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The Impact of Disability Benefits on Labor Supply: Evidence from the VA's Disability Compensation Program†

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Combining administrative data from the US Army, Department of Veterans Affairs, and Social Security Administration, we analyze the effect of the VA's Disability Compensation (DC) program on veterans' labor force participation and earnings. We study the 2001 Agent Orange decision, a unique policy change that expanded DC eligibility for Vietnam veterans who served in theater but did not expand eligibility to other veterans of this era, to assess the causal effects of DC enrollment. We estimate that benefits receipt reduced veterans' labor force participation by 18 percentage points, though measured income net of transfer income rose on average. (*JEL* H51, I12, I18, J14, J22, J28, J31)

The United States' federal government provides income protection to individuals with disabilities through the Social Security Disability Insurance (SSDI) and Supplemental Security Income (SSI) programs. More than 13 million disabled adults were enrolled in one or both of these programs in 2014 and benefits paid in that year were nearly $200 billion. A substantial literature investigates whether the low employment rates among program recipients reflect the effects of the programs or if instead SSDI and SSI simply provide support to individuals who would not otherwise be working. Estimating the effects of these two federal programs has been difficult because the eligibility rules and benefit formulas are uniform nationally. As a result, there is no natural non-eligible group to use as a basis for comparison.

A third major disability program in the US is available only to veterans of military service. Administered by the US Department of Veterans Affairs (VA), the Disability

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Compensation (DC) program pays benefits to veterans with medical conditions that resulted from their military service. Nearly 4 million veterans received $54 billion in DC benefits in 2014, making total DC payments equivalent to total SSI payments in the same year (US Department of Veterans Affairs 2015 and US Social Security Administration 2015). Throughout the twentieth century, the DC program's medical eligibility criteria and potential benefits were the same for all military veterans. But in the summer of 2001, the VA expanded the medical eligibility criteria for almost half of Vietnam-era veterans while leaving the program unchanged for other veterans. This represented the first significant change to a federal disability program in the United States that applied to one clearly defined group of adults but not to another in the same age range.

The impetus for this change was a 2000 Institute of Medicine study that linked exposure to Agent Orange and other herbicides used by the US military during the Vietnam War to the onset of Type 2 Diabetes. As a result, diabetes was added to the list of covered conditions for Vietnam-era veterans who had served "in theatre" in Vietnam, Cambodia, or Laos during the conflict. Vietnam-era veterans who did not serve in theatre were unaffected by this change. While the share of Vietnam-era veterans enrolled in the DC program had been trending up gradually prior to 2001, the adoption of the Agent Orange policy in 2001 coincided with a sharp acceleration in the fraction of Vietnam-era veterans receiving DC benefits (Figure 1). By 2014, more than 18 percent of Vietnam-era veterans were receiving DC benefits. No similar changes in rates of DC enrollment occurred for veterans from earlier service eras.[1]

The VA's adoption of the Agent Orange policy offers an unusual research opportunity: almost three decades after the end of the Vietnam War, veterans who served in theatre were unexpectedly granted presumptive eligibility for financially significant DC benefits without a precipitating change in health. Our analysis exploits the contrast in expanded benefits eligibility between in-theatre and not-in-theatre veterans to study the impact of benefits receipt on veterans' labor supply. Adopting the terminology used by the military, we distinguish among "boots on the ground" (BOG) Vietnam-era veterans—the veterans directly affected by the Agent Orange policy—and "not on ground" (NOG) veterans, whose DC benefit eligibility was not expanded. We analyze unique administrative data for a sample of more than 4 million US Army veterans to compare the evolution of labor market outcomes among BOG veterans to other Vietnam-era veterans who did not serve in theatre during the Vietnam conflict (NOG). By using other Vietnam-era veterans as our comparison group, we account for the possibility that veterans would have retired sooner (or later) than nonveterans for reasons unrelated to the DC program. Data prior to 2001 allows us to account for possible differential trends between BOG and NOG veterans.

[1] Recent veterans account for an even larger fraction of the growth in DC enrollment over the past 15 years. The number of Gulf War-era veterans enrolled in DC increased from 0.32M in 2000 to 1.68M in 2014, while the number of Vietnam-era veterans enrolled in DC increased from 0.74M to 1.32M during the same timeframe. By comparison, the number of DC recipients from other eras (mostly WWII, Korean, and Peacetime-era veterans) declined from 1.24M to 0.96M (US Department of Veterans Affairs 2001 and 2015). See Duggan, Rosenheck, and Singleton (2010) for a comparison of Vietnam veterans to those from earlier service eras.

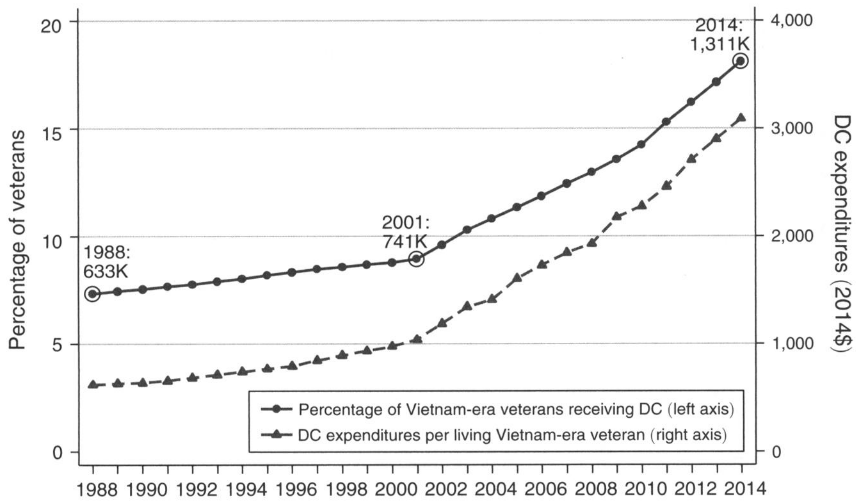

Figure 1. Number and Percentage of Veterans Enrolled in DC

Notes: This figure reports the percentage of Vietnam-era veterans enrolled in the Veterans Disability Compensation (DC) program (left axis) and annual DC Expenditures per living veteran (right axis). The numbers above the first series indicate the number of Vietnam-era veterans enrolled in DC in 1988, 2001, and 2014.

Source: Prior to 1999, all data is from Annual Statistical Abstracts of the United States. From 1999 through 2014, annual DC enrollment information is from Veterans Benefits Administration Annual Reports. The annual number of living veterans is from VetPop2007, VetPop2010, and VetPop2014.

A large body of research, surveyed in Bound and Burkhauser (1999), investigates the effects of the SSDI and SSI programs on labor supply and other outcomes.[2] There has been much less research on the VA's Disability Compensation program. Autor and Duggan (2007); Autor, Duggan, and Lyle (2011); and Coile, Duggan, and Guo (2015) use data from the Current Population Survey (CPS) to explore how labor force participation changed for male Vietnam-era veterans relative to similarly aged nonveteran males after the 2001 policy change. All three studies demonstrate a significantly larger decline in labor force participation among Vietnam-era veterans in the post-2001 period, though their confidence intervals are compatible with a wide range of effect sizes.[3]

A broad concern with this body of evidence is that veterans might retire sooner than nonveterans for reasons unrelated to the DC program. Using the Vietnam-era draft lottery as an instrumental variable for Vietnam-era military service, Angrist, Chen, and Frandsen (2010) estimate that employment was lower and transfer income receipt was higher among low-skilled veterans than among low-skilled nonveterans.

