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ABSTRACT

Military spending, fatalities, and the destruction of capital, all of which are immediately felt and are often large, are the most overt costs of war. They are also relatively short-lived. The costs of war borne by combatants and their caretakers, which includes families, communities, and the modern welfare state, tend instead to be lifelong. In this paper I show that a significant component of the public costs associated with U.S. wars are long-lived. One third to one half of the total present value of historical war costs have been absorbed by benefits distributed over the remaining life spans of veterans and their dependents. The half-life of these benefits has averaged more than 30 years following the end of hostilities. Estimates of the value of injuries and deaths, while uncertain, suggest that the private burden of war borne by survivors, namely the uncompensated costs of service-related injuries, are also large and long-lived.

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1 Introduction

Interest in the economics of armed conflict is on the rise. Blattman and Miguel (2010) review recent research efforts and issue a plea for improved data collection efforts. Glick and Taylor (2010) examine the trade costs of warfare, estimating them to be similar in magnitude to the human costs. A focal point of interest has been the cost of the 21st century U.S. wars in Iraq and Afghanistan, examined extensively by Stiglitz and Bilmes (2008) and also by Nordhaus (2002), Wallsten and Kosec (2005) and Davis, Murphy and Topel (2009). The three trillion dollar price tag estimated by Stiglitz and Bilmes, a focal point of much popular attention, includes present and future spending on military activities, support of veterans, the uncompensated costs of death and disability, and macroeconomic and borrowing costs. Edwards (2010) reviews these studies.

Nordhaus (2002) provides historical context by examining direct military spending in past U.S. conflicts, and Edelstein (2000) reviews the history of 20th century war cost assessments dating back to Clark (1931). A textbook treatment of the macroeconomics of warfare would discuss defense spending and its effect on aggregate demand, alongside the death toll and capital destruction. But such an analysis omits several key types of costs that, as Nordhaus discusses, are more difficult to reckon. The most apparent omissions are the budgetary costs of compensating and caring for surviving veterans, which Clark (1931) omitted. Far less easy to measure are any uncompensated costs of injury and death borne by veterans and their families. And there are also readjustment costs borne by children, spouses, and communities, all of which are even more nebulous (Institute of Medicine, 2010). In addition, the costs of military action should be weighed against those of inaction, as argued and operationalized by Wallsten and Kosec (2005) and Davis, Murphy and Topel (2009). In the case of veterans' benefits in the U.S., the counterfactual quickly becomes convoluted as a result of the overlapping social safety nets provided by Medicare and VA health benefits.

Goldin and Lewis (1975) assess the costs of the Civil War using a broad methodology designed to capture the budgetary, human, and opportunity costs, namely the costs of foregone consumption or any benefits of accelerated industrialization. But their analysis appears to omit veterans' benefits, and it calculates the human costs solely as the present value of future wages foregone either because of death or wounds.[1] The recent analysis by Glick and Taylor (2010) extends these techniques to losses on all sides in the two world wars. Research into the economic valuation of life has revealed that the willingness to pay for mortality risk reduction implies a value of a statistical life (VSL) in modern periods that is much larger than the capitalized value of future wages alone (Viscusi, 1993; Viscusi and Aldy, 2003). The true human costs of historical warfare depend on the VSL and, by extension, its income elasticity, a parameter of independent interest and uncertain magnitude over space and time (Viscusi and Aldy, 2003; Costa and Kahn, 2004; Hall and Jones, 2007).

In this paper, I reassess the human costs of U.S. wars alongside a broader accounting of their budgetary costs, which consist of veterans' health and disability benefits in addition to direct military costs. By and large, these data exist already in the Historical Statistics of the United States for periods prior to 1970. To produce a full accounting of costs for conflicts with surviving veterans and dependents past 1970, I extrapolate using standard techniques. I augment these data with estimates of VA disability ratings, which provide some sense of health conditions among surviving veterans, drawn from an array of recent cross sectional surveys.

The most ironclad and interesting result is that the budgetary costs of providing death and disability compensation, health care, and survivors' benefits to veterans and their dependents are large and long-lasting. I find that those costs represent between one third and one half of the total present value of all war costs, and their half life has averaged more than thirty years and may be rising with recent conflicts. That a component of direct war costs should be so large and persistent is a novel finding that modifies the textbook conceptualization of modern wars as costly but relatively short. The timing result also mirrors the insight recently offered by the Institute of Medicine (2010) and Edwards (2010) regarding the life

[1]Goldin and Lewis assume that all Civil War wounded lose half their future earning potential, while the dead lose it all.

cycle of veterans' disability benefits, which tend to peak some thirty years after hostilities cease. Rapidly rising costs of medical care have no doubt recently contributed to this general pattern, but it also predates the modern VA system and the period of significant health care price inflation. Rather, the life cycle of veterans' benefits appears to reflect an initial latency and persistence of service-related disability among surviving veterans.

Much uncertainty surrounds the economic value of historical losses of life and health, but estimates I recover are never small. The human costs of recent warfare in particular are unambiguously large. The private costs of disability are as long-lived as the public costs of compensation and health care. For recent cohorts of veterans, the uncompensated private costs, which is the difference between the two, also called the *social economic costs* by Stiglitz and Bilmes (2008), appear to be large. During far-removed historical periods, the result depends on assumptions regarding injury prevalence and on the income elasticity of the VSL. When the latter is high, the estimated costs of lost lives and health during historical periods are lower because incomes were much lower then than they are now. A given dollar amount of veterans' benefits compensates relatively more for a given level of harm when the income elasticity of the VSL is high.

In the sections that follow, I first describe my data sources in greater detail and provide a summary overview of personnel involved in major U.S. wars and causalities. Then I calculate the life cycles of veterans and of war-related budgetary costs for each past U.S. conflict, and I compare and contrast each across conflicts. Next I present and discuss estimates of VA disability ratings among survivors of recent wartime and peacetime cohorts. The VA disability ratings facilitate a back-of-the-envelope estimate of the net health impact on surviving veteran cohorts, which I cost out according to assumptions about the income elasticity of the VSL. In the final section I discuss a limited counterfactual scenario, in which I omit any discussion of the costs of avoiding war and focus on the budgetary and private impacts of warfare relative to a baseline of maintaining peacetime forces only. Such a scenario raises the obvious question of why countries would have a standing military at all, if it were never used, but I believe the scenario still provides new and useful, if limited, insights as a counterfactual.[2]

2 Data and assumptions

2.1 Historical Statistics of the U.S.

My primary data source for information on wars and veterans are the Historical Statistics of the United, Tables Ed1–399 States (Carter et al., 2006). Of these, the preponderance of statistics are derived from Tables Ed1–5, which list casualties for major U.S. wars; Tables Ed168–170, which show the estimated direct military costs of U.S. wars; and Tables Ed324–336, which present the expenditures of the Veterans Administration and its predecessor agencies by veterans' period of service.[3] I augment the casualty lists for recent wars using data from the Statistical Information Analysis Division (SIAD) of the Defense Manpower Data Center, which are current through March 6, 2010.[4] Military spending for the First Gulf War and for Operations Enduring and Iraqi Freedom (OEF/OIF) are taken from are taken Nordhaus (2002) and Stiglitz and Bilmes (2008) respectively, the latter the "realistic-moderate" forecast as of 2008.

Costs of veteran cohorts prior to 1866, which are primarily those associated with the Revolutionary War cohort, are given in a single lump sum, which I distribute across years according to other sources.[5] Costs by conflict end in 1970, so I extrapolate costs for World

[2]Military forces can still have value solely as a deterrent, as evidenced by the presence of large nuclear arsenals among major world powers. But it is clear that wars can also bring benefits to victors that may include territory, freedom or its inverse, and possibly economic growth. Several studies seem to suggest that war is never a net benefit, however (Goldin and Lewis, 1975; Nordhaus, 2002).

[3]Following the Civil War, a number of former Confederate states independently established pensions for veterans of the Confederacy. But to my knowledge, whatever statistics may exist have not been assembled, let alone examined.

[4]http://siadapp.dmdc.osd.mil/personnel/CASUALTY/castop.htm

[5]For the Revolutionary War cohort, I distribute nominal dollars across years according to amounts reported for several non-consecutive years by Glasson (1918), and then after 1840 according to the diminution pattern of spending on veterans of the War of 1812, shifted 32 years earlier in time. The total sum of nominal dollars I set a small amount of undistributed spending on veterans of the War 1812 as occurring in 1871, the last year before which annual spending is reported.

War I and later wars to 1997 using Tables Ed311–323, which lists VA costs by function through 1998; and Ed351–371, which presents compensation and pension (VBA) costs by period of service through 1997.[6] For veterans of the Spanish-American War and earlier conflicts, who are effectively extinct by 1970, I model nominal costs as declining 15 percent annually, which is roughly the average rate of decline observed for extinct cohorts in the data. I also institute this rule for the World War I cohort after 1997.

For the World War II, Korean, Vietnam, and First Gulf War cohorts after 1997, I model costs per surviving veteran plus costs per survivor. A more precise method of forecasting would model additional parameters, such as the proportion of veterans who utilize health care and compensation programs and the intensity of utilization, where the latter is based on health status. But data limitations hamper that level of analysis, and evidence both from aggregate time series and cross sections suggest that focusing on usage per surviving veteran is a reasonable alternative, at least for cohorts past a certain age. I explore the cross-sectional trends that support this perspective in section 5.1 below.

Veteran populations are given for historical periods in Tables Ed245–261, and for future periods by the VetPop 2007 projections obtained from the VA website.[7] I measure total nominal costs net of survivor benefits per surviving veteran in 1997 as $1,531 for the World War II cohort, $890 for the Korean cohort, and $1,489 for the Vietnam cohort, and I assume a per capita cost of $1,500 for First Gulf War veterans. This assumption seems reasonable in light of similarities in disability rates between Vietnam and First Gulf War veterans that emerge in the cross-sectional surveys I examine in section 5.1.[8] Growth in real per capita

[6]Based on patterns observed during the overlapping of these series between 1960 and 1970, I assign half of "All Other Expenditures" (Ed323) to veterans and recover an annual scaling factor that recovers total VA spending (medical plus compensation and pensions plus vocational plus half of other) from compensation and pensions alone. I apply these methods to VA costs for the World War I, World War II, Korea, Vietnam, and First Gulf War cohorts.

[7]The latter categorizes as "Gulf War" all veterans serving after 1990. I extrapolated the number of veterans of the First Gulf War from these figures by assuming there are 2,223,000 surviving veterans up to the peak of the VetPop series, in 2025, after which survivorship follows the same course, falling in half by 2054. By comparison, the Vietnam cohort is expected to halve around 2027. This technique will likely overstate the number of surviving First Gulf War veterans because in the VetPop data they are mixed in with younger cohorts.

