still higher for high-SES vets). The difference in findings for years of college and college graduation rates suggests that eligibility for funding had a particularly large effect on those low SES veterans who did enroll in college, but had little impact on college attendance for low SES veterans. The final column in Table 9 provides more evidence for this hypothesis.

The descriptive statistics in Table 8 once again point to possible selection differences between the Korean and post-Korean groups of veterans. Low SES Korean veterans are much more likely to recall entering the military with a high school degree than low SES post-Korean veterans are. It is clear that selection effects that differ for high and low SES veterans between the two periods create a bias in the estimate of the difference in causal effects between the two groups. The extensive controls may suffice to adjust for much of these selection differences. In addition, it is worth pointing out that the bias created by these differences seems to run in the opposite direction from these findings. A selection process leading to low education at entry for

²² It would be interesting to further subdivide these results to check effects within the broad high-SES and low-SES groups I have defined here. Unfortunately, limited sample sizes and the resulting high standard errors make the results of doing so unreliable.

low-SES post-Korean veterans would seem to select against interest in education after military exit for these veterans as well. Such a selection process would create a bias toward a greater measured impact of the Korean GI bill among low-SES veterans.

As a further check on potential selection bias, I also ran the regressions in Table 9 with the sample split between those veterans with a high school degree at military entry and those veterans who were high school dropouts at military entry (results not shown). Among these groups, there is no significant difference in education prior to military entry between the Korean and post-Korean periods. The high SES group continues to show a considerably larger impact from Korean service than the low SES group in both of these subsamples. Although the difference is no longer statistically significant due to limited sample size it is quite close in magnitude to the difference shown in Table 9.

The combination of possible selection effects and small sample sizes makes these results more suggestive than definitive. But clearly there is no evidence that veterans from families in the bottom half of the SES distribution experienced a greater causal effect from the Korean War GI bill than higher SES veterans did. Selection effects would have to be very large to reverse this finding. As the model in Appendix B demonstrates, the results suggest some combination of low financial barriers to college entry and a distribution of the perceived ability to benefit from college that was more favorable to post-military college entry among higher-SES veterans.

EVIDENCE ON THE WWII GI BILL AND POST-SECONDARY SCHOOLING

Effects on Mean Education Levels

In the case of the Korean War GI bill, it is possible to directly compare subsidy-eligible veterans to non subsidy-eligible veterans. Since essentially all veterans in the WWII period and the Korean period that immediately followed were eligible for education subsidies, this strategy cannot be pursued in the case of the WWII GI bill. The evidence on the effects of the WWII GI bill is therefore more speculative than the results presented above on the Korean War GI bill. Given the significance of the legislation, though, so long as the evidence is new and informative it is worthwhile to present it.

Comparisons Between Veterans and Civilians

The first method I use to examine the effects of the WWII GI bill is a simple regression comparing educational outcomes of veterans and civilians. I use the background information in the OCG to adjust for many baseline differences between the groups. I also generate a lower bound estimate of effects by using older cohorts as a control group for younger ones.

Military entry during the WWII period involved an extensive and complex process of self-selection (through volunteering) and formal selection through mental and physical tests (see Appendix A). Furthermore, it is likely that military service itself has an independent causal effect on education. Therefore, the difference in education between veterans and civilians may not represent the effect of the GI bill subsidy. It is useful to put the different effects of military service on education in the WWII period into a simple accounting framework. Begin with a simple regression comparing veterans and civilians:

$$(7) S_i = a + X_i \beta_1 + C_i \beta_2 + V_i \beta_3 + e_i$$

Each individual's level of post-secondary schooling S_i is modeled as the sum of an intercept, effects from a vector of background variables X_i , a cohort of birth effect β_2 that represents changes in educational availability and costs over time, and an effect β_3 that is directly associated with a military service dummy V .²³ The military service effect β_3 can be represented as:

$$(8) \beta_3 = \Theta_1 + \Theta_2 + \Theta_3$$

Here, Θ_1 is the selection effect caused by differences between veterans and civilians that are not controlled for in the vector of covariates X . Θ_2 is the direct causal effect of military service on education. Θ_3 is the effect of the GI bill subsidy on education. My goal is to make at least a

²³ Note that the cohort of birth effect β_2 will include any general effects on education of exposure to the WWII period, such as were discussed in the historical background section above, so long as these effects are assumed to be the same for veterans and civilians.

rough estimate of Θ_3 . To do so requires strong assumptions about the likely sign and rough magnitude of the other two effects. These assumptions are necessary because there does not appear to be data available that will allow a full adjustment for either the selection effect or the direct causal effect of military service.²⁴

Table 10 presents descriptive statistics on veterans and civilians among two-year birth cohorts of men born between 1909 and 1927, using a merged sample of the 1962 and 1973 OCGs.²⁵ As the table shows, veterans entered the military at widely varying ages, depending on their birth cohorts. This would likely lead to different effects of both military service and the GI bill subsidy on education. Only the last few cohorts enter the military at an age that is clearly earlier than the conventional age of college entry.

Table 11 runs the regression in (5) separately for each birth cohort. The first column adjusts for family background and race as covariates. The second column adds additional controls for work history (occupation of first full-time job and age at which the first full-time job was obtained) as of 1940 or before, and marital history (age at first marriage) in 1940 or before for all cohorts aged 18 or over in 1940. Since the United States did not enter WWII until December 1941, data from 1940 or before can safely be taken as exogenous to military service.

If I assume that $\Theta_1 + \Theta_2$ is non-negative, then the coefficient on veteran status reported in the table is an upper bound on the effects of the WWII GI bill on post-secondary educational

²⁴ A sufficiently plausible instrument for veterans status would allow us to eliminate the selection effect Θ_1 , but I do not believe a perfect instrument is readily available in the WWII period. Angrist and Krueger (1994) and Bound and Turner (1999) use period of birth as an instrument for WWII veterans status among men born in 1923-28. The relation they exploit is created by the rapid and monotonic drop in WWII service for men turning 18 around the time of Japan's surrender in August, 1945. This method may not fully eliminate selection effects because: 1) Period of birth may not be exogenous to education, even after conditioning on a linear age trend. This is especially true at the end of WWII, when there were many independent changes in education taking place. 2) With the close of the war, selection into the military changes and veterans rapidly became much more likely to be volunteers as opposed to draftees (see Appendix A). The instrument will tend to select out men volunteering near the close of the war. The effect of service on these volunteers likely differs from the effect on earlier draftees. 3) Men born in 1927-29 who did not serve near the close of WWII were disproportionately likely to be selected for the Korean War draft and thus become eligible for the Korean War GI bill. The effects of this service on education are difficult to adjust for. In any case, Bound and Turner's use of this method to examine the effects of the WWII GI bill produces results that are compatible with those found here.

²⁵ The 1927 cohort is limited to one year because there is very limited WWII service among the 1928 cohort, who were essentially all volunteers. Most men born in the latter half of 1927 were also volunteers.

attainment among eligible veterans.²⁶ The key assumption here is that the selection effect on education among veterans is at least as great as any negative effects of service on post-secondary education. This assumption is supported by data in the 1973 OCG, which includes information on education prior to military entry for veterans. There is no similar data for civilians, but education levels among veterans even prior to military entry show that they already had much higher levels of education than non-veterans.²⁷ The fact that the military selection process was designed to exclude the least fit and intelligent draftees also supports the assumption of a strong selection effect (see Appendix A).

This assumption alone immediately yields reasonably strong conclusions about the effects of the WWII GI bill. For cohorts born in 1920 or before, the effect does not appear to be large. After adjusting for available pre-war covariates, the remaining effect on college graduation is small and statistically insignificant. The effect on years of post-secondary education received is quite limited, under 10% with an implied elasticity of a bit under .15. Since some 50% of WWII veterans were born prior to 1921, this finding is important.

Other evidence supports the hypothesis that younger veterans were far more likely to use GI bill funding for college than veterans who joined the military in their mid twenties or after. In a survey of undergraduate veterans at 16 colleges and universities, the Educational Testing Service found that 85% were born after 1923 (Frederickson and Schrader, 1951). A Veterans Administration survey found that as of November 1949, 83% of veterans receiving funding for post-secondary education were under the age of 30. Veterans in college had an average age of 25.9 years old, as compared to an average age for all veterans in the survey of 31 years old (Department of Veterans Affairs, 1950). My own tabulations from the 1978 Survey of Veterans show that about 5% of veterans born before 1920 recall using the GI bill for college, while 21%

²⁶ This would be the case if Θ_2 , the direct effect of military service on post-secondary education, is either positive or, if negative, has an absolute value less than the value of Θ_1 , the effect of uncontrolled selection differences on education.

²⁷ For example, among men born in 1917-18, who were on average about 24 when they entered the military, veterans recall an average of .6 years of post-secondary education on military entry. But non-veterans report only .53 years of post-secondary education at the survey date in 1973. Among veterans in the peak birth cohorts of 1923-26, who joined the military in their teens on average, 54% of veterans recall a high school degree on military entry, while 42% of non-veterans report high school graduation by 1973.

of veterans born after 1920 did. These findings are consistent with the belief that commitment to a career and family sharply raised the opportunity costs of college entrance during this period.

In contrast to the findings for earlier cohorts, cohorts born in the mid 1920s (1923 to 1926) show very high effects from WWII service. These are upper bounds and include selection effects, which are likely to be particularly large for these groups, since they were too young at the start of the war to allow controls for pre-war marital and work history. But note that even the coefficients that do not adjust for pre-war information show a sharp increase for mid-1920s cohorts, providing more evidence of a strong age effect on response to the GI bill. This sudden increase in the veteran/civilian education differential among mid-1920s cohorts is a robust result that can be found in simple Census regressions as well.²⁸

The strong effect of age on responses to the GI bill offer suggests a method for estimating a lower bound GI bill effect for the peak cohorts born in the mid 1920s. The older 1921-22 birth cohort can be used as a kind of comparison group to estimate the effect of the GI bill on the younger 1923-26 cohorts. Subtracting the coefficient on veteran status for the 1921-22 cohort from that for the later 1920s cohort gives the following:

$$(9) \quad \beta_3^* - \beta_3 = (\Theta_1^* - \Theta_1) + (\Theta_2^* - \Theta_2) + (\Theta_3^* - \Theta_3)$$

Here, the "*" represents the values for the later 1920s cohort, and the unstarred value is for the 1921-22 cohort. Neither coefficient is adjusted for any pre-war work or marital history. The final term in equation (9) is a lower bound estimate of the GI bill effect, since it assumes no causal effect at all for the GI bill among the 1921-22 cohort (which is almost certainly wrong). The other two terms represent potential sources of bias. It is necessary to make strong assumptions about them in order to draw conclusions about a possible lower bound.