[2] Absent a natural non-eligible group to use as a basis for estimating the causal effect of SSDI, recent research has used variation in the propensity to award disability benefits across disability examiners (Maestas, Mullen, and Strand 2013; Autor et al. 2015) and administrative law judges (French and Song 2014). Our paper is closer in spirit to Gruber (2000), who analyzes the impact of disability benefits on labor supply in Canada in the 1980s and 1990s by contrasting Quebec (no expansion of benefits) with the rest of Canada (expanded benefits).

[3] Duggan, Rosenheck, and Singleton (2010) use five years of data from the Veterans' Supplement of the CPS to compare changes in labor force participation among Vietnam veterans who served in theater and other Vietnam-era veterans. Given the small sample size, their estimates are very imprecise, as their confidence interval includes the full range of possible effect sizes (zero effect or a one-for-one reduction in labor force participation).

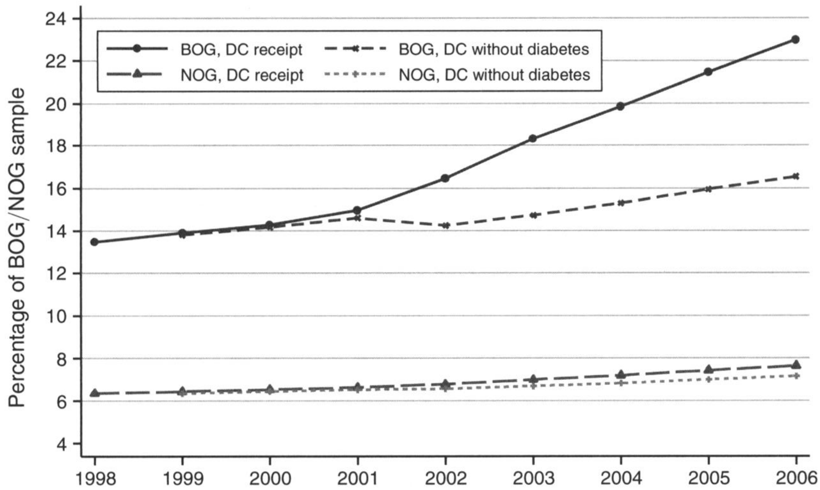

Figure 2. Percentage of BOG and NOG Veterans Enrolled in DC

Notes: This figure reports the annual percentage of BOG and NOG veterans enrolled in DC between 1998 and 2006. "BOG, DC without diabetes" reports the percentage of veterans in the BOG sample who were enrolled in DC but did not receive benefits for diabetes. "NOG, DC without diabetes" reports the percentage of veterans in the NOG sample who were enrolled in DC but did not receive benefits for diabetes. The small drop in BOG veterans enrolled in DC but without a diabetes award between 2001 and 2002 occurs because some BOG veterans who enrolled in DC prior to 2001 received benefits for diabetes after the policy change.

They hypothesize that the lower employment rate of Vietnam-era veterans is due to the availability of Veterans Disability Compensation benefits. In related work on the labor supply of veterans, Boyle and Lahey (2010) study the expansion of the Veterans Health Insurance program to non-disabled veterans in the mid-1990s to analyze changes in labor force participation stemming from increased real incomes and reductions in "job lock."

Using individual-level data from the US Department of Veterans Affairs, we document that DC receipt and enrollment growth were higher among BOG than NOG veterans prior to 2001, but these gaps were relatively stable. After 2001, however, the rate of DC enrollment grew much more rapidly among BOG veterans, as shown in Figure 2. Between 2000 and 2006, the ratio of DC receipt among BOG relative to NOG veterans rose from approximately two-to-one to three-to-one: almost one-in-four BOG veterans in our analysis sample received DC benefits in 2006 versus one-in-twelve among veterans in our NOG sample. This trend break was driven primarily by a sharp increase in the number of diabetes awards to BOG veterans. In fact, DC enrollment growth among BOG veterans shows essentially no break in trend when one excludes DC recipients with a diabetes diagnosis (Figure 2). Using matched data from the Social Security Administration, we also document a differential increase in SSDI enrollment after 2001 among BOG veterans. A plausible channel for this effect, which is about one-tenth as large as the corresponding change in DC enrollment, is that receipt of Veterans Disability Compensation benefits eases financial constraints associated with exiting the labor force and applying for SSDI benefits. Moreover, since SSA regulations require disability adjudicators to consider disability decisions of other federal agencies (US General Accounting Office 2009), a veteran's enrollment in DC may also increase the likelihood that he or she applies for and ultimately receives Social Security disability benefits.

By generating a sharp differential increase in DC enrollment among BOG veterans for reasons unrelated to changing health, the Agent Orange policy change permits a causal estimation of the effect of DC program participation on the labor supply of near-elderly Vietnam veterans. Analyzing this policy-induced variation, we find that labor force participation, defined as having strictly positive earnings for the year in our administrative data, declined sharply among BOG relative to NOG veterans soon after the 2001 policy change. The results are similar for younger (born 1949–1951) and older (born 1946–1948) Vietnam-era veterans in our analysis sample, suggesting that this pattern reflects an effect of the policy rather than a tendency of BOG veterans to retire sooner than their NOG counterparts for reasons unrelated to the DC program. For every 100 individuals who enter the DC program as a result of the policy change, we estimate that 18 drop out of the labor force. The magnitude of this decline reflects in part the size of the cash transfers that DC beneficiaries receive. Among veterans who entered the DC program after 2001, annual benefits averaged \$10,000 in the first year of enrollment and \$17,000 in the fifth year of enrollment. Since DC benefits are not subject to state or federal taxation, their after tax value is roughly equivalent to \$1.30 to \$1.50 in pretax earned income, depending upon the recipient's marginal tax rate. Indeed, the increase in disability benefit income among BOG veterans more than offsets (on average) the reduction in earnings among BOG veterans, so that total incomes of BOG relative to NOG veterans rose steadily after 2001. Combining our labor force participation and benefit receipt estimates, we obtain an estimate of the income elasticity of labor force participation of −0.49, which is in step with the participation elasticity calculated by Boyle and Lahey (2010), who studied labor supply of older nondisabled veterans ages 55 through 64 who were granted access to VA health insurance in the mid-1990s.

Distinct from the SSDI program, which provides income replacement for beneficiaries who are unable to work due to disability, veterans receive DC benefits as compensation for service-related reductions in health and thus, for the most part, are not contingent on veterans' past or present employment. This observation suggests that any DC-induced reduction in labor supply that we detect would be attributable to a non-incentive income effect. However, nearly 15 percent of BOG veterans who were receiving DC by the end of our sample window were receiving maximum DC benefits of approximately \$2,900 monthly because they were deemed unable to work ("Individually Unemployable" or IU) due to their disability. Both for veterans receiving the IU benefit and for those seeking it, the labor supply effects that we estimate are likely to encompass both income and incentive effects.