[8]This method will tend to overstate First Gulf War costs to the extent that the number of veterans on

costs after 1997 is 0 percent for the World War II cohort, 1.5 percent for the Korean cohort, and 3.5 percent for the Vietnam cohort, all extrapolated from trends in the data after 1980. For First Gulf War costs, which the Historical Statistics do not measure well, I assume the same rate of annual increase as found for the Vietnam cohort, and I backcast costs to 1991 by combining that assumption with past headcounts and the $1,500 per capita cost in 1997. I assume a future rate of CPI price inflation of 3 percent. Numbers of survivors by period of service are given by Tables Ed388 and Ed295 up to 1995 for the World War II, Korea, Vietnam, and Gulf cohorts. I decrement each series according to a female cohort life table published by Social Security (Bell and Miller, 2005).[9] Levels of benefits are given by Tables Ed362 and Ed367, and I forecast 6 percent nominal growth beginning from their 1995 levels, roughly the average annual rate of historical increase.

Estimates of real GDP and population from 1790 are available in Tables Ca9–19. For years prior to 1790, I assume constant growth in GDP and population based on the period 1790 to 1810. After 2002, I supplement this series with recent BEA data, and I inflate the series to 2008 chained dollars. Data on CPI inflation with base period 1982–1984 are available in Table Cc1, which I append using recent BLS data. To obtain nominal discount rates, I use a composite of series in Tables Cj1192–1194, which are averages of yields on longer-term issues of either the U.S. government or municipalities. I splice gaps in the first series assuming fixed risk premia between the three. Between 1997 and 2009, I use the market yield on 10-year Treasury securities reported in the Fed's H15 release, spliced with the same assumption. For forecast periods after 2009, I specify a 4.5 percent nominal discount rate and a 3 percent rate of CPI inflation, mirroring the assumptions of Stiglitz and Bilmes (2008).

disability rolls (Institute of Medicine, 2010) and disability ratings both tend to rise as the cohort ages, as shown in section 5.1. I do not capture this dynamic at all in my forecast because of data limitations. But the method will understate costs to the extent that in any period, younger cohorts of veterans are considerably more costly on a per capita basis in the data. Setting First Gulf War costs per capita only slightly above Vietnam costs likely understates the former.

[9]For the World War II cohort, I use the life table for the female cohort born in 1900; for the Korean cohort, I use the 1920 life table; for the Vietnam cohort, 1950; for the First Gulf War cohort, 1970. To the extent that dependents also obtain death pension and compensation benefits, this method will understate true future costs.

Data on federal government debt are provided in Tables Ea587 and Ea728.

In order to assess the total costs of relatively recent wars, one must project veterans' benefits over a fairly long horizon. According to my forecast, nominal flows of costs associated with the First Gulf War are unlikely to cease before 2090. For OEF/OIF, I use the forecasts of spending on veterans provided by Stiglitz and Bilmes (2008).

2.2 Cross-sectional surveys of veterans

In addition to dollars of benefits, another key variable is the health status of surviving veterans. Past studies of historical conflicts have made do with rules of thumb based on official casualty statistics: the "Wounds Not Mortal" category (Goldin and Lewis, 1975; Glick and Taylor, 2010). These studies assume each nonfatal casualty represents a case of 50 percent disability.

My strategy improves on that method by examining VA disability ratings, which are traditionally designed to reflect work disability and can be interpreted as revealing the percentage reduction in quality of life (Stiglitz and Bilmes, 2008). With sufficient data, I could also calculate quality adjusted life years or some other measure, but the added difficulty would be specifying the change in QALYs or health status that is attributable to military service. The VA disability rating is designed to do exactly that.

In principle, all veterans examined by the VA during modern periods should have medical records that indicate their health status in some fashion. We also know from the CPE Union Army Dataset that medical records exist for Civil War era pensions. But a challenge is obtaining statistics that are representative of the average veteran's condition. The Union Army data are neither universal nor weighted, for example.

As of this writing, I am unaware of any official statistics on disability ratings or health conditions for entire veteran cohorts. One of the issues is that under U.S. law, veterans have had to voluntary approach the VA and predecessor agencies in order to obtain VA disability ratings. Time trends in disability headcounts and payments suggest that veterans do not obtain disability ratings all at once, and even if they did, the average service-related disability rating for the cohort is in considerable flux during the first decades after the conflict (Institute of Medicine, 2010). While military service records would probably have recorded physical and possibly mental injuries, it seems unlikely that these records have ever been systematically assessed for entire cohorts of veterans.

What I currently have are several cross-sectional surveys of veterans in which respondents are asked their VA disability ratings and their period of service. These datasets include the 1983 Survey of Aging Veterans (SAV), the 1992 National Survey of Veterans (NSV), the 2001 National Survey of Veterans, and the 2008 American Community Survey (ACS). The first three surveys were commissioned by the VA, they exclusively cover veterans, and they range in size from about 3,000 in the SAV to 11,600 and 20,000 in the two NSVs. The 2008 ACS surveyed some 250,000 veterans out of a total population of around 23.4 million. Earlier waves of the ACS did not ask about VA disability ratings, and neither did the decennial Census. Coverage of VA disability status in various Current Population Surveys exists but is spotty and does not begin before 1985.

3 The scope and aftermath of conflicts

Wars are costly because personnel and matériel must be deployed to combat zones, because hostilities result in deaths and wounded, and because surviving veterans and survivors of deceased veterans require medical care and are entitled to compensation. All of these costs tend to vary with the scope of the conflict, with offensive and defensive military technology, with medical technology, and with the general mortality environment faced by veterans and their survivors.

Table 1 lists statistics detailing several of these dimensions for each major U.S. war. The left panel shows estimates of military personnel involved, military fatalities, the number of service members experiencing wounds that did not result in death, and the number of surviving veterans, calculated as total personnel minus deaths.[10] The right panel displays several crude incidence indicators: the number of wounded per participating personnel, wounded per killed, and wounded per surviving veteran.

Conflicts have varied widely in terms of overall scope, with World War II the largest conflict to date in terms of participants.[11] The most deaths occurred during the Civil War, if fatalities on both sides are counted; otherwise World War II was also the deadliest. Recent conflicts, especially the two following the Vietnam War, have been more limited in scope.

Soldiers serving during the Civil War, especially on the Confederate side, were the most likely in history to have died or been wounded. The indicators in Table 1 reveal that nearly 20 percent of surviving veterans had physical war wounds. Because mental health trauma appears to have been a signature combat ailment in each historical era (Institute of Medicine, 2010), the share of surviving veterans with either physical or mental wounds was probably higher still. In other conflicts, the proportion of survivors with war wounds has fluctuated between 2 and 6 percent, averaging 2.5 percent.

In recent conflicts, most notably OEF/OIF, the share of wounded soldiers per fatality has risen. This statistic measures roughly how likely it is that a service member will survive his or her wounds. While relatively high during the Revolution and the War of 1812 at about 1.5 wounded per death, this measure fell to about 0.75 during the early mechanization of war in the later 19th century. It rose to 1.7 during the World Wars and 2.7 during the Korean and Vietnam conflicts before dropping to 1.2 during the brief and largely airborne First Gulf War. In OEF/OIF to date, the statistic is nearly 7 wounded per death. Improvements in emergency medical care and more rapid evacuation by air to trauma centers are responsible for the improvements in survival probability (Tanielian and Jaycox, 2008).

[10] The "wounds not mortal" category probably does not include mental health trauma per se. The former appears to be a statistic that is reported by the service branches during hostilities in order to describe changes in net force strength. Mental health injuries unaccompanied by physical injuries seem likely to have been coded differently, but it is far from clear. The typical interpretation of these statistics, as in Tanielian and Jaycox (2008) for example, is that they capture the prevalence of nonfatal physical wounds.

[11] As shown in Table 3, the number of participants per resident population was also highest during World War II, at 11.7 percent. Next highest was the Civil War at 9.6 percent, and the Revolution at 7.7 percent. The last three wars have involved 4.4, 0.9, and 0.7 percent of the U.S. population.

Despite the growth in the probability of surviving wounds, the number of wounded as a share of surviving veterans has fallen recently, from about 4.4 percent during the World Wars to 1.8 percent in Korea, Vietnam, and Iraq and Afghanistan. This may reflect an increasing mechanization or automation of warfare, or a force reconfiguration toward more support units and fewer combat units, or both. Other things equal, a more limited share of the wounded among surviving veterans should reduce per-capita need and compensation. But a greater intensity of nonfatal harm among wounded survivors, as implied by their increased survival probability, would clearly work against that.

The severity of wounds is no doubt a major determinant of the future survival of veteran cohorts,[12] but the latter is foremost the product of the prevailing mortality environment, which has improved markedly over time. Figure 1 plots survivorship curves for veterans cohorts starting with the War of 1812, where the horizontal axis shows years from the end of the conflict. As mortality rates have fallen in the U.S. in general, survivorship for each successive cohort of veterans has improved. While it took only about 20 years for survivorship to dwindle to half of all veterans from the War of 1812 and the Mexican War, the half life of the Civil War cohort was 40, more than 45 years for veterans of World War I, and higher still for later cohorts. Today the median veteran is expected to live for more than 60 years following the end of hostilities. These survivorship projections roughly match cohort mortality forecasts provided by the Social Security Administration (Bell and Miller, 2005).

[12]Veterans' benefits may also be a determinant of post-service survival. But research in health economics suggests that at least for the average individual at older ages today, causality may run more from health into wealth rather than the reverse (Adams et al., 2003).

4 The budgetary costs of war and veterans

4.1 Annual costs in 2008 dollars

Figures 2, 3, and 4 plot real veterans' costs in 2008 dollars for ten major U.S. wars for each calendar year. Figure 2 shows real costs for the American Revolution, the War of 1812, and the Mexican War, none of which ever exceeded $80 million in 2008 prices in a year. As discussed by Glasson (1918), pensions for Revolutionary War veterans at first were relatively small, limited primarily to officers but also including some with service-related disabilities. The service-pension act of 1818, originally suggested by the Monroe Administration as a response to perceived need, expanded benefits massively and unexpectedly.[13] Spending on Revolutionary War veterans and their survivors fluctuated but remained high until diminishing rapidly after 1850, some 67 years after the end of the conflict. The wars with Britain and Mexico similarly resulted in large outlays with long right tails, but it was not until the General Law pension system of 1862 and subsequent legislation was passed that spending expanded greatly (Glasson, 1918; Linares, 2001).