In effect, this method uses the 1921-22 cohort as a comparison group for the 1923-26

²⁸ I found this result in the 1960, 1970, and 1980 Censuses, although the exact year of birth when it "kicks in" varies by a year or so depending on the Census. Since the OCG does not include month or quarter of birth, the OCG year of birth figures are slightly approximate, so that the exact birth year of the effect will be different in a Census sample where birth year can be measured more accurately using quarter of birth.

cohort. All the data available indicates that age at exposure to the WWII GI bill strongly affected the opportunity cost of taking advantage of the higher education offer; thus, the 1921-22 cohort was in a sense "less exposed" to the GI bill than the later cohorts that joined the military directly out of high school. However, due to the fact that they were fairly close in age and were subjected to similar military selection procedures, they were probably similar in other ways. The first term in equation (9), the difference in selection effects, is therefore likely to be small. As I detail in Appendix A, cohorts born between 1921 and early 1927 (who were between 18 and 25 during the entire draft period) faced very similar selection processes in the draft.²⁹ Similar proportions of males born in these cohorts served in the military, as shown in Table 10.

The second term in equation (9) is more problematic. The causal effect of military service for the two groups might have differed if men in one cohort were more likely to have their schooling interrupted. It is not possible to directly measure the causal effect of military service on education, but Table 12 gives some circumstantial evidence concerning this effect. It shows a rough estimate of the potential fraction in each birth cohort who might still have been in schooling when they entered the war and the proportion of those men who resumed schooling on military exit. The figures do imply that the 1921-22 cohort may have been slightly more likely to have education interrupted than the 1923-26 cohorts, but the difference appears likely to have been quite small.

Table 13 summarizes the impact estimates and elasticities drawn from the Table 11 results. The upper bound is simply drawn from the Table 11 coefficient, while the lower bound is produced by using the 1921-22 cohorts as a comparison group. For the "upper bound" estimates, the Table 11 coefficient that adjusts for pre-war work experience and marriage is used where possible; this is still represented as an upper bound because these variables may not adjust fully for the effects of selection into the military.

The most striking aspect of this table is the consistency between the point estimates of the elasticities for the 1923-26 cohorts in this table and those found for the Korean War GI bill in Table 7. Especially for years of college, the upper and lower bounds are actually quite close

²⁹ One of the only differences is that 1921-22 cohorts were old enough to volunteer during 1941 and early 1942, before this was disallowed for men over 17 (as it was from mid-1942 through September, 1945).

to those determined for the Korean War GI bill. The elasticities for college degrees appear smaller than those estimated for the Korean War GI bill, and are quite close to the elasticities for years of college. In almost every case, the mid-range Korean elasticity estimates fit neatly into the range determined for WWII.

The lower bound estimate of the GI bill's effect from Table 13 is about a 20% increase in post-secondary education among the peak cohorts of veterans born between 1923 and 1926 due to the GI bill. (The inclusion of statistical uncertainty would of course greatly widen this estimate, but it remains above zero). Applying the Korean War GI bill range of a roughly .4 to .6 elasticity of years of college to a subsidy offer would give an increase of about 25% to 35% in years of college among veterans due to the WWII GI bill. For veterans born between 1909 and 1920, increases in education are much smaller, less than 10%, and for the 1921-22 cohorts the simple correlation from Regression 2 in Table 11 implies about an upper bound of about a 15% to 20% increase.

Due to the disproportionately high level of education among WWII veterans and the high fractions of WWII veterans in the population, these results translate fairly directly into the increases created by the GI bill among all males born in the 1920s. Thus, the point estimates here are quite consistent with an increase in post-secondary education of at least 15-20% created by the GI bill among all males born in the years 1921 to 1926. Because of lower military service percentages, the maximum impact estimate of the GI bill for all males born 1909 to 1920 is smaller, somewhat under 5% in years of college and approximately zero for college graduation.

Evidence From Trends Across Birth Cohorts in Completed Education

Figure 1, which was discussed in the "Historical Background" section above, shows trends in mean post-secondary education levels across birth cohorts, as well as levels of GI bill eligibility due to military service in WWII or Korea. One method of attempting to infer the effect of the WWII GI bill involves measuring the correlation between trends in WWII service and post-secondary education levels across various birth cohorts.

One such trend approach is shown in Table 14. The table shows the results of a regression of the general form:

$$(10) S_C = a + V_C \beta_1 + t \beta_2 + e_i$$

Here, S_C is average post-secondary education or the fraction of college graduates among males in a three-month birth cohort, V_C is the fraction of WWII veterans among that cohort, and t is a linear time trend. This regression can be viewed as an aggregated form (averaged over all individuals in a birth cohort) of equation (7), with all individual covariates removed (i.e. assumed to be similar on average between different cohorts). The effect of being born in a particular time period on education is assumed to be absorbed completely by a linear time trend.

This type of aggregated regression greatly reduces individual selection effects. Military service likelihoods over time are used as an exogenous (to the individual) measure of exposure to military service.³⁰ If selection effects are assumed to be eliminated by this method, then the coefficient β_1 represents the sum of the direct effect of military service on education and the effects of the WWII GI bill on post-secondary education. However, β_1 will include any effects of the WWII period on education that are not picked up by the simple time trend term included in the regression, since these effects are presumably highly correlated with the fraction of men serving in WWII in a given cohort. Because WWII had a negative effect on education, β_1 will therefore be a downwardly biased estimate of the effects of military service plus the GI bill on college education. The overlap with Korean service during the 1927-29 period (which I do not attempt to address) may also lessen the effect of the WWII GI bill as estimated in this regression.³¹ For all these reasons, I believe that results based on the time variation in military service are best taken as suggestive.

In Table 14, the fraction of veterans in a birth cohort is interacted with the period of birth, since (as shown above), period of birth has a strong effect on the response to the GI bill. The birth cohorts are divided into two broad groups, the 1909-20 period where effects were limited, and the 1921-29 period where they appeared to be greater (1928-29 is included to obtain

³⁰ See Shin, 1987 for a formal treatment of the reasons why aggregating or averaging individual-level regressions can greatly reduce selection effects.

³¹ Since Korean veterans are entering the military at a later age there is reason to expect that the effect for them will be smaller than the effect for WWII veterans during this period, who generally entered at the age of 18.

more variance from the drawdown at the end of the war). The 1960 results imply an increase of about 11% in years of education received by veterans in the peak 1921-26 cohorts due to the combination of the GI bill and WWII service, and about 8-9% for all males. As expected, these results are much smaller than those discussed in the previous section.

The estimated impacts do imply that educational growth over the peak WWII period was higher than would be expected from the prewar trend line alone. Given what is known about the effects of WWII on education, the GI bill is the most likely candidate for causing this elevation.

Table 15 and Figure 2 use a different approach, adopted from Olson (1974).³² The table and figure give results of a simple simulation designed to determine whether the population-adjusted number of 4-year undergraduate degrees granted to males during the WWII GI bill period was greater or less than would have been expected given pre-war trends. The WWII GI bill period is defined to include the years 1940 to 1952; during 1940 to 1945 college graduation was negatively impacted by the war, while during 1946 to 1952 degrees granted were increased by the number of returning veterans who obtained their degrees late. I use contemporary data collected by the U.S. Department of the Interior on the number of 4-year undergraduate degrees granted to males. I then adjust these figures using estimates of the male population aged 21 drawn from 1940 and 1950 Census IPUMS samples.

The table and figure show the observed numbers of degrees granted as a fraction of males aged 21, under the actual case of both the GI bill and WWII. Two alternative levels of degree receipt are also shown, based on simulated time trends over the WWII period in the absence of the GI bill. The two time trends used in the simulation are the 1930 to 1940 growth rate in degrees granted as a fraction of males aged 21, and the 1936 to 1940 growth rate in the same figure. The 1930 to 1940 growth rate is low, as it includes the negative effects of the early part of the Depression on education. The 1936 to 1940 growth rate is very rapid, probably partially as a "rebound effect" from the early part of the Depression and also due to rapid rises in high school education created by various factors during the Depression period (Goldin, 1998).

³² I adjust for sex and population, which Olson does not do (he uses all degrees granted to both males and females, and does not divide by population). This makes a noticeable difference in the results. I also omit master's and doctoral degrees, since the appropriate population to use as a denominator for these degrees is unclear.

Figure 2 shows a graphic representation of both the actual trend in 4-year degrees granted as a fraction of men aged 21, and (starting in 1940) the alternative trends based on 1930 to 1940 and 1936 to 1940 growth rates. Table 15 shows summary information on both the total number of degrees actually granted during 1940 to 1952 and the amount that would have been granted under the two simulated counterfactual trends. As the table shows, the actual number of degrees granted as a fraction of males turning 21 during the 1940 to 1952 period is quite close to what would have been expected if the very rapid 1936-40 growth rate had continued over the entire WWII period in the absence of the GI bill. Given the interruption in education created by the war (e.g. the slowdown in the growth rate of high school graduation levels) it seems unlikely that this rapid growth rate would have continued if the GI bill had not had a significant effect.

Assuming that the correct counterfactual increase in undergraduate degrees in the absence of the GI bill is the rather moderate increase observed over the 1930-40 period, this implies a 22% increase in degrees granted among all males due to the WWII GI bill, for a .37 elasticity of college graduation to the GI bill subsidy. This is easily within the ranges previously estimated for males born in 1921-26 using Table 13 and the Korean elasticities. In addition, the Table 15 estimates will tend to be somewhat lower than those in the previous sections, as the Table 15 results are based on the effect of the WWII GI bill on all BA degrees earned over the entire WWII period (1940 to 1952).³³

Differential Effects of the WWII GI Bill by Socio-Economic Status

There has been substantial anecdotal discussion of the impact of the WWII GI bill in opening up college education to veterans from working-class families (e.g. Kerr, 1994). However, there is little empirical information available.³⁴ Unlike the case of the Korean War, it

³³ The impacts of the WWII GI bill shown in Table 13 refer to impacts for persons born between 1921 and 1926. The effects inferred from the Korean War elasticities are relevant to veterans exiting the military at similar ages to the Korean War sample I used, which had an average age at military exit of 23. Some fraction of men who would have graduated during the 1940 to 1952 period were born before 1921 and older than 23 on military exit.