I. The Veterans Disability Compensation Program: Eligibility, Benefits, and Work Incentives

The DC program pays cash benefits and provides prioritized access to VA health facilities to military veterans with service-connected medical conditions, meaning that they are caused or aggravated by their military service. Unlike SSDI and SSI, federal programs that classify disability using a categorical (all-or-nothing) determination, the DC program rates disability on a discrete scale with 11 gradations ranging from 0 to 100 percent in 10 percent increments. Ratings depend on the type and severity of the disability, with more severe conditions receiving a higher rating.[4]

A. *Eligibility and Benefits*

Veterans seeking DC benefits apply to 1 of 56 regional offices of the Veterans Benefits Administration (VBA), which collects necessary information and forwards the information to a Rating Board. For each disability claimed, the Rating Board determines whether the disability is verified, whether it is service connected, and if so, what rating it merits. During the 2000 fiscal year, more than 70 percent of those applying for DC sought benefits for more than one medical condition (US Department of Veterans Affairs 2001). In 2006, current DC beneficiaries averaged 2.97 disabilities per recipient, with the highest number of disabilities per capita among Gulf War and Vietnam-era veterans, and the lowest number among WWII veterans (US Department of Veterans Affairs 2007).

Monthly DC benefits are an increasing and convex function of the veteran's Combined Disability Rating (CDR). In 2014, a CDR of 10 provided a monthly payment of $131, whereas a CDR of 100 provided a monthly payment of $2,858.[5] Veterans receiving a CDR of 30 or higher and who have spouses, dependent children, or surviving parents also receive modest additional benefits. In the modal case where a veteran receives benefits for multiple service-connected disabilities, the veteran's CDR is an increasing, concave function of the individual ratings, where concavity prevents the combined rating from exceeding 100.[6]

The VBA also considers employment capability for veterans with severe disabilities. Veterans who have single disabilities rated at 60 percent or above, or a combined disability rating of at least 70 and one disability rated at least 40, can qualify for the Individual Unemployability (IU) designation if VBA determines that they are unable "to secure and follow a substantially gainful occupation by reason of service-connected disability." Veterans with the IU designation receive cash payments at the 100 percent CDR level even if their CDR is less than 100 percent.[7]

[4] Type 2 diabetes ratings can range from 10 to 100 percent. Many medical conditions have specific ratings, detailed in the Web Automated Reference Material System (WARMS) database http://www.warms.vba.va.gov/bookc.html.

[5] The stated policy of the VBA is that the DC benefits schedule reflects the average reduction in earnings capacity for each value of the CDR. Since benefits determination depends only on CDR and family status, the benefit payment will exceed the earnings loss for some veterans and fail to meet the earnings loss of others. In 2014, the monthly benefit schedule (by CDR) was: $131 (10 percent), $259 (20 percent), $401 (30 percent), $578 (40 percent), $822 (50 percent), $1,041 (60 percent), $1,312 (70 percent), $1,526 (80 percent), $1,714 (90 percent), and $2,858 (100 percent).

[6] In the case of multiple disabilities, the claimant's "residual ability" is used to determine the incremental effect of each disability on the CDR. If, for example, a veteran has two disabilities each rated at 50 percent, his CDR would be equal to the sum of 50 percent for the first disability and 50 percent of his residual capacity (also 50 percent) for the second disability, rounded to the nearest increment of 10 percent. Thus, two disabilities rated at 50 percent results in a CDR of $[50\% + (100\% - 50\%) \times 0.5] = 75\%$, which is then rounded up to 80 percent.

[7] The VBA also indirectly considers employment capability when determining ratings for mental disorders. According to subpart B—Disability Ratings, 38 U.S.C. §4.130, stipulates that the rating criteria for mental disorders depends on a veteran's degree of "social and occupational impairment."

DC benefits generally do not offset and are not offset by other federal transfer benefits, and, once awarded, are rarely retracted. Unlike federal SSDI benefits, DC benefits do not terminate when a recipient reaches retirement age, even for recipients receiving the IU benefit. Moreover, a veteran's ongoing receipt of DC benefits is neither work-contingent nor income-contingent, except in the case that a veteran is seeking or has received the IU rating.[8] DC benefits are also not subject to federal income or payroll tax, which further increases their effective value, as noted above. DC benefits are thus roughly akin to an inflation-indexed annuity that provides monthly payments for as long as a veteran remains alive.

Appendix Table 1 summarizes DC cash benefits paid to all veterans in fiscal year 2006, the final year for which we have individual-level DC data in the analyses below. The average annual payment to the 2.73 million DC recipients in this year was $11,038 per capita, totaling approximately $30.1 billion for the year. Veterans with ratings between 0 and 20 percent accounted for 44 percent of recipients but just 8 percent of dollars paid. Those with ratings at 70 percent or above comprised 21 percent of the population and received 62 percent of the benefits payments.

Total DC benefits payments in constant 2014 dollars rose from $21.1 billion to $54.2 billion between 2001 and 2014. Simultaneously, the estimated veteran population declined from 26.1 million to 22.0 million (US Department of Veterans Affairs 2002 and 2015). As a result of these changes, real annual DC expenditures per living veteran increased by 200 percent (from $810 to $2,460) while the fraction of veterans receiving benefits approximately doubled (from 9 to 18 percent).

B. *Work Incentives under DC*

The graduated scale of DC disability ratings creates a complex set of incentives. Though disability ratings notionally depend exclusively on medical criteria rather than employment status, veterans may nevertheless perceive that their disabilities will receive higher ratings if they are not employed when applying to obtain or increase benefits. Veterans also face an incentive to repeatedly reapply to increase their Combined Disability Ratings as their health conditions evolve.[9] Appendix Table 2 shows that veterans' CDRs and benefit levels tend to rise steeply in the years following enrollment. This pattern of rapidly escalating benefits following enrollment suggests that policies that induce veterans to obtain an initial DC award, even at a low CDR, may lead to substantially larger claims and discourage labor force participation over the longer term.

The availability of the Individual Unemployability designation is apt to amplify these incentives. The IU benefit has significant monetary value: a 2006 General Accounting Office report found that the average present discounted *incremental* value of receiving an IU award in 2005 was approximately $300,000 to $460,000 for veterans age 20 (net of existing benefits), and was $89,000 to $142,000 for veterans age 75 (US GAO 2006). The availability of this benefit appears likely to induce

[8] A Veteran may receive both DC and SSDI payments without any reduction in benefits from either program, though SSI payments will generally be reduced or eliminated by DC payments.

[9] In fact, we observe very few reductions in CDRs in our data, and it is possible that those few that exist reflect coding errors. Veterans face little risk of having their CDRs reduced after the initial award.

at least some subset of work-capable veterans to curtail labor force participation to qualify. Once the IU designation is awarded, veterans face an incentive to maintain low earnings since a veteran can lose the IU rating if his annual labor market earnings (measured by SSA earnings data) exceeds a threshold amount, which was equal to $6,000 in 2004 and 2005 (US GAO 2006).