The Civil War was a watershed event in the development of the modern military compensation system in the U.S., a fact to which Figure 3 attests. The Disability Act of 1890 actually extended benefits to veterans based on length of service, rather than only on specific service-related disabilities (Costa, 1998; Linares, 2001). Under that law, annual spending on Civil War veterans' compensation swelled to almost $4 billion in today's dollars, and all compensation represented almost 30 percent of the federal budget at the time (Costa, 1998, p. 197). Again, these benefits were extremely long-lived, dropping under $1 billion only after 1935, fully 70 years after the conflict.

Benefits for Spanish-American War veterans were limited until expansions in the 1920s

[13] Glasson (1918) discusses this on pages 65–74. Federal budget surpluses following the War of 1812 prompted their actions, but Monroe and others vastly underestimated the number of surviving Revolutionary War veterans. The rapid growth in spending visible in Figure 2 triggered a string of legislative fixes that first restricted and then again expanded benefits.

and 1930s following the creation of the Veterans' Bureau in 1921.[14] The downward spike in benefits and its reversal in the mid 1930s was the result of wrangling between Congress and FDR,[15] presumably over the massive budget deficits of the Great Depression. Spending diminished gradually from a peak of $2 billion in 1939 to less than a quarter billion by 1970.

Figure 4 shows real spending on veterans of World War I and later conflicts. The picture is dominated by the massive spike in benefits on the World War II cohort immediately after hostilities ceased, reaching $60 billion in today's prices in 1947. These short-lived flows, which totaled roughly $6.7 billion in current dollars, reflect the unprecedented educational transfers of the midcentury G.I. Bill (Bound, 2002; Stanley, 2003). These alone accounted for $3.6 billion or about 54 percent of all spending on the World War II cohort in 1947 (OMB, 2009, Table 11.3). Benefits dropped rapidly afterward, reaching a nadir of $16.5 billion in 1956 before climbing to another peak of $37.3 billion in 1975, thirty years after the end of hostilities. The Korean War cohort also saw a massive spike in their benefits around 1956, probably the last year of coverage under the G.I. Bill, which lapsed in 1955 (Institute of Medicine, 2010). Like World War II veterans, their real transfers peaked again around 1975, 23 years after hostilities.

The World War I cohort's peak year of real benefits was probably 1962, some 44 years after the end of the war. The graph depicts another peak in 1971, another 9 years later, but data after 1970 are estimates based only on compensation and pensions by cohort. Still, the uptick measured in 1970 was real.

For the Vietnam cohort, benefits were monotonically increasing almost universally throughout the historical period. I forecast they will peak at just under $30 billion per year around 2020, 45 years after the end of the war. This is because according to the VA's VetPop forecasts, the annual force of mortality only then reaches 3.5 percent, the average annual rate of growth in real costs per capita found in data for that cohort since 1980. First Gulf War costs, which are considerably more uncertain for reasons I discussed in section 2.1, are

[14] *VA History in Brief*, http://www1.va.gov/opa/publications/archives/docs/history_in_brief.pdf
[15] Ibid.

expected to peak around 2045 for the same reason.

4.2 Veterans' costs in present value

The very long-lived nature of veterans' budgetary costs implies that the right way to compare them to short-lived costs of war like military spending is by calculating their present discounted value. For each major war, I deflate spending on veterans in each year past the start of the conflict by a discount factor that reflects the cumulative force of compounded interest measured from the middle year of the conflict. I take as my nominal discount rate the average interest rate on long-term government bonds described in section 2.1 above. This produces a series of present discounted values of future spending on veterans for each conflict in current dollars, which are comparable to the current dollar totals of military spending during the conflict. When comparing different conflicts, I can inflate both of these using the CPI to recover real values in 2008 dollars.

4.2.1 The life cycle of veterans' costs

First, it is useful to examine the time path or life cycle of veterans' spending by constructing the cumulative present value of veterans' spending remaining to be spent as of each year past the end of each conflict. This number can be expressed as a proportion of the total present value of veterans' spending for that conflict. The result is a statistic similar to the survivorship probability measure in a life table. Like survivorship, this statistic reveals how long-lived the costs are, in a present value sense, of treating and compensating veterans of wars.

Figure 5 plots this survivorship series for costs against years since the end of the conflict for each of the 10 major U.S. wars for which I have data and forecasts. There is similarity in that all curves slope upward toward the asymptote at unity, but there is also a considerable amount of heterogeneity in the slopes themselves. The schedules for World War II and the Korean War, at the far left of the figure, are very steeply sloped at first, reflecting the large G.I. Bill disbursements early in the life spans of those cohorts. In both cases, their half lives, where 50 percent of spending has been disbursed, occur relatively quickly, after about 20 years have elapsed. At the other end, spending on veterans from the War of 1812, the Mexican War, and the Spanish American War was all considerably delayed due to the vagaries in development of military pension laws. For these cohorts, half lives were more like 50 or more years. In between these extremes lie the other 5 conflicts, with no clear pattern governing their relative positions. Vietnam and the First Gulf War reach their half lives at 32 and 41 years respectively; World War I reached its at 38 years. Although veterans' survivorship schedules are advancing rightward, as remaining life expectancies increase with mortality declines, the life cycles of costs have not necessarily followed this pattern at all.[16] For all 10 conflicts, the average half life of costs is 37.5 years from the end of hostilities; among the 6 cohorts prior to World War II subject to minimal cost forecasting, the average was 44.2 years.

Compared to the patterns in veterans' survivorship seen in Figure 1, trends in the longevity of veterans' costs follow no clear pattern. This seems odd at first given how the two should be closely related. The differences between them must reflect changes in veteran compensation regimes, which apparently are large enough to overwhelm the effects of monotonically increasing survivorship.[17] In light of this, the shorter life span of benefits following World War II and Korea, while real, is also somewhat misleading. Half lives are shorter because these benefits were front-loaded with massive educational outlays under the G.I. Bill. It would be a mistake to construe such a trend, which may be repeated now under the Post-9/11 G.I. Bill expansion, as indicating a reduction in the net fiscal burden of caring for veterans. Rather, it would represent a net increase in the fiscal burden that also moves its center of gravity forward in time.

[16] By no accident, the two cohorts whose costs follow this pattern are Vietnam and the First Gulf War, no doubt because costs for the latter are entirely estimated based on veterans' survivorship.

[17] If post-service mortality rises with the degree of war wounds, then the trend toward increased survival among the wounded over time could have reduced the half-life of veterans' costs by producing more acutely wounded veterans who die earlier. But the proportion of surviving veterans who were wounded at all has also fallen.

4.2.2 Veterans' costs as a share of total costs

Second, it is revealing to compare the present discounted value of veterans costs associated with military conflict to the direct military costs. Because I am using the same deflator to translate current dollars into real dollars, the results will be independent of whether I inflate historical statistics or not.[18] I present results in billions of 2008 dollars, in order to provide easy comparability to the estimates of Stiglitz and Bilmes (2008).

Table 2 presents historical war costs for the 10 conflicts shown in Figure 5 plus estimates for the ongoing wars in Iraq and Afghanistan produced by Stiglitz and Bilmes. The left side of the table is similar to data presented by Nordhaus (2002), from whom I take the datum on the direct military costs of the First Gulf War. The differences result from my using a later version of the Historical Statistics, in which some updated estimates are provided by Goldin (1980).

The center panel in Table 2 reveals the total and present value of veterans' costs in a variety of formats. In current dollars, veterans' costs literally explode over time, to no great surprise. In real terms, the sum total rises and dips along with the direct costs of military activities, proxying the scope of conflicts. The most useful comparison is the present value of veterans' benefits measured from the midpoint of the war in 2008 dollars, in the third column of the center panel. This number is extremely small for early conflicts, for which appreciable veterans' benefits were a long way off, and considerably larger for more recent conflicts. It reaches $1.4 trillion for World War II, $555 billion for Vietnam, and $372 billion for the First Gulf War. Out of the $3 trillion in costs estimated by Stiglitz and Bilmes (2008), $673 billion represents budgetary veterans' costs.

The rightmost panel in Table 2 shows the total budgetary costs of these eleven major

[18] One could argue that nominal public budgetary costs ought to be deflated using the GDP deflator, because at least in the modern era taxes are raised off of nominal GDP. This logic suggests that from the perspective of measuring the present value of the net tax burden, real direct military costs and real veterans' benefits should be recovered using the GDP deflator. Notwithstanding the large differences in the nature of the federal tax base over time, another problem is that the real value to veterans of veterans' benefits ought to be based off the CPI instead. Without unambiguous theoretical motivations to use different deflators, I choose to apply the CPI to all flows of cash.

U.S. wars, and the share of those total present-value costs attributable to veterans' benefits. The total cost of World War II is almost $6 trillion dollars in today's prices, while the share attributable to veterans' costs is 23.5 percent. The First Gulf War stands out as a very inexpensive military operation that is also associated with a very large amount of veterans' benefits, which account for 80 percent of total costs. This was not unprecedented; the Spanish-American War was also relatively cheap when fought but very expensive in terms of veterans' costs, which account for 78.5 percent of all costs. Across all eleven conflicts, the average share attributable to veterans' costs is 35 percent; for conflicts since World War I, the average is 41 percent.

4.2.3 Relative costs of war and veterans and implicit debt

Finally, it is useful to examine the magnitudes of war costs and participation relative to population, involved personnel, and to GDP. Table 3 reports the share of the resident population involved in each war, the direct military costs and the present value of veterans' costs per involved military personnel, and the ratios to GDP of costs and initial federal debt held by the public.

Participation has varied enormously over these eleven conflicts, ranging from a low of 0.4 percent involved during the Mexican War, to 11.7 percent during World War II. Real costs per soldier have also varied widely and loosely track participation, as one would expect if both measures index the scope of war. But the real costs of the wars in Iraq and Afghanistan per service member are vastly higher than in historical conflicts. Direct military spending per soldier in Iraq or Afghanistan is near the one million dollar mark at three times the quarter million dollars spent per World War II service member. The present value of veterans' costs per OEF/OIF soldier is more than $300,000.

Costs as a share of pre-conflict GDP track the participation rate more closely and provide a better index of scope than do costs per participant. Another natural comparison is between the ratio of war costs per GDP and the ratio of debt held by the public to GDP, which is measured at the beginning and the end of each conflict in the last two columns in Table 3. Other things equal, war costs raise indebtedness, but not necessarily one-for-one.[19] For example, the unprecedented level of direct military spending during World War II, equal to almost three times initial GDP but spread over a period of five years, raised debt held by the public from 36 to 94 percent of GDP.