³⁴ One paper (Behrman et. al, 1989) has examined the equalization effects of the WWII GI bill by comparing intra family inequality in education among WWII veterans to intra family inequality in education for

is not possible to compare subsidy-eligible veterans to nonsubsidy-eligible veterans within particular socioeconomic groups. A simple but potentially enlightening approach is to look at trends in post-secondary education among different SES groups around the WWII period, and see if the 1921-26 birth cohorts I have identified as most affected by the GI bill show a sudden change in education levels for some particular SES group relative to others.

The results of this analysis are shown in Table 16. Since the sample sizes are larger, the SES groups are now arranged roughly into quintiles.³⁵ The full 1927 to 1929 cohorts are included as a drawdown period from the war. The samples have been aggregated by three-year birth cohorts instead of two year cohorts to reduce variance in education by quintile.³⁶

The results are illuminating. The bottom 45% of the SES distribution shows essentially no unusual growth in higher education associated with the peak 1921-26 GI bill period. In fact, growth in post-secondary education for these quintiles is basically stagnant over the peak WWII period, after showing fairly marked growth before it. All of the considerable growth in post-secondary education during 1921-26 occurs in the top 55% of the SES distribution. The fourth quintile shows the greatest absolute and percentage growth in education. The third quintile group also shows very high percentage growth in education, although the absolute growth is not very high due to the low base. The top quintile shows high growth in the early part of the peak period, but simply maintains the high level for the later part.

It is difficult to draw precise conclusions from this table, which gives basically descriptive information. But it does suggest that the benefits of the GI bill were probably

their children. Behrman et. al find that sibship size is correlated with education for the children of veterans, but not for veterans themselves. This finding is interpreted as indicating a lowering in financial barriers to access due to the WWII GI bill. This finding is not directly related to differences in access to education by family SES class over the period, although it is suggestive. I was unable to find a change in the effect of sibship size (as measured by the number of older brothers) on education between the WWII period and surrounding periods using the larger sample available in the 1973 OCG. If anything, the number of older brothers appeared to be a stronger determinant of post-secondary education in the WWII period compared to later periods. Behrman et al's findings may have been due to the particular limitations of comparing veterans to their own children, and the substantial time lapse between the college attendance period of veterans and that of their children.

³⁵ Quintiles cannot be created exactly due to mass points in the SES distribution. The table note shows the actual percentiles covered by each SES group in the overall (all birth cohorts 1912 to 1929) sample distribution.

³⁶ Using 2-year birth cohorts similar to those in Tables 10-11 does not substantially change the results, though it increases the variance.

concentrated among the top half of the SES distribution. This is similar to the findings above on the effects of the Korean War GI bill, although there is more nuance added by the finer division of SES categories. Within the top half of the SES distribution, the information in Table 16 is compatible with some equalizing effects of the legislation.

There are a number of reasons why lower-SES men apparently did not respond strongly to the WWII GI bill. One could be the reason given in Appendix B: during this period there were simply not very many men from lower SES families with perceived ability levels that placed them on the margin of obtaining higher education. In addition, only about 70% of the bottom half of the male SES distribution served in WWII among the 1921-26 cohorts, while 80% of the higher SES groups did. This means that exposure to the GI bill incentive was lower among this group relative to others during the WWII period (though it was still high in an absolute sense). Finally, high wages in war industries may have been more effective in drawing civilian lower-SES men away from higher education.

COSTS AND BENEFITS OF THE GI BILLS

The impact estimates from this paper, when combined with Census information on income and the information on post-war education in the SOV and 1973 OCG allow a rough estimate of the cost-benefit ratio of the GI bills. Table 17 shows some essentially partial equilibrium estimates of the costs and benefits of the two GI bills on the veterans population.

I use a simple methodology to determine costs. The 1978 SOV contains information on education obtained after exit from the military, as well as recalled information on whether GI benefits were used to pay for the education. I ascribe all post-war post-secondary education reported in the SOV by men who stated that they used GI bill benefits to pay for college to the relevant GI bill. Multiplying these figures by the GI bill subsidy for a year of college (see Table 2) produces an estimate of the higher education outlay for the GI bill.

The direct cost estimate produced by this method can be compared to the scanty administrative information that is available on the costs of the WWII GI bill. By 1955, the entire education portion of the portion of the WWII GI bill, including both proprietary school and higher education had been estimated to cost almost \$15 billion in current dollars (President's

Commission on Veteran's Pensions, 1956). A substantial portion of this spending would have been for students in proprietary schools and on-the-job training, who accounted for perhaps two thirds of eventual users of the legislation (see footnote 5 for sources). I estimate a \$5.6 billion cost (1948 dollars) for higher education alone, which seems reasonable but somewhat low.³⁷

In order to go beyond simple cost estimates it is necessary to make assumptions about the causal effects of the GI bills. The two scenarios I use are shown in the table, and use elasticity estimates justified above. The high-impact scenario is a conservative estimate, as the elasticities are drawn from the high end of the middle of the range of possible results that I found, and are considerably lower than the perhaps implausible upper bound estimates in Tables 7 and 13. The lower range scenario uses impact estimates of approximately half those used in the high impact scenario. These elasticities are equal to or slightly less than my lower bound point estimates.

Each elasticity estimate implies a particular percentage increase in education δ among veterans. Let the total number of years of education among veterans be Y . My estimate of the number of those years which are induced by the GI bill subsidy is:

$$(10) \quad M = Y - [Y / (1 + \delta)]$$

The remainder of the years funded by the GI bill are assumed to be education that would have been undertaken without the GI bill. Assuming that marginal and infra marginal veterans received the same GI bill subsidy on average, spending can easily be divided into transfers and behavior-inducing outlays using these estimates of marginal and transfer years. Social costs of the program (as opposed to government outlays) are estimated by multiplying M , the total years of education causally induced by the GI bills, by an estimate from Table 2 of the direct and opportunity cost of a year of private higher education (which is assumed to represent the true resource cost of public education as well).

³⁷ The estimates would differ due to death between 1950 and the survey date of 1978, and also due to the fact that I do not include costs for books and supplies. Although college level users probably used more of their entitlements than proprietary school users, costs per year of proprietary school would have been at least as large and probably larger than costs per year of college, since for-profit proprietary schools charged high tuitions (Department of Veterans Affairs, 1950).

Dividing the high impact estimates for the total educational increase created by the GI bill by the SOV estimate of total post-war education funded by the GI bill, I find that about two-thirds of GI bill higher education spending was a transfer, and one-third was to men on the margin. The low end impact estimate implies that a bit under one-fifth of GI bill higher education spending induced additional education, and slightly over 80% was a transfer.

I combine estimates of the causal impacts of the GI bills with observed data on the returns to education among WWII and Korean War veterans to generate my estimate of the programs' benefits. I do not assume particular rates of return to education, but instead use the following simple regression to empirically observe the return to education among veterans:

$$(11) W_{it} = a + S_{i1} \beta_1 + S_{i2} \beta_2 + X_i \beta_3 + e_i$$

The equation is estimated for veterans only. The dependent variable W_{it} is the individuals real annual earnings in a given period t . I use direct observations for the four Census years 1950, 60, 70, and 80, and generate the intervening years by linear interpolation. Annual earnings are used because additional education is assumed to affect labor supply as well as earning ability once employed.³⁸ S_{i1} is an individual's years of pre-university schooling, S_{i2} is years of post-secondary schooling, and X_i are the limited exogenous covariates available in the Census (state of birth interacted with year of birth, and race).

I multiply the coefficient β_2 by an estimate of the marginal years of schooling induced by the GI bill to produce a benefit estimate for that year.³⁹ This estimate is then discounted to 1948 (for WWII) or 1956 (for Korea). Note that this method assumes that the return to a marginal year of education induced by the GI bill is equal to the return to an average year of education for a given veteran. As Appendix B implies, this may not be true, and the return to education

³⁸ I do not use logs here because linearity makes the overall average effect much easier to compute, and requires no assumptions about the distribution of causal effects from the subsidy. The r -squared from the linear version of this equation (.21) is also much greater than the r -squared from the log version (.08). Results from the log version of this equation give a return of about 8.1% per year of college in the 1960 Census for veterans born between 1923 and 1926, fairly close to the standard Mincer earnings equations results.

³⁹ The years of schooling induced by the GI bill is determined according to Equation (10), except that the total number of years of education among veterans is observed in the Census and not the SOV.

induced by the GI bill may be either greater or smaller than the average (Lemieux and Card, 1998).

Using the method above and no allowance for deadweight loss due to taxation, I calculate that the WWII GI bill created returns of about four times the social costs induced, and the Korean War GI bill returned about three and one-half times its social costs. A high allowance for deadweight loss, of 50 cents per dollar of taxation, results in benefits of about one and a half to two times the total social costs, depending on the impact scenario used.

In most cost/benefit analyses, it is possible to ignore general equilibrium issues because the program itself is not large enough to affect economy-wide prices. This is less realistic with a program the size of the GI bill. As Heckman, Lochner, and Taber (1998) have recently pointed out, the supply changes created by a large educational subsidy will lower the return to education and may induce compensating reductions in educational supply by later cohorts.⁴⁰ Heckman et. al. calculate that taking these general equilibrium effects into account can lower estimates of the increases in education induced by an education subsidy by an order of magnitude.⁴¹

My estimates of the elasticity of educational response to the GI bill subsidies are essentially partial equilibrium estimates. I do not take into account second-order supply changes caused by reductions in the returns to education, either among later cohorts or among civilians in the cohorts directly affected by the GI bill. I use observed wages to calculate both the returns to GI-bill financed education and the counterfactual level of earnings that would have accrued to veterans in the absence of the GI bill. This method does not take into account the fact that wages would have differed in the absence of the GI bill. For these reasons, the estimate of the social benefits of the GI bill that I present here incorporates only a few aspects of what a true general equilibrium benefit analysis would calculate.

⁴⁰ There may actually be some evidence of this effect in Figure 1 -- note the sharp drop in post-secondary educational growth among the cohorts of males near the end of the Korean War.

⁴¹ It is worth pointing out that Heckman et. al. do not take into account the possible network or "spillover" effects of educational subsidies. Later cohorts may observe the success of their older acquaintances or relatives in taking advantage of higher education, and this may lead younger cohorts to be more motivated to obtain higher education themselves. While pure price effects mean that partial equilibrium methods overestimate the impacts of educational subsidies, spillover effects may lead to an underestimate the possible effects of subsidies.