The DC program may also alter work incentives through its interactions with other federal benefits programs, SSDI in particular. Though the DC and SSDI programs have distinct disability screening criteria, the medical information generated by the DC award may alert some veterans that they suffer from impairments that could merit an SSDI award (and vice versa). Receipt of DC benefits may also make the SSDI application process less financially onerous, since SSDI applicants must remain out of the labor force for at least five months before receiving SSDI benefits. Because cash benefits from the two programs are additive rather than offsetting, it is plausible that a veteran's receipt of either DC or SSDI benefits increases his odds of applying for the other.[10]

II. The 2001 Agent Orange Decision, Type 2 Diabetes, and 'Service-Connectedness'

For a disability to be classified as service-connected, it must be "a result of disease or injury incurred or aggravated during active military service." This criterion makes it straightforward for a veteran to obtain compensation for a tangible injury that occurs during military service but significantly more difficult to obtain compensation for a disease that develops later in life, such as cancer or heart disease. Thus, in 2006, the five most prevalent service-connected disabilities were primarily battle traumas: hearing defects, tinnitus, general musculoskeletal disorders, arthritis due to trauma, and scars (US Department of Veterans Affairs 2006). Nevertheless, disabilities that typically develop post-service are also prevalent: post-traumatic stress disorder (PTSD) and hypertensive vascular disease (high blood pressure) were the sixth and ninth most prevalent service-connected disabilities in 2006.

In November of 2000, type 2 diabetes was added to the list of compensable and presumptively service-connected impairments for Vietnam veterans who had served in theater due to their potential exposure to the herbicide Agent Orange. This decision followed the publication of two studies in 1999 and 2000 that found an association between dioxin exposure and diabetes (Calvert et al. 1999 and Air Force Health Study 2000). Reversing a long-maintained position, the National Academy of Sciences' Institute of Medicine (IOM) concluded in 2000 that there was "limited/suggestive evidence of an association between exposure to the herbicides used in Vietnam or the contaminant dioxin and type 2 diabetes" (IOM 2000). Publication of these studies prompted the Secretary of Veterans Affairs to classify type 2 diabetes as presumptively service connected for Vietnam-era veterans who served in-theater.

Our analysis exploits the contrast in expanded benefits eligibility between in-theater and not-in-theater Vietnam-era veterans to study the impact of benefits

[10]The combination of VA health benefits and Medicare benefits from SSDI may also be more attractive than either individually since VA and Medicare differ in ailments covered, rapidity of access to treatment, size of co-payments, and coverage of prescription drugs.

receipt on veterans' labor supply. More broadly, we document how a policy change that reclassified a commonplace but typically non-severe disorder as service-connected catalyzed a surge in DC enrollment, whereby a large fraction of new enrollees obtained very high disability ratings—including 100 percent disability and Individual Unemployability—within a handful of years.

III. Data and Analytic Sample

Our analysis draws on a unique set of linked administrative data sources. The first is a near census of approximately four million veterans who left the Army between 1968 and 1985. The US Army's Office of Economic and Manpower Analysis (OEMA) constructed this database by combining two files from the Defense Manpower Data Center (DMDC): the first DMDC file enumerates essentially every person who left the Army between 1968 and 1985 (designated as the service member's "loss year"); OEMA then merged this "loss year" file with DMDC's Vietnam file, which identifies the vast majority of veterans who served in the Vietnam theater. Online Reference Tables 1 and 2 provide summary statistics on the distribution of loss years, years-of-birth, and start years for military service.

To measure DC participation, OEMA obtained from the VA detailed information about veterans' enrollment and DC benefits received from VA programs in September of each year from 1998 through 2006. To account for mortality, OEMA merged their data to the Social Security Administration Death Master File (DMF), which includes the year of death for any individual in the sample who died prior to 2008. According to DMF data, approximately 13 percent of the 4.1 million individuals in the sample were deceased by late 2007. To collect employment, earnings, SSDI, and SSI information, OEMA contracted with the US Social Security Administration (SSA) to match veterans in the OEMA dataset to enumerate wage earnings and Social Security benefits in each year from 1976 through 2007. This resulted in a successful match for 3.8 million of the 4.1 million veterans in the full dataset, with overall match rates exceeding 90 percent for both BOG and NOG samples, as detailed in online Reference Table 3.

Confidentiality rules prevent SSA from disclosing individual earnings or benefits data. SSA instead provided statistics on earnings and benefits for cells containing five to nine veterans, including: the number of cell members with zero earnings; mean labor earnings; the number receiving SSDI and SSI; and mean SSDI and SSI benefit amounts. In constructing cells, we grouped individuals with similar background characteristics, including gender, race, BOG and NOG status, and year of birth. Our final analysis sample consists of veterans who joined the military between 1966 and 1971 and were born between 1946 and 1951. The Data Appendix provides additional details on sample selection and cell construction.

Panel A of Table 1 compares the BOG and NOG samples. The fraction nonwhite is approximately equal in the two samples (11.3 and 11.8 percent, respectively), as is the fraction with positive earnings in 1998 (84.3 and 85.1 percent). Among those with a non-missing Armed Forces Qualification Test score (AFQT), average scores are also relatively close (52.1 and 53.4). And by construction, the average year-of-birth and the average start year are comparable in the two groups. There

TABLE 1—SAMPLE MEANS FOR BOG AND NOG FULL AND SSA VERIFIED SAMPLES

	Panel A. SSA verified sample		Panel B. Full sample	
	(1) BOG	(2) NOG	(1) BOG	(2) NOG
Verified in SSA data (percent)	100.0	100.0	95.7	89.0
Year of birth	1,948.4	1,948.6	1,948.4	1,948.7
Army start year	1,968.4	1,969.0	1,968.4	1,969.0
Army loss year	1,971.1	1,971.4	1,971.1	1,971.4
Deceased by 1997 (percent)	4.8	2.9	6.2	6.1
Deceased by 2006 (percent)	9.9	7.9	11.5	11.0
Observations	765,849	585,016	806,698	659,283
Race, AFQT, and education (at military entry)				
Nonwhite (percent)	11.3	11.8	11.8	12.7
AFQT score	52.1	53.4	51.7	52.5
Missing AFQT score (percent)	26.4	19.1	25.8	17.7
HS dropout (percent)	31.4	23.3	31.4	24.3
HS grad (percent)	48.1	37.1	48.3	38.0
Some college (percent)	14.5	14.4	14.3	14.2
College grad or higher (percent)	4.8	9.2	4.7	8.6
Missing education (percent)	1.1	15.3	1.2	14.3
Labor force status				
Positive earnings 1998 (percent)	84.3	85.1		
Positive earnings 2000 (percent)	82.8	84.1		
Positive earnings 2006 (percent)	71.3	74.4		
ln(cell mean earnings) 1998	10.69	10.71		
ln(cell mean earnings) 2000	10.67	10.71		
ln(cell mean earnings) 2006	10.38	10.46		
Disability receipt and benefits				
DC receipt 1998 (percent)	13.5	6.3	13.5	6.2
DC receipt 2000 (percent)	14.3	6.5	14.2	6.4
DC receipt 2006 (percent)	23.0	7.6	22.9	7.5
Mean annual DC payment 1998	1,589	771	1,601	778
Mean annual DC payment 2000	1,931	870	1,943	876
Mean annual DC payment 2006	3,969	1,220	3,971	1,227
Mean annual DC pay 1998 if > 0	10,700	10,155	10,772	10,302
Mean annual DC pay 2000 if > 0	12,275	10,925	12,337	11,066
Mean annual DC pay 2006 if > 0	16,194	12,746	16,241	12,863
SSDI receipt 1998 (percent)	5.6	4.6		
SSDI receipt 2000 (percent)	6.8	5.5		
SSDI receipt 2006 (percent)	12.6	9.7		
SSI receipt 1998 (percent)	0.7	1.0		
SSI receipt 2000 (percent)	0.7	1.0		
SSI receipt 2006 (percent)	0.7	1.3		

Notes: Panel A reports summary statistics for veterans in the BOG and NOG samples described in Section III and the Data Appendix. Panel B includes veterans who did not verify with the Social Security Administration but makes all other sample restrictions described in the Data Appendix. Earnings and DC payment values are in 2014 dollars. Disability, employment, and earnings information only reflect living veterans. All sample members were born between 1946 and 1951 and commenced Army service between 1966 and 1971.

are also clear differences between the BOG and NOG samples. BOG veterans are more than twice as likely as NOG veterans to be receiving DC benefits in 2000 (14.2 versus 6.4 percent), just prior to the 2001 policy change. This may in part reflect the toll of military service for those who served in the Vietnam theater.[11]

[11] Members of the NOG sample are more likely to have missing data on education and less likely to have missing AFQT score data.