By contrast, the present value of future veterans' costs as a share of GDP is directly comparable to the debt-to-GDP ratio at the end of each conflict. The former is a measure of implicit debt, the latter explicit debt, both scaled to income. An analogous measure is the unfunded future liabilities of Social Security or Medicare, which respectively are on the order of $5.3 and $13.4 trillion today,[20] or roughly 40 and 90 percent of GDP. The implicit debt associated with veterans' costs has tended to be much smaller, on the order of 4 percent of GDP, except in the cases of the World Wars and the Civil War, after which implicit debts were between 20 and 50 percent of GDP. This analogy is also appropriate for another reason. Like Social Security and Medicare spending, compensation and medical care for veterans represent transfers of resources rather than additions to income. In this regard, the share of total war costs attributable to veterans is likely to understate their net fiscal burden relative to that of direct war costs, because the latter add to GDP.[21]

[19]Military spending is a direct addition to GDP, and although there may be some degree of crowding out, the former raises the latter. But not only would GDP, the denominator, rise and reduce the debt to GDP ratio, but part of military spending will also be self-financing because income is taxed. If the defense spending multiplier is unity and the federal tax take out of GDP is 0.18, for example, then only 82 percent of direct military costs represents unfunded net borrowing.

[20]Board of Trustees, Federal Old-Age and Survivors Insurance and Disability Insurance Trust Funds (2009); Boards of Trustees, Federal Hospital Insurance and Federal Supplementary Medical Insurance Trust Funds (2009).

[21]Pensions, or compensation unrelated to service-connected disability, are taxable, while VA disability compensation is not. This would imply a net negative effect of veterans' transfer payments on the overall tax take. If veterans spend their transfers at a faster rate than other taxpayers, however, there could in theory be a positive effect on taxes via a stimulative "multiplier" effect on national income.

5 War-related costs of injury and death

The budgetary costs of war, which include the costs of compensation and treatment for war-related trauma, are what governments and by extension taxpayers pay. But these transfers may or may not fully compensate veterans and their survivors for war wounds. The system of VA disability compensation, in which service-related disability is scored as a percentage of total disability, is based on the ability to work and calibrated to the present value of future labor market earnings (Institute of Medicine, 2007; Stiglitz and Bilmes, 2008). But the now traditional view in health economics is that the full cost of disability to an individual is reflected in his or her willingness to pay for reductions in risks to life and health. In modern periods, the willingness to pay to avoid death or a particular illness is much larger than is implied by the capitalized value of future wages foregone (Viscusi, 1993; Viscusi and Aldy, 2003). The human costs of warfare therefore hinge on the values of a statistical life and a statistical injury, and not necessarily on VA and military compensation.

Given enough information, it would be possible to characterize and cost out each service-related injury or death for every conflict. In practice, such a strategy faces two impediments. First, there is a lack of consistency in any detailed measures of health status and conditions across cohorts of veterans. For more than one conflict, one would have to cobble together such data from an array of disparate sources. The second problem is that it is difficult to measure service-related health conditions as opposed to all health conditions. Standard health surveys do not ask whether conditions are related to military service; such data presumably is only available through the VA.

Data on specific conditions related to service are no doubt available in some form for many cohorts of veterans from the VA. But a far more expeditious strategy is instead to use survey-level measures of the VA disability rating alone. The measure is designed to quantify service-related poor health as a percentage of total disability, so in principle it measures something akin to a quality-adjusted life. If one is willing to assume that a life spent with x percent VA disability is worth x percent of a disability-free life, then the total gross cost of service-related disability borne by that veteran is x times the value of a statistical life. Stiglitz and Bilmes (2008) use precisely this methodology, applying the VA disability rating to the VSL in order to recover the *social economic costs*, defined as the difference between the gross costs and all disability compensation, of the wars in Iraq and Afghanistan.

In this section, I construct estimates of the costs of injury and death associated with major U.S. wars using this methodology. The two key components are the prevalence of disability and death among veterans, and the value of a statistical life.

5.1 Cohort-specific trends in VA disability ratings

The primary component of the historical costs of disability and death are the relative magnitudes of each among veterans. Deaths are easy to measure while disability is more difficult. Past studies have assumed that all service members who were reported as having "wounds not mortal" in the official military statistics were 50 percent disabled, while no other veterans suffered any disability (Goldin and Lewis, 1975; Glick and Taylor, 2010). For conflicts in the distant past, this assumption is difficult to assess. For recent wars, I can measure self-reported VA disability ratings for veteran cohorts and directly compare those statistics to numbers wounded in action.

Table 4 presents weighted sample statistics from four cross-sectional snapshots taken since 1980: the 1983 Survey of Aging Veterans (SAV), the 1992 and 2001 National Surveys of Veterans (NSV), and the 2008 American Community Survey (ACS). The only dataset that measures the World War I cohort, which on average was born before the 20th century, is the 1983 SAV. Veteras from later conflicts are sequentially picked up in later surveys, ending with the recently released 2008 ACS, which measured 14,588 veterans of the Iraq and Afghanistan era. For each conflict, the first three rows report the VA disability rating averaged over all surviving veterans, the average VA disability rating among veterans with a positive rating, and the share of the cohort with a positive rating. The next four rows list weighted headcounts, the average age of the cohort, and the sample size.

There is a limited degree of uniformity across veteran cohorts in their average VA disability level in these data, which has hovered between 2 and 6 percent disabled. Veterans with a positive rating typically experience about 35 percent disability, while they have accounted for 10–15 percent of their cohort, sometimes less as in the case of the Korean War. But behind this rough average that is immediately evident there is considerable variation over ages and cohorts.[22]

Across all cohorts, there is a clear upward trajectory in the average VA disability rating over the life cycle, which appears to decelerate after age 60 but continues to increase. The exceptions to this pattern arise only when comparing the much smaller 1983 SAV to the later surveys, and they are probably spurious. As revealed by the head counts of disabled veterans, which appear below the prevalence indicators, the aggregate level of need ultimately declines as the cohort dies off over time. Aggregate need drives the real dollars spent on veterans shown in Figures 2–4, which explains the hump-shaped trajectory. But per capita need as indexed here appears to increase continuously throughout age for these cohorts, driven by increases along both extensive and intensive margins. This is the opposite of what one would expect to happen naturally through attrition if mortality rates were increasing in the level of VA disability. That both the prevalence and severity of disability appear to increase within a cohort over time suggests that latent conditions are revealing themselves during the course of aging.

There also is interesting variation across conflicts or cohorts, especially along the extensive margin, or the share of veterans with a positive VA disability rating. Successively younger cohorts of veterans seem to have higher VA disability ratings on average than older cohorts did, both overall and at comparable ages. This appears to be driven more by a greater prevalence of positive ratings within the cohort rather than a higher level or intensity of VA

[22]I recognize that age, time, and cohort effects cannot be independently identified in observational data. But I argue that there are clear theoretical reasons to support the existence of age and cohort effects. Health conditions can often be latent over the life cycle, suggesting that age effects are likely to matter; and cohorts of veterans clearly differ in their exposure to risks because they served in different theaters and used different defensive and offensive military technology.

disability among those with positive ratings. The patterns in VA disability in Table 4 do not match the trends in percent wounded across conflicts that were presented in Table 1. In the two World Wars, the latter was 4.2 percent; in Korea and later, it dropped to 1.8 percent. By comparison, the average VA disability rating has risen, reaching 6.3 percent among Vietnam and First Gulf War veterans, the latter at a far younger age. If VA disability is the gold standard of measurement, it would appear that the incidence of war wounds in the defense department statistics is a poor measure of the average health impact of warfare.

A very similar picture emerges when I examine VA disability among veterans who have served only during peacetime. These statistics are reported in Table 5 for cohorts who served only during three recent interwar periods. Average VA disability ratings for these peacetime cohorts are not zero, although they average only one or two percent rather than up to six. This is because the share with any disability is considerably lower than among war veterans, and never above 8.2 percent in the table. Both the share disabled, and to a lesser extent the intensity of disability among the disabled, rise within these peacetime cohorts as they age, just as within wartime cohorts. The minimum average disability rating across all peacetime cohorts is 0.5 percent.

The evolution of VA disability over the life course, the strong age effects that I argue are in the data, motivate the use of extrapolative techniques to forecast and backcast average VA disability trends. Assuming a floor on the average VA disability rating of 0.5 percent, which is the smallest measure within samples shown in Tables 4 and 5, I extrapolate average VA disability ratings by age for the five wartime cohorts starting with World War II assuming piecewise linear trajectories through age. Figure 6 plots the actual data, shown by the markers, alongside extrapolated values. These estimates should be viewed with skepticism given the small number of cohorts and limited time period of observation. Forecasts for the First Gulf War and the wars in Iraq and Afghanistan are based on few real data points, and it is certainly conceivable that there are upper limits on disability ratings that younger cohorts will simply reach earlier in their lives. But the similar age slopes that emerge across different cohorts in the data are reassuring, as is the fact that Vietnam veterans have remained so different from earlier cohorts.

Strong age effects in the average VA disability rating raise the question of exactly what rate to use in determining the total lifetime impacts of war on the health of a cohort. If there were known bottlenecks in assigning VA disability ratings that drove the age-related trajectory, one could argue that the maximum observed rating is the appropriate measure of lifetime harm. But the delays of several decades apparent in the data seem more likely to have emerged from the latency of health impacts. If latency is important, the lifetime impact on health is arguably best captured by an average of VA disability ratings over all ages, ideally weighted by survivorship. I assume VA disability rates are flat after the levels shown at age 90 in Figure 6, and I apply the survivorship probabilities shown in Figure 1 to recover the following lifetime average VA disability ratings for wartime cohorts, which are also shown in Table 6: World War II, 1.8 percent; Korea, 1.7 percent; Vietnam, 5.2 percent; First Gulf War, 9.8 percent; Iraq and Afghanistan, 9.4 percent.

The paucity of data on VA disability ratings for veterans of conflicts prior to World War II hinders cost estimates for those periods. But with average lifetime VA disability rates for later conflicts, I can estimate the costs of death and disability using assumptions about the historical value of a statistical life.

5.2 Historical trends in the value of a statistical life

Stiglitz and Bilmes (2008) assume the value of a statistical life (VSL) equals \$7.2 million in 2007 dollars, which equals the central estimate of \$6.2 million in 2002 dollars used by the Environmental Protection Agency (Dockins et al., 2004) adjusted for inflation. The earlier estimate was itself an inflation-adjusted update of EPA's earlier assumption of \$4.8 million in 1990 dollars. All these figures fit within the relatively wide range of \$4 to \$9 million implied by U.S. labor market data on wage differentials associated with mortality risks (Viscusi and Aldy, 2003). But is the VSL really fixed in real terms over time, as Stiglitz and Bilmes (2008) and others have assumed? If there is any growth in the VSL over time, it will strongly affect estimates of the private costs of disability and death during historical periods.