CONCLUSIONS

It would be surprising indeed if a program of the magnitude of the mid-century GI bills did not have an effect on educational attainment. Midrange estimates calculated above imply that the GI bills raised average years of post-secondary education by about 13% to 18% among all men born between 1930 and 1933, and at least 15% to 20% among all men born between 1921 and 1926. Since over 50% of men born in the "notch" years of 1927-29 also served in either WWII or Korea, it is likely that these years also saw a substantial effect of the legislation. Thus, the GI bills probably increased total years of post-secondary educational attainment among all men born between 1921 and 1933 by about 15% to 20%. Effects were much smaller for men born before 1921.

This is a substantial effect. Based on the time trend analysis in Tables 14 and 15, it was more than enough to compensate for what was likely an independent negative effect of the WWII period on post-secondary education. The Korean GI bill also probably contributed to the noticeably rapid growth in post-secondary education among men born in the early 1930s. The effect was also sufficient to create a positive benefit/cost ratio for the legislation, at least in a partial equilibrium analysis.

However, the GI bills were evolutionary and not revolutionary legislation. Educational growth was rapid before the war. In fact, as Table 15 shows, if the rapid growth in BA degrees granted that occurred in 1936-40 had continued, its effects would likely have been quite similar to the combined effects of the GI bill and WWII. The way had been prepared for the legislation by the very rapid growth in higher education during the early part of the century. The GI bills had a substantial impact in maintaining and moderately increasing this rate of growth, but they picked up an existing trend.

I also find that any equalizing effect of the GI bills on the distribution of post-secondary educational attainment occurred among veterans from families in the top half of the SES distribution. The GI bills may have made college more accessible for the children of the middle and upper middle class, but apparently they had little effect among those of the working class. In this area, too, the effects of the GI bills were not revolutionary.

APPENDIX A: Selection into Military Service During WWII and the Korean War

SOURCES: Selective Service, 1948, 1956a, 1956b.

There were two basic methods by which individuals entered military service during WWII: volunteering and induction through the draft. Volunteering was permitted on an unlimited basis through December, 1942. From December, 1942 through August, 1945, volunteering was prohibited, but continued on a limited basis for 17 year old men. Beginning in September, 1945, volunteering was again permitted and became common. During this period, the services had a policy of only recruiting men aged 18 to 25.

Previous to December, 1942, roughly one third of inductions into the army came through voluntary enlistments. From January, 1943 through August, 1945, which was the period when overall inductions were highest, about 12% of inductions were voluntary enlistments. From the cessation of hostilities in September, 1945 until the officially declared end of the war in 1947, voluntary enlistment became the major source of military manpower; some three-quarters of soldiers were supplied this way. Overall, about 70% of WWII veterans entered through the draft.

Through a series of registrations beginning in 1940, all civilian males aged from 18 to 64 years old in the United States were required to register with their local draft boards. Liability for actual induction was always limited by age (both formally and informally), but varied throughout the war. In the beginning of the war, men aged 45 or over were automatically excused from service. As the war went on strong preferences for younger men (especially those from 18 to 25 years of age) were put in place.

After men were called up, local draft boards classified them based on their ability to serve in the military. Men over the age of 25 and especially those over 30 were granted deferments of all sorts much more readily than younger men were. The nature of deferments changed over the course of the war. Certain deferments that were important at the very beginning of the war (e.g. deferments for those men with dependent children) were effectively eliminated as the war went on and manpower needs became more pressing. There was no general deferment for college students during WWII. Below, I briefly summarize the four categories of deferment that remained significant throughout the war:

MENTAL DEFECTS: As of 1945, roughly 7% of all male registrants in the 19-25 age group were placed in class 4F due to mental defects. Some additional number with less serious mental defects were classified as limited service only, a classification which made it far easier to get employment and other sorts of deferments. Roughly two-thirds of those disqualified for mental reasons were classed as unfit due to mental disease. Another third were disqualified for mental defect, defined as illiteracy and scores below about the 5th to 10th percentile on intelligence tests.

PHYSICAL DEFECTS: Approximately another 7% of registrants in the 19-25 age group in 1945 were disqualified for physical defects. Again, more were classified as limited service only

due to less serious physical defects. Physical defects accounting for a high fraction of disqualifications included musculoskeletal, hearing, and vision disorders, hernias and heart problems.

EMPLOYMENT DEFERMENTS: These were deferments for "necessary men" employed in crucial industries, including agriculture, weapons manufacturing, railroads and skilled technical services. Some 6% of males aged 19-25 in 1945 received these deferments. These deferments were actually quite difficult to procure for males aged 25 or under, but standards grew more lax with the age of the registrant. The great majority of younger men with employment deferments had also been classified for limited service due to deficiency.

AGRICULTURAL DEFERMENTS: Workers on non-subsistence farms were able to take advantage of a blanket deferment available to all agricultural workers. About 4.6% of all males aged 19-25 in 1945 received these agricultural deferments.

The system of induction and deferments during the Korean War was generally similar to that used in WWII, but there were many differences. Major differences were in the treatment of age, the existence of new deferments, and standards for occupational and agricultural deferment. Other standards remained as described above. In addition, volunteering was permitted throughout the Korean War; about half of all entries to the armed forces during the period came through voluntary enlistment. However, many of these enlistments occurred after a man was informed of draft selection (volunteering permitted selection of service branch, which draftees could not do). So draft pressure probably played an important role for the majority of inductees.

Military liability in the Korean War was limited to those between the ages of 18½ and 25. Preference in draft induction was technically supposed to be given to older persons in this age group (although in practice it seems that younger individuals made up the bulk of those who actually wound up serving). Thus, a typical call up would begin by inducting the oldest eligible (non-deferred) male and working downward. Although draft liability did not begin until 18½ years of age, the military recruited among 17 and 18 year old men.

There were several new deferments and exemptions added during the Korean War period. Through mid 1953, there was also a deferment available for males with dependent children. During the war, about 15-20% of all non-veteran males in militarily liable age groups were deferred due to dependency. The Korean War draft also introduced the concept of a general college student deferment. The deferment was not uncommon, but it was by no means automatic. By 1952 roughly one-sixth of male college students were classified as deferred from service due to college enrollment. In addition, college students could delay induction until the end of the current academic year of enrollment. This deferment continued after the end of the war.

Finally, the Korean War draft nearly eliminated deferments for skilled industrial workers and greatly reduced them for agricultural workers. This was because the dependency deferment and the exemption of all males aged 26 or over left sufficient manpower to fill most occupations.

Appendix B: Educational Choice Model

Each individual chooses their post-secondary educational level based on maximizing the costs and benefits of schooling, which depend on the level of schooling, the costs of schooling, and an individual-specific ability parameter:

$$\text{Eq. B-1)} \quad U = \log(Y(S)) * B_i - C(S, W_i)$$

Here, $Y(S, b_i)$ is the discounted lifetime return to a level of post-secondary schooling and is concave and increasing in S . C is a function determining the discounted utility costs of schooling (direct and opportunity) and is convex and increasing in S . W_i is the individual's access to wealth, which may affect the net income that they will receive if schooling is chosen over other options.⁴² Costs of education are convex and decreasing in wealth level. Furthermore, $dC/dSdW < 0$, or the discounted marginal utility costs of additional schooling decline as wealth increases. These are straightforward implications of a period-specific utility function that is concave in income. The final parameter, B_i , is an individual-specific ability parameter that affects the perceived ratio between the benefits and costs of schooling.⁴³

Maximization of this function at the initial level of wealth W_i will produce an equilibrium level of education for each individual, where the marginal return to education equals the marginal cost as "deflated" by the individual's level of perceived ability:

$$\text{Eq. B-2)} \quad S^*(B_i, W_i) \text{ such that } Y_S(S)/Y(S) = C_S(S, W_i) / B_i$$

In order to illuminate the effects of the subsidy on education for persons of differing income levels, imagine the following situation. Define two income groups, characterized by their family wealth levels W_H and W_L . In an equal opportunity scenario, where there are no borrowing constraints whatsoever, $W_H = W_L$. This is due to the fact that family income will not affect allocation of wealth over the individual's lifetime, and thus will not affect living standards during the educational period. Wealth levels may still affect the purchase of education as a consumption good (which I do not address here), but not as an investment good. In all other cases, where borrowing constraints do exist, $W_H > W_L$.

Increase W to $W+G$ for both groups. In the equal opportunity scenario, dC_S/dG is equal

⁴² This parameter refers to wealth as it affects access to income if education is chosen vs. other options. Where there are no borrowing constraints whatsoever individuals may have different wealth levels but these will be irrelevant to the schooling investment since the individual can freely reallocate wealth over their lifetime. (Wealth level may still affect the education decision if education is undertaken purely for consumption value, a possibility I will not deal with here). In this case the value of W would be equal for all individuals, as the cost of schooling would not be affected by it.

⁴³ It is important to note that because this is a subjective decision problem B is only a perceived ability to benefit from education. It therefore may reflect differences in knowledge about educational opportunities or in self-confidence as much or more than differences in intelligence or actual ability to benefit from education.

for both groups. In other cases, however, the fact that education costs are convex and decreasing in wealth level gives us, for any given level of education S , the implication that:

$$\text{Eq. B-3) } dC_S(S, W_H) / dG < dC_S(S, W_L) / dG$$

Equation B-3 implies that in a case where unequal opportunity holds and perceived ability distributions are equal between the two groups the subsidy will have a greater average causal effect on education among the low-income group.⁴⁴ This is what is meant by the prediction that in a case of unequal opportunity the GI bill is likely to have a stronger effect on the education of low-income groups.

However, where the distribution of perceived ability differs between the groups the situation changes, even though dC/dG will still be greater for the low-income group. In this case, "anything goes" and the final effects of the subsidy on education depend on the exact distribution of ability. This can be seen intuitively by looking at Equation 6-2 and noting that perceived ability acts as a "deflator" on any effects the subsidy will have. The differential effects of the subsidy on education will not be determined directly by dC_S/dG , but by dC_S/dG divided by $B_{i..}$

I will give an example of how this ability effect works by focusing on a different statistic. Take the percentage of individuals in a particular income group who will obtain a post-secondary education level equal to or greater than some fixed post-secondary education level S^* . How will this be changed by the subsidy? Take f_H to be the distribution function for perceived ability among the high-income group, and similarly f_L for the low income group. The change in the fraction of a particular income group (e.g. the high income group) receiving education levels S^* or above due to the subsidy G will be equal to:

$$\text{Eq. B-4) } \int (B_{iH} \dots B_{0H}) f_H(B), \text{ where}$$

$$B_{0H} = B_0 \text{ such that } Y_S(S^*) / Y(S^*) = C_S(S^*, W_H) / B_0, \text{ and}$$

$$B_{iH} = B_1 \text{ such that } Y_S(S^*) / Y(S^*) = C_S(S^*, W_H + G) / B_1$$

We can compare these two changes for the high and low income groups to see what fraction of each group will move above the education "threshold" S^* .