An examination of trends in key outcome variables in the BOG and NOG samples prior to 2001 reveals many similarities: the fraction with zero earnings increased by similar, though not identical, amounts for both samples between 1998 to 2000 (by 1.5 and 1.0 points for BOG and NOG samples, respectively), as did the fraction receiving SSDI benefits (1.2 and 0.9 points for BOG and NOG samples). Our analysis will control for any differential trends in outcome variables that precede the policy change.

A remaining concern with the primary analytic sample is that individuals who are matched in the SSA data may systematically differ from those who are not. This is especially an issue for veterans who died prior to 1997. As shown in columns 1 and 2 of panel B in Table 1, the fraction of veterans in the full sample who were deceased as of 1997 was 6.2 and 6.1 percent in the full BOG and NOG samples but only 4.8 and 2.9 percent in the SSA verified samples—though, notably, the fraction of veterans who died between 1997 and 2007 in the BOG and NOG samples is closely comparable in both the full sample and the SSA verified sample. The lower SSA match rate for deceased veterans is a consequence of SSA's record matching criteria, which requires a match on subjects' full names, SSN, and date of birth. Due to poor optical character recognition, the NOG data contained a relatively high frequency of garbled names. We worked with the credit information provider TransUnion to obtain names for those with incomplete information.[12] Due to limited availability of archival credit information prior to 1997, TransUnion could not provide names for most veterans who passed away before that year, leading to a low overall match rate for NOG soldiers who died prior to 1997. Differential mortality match for the BOG and NOG samples is not a major threat to the validity of our research design, however, since our primary focus is on outcomes from 1998 forward.[13] Thus, soldiers who were deceased as of 1997 from both BOG and NOG samples are excluded from the analysis.

To benchmark the representativeness of the sample, we compare the OEMA data with a similarly drawn group of male veterans from the 2000 IPUMS Census file. Using the 5 percent Census IPUMS extract, we draw a group of all males born between 1946 and 1951, limiting to (self-reported) Vietnam-era veterans. Appendix Table 3 provides a side-by-side comparison of age, race, schooling, annual earnings, and share with nonzero earnings in the OEMA and census samples. Race and labor force participation rates are closely comparable: the fractions of the OEMA and census samples with nonzero earnings are 84.1 percent and 82.3 percent, respectively, while the percent nonwhite are 11.3 and 13.3. Reflecting the fact that OEMA data capture education at the time of military enlistment (average age of 20) while the census data reflect educational attainment in late adulthood, the OEMA sample reports considerably lower educational attainment than the census sample. Average earnings in the OEMA sample are also about 10 percent lower than in the census sample. This gap may reflect earnings differences between Army veterans and those

[12] TransUnion performed this work pro bono. Our original sample had 1.7 million observations with a missing name. TransUnion was able to provide names for 1.5 million of these observations upon confirming a match with date of birth and social security number.

[13] A post-reform analysis showed that changes to labor force participation cannot be attributed to differential mortality between the BOG and NOG samples.

of other branches of the military. SSA data may also fail to capture some earnings sources, including self-employment and non-covered work. Overall, our comparison of OEMA and census data provides some assurance that the OEMA sample is representative of the target population of Vietnam-era Army veterans, measured in terms of age, race, labor force participation, and earnings.

IV. The Impact of the Agent Orange Policy on Receipt of Disability Benefits

As described above, the Agent Orange policy spurred a steep rise in Disability Compensation enrollment and may have had spillover effects on enrollment in other federal disability programs. We focus our study on the subsequent effects of this policy by estimating impacts on DC enrollment, SSDI and SSI enrollment, and finally, total federal disability benefits.

A. *Enrollment in Veterans Disability Compensation*

Recall from Figure 2 that prior to the Agent Orange change in 2001, DC enrollment was rising somewhat more rapidly among BOG than NOG veterans. But DC enrollment among BOG veterans accelerated substantially after 2001. Panel A of Table 2 shows that BOG DC enrollment increased by 0.4 percentage points per year between 1998 and 2000 (from 13.5 to 14.3) and by 1.6 percentage points annually between 2001 and 2006 (from 15.0 to 23.0). In contrast, DC enrollment growth among NOG veterans remained small and relatively steady, increasing from 0.1 percentage points per year between 1998 and 2000 (from 6.3 to 6.5) to 0.2 percentage points per year between 2001 and 2006 (from 6.6 to 7.6).[14] Data from the National Health Interview Survey (Schiller et al. 2010) indicate that the fraction of individuals with diabetes varies substantially by race, with rates among blacks substantially higher than among whites. Consistent with this fact, an examination of the trends in DC enrollment in Table 2 reveals that DC enrollment increased about 40 percent more among BOG nonwhites (from 19.3 to 30.2, a rise of 10.9 percentage points) than among BOG whites from 2001 to 2006 (from 14.4 to 22.1, a rise of 7.7 percentage points).[15]

These BOG-NOG contrasts in DC enrollment may reflect differences in veteran characteristics as well as any impact of the Agent Orange policy. To account for these factors, we estimate a set of OLS models that regress DC enrollment on a full set of controls for veterans' year-of-birth, race, and AFQT score quintile.[16] For consistency with the subsequent analysis of labor market outcomes, our DC variables are calculated as means over five to nine veterans grouped at the level of SSA

[14] The policy change took effect in July 2001 and we measure DC enrollment in September. Thus, our 2001 data is arguably more "pre" than "post," though it's likely that the policy change did contribute to DC enrollment growth between September 2000 and September 2001 in our data.

[15] The proportional increases among blacks and whites were similar, about 50 percent between 2001 and 2006. However, the proportional increase was much larger among BOG than NOG veterans: 53 versus 15 percent.

[16] Veterans with low AFQT scores are more likely to enroll in DC (Autor, Duggan, and Lyle 2011), and average scores differ slightly between BOG and NOG veterans.