Economic theory suggests the VSL ought to depend on the marginal utility of living relative to that of consumption.[23] Two prior studies systematically assess how the VSL varies over space and time. Viscusi and Aldy (2003) conduct a meta-review of the literature on the VSL in U.S. labor market studies since the 1960s and in a cross section of countries. They estimate the income elasticity of the VSL, η_{VSL}, in the range of 0.5 to 0.6. Costa and Kahn (2004), who examine U.S. data between 1940 and 1980, report η_{VSL} to be around 1.5 to 1.7. In an interesting study of the decision to deploy costly military resources in order to reduce casualties, Rohlfs (2006) estimates a VSL in World War II, roughly \$1 million in 2003 dollars, that is consistent with the findings of Costa and Kahn (2004).

[23] The question is how these may vary over time. The former is equal to the lifetime sum of discounted streams of flow utility from consumption, $u(c(t))$, while the latter is $u'(c(t))$. Then the VSL for a particular cohort is given by

$$VSL = \frac{\int_0^T e^{-\rho t} u(c(t))\ dt}{u'(c(t))}, \tag{1}$$

where ρ is the time discount rate and T are years of remaining life. A standard treatment in the literature on the value of life in the aggregate (Nordhaus, 2002; Becker, Philipson and Soares, 2005; Hall and Jones, 2007) is to assume flow utility is isoelastic plus a constant:

$$u(c(t)) = \frac{c(t)^{1-\gamma}}{1-\gamma} + b. \tag{2}$$

If one further assumes a constant interest rate equal to ρ, then optimal consumption is flat over the lifetime at some $\bar{c}$, which is determined by the level of lifetime wealth, and equation (1) simplifies to

$$VSL = \frac{1-e^{-\rho T}}{\rho} \cdot \frac{u(\bar{c})}{u'(\bar{c})} = \frac{1-e^{-\rho T}}{\rho} \cdot \left(\frac{\bar{c}}{1-\gamma} + b\bar{c}^{\gamma} \right). \tag{3}$$

For determining change in the VSL over time, the two additive functions of $\bar{c}$ in equation (3) are important; the other elements are either constant or relatively inconsequential. As discussed by Hall and Jones (2007), the critical issue is the level of γ, which the inverse of the elasticity of intertemporal substitution in consumption, and it is the rate at which the marginal utility of consumption declines. When that rate is high, the marginal utility of consumption falls quickly as consumption rises over time. If γ is sufficiently high that the marginal utility of consumption falls faster than the marginal utility of life, the VSL rises. When γ is low, the reverse is true. And to a first approximation, the consumption elasticity of the VSL, is roughly equal to γ:

$$\eta_{VSL} \equiv \frac{\partial \log VSL}{\partial \log \bar{c}} \approx \gamma.$$

Murphy and Topel (2006) provide a more extensive theoretical treatment and arrive at a similar result.

A problem is that γ is an unknown parameter. Empirical studies, which are typically based on financial data, do not agree on its magnitude, and its value in calibration exercises ranges between 0.5, 1, 2, and can be larger. As a result, it is better to rely on direct estimations of η_{VSL}.

Uncertainty about the magnitude of η_{VSL} is a clear hindrance for studies of the value of health improvements or harms over long historical periods. Such studies have typically assumed $\eta_{VSL} \geq 1$, as reported by Costa and Kahn (2004) and Rohlfs (2006) because such a level is consistent with other microeconometric estimates of parameters and appears to fit historical trends better. For example, Nordhaus (2003) assumes $\eta_{VSL} = 1$ but suspects that is too low given the rising share of GDP that is devoted to health spending; that trend suggests the marginal utility of consumption must be falling faster than the marginal utility of living, hence $\eta_{VSL} > 1$. Murphy and Topel (2006) argue that an array of indirect micro and macro empirical evidence suggests $\eta_{VSL} > 1.33$, and Hall and Jones (2007) make a similar assumption. While the empirical literature does not speak with one voice on what η_{VSL} is, the emerging consensus at least in longitudinal studies seems to be that it is equal to or greater than unity.

Because there is uncertainty about η_{VSL}, I produce two sets of time series of the VSL, one based on the findings of Costa and Kahn (2004) and the other on Viscusi and Aldy (2003). First, I use the estimates reported by Costa and Kahn (2004) of the VSL between 1940 and 1980 and forecast and backcast it using their estimate of $\eta_{VSL} = 1.5$, inflating all into 2008 dollars. These estimates are shown in the third column of Table 6, where the implied VSL ranges from \$93,000 in 1783 to \$1.9 million in 1945 and \$14.9 million in 2008.

Alternatively, I estimate a time series using the results of Viscusi and Aldy (2003), who settle on a median estimate of \$7 million per statistical life in 2000 and an elasticity of $\eta_{VSL} = 0.5$ or 0.6. I inflate the \$7 million figure to 2008 dollars using the CPI, and I backcast and forecast the VSL using $\eta_{VSL} = 0.5$. This time series appears in the sixth column of Table 6. Because the assumed income elasticity is lower, the backcast VSL is considerably higher, \$1.6 million in 1783 and \$5.3 million in 1945. But the forecast is lower than in the Costa and Kahn (2004) series, reaching \$9.2 million in 2008. This is still higher than other recent estimates in which the VSL is assumed to be fixed in real terms, such as the level of \$7.2 million in 2007 assumed by Stiglitz and Bilmes (2008).

5.3 Costs of injury and death in 2008 dollars

The other columns in Table 6 tally the estimated costs associated with death and disability among service members for as many major U.S. wars as I have data. I can place values on lives lost back to the Revolutionary War, but data limitations preclude me from calculating the costs associated with disability for cohorts of veteran who served before World War II. The cost associated with death is the product of the number of war fatalities and the estimated VSL at the end of the war the number of war deaths, which equals the aggregate willingness to pay to avoid them. Similarly, the cost of disability is the product of the number of surviving veterans, the lifetime average VA disability rating estimated for that cohort, and the VSL. The implicit assumption is that being x percent disabled is equivalent to losing x percent of a life.

These costs are very large regardless of which VSL baseline I use. This is because the levels of the VSL always tend to be high regardless of their income elasticity. The cost of World War II deaths ranges from $764 billion to $2.2 trillion, or between roughly 20 and 50 percent of the direct military cost. In the case of the Civil War, the costs associated with deaths are several orders of magnitude greater than the direct military costs. Costs of deaths in Iraq and Afghanistan total between $50 and $80 billion depending on on the VSL series used.

The costs of disability are very large also because the VSL is high, and also because lifetime average VA disability rates among veteran cohorts are high, especially among the Vietnam and later cohorts. Disability among the World War II cohort was less costly than deaths, presumably because the mortality rate was sufficiently high relative to VA disability rates among survivors. In Korea, however, survival had improved enough to push the costs of disability to around two or three times the cost of deaths. This trend has continued. For each of the last three conflicts starting with Vietnam, I estimate the costs of disability to be $2 trillion or more, a figure that dwarfs all associated budgetary costs and is large relative to other recent estimates. By comparison, Stiglitz and Bilmes (2008) estimate the total costs of disability to be between \$250 and \$367 billion,[24] while Wallsten and Kosec (2005) project \$100 billion. If the lifetime average VA disability rate among OEF/OIF soldiers were 1 percent rather than my extrapolation of 9.4 percent, then the costs of statistical injury would total between \$200 and \$300 billion, or about a ninth of the estimates shown in Table 6. If VA disability rates for this cohort were instead to remain at the level of 2.9 percent shown in Table 4, total costs of disability would range between \$550 and \$900 billion.

6 A counterfactual: Peacetime costs

In assessing the costs of war, it is worthwhile to posit a counterfactual scenario in order to gauge costs in relation to alternatives. The difficulty lies in imagining a world without war. An extreme scenario in which no standing army is maintained seems especially far-fetched, but other baselines may seem equally implausible. A useful if perhaps not completely plausible counterfactual is to imagine the U.S. maintaining a peacetime military only. Such a scenario implicitly assumes that the power of deterrence alone could prevent war, which may not be right.

Table 5 reveals that even peacetime veterans claim VA disability, although at much lower average rates because the prevalence of disability is reduced. On average, the peacetime veterans in Table 5 experience disability rates between 2 and 6 times as high as similar wartime veterans in Table 4, with a focal point of about 2.5. It is more difficult to compare VA spending per veteran between wartime and peacetime veterans. But to the extent the Historical Statistics allow the analysis, they reveal a roughly similar story. The ratio of spending per wartime veteran to spending per peacetime veteran averaged about 2.5 for compensation and health spending combined between 1960 and 1970, and 1.9 for compensation alone. And for the entire period from 1960 to 1997, compensation was also about 1.9 times higher for wartime veterans. A factor of 2.5 separating costs per capita seems like a reasonable figure

[24]Here I am counting all the social economic costs listed by Stiglitz and Bilmes (2008) in Table 4.1, minus the cost of deaths, and not including the offsetting disability benefits.

given the evidence on disability and need and on actual transfers.

The other major difference between peacetime and wartime is force strength, which determines the number of veterans produced. Estimates in Table 5 suggest that roughly 250,000 unique veterans are produced per year in peacetime. This rate may have fallen in recent years under the all-volunteer force, but it is roughly consistent with data on annual military accessions during the 1990s.[25] As revealed in Table 1, wartime troop levels vary widely across conflicts. During the wars in Iraq and Afghanistan, there has been no apparent increase in force strength above peacetime levels, although reservists and National Guard have been utilized to an unprecedented degree. Excluding the most recent war, a reasonable baseline is that a wartime year produces a million veterans, or 4 times as many as a peacetime year. Combining the factor of 2.5 from the difference in per capita benefits with the four-fold increase in veterans yields a difference of a factor of 10 between wartime and peacetime veterans' costs.

By comparison, real direct military spending on recent wars has averaged about $125 billion per year, equal to roughly 25 percent of the average real defense budget over the past two decades. That is, each year of war raises direct military spending by 25 percent. The direct costs of warfare can certainly be high, as evidenced by the accumulated total for the wars in Iraq and Afghanistan, which currently exceeds a trillion dollars over 9 years. But the component of military costs that is most sensitive to military action actually appears to be future veterans' compensation and benefits.

This result would be bolstered if the total costs were expanded to include any uncompensated costs of injury and death that are borne by veterans. The sensitivity of veterans' costs to warfare is also more salient because direct military spending raises GDP and thus lowers its net fiscal impact, while the same may not be true for veterans' benefits.

[25]These data, reported in Table 584 of the 2000 Statistical Abstract of the U.S., show first enlistments at about 180,000 per year and reenlistments around 190,000 during the 1990s. Considering that the overall force size was roughly stationary during this period, these statistics suggest that the annual production of veterans was around 200,000.