It is clear that whichever group has a greater portion of its perceived ability distribution in the margin swept out by the change in costs will be most affected by the subsidy. Thus, the population most affected by the subsidy will be those with perceived ability levels "just below" the ability level that justified college attendance for their pre-subsidy level of family income.

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⁴⁴ Implications about the average causal effect of the subsidy can be derived by integrating over pre-service levels of education. In the case where pre-service levels of post-secondary education are higher among the poorer group, the stated implication may not hold, but this is an unrealistic case.

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TABLE 1
Length of Service and GI Bill Eligibility for Active Duty Veterans

<i>Months of Active Duty Service</i>	<i>World War II</i>		<i>Korean War</i>	
	<i>Percentage of Veterans</i>	<i>Months of GI Bill Eligibility</i>	<i>Percentage of Veterans</i>	<i>Months of GI Bill Eligibility</i>
0 to 6	1.2	12 to 18	0.5	0 to 9
6 to 12	2.5	18 to 24	0.5	9 to 18
12 to 24	16.3	24 to 36	30.6	18 to 36
≥ 24	80.0	≥ 36	68.4	36

Source: 1978 Survey of Veterans. President's Commission (1956) gives eligibility rules.

Notes: World War II GI bill eligibility is 12 months plus service period to a maximum of 48 months; Korean War GI bill eligibility is 1.5 times active service period to a maximum of 36 months. Sample includes only those discharged for non-medical reasons.

TABLE 2
College Cost Reduction due to the World War II and Korea GI Bills

	<i>World War II (1948)</i>		<i>Korea (1956)</i>	
	<i>Private University</i>	<i>Public University</i>	<i>Private University</i>	<i>Public University</i>
<i>Cost per academic year</i>				
Tuition and fees (dollars)	402	102	626	148
Opportunity cost (dollars)	1,390	1,390	1,890	1,890
Total cost (dollars)	1,792	1,492	2,516	2,038
<i>GI Bill subsidy per academic year, by family composition</i>				
	<i>Subsidy in dollars</i>			
No children	1,040	782	990	990
1 child	1,310	1,050	1,210	1,210
≥ 2 children	1,450	1,192	1,440	1,440
	<i>Subsidy as a percentage of total cost</i>			
No children	58	52	39	49
1 child	73	70	48	59
≥ 2 children	81	80	57	71

Sources: Program rules based on President's Commission (1956). Tuition data from authors calculations based on tuition and fee data drawn from American Council on Education (1948, 1956). Tuition/fee data weighted by the male enrollment at each campus to produce overall mean. (Tuition information from other sources may differ slightly based on different treatment of fees). Income data for opportunity cost calculation from Census Bureau web site: www.census.gov/hhes/income/histinc/p07.html.

Notes: All figures are in nominal dollars (1948 for WWII, 1956 for Korea). WWII GI bill stipends are based on stipend levels for February, 1948 and after; 1945-7 levels were somewhat lower. All figures are based on an academic year of 9 full-time months of education. The opportunity cost is calculated as 75 percent of the median income of all males between 20 and 24 years old having income in the relevant year.

TABLE 3
Korean War Legislation Chronology

<i>Date</i>	<i>Event</i>
June 27, 1950	Official declaration of Korean War
July, 1952	Passage of Korean War GI bill. Veterans are eligible based on time served between June 27, 1950 and an unspecified end date to the war.
June, 1953	Cease fire treaty in Korean War
January 31, 1955	Declaration of close of Korean War. Law makes all who served by this date eligible for GI benefits based on full service period.
June, 1966	Post-Korean GI bill retroactively makes veterans who joined after January, 1955 eligible for benefits.

SOURCE: Udell (1968).

TABLE 4
Descriptive Statistics for Treatment (Korean Service) and Comparison Groups:
1973 Occupational Change in a Generation and 1978 Survey of Veterans Samples

	<i>1973 OCG Sample</i>		<i>1978 SOV Sample</i>	
	Yes	No	Yes	No
Korean service				
Dates of military entry	2/54 to 1/55	2/55 to 1/56	6/50 to 1/55	2/55 to 1/60
Dates of military release	2/55 to 1/60	2/56 to 1/61	2/55 to 1/61	2/56 to 1/61
Education at military entry ^a	12.1 (0.13)	12.0 (0.17)	12.0 (0.10)	12.2 (0.11)
Education, survey year	13.2 (0.15)	12.84 (0.19)	13.1 (0.13)	13.1 (0.14)
Post-sec. ed. at military entry	.79 (0.08)	.92 (0.11)	0.66 (0.07)	0.76 (0.08)
Post-sec. ed., survey year	1.59 (0.12)	1.40 (0.13)	1.64 (0.10)	1.49 (0.11)
% HS grads at military entry	72.6 (2.6)	63.8 (3.2)	76.8 (2.0)	78.6 (2.1)
% HS grads, survey year	82 (2.2)	77 (2.8)	81 (1.9)	83.7 (1.9)
% college grads at military entry	13.2 (1.9)	17.6 (2.5)	9.7 (1.4)	13.5 (1.7)
% college grads, survey year	28.6 (2.6)	24.3 (2.8)	27.4 (2.1)	24.9 (2.3)
Age at military entry	20.4 (0.14)	20.3 (0.17)	n.a.	n.a.
Age at military release	23 (0.13)	22.9 (0.15)	23.3 (0.11)	22.8 (0.12)
Age, survey year	38.2 (0.15)	37.1 (0.17)	45.1 (0.12)	42.5 (0.13)
Sample size	305	227	437	365

Sources: 1978 Survey of Veterans; 1973 Survey of Occupational Change in a Generation.

Notes: Standard errors are in parentheses. n.a. = not available.

^a At military release for SOV sample.

TABLE 5
Estimated Impact of Korean War GI Bill Eligibility on Higher Education

Dependent Variable	OCG Sample			SOV Sample	
	Years of College	Years of College	College Grad. (1/0)	Years of College	College Grad. (1/0)
Korean Service (GI Bill Eligible)	.202 (.107)	.243 (.112)	.058 (.025)	.241 (.106)	.051 (.023)
Black	—	-.05 (.20)	-.08 (.04)	-.18 (.18)	-.076 (.041)
Pre-Service Education, Individual Years	15 Classes (P = .000)	15 Classes (P = .000)	15 Classes (P = .000)	16 Classes (P = .000)	16 Classes (P = .000)
Age at Induction, Individual Years	—	16 Classes (P = .13)	16 Classes (P = .33)	—	—
Father's Socio-Economic Status	—	5 Classes (P = .11)	5 Classes (P = .34)	—	—
Ethnicity	—	4 Classes (P = .02)	4 Classes (P = .22)	—	—
Census Division of Birth	—	10 Classes (P = .11)	10 Classes (P = .08)	—	—
Father's Education	—	5 Classes (P = .20)	5 Classes (P = .12)	—	—
Mother's Education	—	5 Classes (P = .11)	5 Classes (P = .13)	—	—
Family Income	—	6 Classes (P = .89)	6 Classes (P = .55)	—	—
Father's Occupation	—	9 Classes (P = .20)	9 Classes (P = .82)	—	—
Drafted (1=Yes)	—	—	—	-.14 (.12)	-.04 (.028)
Service Branch	—	—	—	4 Classes (P = .77)	4 Classes (P = .82)
Rank	—	—	—	4 Classes (P = .22)	4 Classes (P = .71)
R-Square	.64	.69	.66	.53	.46

SOURCES: 1973 Survey of Occupational Change in a Generation, 1978 Survey of Veterans.

NOTES: Standard errors in parentheses; P-values for F-tests are in parentheses in the case of multiple classes. All classes have one dummy variable each except for one omitted class. Post-secondary education

top coded at 5 years in OCG, 6 years in SOV.

TABLE 6
Estimated Use of Korean and Post-Korean GI Bill Funding By 1973

<i>Percent of Each Sample With...</i>	<i>Korean Service</i>	<i>No Korean Service</i>
no GI bill funded education by 1973	50.1	83.1
GI bill funded college education within 4 years of military release	27.9	2.7
GI bill funded college education from 5 years after release to 1973	2.4	6.9
GI bill funded non-college education within 4 years of military release	15.1	1.9
GI bill funded non-college education from 5 years after release to 1973	4.5	5.4
Average months of GI bill college education funded By 1973	8.0 (.64)	2.2 (.38)
Difference in months of GI bill funded college education by 1973, regression-adjusted for education at military release*	5.9 (.75)	

Standard errors in parentheses.

SOURCE: Answers to survey questions on use, duration, and start year of VA funding, 1978 Survey of Veterans.

NOTES: GI bill funded college education was assumed for veterans who had attended college after military discharge and reported 4 or more months of GI bill educational funding. GI Bill funding by 1973 was estimated from the start year of GI bill training and the number of months of GI bill training undertaken. Korean service veterans joined the military on or before January, 1955, while veterans with no Korean service entered after this date.

* Regression adjusted using dummies for individual years of education at release.

TABLE 7

Estimated Impacts of Korean War GI Bill Eligibility
Including Adjustments For Later Use of Post-Korean GI Bill Among Comparison Group

<i>Assumed increment in post-secondary education per month of post-Korean GI bill college funding received by the comparison group</i>	<i>OCG Sample Impact Estimate (SE)</i>		<i>SOV Sample Impact Estimate (SE)</i>	
	<i>Years of College</i>	<i>College Grad (1/0)</i>	<i>Years of College</i>	<i>College Grad (1/0)</i>
Lower Estimate: None (Table 5 Result)	.243 (.112)	.058 (.025)	.241 (.106)	.051 (.023)
Mid-Range Estimate: Mean causal effect per month of GI bill funding induced by Korean GI Bill eligibility	.33 (.12)	.081 (.03)	.36 (.12)	.076 (.026)
Upper Bound Estimate: twice mid-range estimate	.43 (.15)	.102 (.033)	.48 (.16)	.101 (.034)
<i>Point estimates: elasticity of post-secondary education to GI Bill subsidy</i>				
Lower Estimate	.36	.50	.34	.46
Mid-Range Estimate	.52	.78	.56	.77
Upper Bound Estimate	.73	1.09	.82	1.17

SOURCE: Tables 4, 5, 6, author's calculations using the 1978 SOV.