TABLE 2—DC RECEIPT AND DIABETES COMPENSATION AMONG BOG AND NOG VETERANS, 1998–2006

	Full sample		Whites		Nonwhites	
	BOG (1)	NOG (2)	BOG (3)	NOG (4)	BOG (5)	NOG (6)
Panel A. Percentage enrolled in DC						
1998	13.5	6.3	13.0	6.0	17.1	9.0
1999	13.9	6.4	13.4	6.1	17.7	9.2
2000	14.3	6.5	13.8	6.2	18.2	9.3
2001	15.0	6.6	14.4	6.3	19.3	9.4
2002	16.4	6.8	15.8	6.4	21.4	9.7
2003	18.3	7.0	17.6	6.6	24.0	10.0
2004	19.9	7.2	19.1	6.8	26.0	10.3
2005	21.4	7.4	20.6	7.0	28.2	10.6
2006	23.0	7.6	22.1	7.2	30.2	10.9
Panel B. Percentage receiving compensation for diabetes, conditional on DC enrollment						
1998						
1999	0.7	1.4	0.6	1.2	1.3	2.2
2000	0.7	1.4	0.6	1.2	1.3	2.2
2001	2.4	1.6	2.2	1.4	3.9	2.5
2002	13.3	3.3	12.4	3.0	18.3	4.8
2003	19.6	4.4	18.4	4.0	26.2	6.3
2004	22.9	5.2	21.8	4.8	30.0	7.2
2005	25.6	5.8	24.4	5.4	32.8	7.8
2006	28.1	6.4	26.9	6.0	35.2	8.4

Notes: Panel A of this table reports the percentage of veterans in the BOG and NOG samples who were enrolled in the DC program between 1998 and 2006. Panel B reports the percenage of DC enrolled veterans who received compensation for diabetes. The year 1998 is not included in panel B because our data include specific conditions for 1999 through 2006 only.

reporting cells. We estimate the following equation for 1998 through 2006, weighting each cell-year by the number of veterans in the cell:

$$(1) \qquad Y_{jt} = \alpha_t + \gamma_0 \times BOG_j + \sum_{1999}^{2006} \gamma_t \times BOG_j + \mathbf{X}_{jt}'\beta_t + \varepsilon_{jt}.$$

The outcome variable Y_{jt} is the percentage of cell j enrolled in the DC program in September of year t, and BOG_j is an indicator variable that is set equal to one if veterans in cell j are in the BOG sample, and is otherwise equal to zero (cells include either all BOG or all NOG veterans). The term α_t is a vector of 9 indicator variables for each year considered, and $\mathbf{X}_{jt}$ is a vector set of 14 indicator variables corresponding to the possible values of year-of-birth, AFQT quintile, and race.[17] We interact each of these 14 indicator variables with 9 year-specific indicator variables to account for differential levels of growth rates in DC enrollment by age, race, or

[17] The sample contains six possible values of YOB (1946 through 1951), two possible values of race (white and nonwhite), and six possible values of AFQT quintiles (we group those with a missing AFQT into a sixth category). Given there are 9 years of data used in these estimates, we are including 126 interactions. Because we apply OLS models to cell means and weight by the number of individual observations in each cell, the cell level estimates will be in most cases algebraically identical to those that we would obtain if cells were instead disaggregated to individual level rows. One exception to this dictum arises from the fact that 10 percent of cells have more than one AFQT quintile represented within the cell. We assign the cell to the AFQT quintile nearest to the cell's mean AFQT quintile in these cases, meaning that the cell-level and corresponding individual level regressions will differ slightly.

Table 3—DC Receipt in the BOG versus NOG Samples from 1998–2006 Dependent Variable: Percentage of Cell Enrolled in DC

	Panel A. All		Panel B. YOB: 1946–1948		Panel C. YOB: 1949–1951	
	(1)	(2)	(1)	(2)	(1)	(2)
BOG	6.97	6.91	7.12	7.06	6.83	6.77
	(0.06)	(0.06)	(0.08)	(0.08)	(0.08)	(0.08)
BOG × (YR-1998)		0.40		0.40		0.40
		(0.01)		(0.01)		(0.01)
BOG × (YR-2001) × (YR ≥ 2002)		0.99		1.04		0.93
		(0.01)		(0.02)		(0.02)
BOG × (YR99)	0.33		0.34		0.32	
	(0.01)		(0.02)		(0.02)	
BOG × (YR00)	0.59		0.58		0.61	
	(0.02)		(0.02)		(0.02)	
BOG × (YR01)	1.18		1.18		1.18	
	(0.02)		(0.03)		(0.03)	
BOG × (YR02)	2.46		2.55		2.37	
	(0.03)		(0.04)		(0.04)	
BOG × (YR03)	4.08		4.22		3.92	
	(0.03)		(0.04)		(0.05)	
BOG × (YR04)	5.39		5.58		5.18	
	(0.04)		(0.05)		(0.05)	
BOG × (YR05)	6.71		6.93		6.45	
	(0.04)		(0.06)		(0.06)	
BOG × (YR06)	7.98		8.28		7.65	
	(0.04)		(0.06)		(0.06)	
Outcome mean (1998)	10.36		10.75		9.94	
Outcome mean (2001)	11.31		11.76		10.84	
Outcome mean (2006)	16.25		17.14		15.29	
Observations (Cell) × (Year)	2,142,029		1,104,897		1,037,132	

Notes: This table reports estimates of equations (1) and (2) where the dependent variable is the percentage of each cell enrolled in the Disability Compensation program each year. Panel A includes all veterans in our sample and other panels restrict the sample to veterans in the specified group. Each cell has one observation for each year between 1998 and 2006. (YR-1998) and (YR-2001) are linear time trends. All regressions include year fixed effects and fixed effects for each combination of (AFQT-quintile) × (year), (year of birth) × (year), and (race) × (year), where race is defined as white or nonwhite and veterans with a missing AFQT score are grouped into a sixth AFQT category. All regressions weight each observation according to the number of veterans in the cell. Standard errors, clustered on cell, are reported in parentheses.

AFQT level during the 1998 through 2006 period. The coefficient γ_0 corresponds to the (conditional) baseline DC enrollment gap between BOG and NOG veterans in the base year of 1998, while the coefficient vector γ_t estimates the *difference* in this gap in each subsequent year 1999 through 2006 relative to the enrollment gap in 1998.

The statistically significant estimate of 6.97 for γ_0 in the first column of panel A, Table 3 implies a 7 percentage point gap in DC enrollment between the BOG and NOG samples in the baseline year (1998) after controlling for race, year-of-birth, and AFQT quintile, quite similar to the unconditional estimated difference of 7.2 percentage points in columns 1 and 2 of panel A, Table 2 (13.5 for BOG versus 6.3 for NOG). The next eight rows of the first column in Table 3 display the estimates for γ_t in each year from 1999 through 2006. The statistically significant estimates of 0.33 and 0.59 for γ_{1999} and γ_{2000} imply that DC enrollment was increasing more rapidly (by 0.3 percentage points annually) for the BOG than NOG sample prior to the 2001 policy change. Beginning in 2001, these coefficients increase much more rapidly, by about 1.4 percentage points per year, and reach a cumulative differential of 7.98 percentage points by September of 2006. As shown in panels B and C of Table 3, the point estimates differ only modestly by birth cohort (1946–1948 and 1949–1951), with slightly larger effects for the older than the younger group (8.28 and 7.65 percentage points, respectively).