7 Conclusion

Since the Civil War, at least a third of the federal budgetary costs associated with warfare have been decidedly long-lived. Direct military spending still accounts for the majority of war-related spending, but veterans' benefits represent a significant minority that follows a very different life cycle. In this paper, I have shown that as much as 80 percent of the total present value of U.S. war spending in a conflict has been allocated to veterans' compensation and benefits, which are spread out over the relatively long remaining life spans of veterans and their survivors. Even for short, seemingly cheap engagements like the Spanish American War or the more recent First Gulf War, the unfunded liability of future veterans' benefits looms as a significant fiscal burden.

The half life of the present value of veterans' costs tends to be 30 years or more. The front-loading of benefits through educational subsidies like the G.I. Bill tends to reduce the half life of costs, but the net effect of such an expansion is to raise the fiscal burden, not reduce it. The committing of troops to a war zone has lasting implications for fiscal policy in addition to short-term impacts on the economy and tax revenues via direct military spending. Depending on the scope of the conflict, the unfunded obligation to pay future veterans' benefits starting from the end of the conflict can range from 5 to 50 percent of GDP. This is a very large commitment.

It is less clear what the net effects of transfers to veterans and their dependents may be. As opposed to military purchases, transfers do not affect income unless the propensity to spend them is higher than it is among taxpayers. At worst, higher tax rates needed to fund transfers are disincentives to work and save that may have a depressing effect on GDP. At its root, veterans' spending is designed either to compensate for service-related disability or for time served, or to treat injuries. One of the open questions is to what extent veterans are compensated for their injuries. Estimates of the private cost of war-related injuries and deaths seem to imply there are many uncompensated wounds of war. Part of this is due to high estimates of the value of a statistical life, and part is due to high VA disability rates among recent cohorts of veterans.

This study has omitted any costs of war associated with the loss of civilian life or the destruction of capital. Nor has it assessed the costs borne by opposing sides in conflicts nor the costs of military inaction. As a result, I have little to say about the calculus of military conflict that might lead governments to war or peace, which is a clear gap in our knowledge and a subject of much interesting research Blattman and Miguel (2010). My goals have been to illustrate the life cycle of veterans' costs and assess their fiscal implications, which are large.

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Table 1: Participants, deaths, and wounded in major U.S. wars

Conflict	Personnel	Killed	Wounds not mortal	Surviving veterans	Wounded as a share of: Personnel	Killed	Survivors
Revolutionary Wars (1775-1783)	217,000	4,435	6,188	212,565	0.029	1.395	0.029
War of 1812 (1812-1815)	286,730	2,260	4,505	284,470	0.016	1.993	0.016
Mexican War (1846-1848)	78,718	13,283	4,152	65,435	0.053	0.313	0.063
Civil War (1861-65)	3,277,556	622,511	478,968	2,655,045	0.146	0.769	0.180
Confederate	1,064,193	258,000	197,087	806,193	0.185	0.764	0.244
Union	2,213,363	364,511	281,881	1,848,852	0.127	0.773	0.152
Spanish American War (1898)	306,760	2,446	1,662	304,314	0.005	0.679	0.005
World War I (1917-1918)	4,734,991	116,516	204,002	4,618,475	0.043	1.751	0.044
World War II (1941-1945)	16,112,566	405,399	671,846	15,707,167	0.042	1.657	0.043
Korea (1950-1953)	5,720,000	36,576	103,284	5,683,424	0.018	2.824	0.018
Vietnam (1964-1972)	8,744,000	58,200	153,303	8,685,800	0.018	2.634	0.018
First Gulf War (1990-1991)	2,225,000	383	467	2,223,038	0.000	1.219	0.000
Iraq and Afghanistan (OEF/OIF) (2001-)	2,100,000	5,376	36,906	2,094,624	0.018	6.865	0.018

Sources: For the Korean War and earlier, Historical Statistics of the United States (Carter et al., 2006); for Vietnam and later, the Statistical Information Analysis Division (SIAD) of the Defense Manpower Data Center. Personnel are the number serving worldwide during the conflict. For the First Gulf War, deaths exclude 1,565 non-theater deaths. Surviving veterans are calculated as the difference between personnel and killed.

Table 2: Budgetary costs of major U.S. wars

Conflict	Direct miliary costs: Millions of current dollars	Direct miliary costs: Billions of 2008 dollars	Historical and projected veterans' benefits: Millions of current dollars	Historical and projected veterans' benefits: Billions of 2008 dollars	Historical and projected veterans' benefits: Present value in billions of 2008 dollars	Total war costs in billions of 2008 dollars	Veterans' benefits share
Revolutionary Wars (1775-1783)	100	1.8	70	762	0.1	1.8	0.032
War of 1812 (1812-1815)	89	1.1	49	483	0.0	1.1	0.022
Mexican War (1846-1848)	82	2.1	64	662	0.2	2.4	0.091
Civil War (1861-65)	3,334	57.1					
Confederate	1,032	17.7					
Union	2,302	39.5	8,576	75,962	30.2	69.6	0.433
Spanish American War (1898)	270	7.0	5,767	27,895	25.5	32.5	0.785
World War I (1917-1918)	32,700	466.3	96,181	259,279	305.7	771.9	0.396
World War II (1941-1945)	360,000	4,480.3	542,308	742,833	1,373.1	5,853.4	0.235
Korea (1950-1953)	50,000	406.2	201,822	178,189	215.6	621.8	0.347
Vietnam (1964-1972)	140,600	869.9	1,806,737	648,245	554.8	1,424.7	0.389
First Gulf War (1990-1991)	61,000	96.4	2,259,350	407,165	371.9	468.3	0.794
Iraq and Afghanistan (OEF/OIF) (2001-)	1,559,000	1,559.0			673.3	2,232.3	0.302

Sources: Historical Statistics of the United States (Carter et al., 2006), Nordhaus (2002), Stiglitz and Bilmes (2008), and author's calculations. For the last, see the text. The present values of veterans' benefits are calculated from the perspective of the midpoint of the conflict. From that point, future nominal veterans' benefits are deflated by the cumulative force of nominal discounting. Then the total present value at the midpoint is inflated to 2008 dollars using the historical CPI from the Historical Statistics. Nominal and real dollar totals for veterans' costs paid by the former Confederate states following the Civil War exist in principle but are currently unavailable. Those for OEF/OIF are not reported by Stiglitz and Bilmes.

Table 3: Relative budgetary costs and impacts of major U.S. wars

Conflict	Personnel per resident population	Ratio to personnel: Direct military costs in 2008 dollars	PDV of veterans' costs in 2008 dollars	Ratio to GDP: (measured at) Direct military costs (start)	PDV of veterans' costs (end)	Initial federal debt (start)	Final federal debt (end)
Revolutionary Wars (1775-1783)	0.077	8,113	267	0.589	0.014		
War of 1812 (1812-1815)	0.035	3,807	87	0.107	0.002	0.061	0.137
Mexican War (1846-1848)	0.004	27,232	2,723	0.040	0.003	0.008	0.018
Civil War (1861-65)	0.096	17,434		0.714	0.211	0.017	0.239
Confederate	0.114	16,613		0.221			
Union	0.090	17,828	13,632	0.493	0.211		
Spanish American War (1898)	0.004	22,779	83,182	0.016	0.059	0.074	0.074
World War I (1917-1918)	0.045	98,469	64,559	0.628	0.296	0.040	0.115
World War II (1941-1945)	0.117	278,062	85,218	2.841	0.499	0.359	0.942
Korea (1950-1953)	0.036	71,020	37,695	0.170	0.069	0.736	0.570
Vietnam (1964-1972)	0.044	99,482	63,450	0.212	0.074	0.384	0.252
First Gulf War (1990-1991)	0.009	43,338	167,134	0.011	0.039	0.387	0.414
Iraq and Afghanistan (OEF/OIF) (2001-)	0.007	742,381	320,619	0.152	0.047	0.329	

Sources: See the notes to Tables 1 and 2. Prior to 1940, debt is federal public debt, from Historical Table Ea587; since 1940, it is federal debt held by the public, from Historical Table Ea728. GDP and debt are measured either at the beginning or end of each conflict. The Spanish American War began and ended in the same year.

Table 4: VA disability ratings among wartime veterans

		Dataset and year			
		SAV	**NSV**	**NSV**	**ACS**
Conflict	**Measure**	**1983**	**1992**	**2001**	**2008**
World War I	Average VA disability, all survivors	4.1			
(1917-1918)	Average VA disability given positive rating	57.3			
	Share with a positive rating	7.1			
	Veterans with a positive rating	*4*			
	All surviving veterans	*56*			
	Average age	87.1			
	Sample size	56			
World War II	Average VA disability, all survivors	4.4	3.6	4.0	4.4
(1941-1945)	Average VA disability given positive rating	34.0	32.1	32.8	35.5
	Share with a positive rating	12.8	11.3	12.2	12.4
	Veterans with a positive rating	*356*	931,480	629,282	329,148
	All surviving veterans	*2779*	8,224,585	5,149,093	2,661,782
	Average age	63.1	69.5	78.0	84.4
	Sample size	2,779	4,016	4,565	32,692
Korea	Average VA disability, all survivors	4.7	1.9	3.4	3.6
(1950-1953)	Average VA disability given positive rating	42.9	29.3	34.8	34.9
	Share with a positive rating	11.0	6.5	9.7	10.3
	Veterans with a positive rating	*12*	283,663	354,050	270,209
	All surviving veterans	*109*	4,350,228	3,641,419	2,612,820
	Average age	56.2	59.6	69.0	75.9
	Sample size	109	2,111	3,085	33,342
Vietnam	Average VA disability, all survivors		2.7	5.3	6.3
(1964-1972)	Average VA disability given positive rating		29.4	35.7	42.0
	Share with a positive rating		9.2	15.0	15.0
	Veterans with a positive rating		778,129	1,252,556	1,100,773
	All surviving veterans		8,477,848	8,361,037	7,358,856
	Average age		44.0	53.5	60.4
	Sample size		3,393	7,063	87,203
First Gulf War	Average VA disability, all survivors			4.8	6.3
(1990-1991)	Average VA disability given positive rating			29.1	35.4
	Share with a positive rating			16.6	17.7
	Veterans with a positive rating			494,997	626,495
	All surviving veterans			2,989,579	3,534,460
	Average age			32.8	38.6
	Sample size			2,129	33,718
Iraq and Afghanistan	Average VA disability, all survivors				2.9
(OEF/OIF)	Average VA disability given positive rating				33.1
	Share with a positive rating				8.6
(2001-)	Veterans with a positive rating				148,559
	All surviving veterans				1,725,203
	Average age				27.4
	Sample size				14,588

Sources: Author's calculations from data in the 1983 Survey of Aging Veterans (SAV), the 1992 and 2001 National Surveys of Veterans (NSV), and the 2008 American Community Survey (ACS). Veterans of multiple wars or periods are counted as belonging to the earliest war. The 1983 SAV did not have sample weights but was designed to be representative; *italics* denote unweighted raw counts of veterans in the survey.