NOTES: See text for full explanation of this table. Standard errors for mid-range estimates determined using simulation. Standard errors for upper bound assume no variance in maximum estimate of impact. For 1978 SOV calculations are performed using months of GI bill education recorded as of 1978, not the 1973 figures shown in Table 6. Elasticities are estimated using an average price reduction of 50% for the Korean War GI bill (see Table 2) and the average levels of education at the survey date, as shown in the descriptive statistics in Table 4. Post-secondary education top-coded at 5 years in OCG, 6 years in SOV.

TABLE 8
Descriptive Statistics of Treatment and Comparison Groups Drawn From the 1973 OCG, By
Socio-Economic Status (SES) of Origin Family

<i>Korean Service</i>	<i>SES > Median</i>		<i>SES <= Median</i>	
	<i>Yes</i>	<i>No</i>	<i>Yes</i>	<i>No</i>
Sample Size	136	112	152	98
Education at Military Entry	12.7 (.19)	12.9 (.25)	11.7 (.18)	11.2 (.21)
Education, Survey Year	14.1 (.22)	13.7 (.23)	12.5 (.20)	11.9 (.23)
Post-Sec. Ed. at Military Entry	1.19 (.14)	1.36 (.18)	.50 (.10)	.36 (.11)
Post-Sec. Ed., Survey Year	2.33 (.18)	1.97 (.20)	1.04 (.15)	.72 (.14)
% HS Grads at Military Entry	74.6 (3.7)	77.7 (3.9)	72.5 (3.6)	52.1 (5.1)
% HS Grads, Survey Year	87.1 (2.9)	89.0 (3.0)	78.7 (3.3)	65.7 (4.8)
% College Grads, Military Entry	20.0 (3.4)	27.1 (4.2)	8.1 (2.2)	5.3 (2.3)
% College Grads, Survey Year	42.0 (4.2)	36.2 (4.6)	18.9 (3.2)	9.2 (2.9)
Age at Military Entry	20.4 (.19)	20.4 (.24)	20.4 (.21)	20.0 (.23)
Age at Military Release	23.0 (.17)	23.0 (.22)	23.1 (.19)	22.7 (.22)
Age, Survey Year	38.3 (.19)	37.3 (.25)	38.2 (.24)	36.8 (.23)

SOURCE: 1973 OCG.

NOTES: Socio-economic status (SES) is defined using the Duncan measure of occupational status based on the father's occupation (Duncan, 1961). High SES group includes roughly the upper 45% of the total population SES distribution for each birth year among the OCG sample, low SES group includes roughly the lower 55%. Percentiles are based on distribution of SES in two-year cohorts of birth.

TABLE 9
Differential Effects of Korean War GI Bill, By Socio-Economic Status

<i>Dependent Variable</i>	<i>Years of College</i>		<i>College Grad (1/0)</i>		<i>College Attend (1/0)</i>
High SES Effect (SES > median)	.428 (.167)	.463 (.168)	.079 (.039)	.074 (.04)	.093 (.047)
Low SES Effect (SES ≤ median)	.064 (.137)	-.018 (.159)	.042 (.03)	.040 (.032)	-.045 (.049)
<i>F Test for Difference</i>	3.27 (P = .07)	4.29 (P = .04)	.6 (P = .44)	.46 (P = .5)	4.77 (P = .03)
Black	—	-.05 (.23)	—	-.07 (.048)	.02 (.076)
Father's SES	5 Classes (P = .25)	5 Classes (P = .11)	5 Classes (P = .30)	5 Classes (P = .32)	5 Classes (P = .47)
Pre-Service Education, Individual Years	15 Classes (P = 0.0)	15 Classes (P = 0.0)	15 Classes (P = 0.0)	15 Classes (P = 0.0)	15 Classes (P = 0.0)
Age at Entry	—	17 Classes (P = .32)	—	17 Classes (P = .55)	17 Classes (P = .32)
Ethnicity	—	3 Classes (P = .02)	—	3 Classes (P = .25)	3 Classes (P = .27)
Census Division of Birth	—	10 Classes (P = .14)	—	10 Classes (P = .08)	10 Classes (P = .10)
Father's Education	—	5 Classes (P = .21)	—	5 Classes (P = .12)	5 Classes (P = .45)
Mother's Education	—	5 Classes (P = .22)	—	5 Classes (P = .17)	5 Classes (P = .40)
Family Income	—	6 Classes (P = .98)	—	6 Classes (P = .80)	6 Classes (P = .95)
Father's Occupation	—	8 Classes (P = .31)	—	8 Classes (P = .54)	8 Classes (P = .09)
R-Square	.66	.69	.63	.66	.58

SOURCE: 1973 OCG. NOTES: Socio-economic status (SES) is defined using the Duncan measure of occupational status based on the father's occupation (Duncan, 1961). High SES effect interacts Korean GI Bill eligibility with a dummy for father's SES greater than the median; low SES effect interacts GI bill eligibility with a dummy for father's SES less than or equal to the median. High SES corresponds to top 45% of SES distribution in each two-year period of birth, due to a mass point at the median. Sample size is 498 for all models.

TABLE 10
Descriptive Characteristics for Various Cohorts of Males Affected By WWII

<i>Cohort (Years of Birth)</i>	<i>Civilians</i>			<i>WWII Veterans</i>			
	<i>% WW2 Vets</i>	<i>% College Grads</i>	<i>Mean Years College</i>	<i>Age at Military...</i>		<i>% College Grads</i>	<i>Mean Years College</i>
				<i>Entry</i>	<i>Release</i>		
1909-10	28 (1.0)	7.4 (.7)	.48 (.03)	31.7	36.3	15 (1.9)	.81 (.07)
1911-12	34 (1.1)	7.2 (.7)	.48 (.04)	30.1	34.3	16.6 (1.5)	.92 (.07)
1913-14	40 (1.1)	8.7 (.8)	.56 (.04)	28	32.5	11.2 (1.1)	.70 (.06)
1915-16	54 (1.1)	8.4 (.9)	.51 (.04)	26.4	30.8	12.3 (1.0)	.80 (.05)
1917-18	64 (1.0)	9.3 (1.0)	.53 (.05)	24.2	29	15.4 (.9)	.89 (.04)
1919-20	74 (.9)	9.5 (1.1)	.53 (.05)	22.2	27	11 (.8)	.72 (.04)
1921-22	75 (.9)	8.1 (1.1)	.51 (.06)	20.7	25.1	15.4 (.8)	.93 (.04)
1923-24	79 (.8)	8.1 (1.2)	.49 (.06)	19.3	23.4	19.7 (.9)	1.08 (.04)
1925-26	73 (.9)	8.7 (1.1)	.51 (.05)	18.2	21.8	20.8 (1.0)	1.18 (.04)
1927	58 (1.4)	11.1 (1.4)	.62 (.07)	17.9	21.4	19.2 (1.5)	1.12 (.07)

SOURCE: Merged 1962 and 1973 OCG.

NOTES: Data on average age of military entry and release from 1973 OCG. Year of birth determined as survey year minus age minus 1. Post-secondary education top-coded at 5 years.

TABLE 11
Effects of WWII Military Service on Post-Secondary Education, by Cohort

Cohort (Birth Years)	Sample Size	Regression 1		Regression 2 (Includes pre-1941 work, marital history)	
		Dependent Variable...		Dependent Variable...	
		Years of College	College Grad (1/0)	Years of College	College Grad (1/0)
		Veteran Coefficient	Veteran Coefficient	Veteran Coefficient	Veteran Coefficient
1909-10	1837	.193 (.087)	.043 (.02)	.035 (.077)	.013 (.018)
1911-12	1835	.332 (.078)	.075 (.018)	.20 (.07)	.049 (.016)
1913-14	1978	.051 (.066)	.013 (.014)	.014 (.06)	.003 (.013)
1915-16	2050	.146 (.063)	.014 (.014)	.017 (.06)	-.013 (.014)
1917-18	2230	.189 (.071)	.026 (.015)	.107 (.065)	.012 (.014)
1919-20	2365	.037 (.063)	-.009 (.014)	.02 (.06)	-.013 (.013)
1921-22	2340	.171 (.070)	.027 (.015)	.136 (.069)	.021 (.015)
1923-24	2392	.379 (.073)	.076 (.016)	NA	NA
1925-26	2400	.36 (.069)	.067 (.016)	NA	NA
1927	1169	.30 (.10)	.04 (.022)	NA	NA
Average Impact, 1909-20*	12295	.14 (.029)	.021 (.007)	.065 (.028)	.004 (.006)
Average Impact, 1923-26*	4792	.37 (.054)	.072 (.011)	NA	NA

SOURCE: Merged 1962 and 1973 OCG.

NOTES: Regression 1 controls for father's education (5 categories), father's occupation (9 categories), father's SES (6 categories), year of birth, and region of birth (10 categories). All categories are fully interacted with the OCG year and cohort of birth. Regression 2 controls for all the variables from regression 1, plus categorical variables for age at first FTFY job if obtained before 1941, SES of first FTFY job if obtained before 1941, age at first marriage if before 1941, and categorical variables for no marriage or job prior to 1941.

*Weighted by fraction of cohort serving in WWII.

TABLE 12
Educational Interruptions Among Various Birth Cohorts

Birth Cohort	Mean Age at Military Entry	Percentage of veterans with HS degree and no FTFY job prior to military entry.*	Percentage of these veterans receiving at least 1 additional year of education after military release
1917-18	24.2	16.8 (1.4)	65.7 (4.5)
1919-20	22.2	19.3 (1.3)	62.5 (3.8)
1921-22	20.7	27.8 (1.5)	62.6 (3.0)
1923-24	19.3	34.3 (1.5)	67.1 (2.6)
1925-26	18.2	41.5 (1.6)	65.2 (2.5)

SOURCE: 1973 OCG.

*This is meant to be a rough indicator of the fraction of veterans who might have interrupted plans for post-secondary education upon entry to the military.