The sharp break in trend for DC enrollment among BOG relative to NOG veterans motivates a parameterized version of equation (1) found in even-numbered columns of Table 3. For this specification, we replace the full set of year-by-BOG interactions with two linear time trends: a pre-2001 trend and a post-2001 trend *change*, estimated relative to the pre-2001 trend:

$$(2) \qquad Y_{jt} = \alpha_t + \gamma_0 \times BOG_j + \delta_0 \times BOG_j \times (t - 1998) + \delta_1 \times BOG_j \times (t - 2001) \times 1[t \geq 2002] + \mathbf{X}'_{jt}\beta_t + \varepsilon_{jt}.$$

This equation consistently estimates the causal effect of the Agent Orange policy change on DC enrollment under the assumption that the preexisting trend in the difference in DC enrollment between the BOG and NOG samples would have continued after 2001. In this equation, δ_0 captures the preexisting trend in BOG relative to NOG DC participation just prior to the policy change, while δ_1 estimates any additional change in the BOG relative to the NOG trend following the policy. We define 2002 to be the first post-policy year since the policy change took place in July 2001 and DC participation data are from September of each year.

Estimates of equation (2) in the even-numbered columns of Table 3 highlight the significant trend increase in DC enrollment among BOG relative to NOG veterans following the 2001 policy change. Because we treat 2001 as a pure pre-policy year, the estimate of δ_0 in each case is slightly larger and the estimate of δ_1 slightly smaller than is suggested by the year-by-year estimates. The magnitude of the trend break is similar between the two birth cohort groups (1946–1948 and 1949–1951). In panel A of Table 4, we split the sample by race (white/nonwhite) and by AFQT score. The acceleration in DC enrollment is largest among BOG veterans who are nonwhite and who have relatively low (below the fortieth percentile in the sample) AFQT scores.

In addition to showing a sharp acceleration in BOG DC enrollment following the 2001 Agent Orange policy, Figure 2 also reveals that, after 2001, there was only a modest increase in the fraction of BOG veterans receiving DC benefits *absent* a diabetes award. Thus, the rapid growth in DC enrollment among BOG veterans appears substantially accounted for by an influx of new diabetes awards. Figure 3 further relates these enrollment trends to the Agent Orange policy, showing a steep increase in the likelihood that BOG but not NOG veterans receive compensation for diabetes, both in the year of current DC receipt and in the year of initial DC enrollment. As documented in panel B of Table 2, the fraction of DC beneficiaries

Table 4—Disability Compensation Outcomes in the BOG versus NOG Samples from 1998–2006

	All (1)	Nonwhites (2)	Whites (3)	AFQT < 45 (4)	AFQT ≥ 45 (5)
Panel A. Dependent variable: percentage of cell enrolled in DC					
BOG	6.91	7.72	6.80	8.33	5.93
	(0.06)	(0.19)	(0.06)	(0.10)	(0.08)
BOG × (YR-1998)	0.40	0.61	0.37	0.52	0.31
	(0.01)	(0.03)	(0.01)	(0.02)	(0.01)
BOG × (YR-2001) × (YR ≥ 2002)	0.99	1.27	0.95	1.19	0.81
	(0.01)	(0.04)	(0.01)	(0.02)	(0.02)
Outcome mean (1998)	10.36	13.44	9.96	11.55	8.98
Panel B. Dependent variable: percentage of cell with CDR of 40 or higher					
BOG	3.05	3.51	2.99	4.10	2.63
	(0.04)	(0.12)	(0.04)	(0.07)	(0.05)
BOG × (YR-1998)	0.39	0.58	0.36	0.53	0.29
	(0.01)	(0.03)	(0.01)	(0.01)	(0.01)
BOG × (YR-2001) × (YR ≥ 2002)	0.78	1.12	0.74	0.96	0.61
	(0.01)	(0.04)	(0.01)	(0.02)	(0.01)
Outcome mean (1998)	3.99	5.29	3.83	4.87	3.13
Panel C. Dependent variable: percentage of cell with IU status					
BOG	0.27	0.35	0.26	0.41	0.24
	(0.01)	(0.05)	(0.02)	(0.03)	(0.02)
BOG × (YR-1999)	0.16	0.20	0.16	0.25	0.12
	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)
BOG × (YR-2001) × (YR ≥ 2002)	0.20	0.27	0.19	0.23	0.15
	(0.01)	(0.03)	(0.01)	(0.02)	(0.01)
Outcome mean (1999)	0.55	0.70	0.53	0.71	0.42
Panel D. Dependent variable: cell mean annual DC payment					
BOG	779	945	756	1,089	684
	(10)	(33)	(10)	(19)	(13)
BOG × (YR-1998)	115	161	109	161	86
	(2)	(7)	(2)	(4)	(3)
BOG × (YR-2001) × (YR ≥ 2002)	195	295	182	243	147
	(3)	(11)	(3)	(6)	(4)
Outcome mean (1998)	1,093	1,449	1,048	1,344	865
Observations (Cell) × (Year)	2,142,029	232,540	1,909,489	660,866	988,801

Notes: This table reports estimates of equation (2) where the dependent variable is indicated in each panel heading. Panel C excludes observations from 1998 since we do not observe IU status in that year. Annual DC payments are in 2014 dollars. (YR-1998), (YR-1999), and (YR-2001) are linear time trends. All regressions include year fixed effects and fixed effects for each combination of (AFQT-quintile) × (year), (year of birth) × (year), and (race) × (year). Column 1 includes all veterans in our sample and columns 2–5 restrict the sample to veterans in the specified group. Columns 1–3 group veterans with a missing AFQT score into a sixth AFQT category, while columns 4–5 exclude veterans with missing AFQT scores. All regressions weight each observation according to the number of veterans in the cell. Standard errors, clustered on cell, are reported in parentheses.

receiving compensation for diabetes among BOG veterans rose from 2.4 to 28.1 percent (25.7 points) between 2001 and 2006 versus 1.6 to 6.4 percent among NOG veterans (4.8 points).[18] Figure 4 underscores that the increase in DC enrollment was

[18] One reason that DC receipt for diabetes may also have increased (slightly) in the NOG sample is that our data only imperfectly classify BOG and NOG veterans; some veterans categorized as NOG may in fact have served in theater. In addition, administration of DC benefits appears to be somewhat discretionary. Even prior to the Agent

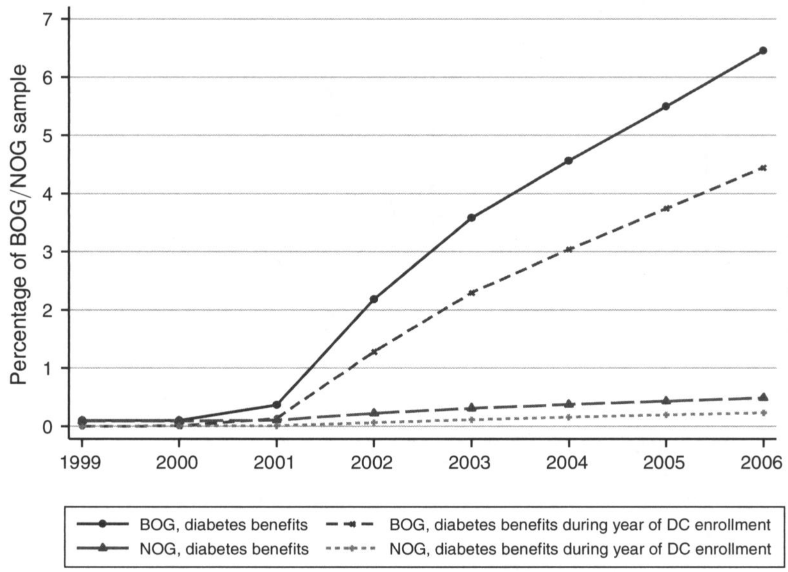

FIGURE 3. PREVALENCE OF DC BENEFITS FOR DIABETES IN THE BOG AND NOG SAMPLES

Notes: This figure reports the annual percentage of BOG and NOG veterans who were enrolled in DC and who received DC benefits for diabetes. BOG, diabetes benefits during year of DC enrollment refers to the percentage of veterans in the BOG sample who were enrolled in DC, received benefits for diabetes, and began receiving diabetes benefits the same year they enrolled in DC.

similarly rapid among older (YOB 1946–1948) and younger (YOB 1949–1951) Vietnam veterans in our sample, as is also shown in panels B and C of Table 3.