Table 5: VA disability ratings among peacetime-only veterans

		Dataset and year		
		NSV	NSV	ACS
Conflict	**Measure**	**1992**	**2001**	**2008**
Between WWII and Korea	Average VA disability, all survivors	0.5	0.7	1.6
(1947-1950)	Average VA disability given positive rating	21.8	27.8	29.0
	Share with a positive rating	2.5	2.4	5.6
	Veterans with a positive rating	1,291	1,031	9,438
	All surviving veterans	52,033	42,792	167,376
	Average age	61.8	71.5	78.9
	Sample size	25	30	2,009
Between Korea and Vietnam	Average VA disability, all survivors	0.6	1.2	1.4
(1955-1964)	Average VA disability given positive rating	25.0	34.8	28.7
	Share with a positive rating	2.4	3.4	4.8
	Veterans with a positive rating	53,798	74,280	115,482
	All surviving veterans	2,275,898	2,188,335	2,418,879
	Average age	53.4	62.8	69.4
	Sample size	744	1,473	30,838
Between Vietnam and First Gulf War	Average VA disability, all survivors	1.1	2.8	2.8
(1975-1990)	Average VA disability given positive rating	21.4	34.8	34.4
	Share with a positive rating	5.3	8.2	8.2
	Veterans with a positive rating	190,966	221,610	251,184
	All surviving veterans	3,631,572	2,706,919	3,080,714
	Average age	30.0	40.3	47.3
	Sample size	1,149	1,624	264,692

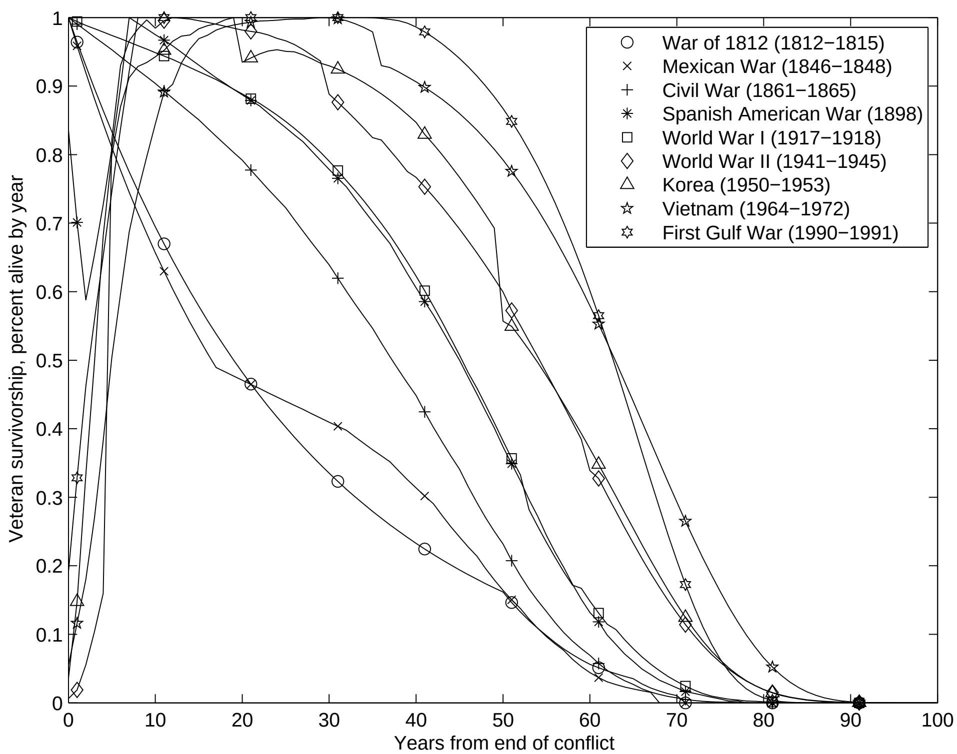
Sources: Author's calculations from data in the 1992 and 2001 National Surveys of Veterans (NSV), and the 2008 American Community Survey (ACS). Veterans of multiple wars or periods are counted as belonging to the earliest war. For example, all veterans identified as belonging to the period between the Korean and Vietnam wars served then but could not have served during any conflict nor during any earlier peacetime period.

Table 6: Costs of death and injury resulting from major U.S. wars

			Value of Statistical Life (VSL) from Costa and Kahn (2004)			Value of Statistical Life (VSL) from Viscusi and Aldy (2003)		
Conflict	**GDP per capita in 2008 dollars**	**Lifetime average VA disability rating**	**VSL in 1,000's of 2008 dollars**	**Costs of death billions of 2008 dollars**	**Costs of disability billions of 2008 dollars**	**VSL in 1,000's of 2008 dollars**	**Costs of death billions of 2008 dollars**	**Costs of disability billions of 2008 dollars**
Revolutionary Wars (1775-1783)	1,516		93	0.4		1,612	7.1	
War of 1812 (1812-1815)	1,902		131	0.3		1,805	4.1	
Mexican War (1846-1848)	2,519		199	2.6		2,078	27.6	
Civil War (1861-65)	3,147		278	173.1		2,322	1,445.5	
Confederate	3,147		278	71.7		2,322	599.1	
Union	3,147		278	101.3		2,322	846.4	
Spanish American War (1898)	5,317		610	1.5		3,018	7.4	
World War I (1917-1918)	7,628		1,049	122.2		3,615	421.2	
World War II (1941-1945)	16,542	1.8	1,885	764.2	532.9	5,324	2,158.3	1,505.2
Korea (1950-1953)	16,910	1.7	2,353	86.1	227.3	5,383	196.9	520.1
Vietnam (1964-1972)	25,486	5.2	6,499	378.2	2,935.3	6,608	384.6	2,984.6
First Gulf War (1990-1991)	36,215	9.8	9,483	3.6	2,067.4	7,877	3.0	1,717.3
Iraq and Afghanistan (OEF/OIF) 2001-	49,021	9.4	14,935	80.3	2,940.6	9,165	49.3	1,804.5

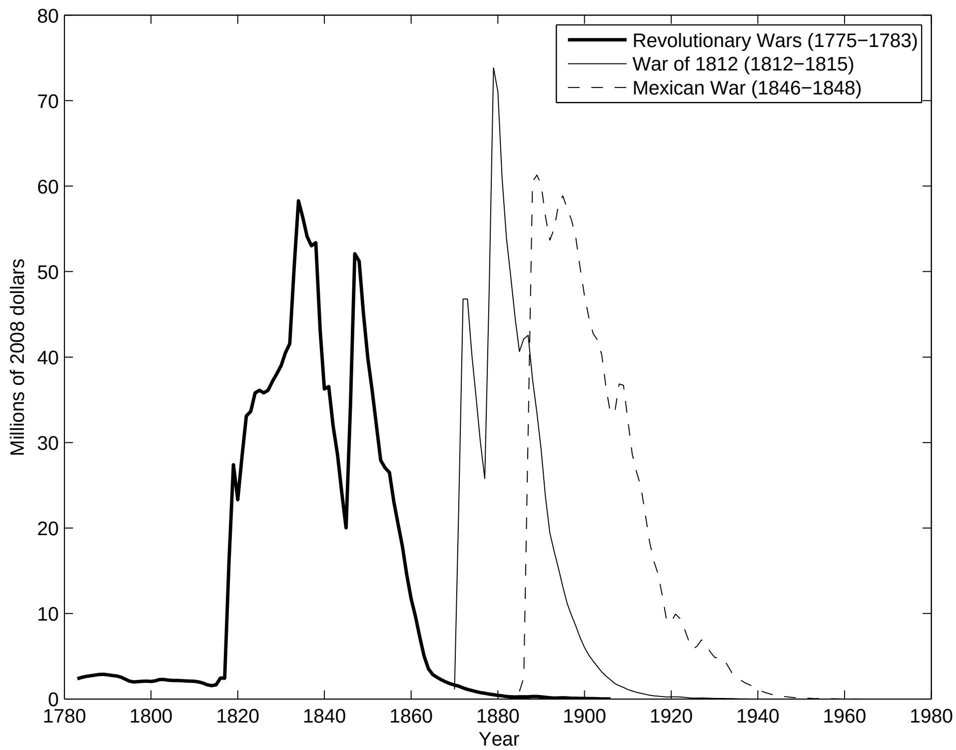
Sources: See earlier tables. Income (GDP) and the value of a statistical life (VSL) are measured at the final year of the conflict. I specify two alternative time series of the VSL by extrapolating from the results of Costa and Kahn (2004) or Viscusi and Aldy (2003). Costa and Kahn (2004) measure the VSL directly for the U.S. between 1940 and 1980; I geometrically interpolate the VSL for intervening years, and I forecast from 1980 and backcast from 1940 using the GDP series and their preferred estimate of the income elasticity of the VSL, $\eta_{VSL} = 1.5$. Viscusi and Aldy (2003) place the median estimate of the VSL at $7 million in current collars in the year 2000 and recover $\eta_{VSL} = 0.5$ based on their meta-analysis. I forecast and backcast their VSL from 2000 using the GDP series and $\eta_{VSL} = 0.5$. Lifetime average VA disability ratings apply to the entire cohort of surviving veterans (not just those injured) and are based on data and extrapolations shown in Table 4 and Figures 1 and 6 and as described in the text. The costs of death are the product of killed and the VSL. The costs of disability are calculated as the product of surviving veterans, the VSL, and the lifetime average VA disability rating.