TABLE 13:
Approximate Bounds for Effects of WWII GI Bill Eligibility

<i>Cohort</i>	<i>Years of College</i>		<i>College Grad (1/0)</i>	
	<i>Impact (SE)</i>	<i>Elasticity to GI Bill Subsidy (Point Estimate)</i>	<i>Impact (SE)</i>	<i>Elasticity to GI Bill Subsidy (Point Estimate)</i>
1923-26 Lower Bound	.20 (.07)	.36	.045 (.016)	.29
1923-26 Upper Bound	.37 (.05)	.81	.072 (.011)	.92
1921-22 Upper Bound*	.136 (.069)	.30	.021 (.015)	.27
1909-20 Upper Bound*	.065 (.028)	.15	.004 (.006)	.05

See text for full explanation of this table. Upper bounds come from the results in Table 11, while the lower bound for the 1923-26 cohorts is calculated using the 1921-22 birth cohorts as a comparison group. Elasticities are calculated using a rough price reduction of 60% for the WWII GI bill.

*Uses Regression 2 results from Table 11; all the 1923-26 results use Regression 1 results from Table 11.

TABLE 14
Post Secondary Education and WW2 Veterans Status, 3-Month Birth Cohort

<i>Years</i>	<i>1909-1929 By Quarter (84 Birth Quarters)</i>			
<i>Sample</i>	<i>1960 Census Sample</i>		<i>1970 Census Sample</i>	
Dependent Variable	Mean Post-Secondary Educ.	% College Graduates	Mean Post-Secondary Educ.	% College Graduates
Fraction WW2 Veterans Interacted With...				
Cohorts in 1909-1920	-.018 (.029)	-.023 (.006)	-.012 (.028)	-.015 (.007)
Cohorts in 1921-1929	.096 (.026)	.004 (.005)	.055 (.025)	.01 (.0049)
Linear Time Trend	.0043 (.0003)	.0009 (.0001)	.0057 (.0003)	.001 (.0001)
Constant	.508 (.016)	.08 (.003)	.535 (.019)	.0816 (.003)
Adj. R-Squared	.91	.91	.925	.918
<i>For Peak (1921-26) Cohorts...</i>				
Mean Dependent Variable	.84	.14	.92	.15
Fraction WWII Vets	.74	.74	.78	.78

SOURCES: 1960, 1970 Census IPUMS.

TABLE 15
Actual 4-Year Undergraduate Degrees Granted vs. Simulations

Growth Assumption	Growth Rate	Bachelor's degrees granted as fraction of males turning 21, 1940 through 1952
Actual Fraction	As Observed	12.7%
1930-40 Growth Rate	1.7% annually	10.4%
1936-40 Growth Rate	5.1% annually	12.8%

SOURCES: Degrees granted, U.S. Department of Commerce (1975), Series H 751-765, population from 1940 and 1950 Census IPUMS.

NOTES: See Figure 2 for a graphic depiction of the trends summarized in this table, and text for further explanation. Numerator is 4-year undergraduate degrees granted; denominator is the number of males born between 1919 and 1931 (i.e. turning 21 1940-52). Simulated growth scenarios project from degrees granted in 1940 through to 1952 based on pre-war growth rates. Data on degrees granted is not available for 1941, 1943, 1945, and 1947; it was estimated by linear interpolation. Simulation results available from author on request.

TABLE 16

Education by Birth Cohort and Socio-Economic Status (SES), All Males
Cohorts affected by WWII are shown; peak WWII effects among men born 1921-26

Cohort (Years of Birth)	Mean Post-Secondary Education					% Graduating College					% Attending College				
	Quintiles of Father's SES*					Quintiles of Father's SES*					Quintiles of Father's SES*				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1912-14	.19 (.04)	.26 (.03)	.47 (.07)	.75 (.07)	1.5 (.09)	3.0 (.8)	4.1 (.7)	7.6 (1.4)	11.6 (1.4)	24.5 (1.9)	6.6 (1.1)	8.6 (.9)	14.3 (1.8)	24.4 (1.9)	44.4 (2.2)
1915-17	.25 (.04)	.37 (.04)	.42 (.06)	.75 (.06)	1.85 (.09)	3.8 (.8)	5.6 (.8)	6.1 (1.1)	11.4 (1.3)	33.5 (2.1)	8.8 (1.2)	13.3 (1.1)	13.9 (1.7)	23.8 (1.8)	51.5 (2.1)
1918-20	.37 (.04)	.40 (.04)	.50 (.05)	.69 (.06)	1.72 (.08)	5.4 (.9)	6.7 (.8)	6.0 (1.1)	10.9 (1.3)	29.6 (1.8)	13.7 (1.3)	12.4 (1.0)	19.7 (1.8)	22.6 (1.8)	49.1 (2.0)
1921-23	.38 (.04)	.38 (.04)	.61 (.06)	.91 (.07)	2.2 (.08)	4.9 (.9)	5.3 (.8)	10.0 (1.2)	14.4 (1.4)	40.9 (2.0)	13.1 (1.3)	13.8 (1.2)	20.2 (1.6)	29.0 (1.8)	59.1 (2.0)
1924-26	.42 (.05)	.38 (.04)	.83 (.06)	1.32 (.07)	2.2 (.08)	7.6 (1.0)	6.5 (.9)	13.9 (1.3)	23.1 (1.6)	41.7 (2.0)	13.8 (1.4)	11.8 (1.1)	24.9 (1.6)	39.5 (1.8)	61.1 (1.9)
1927-29	.46 (.05)	.49 (.05)	.71 (.05)	1.25 (.07)	2.2 (.09)	7.0 (1.0)	7.6 (1.1)	11.7 (1.1)	21.8 (1.6)	39.8 (2.1)	14.4 (1.4)	16.2 (1.5)	21.6 (1.4)	36.8 (1.9)	60.5 (2.1)

NOTES: Weighted combination of 1962 and 1973 OCGs. Percentiles are based on percentile values of SES in two-year periods of birth for each individual. Socio-economic status (SES) is defined using the Duncan measure of occupational status based on the father's occupation (Duncan, 1961).

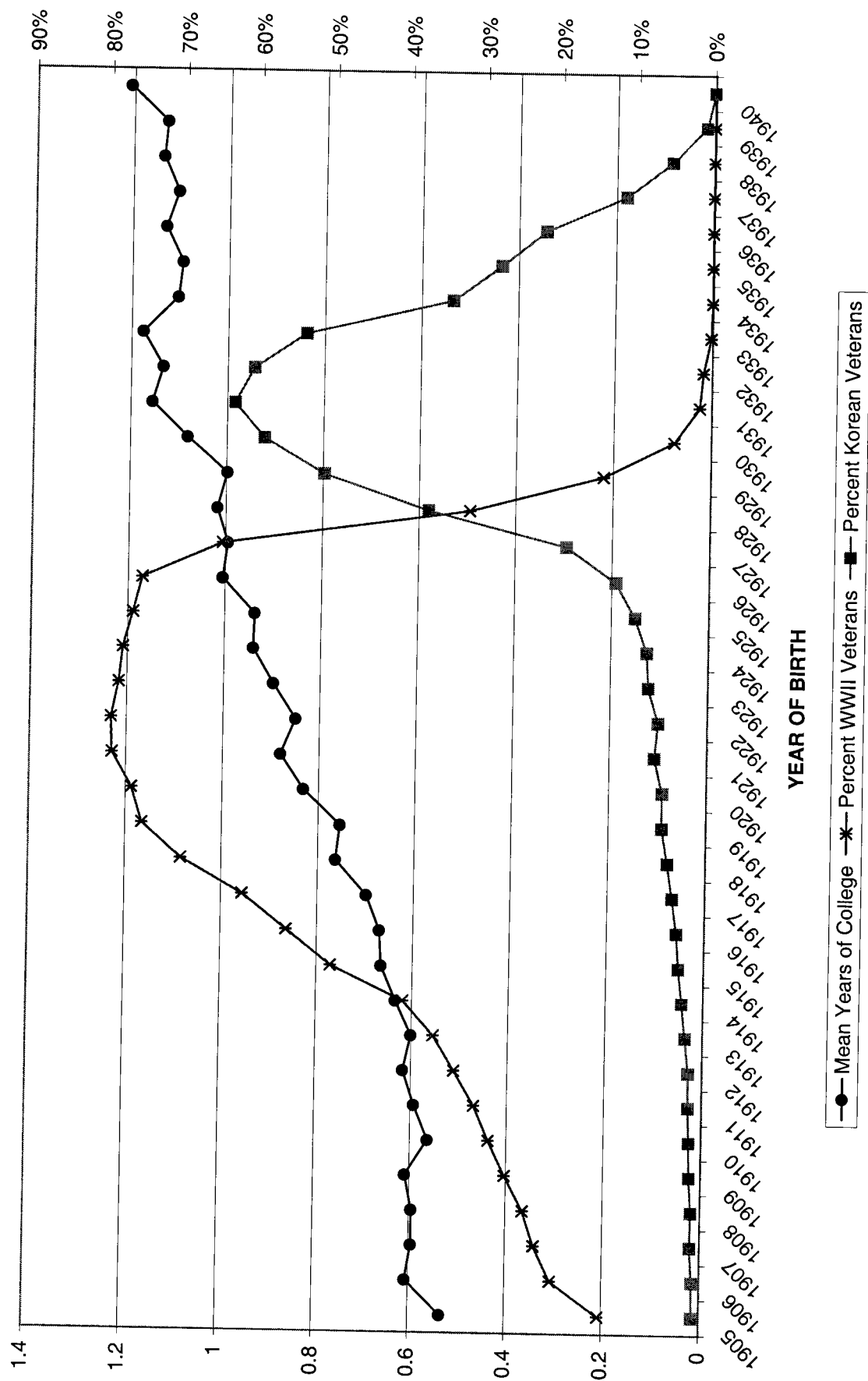
* It is not possible to produce perfect quintiles due to modal points in the distribution. The average quintile values for percentiles of father's SES over the entire period (which approximate the quintile values for each period) are: first quintile, 0-18%; second quintile, 18-44%; third quintile, 44-61%; fourth quintile, 61-81%; fifth quintile, 81-100%.

TABLE 17
Estimates of Benefits and Costs of GI Bills

<i>Scenario (Impact)</i>	<i>World War II GI Bill</i>		<i>Korean GI Bill</i>	
	<i>Low</i>	<i>Medium/High</i>	<i>Low</i>	<i>Medium/High</i>
Real Discount Rate	.04	.04	.04	.04
Elasticity of years of college to GI bill subsidy for veterans in...				
1909-20 birth cohorts	.10	.15	n.a.	n.a.
1921-22 birth cohorts	.15	.3	n.a.	n.a.
1923-27 birth cohorts	.3	.6	n.a.	n.a.
1930-34 birth cohorts	n.a.	n.a.	.3	.6
Total Direct Program Costs (Billions of \$)	5.6	5.6	1.8	1.8
Marginal Direct Costs	1.0	1.8	.30	.62
Transfer Direct Costs	4.6	3.7	1.5	1.2
Total Social Costs Induced (Billions of \$)	1.7	3.2	.68	1.4
PV of Benefits Estimated To Veterans Through 1980 (Billions of \$)	6.7	12.3	2.4	5.0
Benefit/Cost Ratio				
Assuming No Deadweight Loss of Tax	3.9	3.9	3.5	3.5
Assuming Deadweight Loss of .50 for every \$1.00 in Tax	1.5	2.1	1.5	2.2

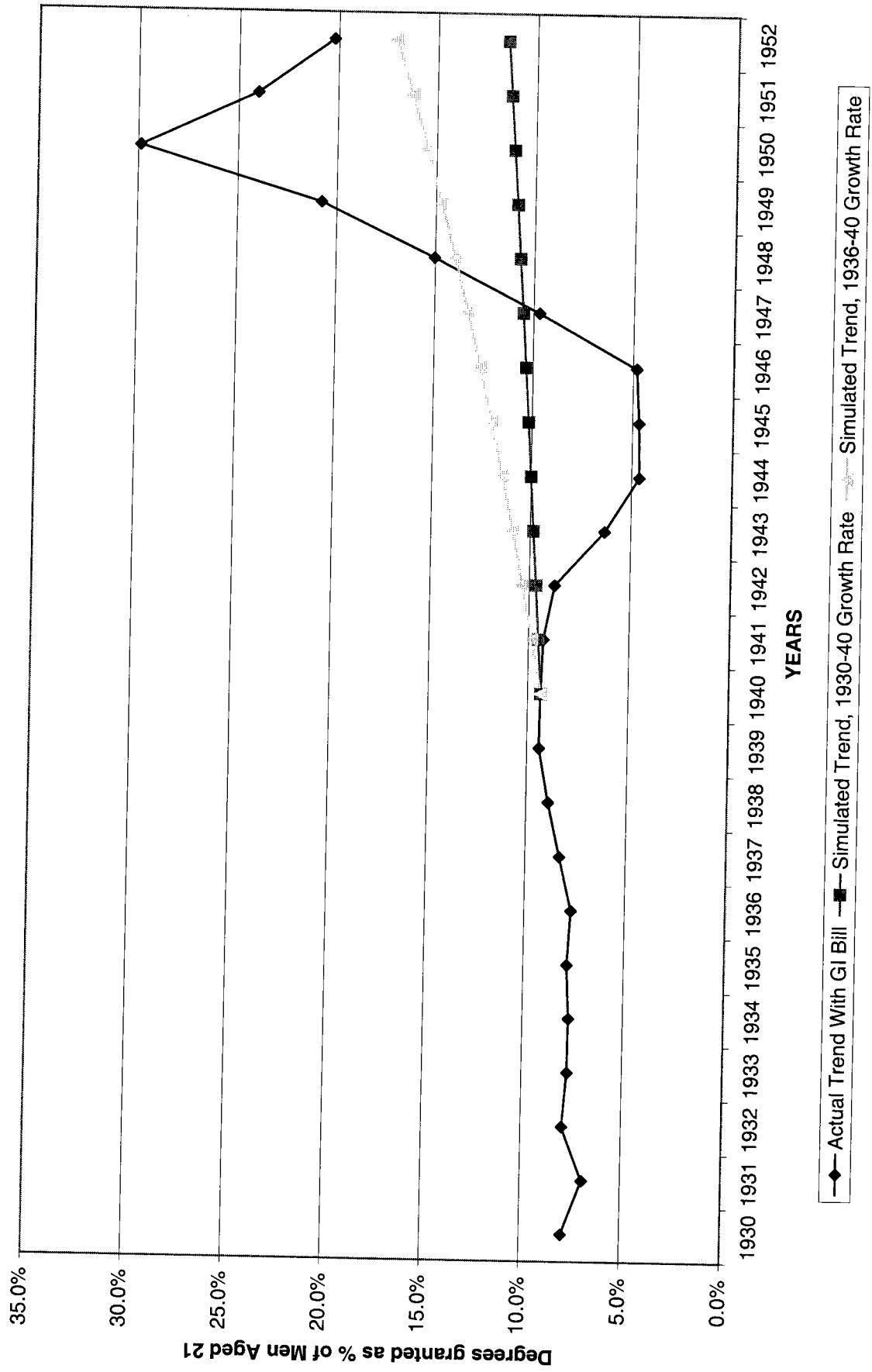
NOTES AND SOURCES: See text for further explanation and discussion. All figures in real discounted 1948 dollars for WWII, real discounted 1956 dollars for Korea. Cost estimates are derived from education figures in the 1978 SOV. Induced costs include private spending and opportunity costs as well as state government costs due to additional subsidies paid to public educational institutions enrolling veterans. Social costs reflect the average cost of a year's tuition at a private university (assumed to reflect the true resource cost of a year of higher education) plus opportunity cost of 9 months of wages for an 18-24 year old high school graduate. See Table 2 for sources of these costs. Elasticities assume 60% cost cut created by the WWII GI bill, and 50% for the Korean War GI bill.

Figure 1: College Education and Military Service Among Males, 1970 Census



Year of Birth		Years of College	% WW2 Veterans	% Korean Veterans
1905	0.534307	13%	1%	
1906	0.607074	20%	1%	
1907	0.59528	22%	1%	
1908	0.595214	23%	1%	
1909	0.610016	26%	2%	
1910	0.564039	28%	2%	
1911	0.593464	30%	2%	
1912	0.617251	33%	2%	
1913	0.601262	36%	2%	
1914	0.634416	40%	3%	
1915	0.665573	50%	3%	
1916	0.67008	56%	4%	
1917	0.698247	61%	4%	
1918	0.763418	70%	5%	
1919	0.754852	75%	6%	
1920	0.832085	76%	6%	
1921	0.880329	79%	7%	
1922	0.849854	79%	7%	
1923	0.897188	78%	8%	
1924	0.940446	78%	8%	
1925	0.93822	76%	10%	
1926	1.005368	75%	12%	
1927	0.99545	65%	19%	
1928	1.018107	32%	37%	
1929	0.998445	14%	51%	
1930	1.081972	5%	59%	
1931	1.155599	2%	63%	
1932	1.133817	1%	61%	
1933	1.176408	0%	54%	
1934	1.104581	0%	34%	
1935	1.095998	0%	28%	
1936	1.130694	0%	22%	
1937	1.105829	0%	12%	
1938	1.136884	0%	6%	
1939	1.130631	0%	1%	
1940	1.206505	0%	0%	
1941	1.209758	0%	0%	
1942	1.267239	0%	0%	
1943	1.225166	0%	0%	
1944	1.231076	0%	0%	
1945	1.180493	0%	0%	
		0%	0%	

Figure 2: Bachelor's Degrees Granted to Men, Various Assumptions



POPULATION AGED
21

DEGREES GRANTED...
Actual/Ext

FRACTION

Year	Population	DEGREES GRANTED... Actual/Ext	FRACTION	Year
1930	928894	73615	0.079250162	928894
1931(ext)	1132372	78443	0.069273172	1046494
1932	1046494	83271	0.079571407	1068990
1933(ext)	1070805	82806	0.077330606	1122419
1934	1068990	82341	0.077026913	1096806
1935(ext)	1074785	84204	0.078344971	1169361
1936	1122419	86067	0.076679921	1187943
1937(ext)	1106442	91872	0.083033724	1206762
1938	1096806	97678	0.08905677	1216806
1939(ext)	1101796	103612	0.094039187	1168098
1940	1169361	109546	0.093680224	1100776
1941(ext.)	1150797	106717	0.092733123	1117986
1942	1187943	103889	0.087452849	
1943(ext)	1266450	79877	0.063071578	
1944	1206762	55865	0.046293304	
1945(ext)	1225130	57264	0.046741162	
1946	1216806	58664	0.048211465	
1947(ext)	1205400	117139	0.09717853	
1948	1168098	175615	0.150342694	
1949	1267531	263208	0.207654093	
1950	1100776	328841	0.298735619	
1951	1158671	278240	0.240137192	
1952	1117986	225981	0.202132227	

TABLE 4-12: Actual Degrees Granted vs. Simulations
(As a fraction of males aged 21)

Assumption 1: 1930-1940 growth rate:
Assumption 2: 1936-1940 growth rate:

1.7%
5.1%

Year	Population	Actual Fraction	Degrees	Assumption 1 Fraction	Degrees	Assumption 2 Fraction	Degrees
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1940	1169361	9.4%	109546	9.4%	109546	9.4%	109546
1941*	1150797	9.3%	106717	9.5%	109625	9.8%	113341
1942	1187943	8.7%	103889	9.7%	115072	10.4%	123006
1943*	1266450	6.3%	79877	9.9%	124747	10.9%	137867
1944	1206762	4.6%	55865	10.0%	120872	11.4%	138113
1945*	1225130	4.7%	57264	10.2%	124782	12.0%	147413
1946	1216806	4.8%	58664	10.4%	126025	12.7%	153928
1947*	1205400	9.7%	117139	10.5%	126949	13.3%	160313
1948	1168098	15.0%	175615	10.7%	125096	14.0%	163327
1949	1267531	20.8%	263208	10.9%	138035	14.7%	186329
1950	1100776	29.9%	328841	11.1%	121897	15.5%	170122
1951	1158671	24.0%	278240	11.3%	130472	16.2%	188263
1952	1117986	20.2%	225981	11.5%	128015	17.1%	190977
TOTALS, 1940-52							
	15,441,711		1,960,846		1,601,133		1,982,545
% of all turning 21, 1940-52		12.7%		10.4%		12.8%	

Sources: 1950 Census and Bureau of Education biannual reports, 1936-1952

Actual	Hyp 1	Hyp 2
7.9%		
6.9%		
8.0%		
7.7%		
7.7%		
7.8%		
7.7%		
8.3%		
8.9%		
9.4%		
9.4%	9.4%	9.4%
9.3%	9.5%	9.8%
8.7%	9.7%	10.4%
6.3%	9.9%	10.9%
4.6%	10.0%	11.4%
4.7%	10.2%	12.0%
4.8%	10.4%	12.7%
9.7%	10.5%	13.3%
15.0%	10.7%	14.0%
20.8%	10.9%	14.7%
29.9%	11.1%	15.5%
24.0%	11.3%	16.2%
20.2%	11.5%	17.1%