Figure 1: The life cycles of veterans of major U.S. wars



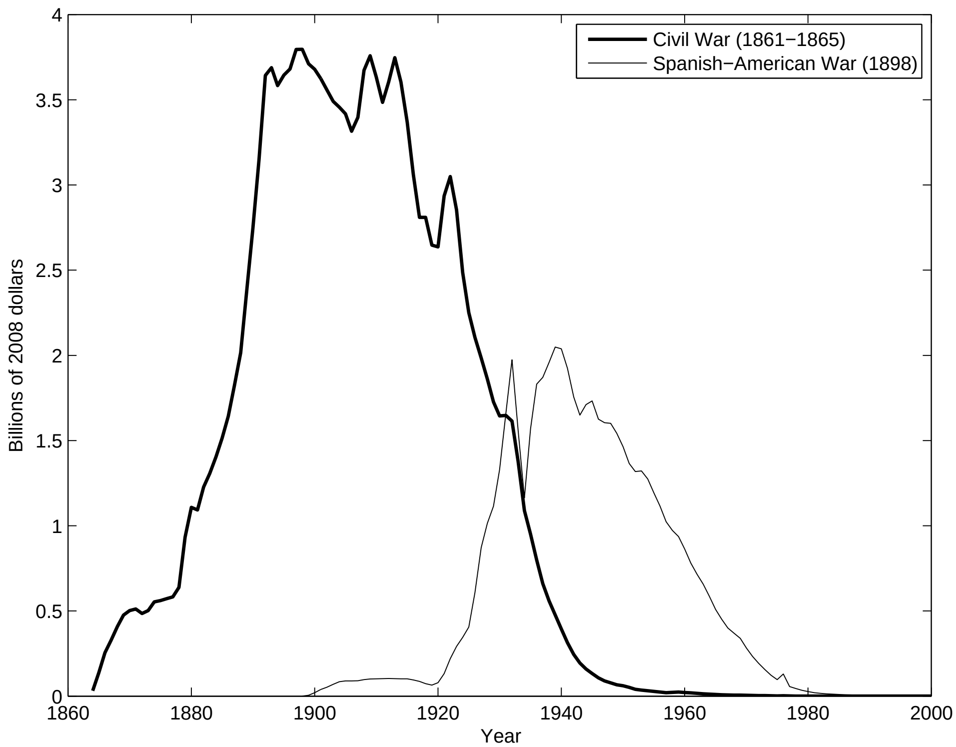
Notes: Data are the proportion of veterans surviving each year by period of service, constructed as the ratio of veterans in the given year divided by the maximum over all years. Some survivorships are less than unity because conflicts are ongoing. For the Spanish American War, veteran population counts are volatile for unknown reasons. The sources are Tables Ed 245–261 in the *Historical Statistics of the United States* (Carter et al., 2006), and projections from the VA's VetPop 2007 model. Prior to 1940, data are reported only every 5 years or less and are loglinearly interpolated. Unless given in the data, initial populations are equal to surviving war participants as shown in Table 1.

Figure 2: Real spending on veterans of major U.S. wars, 1783-1860



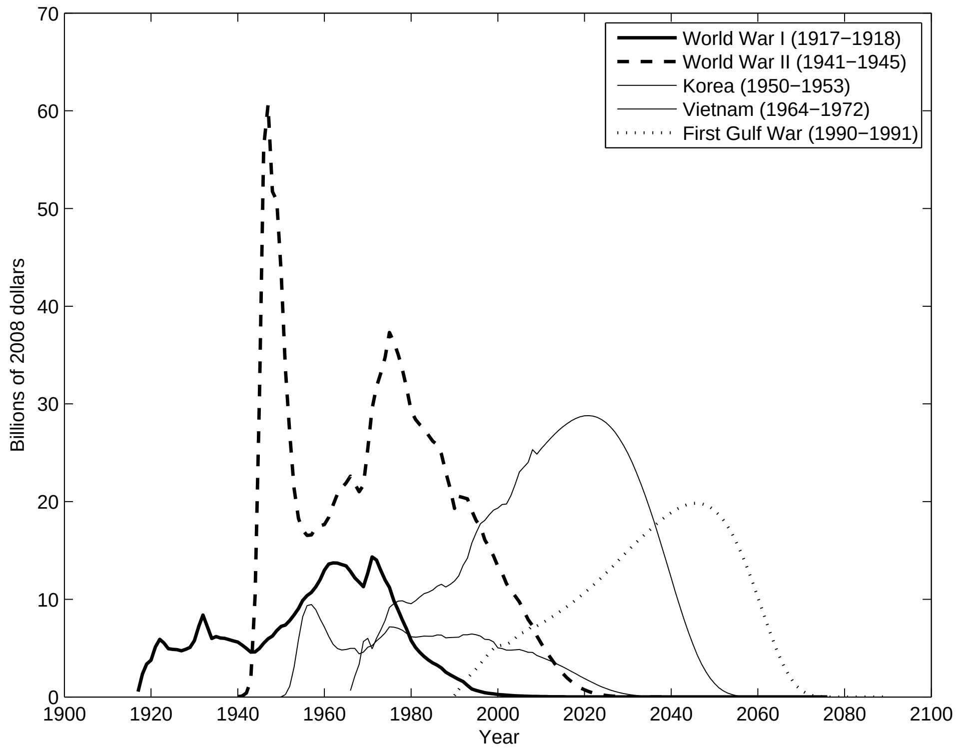
Notes: Data are nominal spending on veteran cohorts deflated or inflated by the CPI to produce 2008 dollars. The sources are Tables Ed 324–336 and Cc 1–2 in the *Historical Statistics of the United States* (Carter et al., 2006).

Figure 3: Real spending on veterans of major U.S. wars, 1861-1917



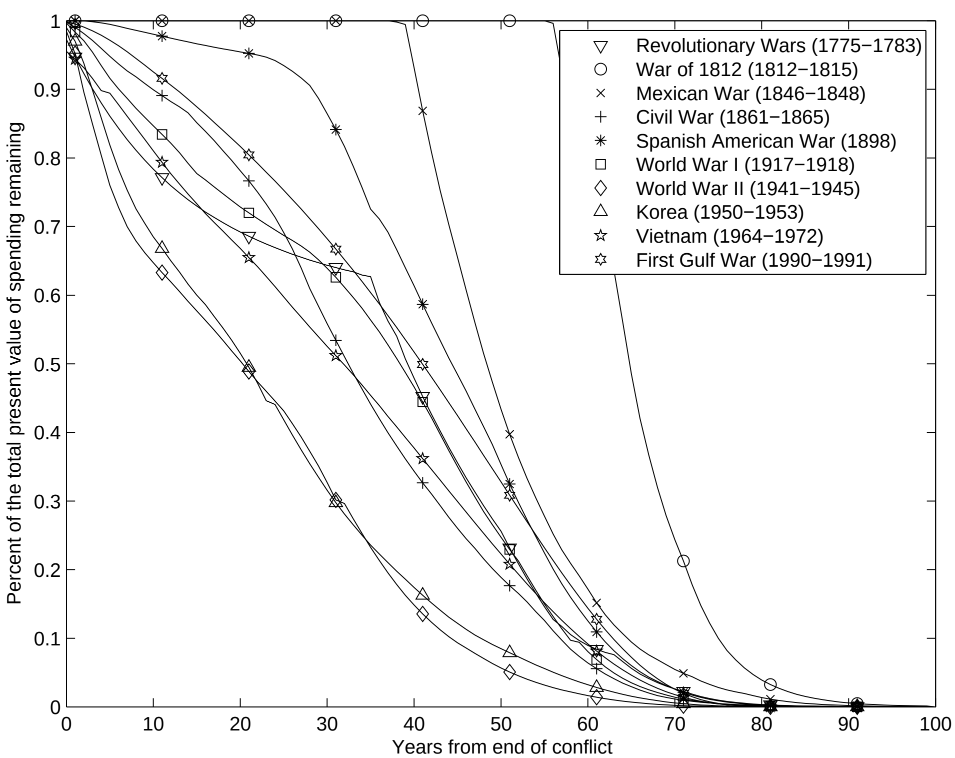
Notes: Data are nominal spending on veteran cohorts deflated or inflated by the CPI to produce 2008 dollars. The sources are Tables Ed 324–336 and Cc 1–2 in the *Historical Statistics of the United States* (Carter et al., 2006).

Figure 4: Real spending on veterans of major U.S. wars since 1918



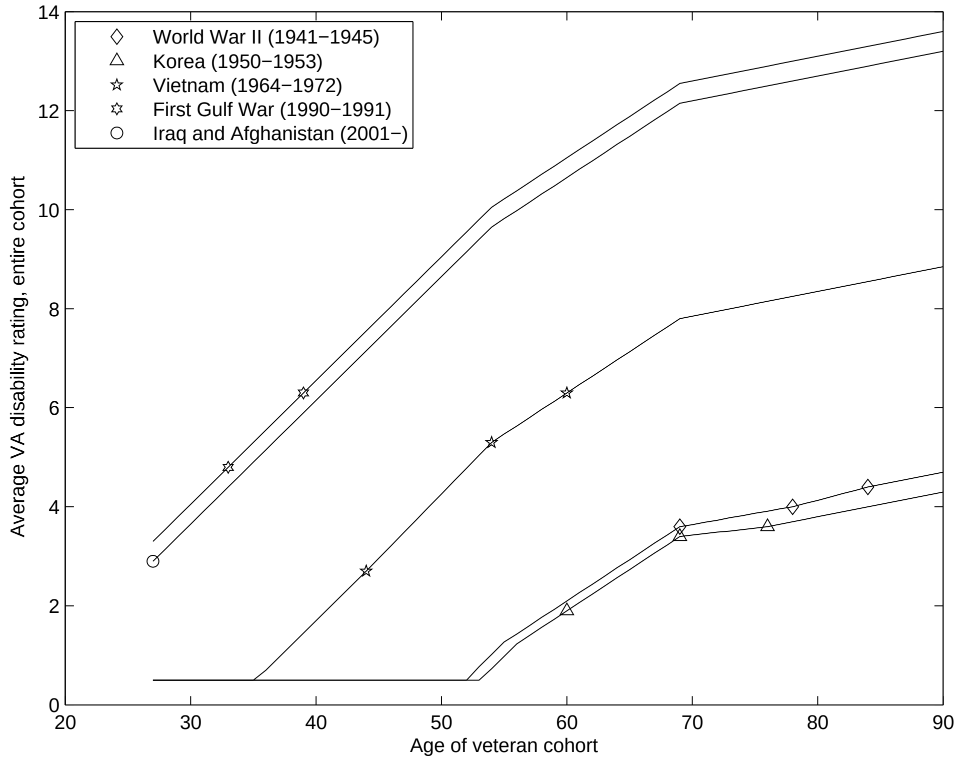
Notes: Data are nominal spending on veteran cohorts deflated or inflated by the CPI to produce 2008 dollars. The sources are Tables Ed 311–323, Ed 324–336, Ed 351–371 and Cc 1–2 in the *Historical Statistics of the United States* (Carter et al., 2006), and author's calculations and forecasts as described in the text.

Figure 5: The life cycles of present-value veterans' costs for major U.S. wars



Notes: The data show at each year following the end of hostilities the percent of the total present value of past, present and future veterans' costs associated with the conflict that remain to be paid out. For example, a figure of 0.5 in year 20 means that 20 years after the conflict, half of the total present value of costs have been paid out. Present values are calculated from the perspective of the end of the conflict. For sources, see the text.

Figure 6: Trajectories of average VA disability ratings among cohorts since World War II



Notes: Statistics are the average VA disability rating within a veteran cohort. Actual data are shown by the markers and are taken from Table 4. The rest of the data are extrapolated by assuming piecewise linear age effects are common across all cohorts, fixed cohort effects, and a floor on VA disability of 0.5 percent, the minimum within samples shown in Tables 4 and 5.