While our estimates so far capture the extensive margin (i.e., participation) impact of the Agent Orange policy, panels B through D of Table 4 consider outcomes that combine extensive (participation) and intensive (rated severity) margins. Prior to the policy change, the percentage of BOG relative to NOG veterans with Combined Disability Ratings of 40 or higher rose by 0.39 percentage points annually; panel B shows that this differential rose to 1.17 percentage points annually (0.39 + 0.78) after 2001. Panel C reveals a similar pattern for the percentage of veterans with an IU designation.[19] Similarly, panel D indicates that the year-over-year increase in annual mean DC benefits paid to BOG relative to NOG veterans rose from $115 prior to the policy change to $310 per year after 2001 ($115 + $195). Consistent with the estimates for DC enrollment by race and AFQT score, the estimates indicate that CDRs and benefits payments increased more rapidly among nonwhite than white BOG veterans, and more rapidly among low-AFQT than high-AFQT BOG veterans.

Orange decision in 2000, 1.4 percent of BOG and 0.7 percent of NOG DC recipients were receiving compensation for service-connected diabetes (panel B of Table 2). Finally, some NOG veterans may have served in Korea in 1968 or 1969, which would also entitle them to DC benefits for type 2 diabetes. These sources of slippage do not invalidate our identification strategy provided that the post-2001 trend break in DC receipt in BOG versus NOG veterans is induced by the Agent Orange Policy change, which seems likely.

[19] Estimates of equation (2), where the outcome is the percentage of the cell receiving a CDR of 100 without IU status (not reported), are nearly identical to results reported in panel C of Table 4 for IU status, suggesting that the Agent Orange policy spurned a comparable rise in both IU designations and CDRs of 100.

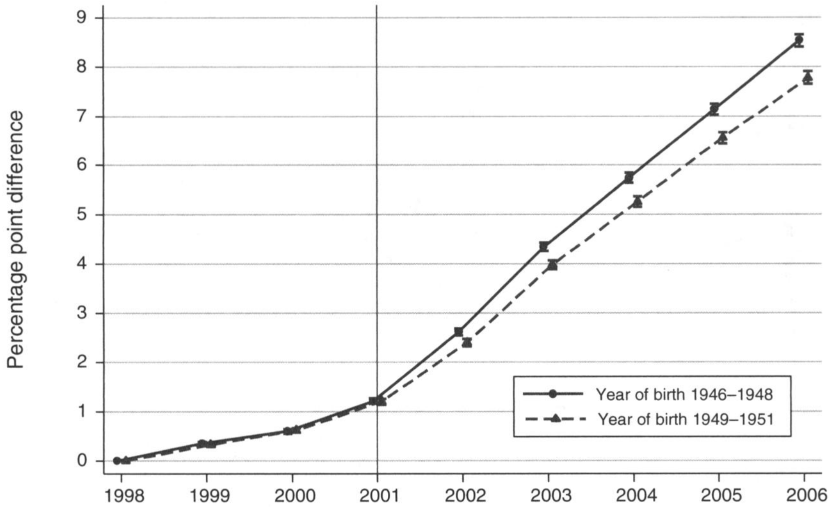

FIGURE 4. EVOLUTION OF DC RECEIPT AMONG BOG RELATIVE TO NOG VETERANS, 1998–2006: BIRTH COHORTS 1946–1948 AND 1949–1951

Notes: This figure reports annual percentage point differences and 95 percent confidence intervals between BOG DC receipt and NOG DC receipt for two veteran birth cohorts: 1946–1948 and 1949–1951. The vertical line indicates the year of the Agent Orange policy change. Each series is normalized to the BOG-NOG difference in DC receipt as of year 1998.

B. *Enrollment in Other Federal Disability Programs*

Workers applying for SSDI benefits are unlikely to qualify for an award if they participate gainfully in the labor force while their case is being decided (Autor et al. 2015). Knowledge of this fact may deter workers with residual work capacity from applying for SSDI since they would have to forfeit potential earnings in pursuit of an uncertain benefit. Since, as we document below, many veterans *did* leave the labor force after becoming eligible for DC benefits, it is plausible that a subset that would otherwise have been deterred from seeking SSDI benefits would choose to pursue these benefits as an indirect consequence of the Agent Orange policy.[20]

To examine these potential spillovers, we estimate models analogous to equation (2) where the outcome variable is the probability of SSDI receipt among BOG and NOG veterans (again measured at the level of SSA reporting cells). Reflecting the longer sample window available for the SSA outcomes, these models include two additional "pre" years, 1996 and 1997, and one additional "post" year, 2007. Panel A of Table 5 shows that, like DC enrollment, SSDI receipt was trending upward faster among BOG than NOG veterans by 0.13 percentage points per year prior to the 2001 policy change. But this trend accelerated after 2001, increasing to 0.25 percentage points (0.13 + 0.12) annually. Notably, the estimated effect on SSDI is only

[20]Borghans, Gielen, and Luttmer (2014) find related evidence of program spillovers in disability receipt. On average, Dutch DI recipients offset a €1.00 loss in DI benefits with a €0.30 increase in other social support programs. Duggan, Singleton, and Song (2007) find evidence that reductions in Social Security retirement benefits stemming from the rising US full retirement age have lead to an increase in SSDI enrollment among cohorts facing a higher full retirement age.

Table 5—SSDI, SSI, and Total Disability Income in the BOG versus NOG Samples

	All (1)	Nonwhites (2)	Whites (3)	AFQT < 45 (4)	AFQT ≥ 45 (5)
Panel A. Dependent variable: percentage of cell receiving SSDI					
BOG	0.74	1.14	0.69	1.12	0.81
	(0.04)	(0.15)	(0.04)	(0.09)	(0.05)
BOG × (YR-1996)	0.13	0.19	0.13	0.14	0.11
	(0.01)	(0.03)	(0.01)	(0.02)	(0.01)
BOG × (YR-2001) × (YR ≥ 2002)	0.12	0.06	0.12	0.12	0.10
	(0.01)	(0.05)	(0.01)	(0.03)	(0.02)
Outcome mean (1996)	4.51	6.69	4.23	6.77	3.08
Observations (Cell) × (Year)	2,862,513	310,987	2,551,526	883,832	1,321,309
Panel B. Dependent variable: percentage of cell receiving SSI					
BOG	−0.238	−0.353	−0.222	−0.328	−0.063
	(0.017)	(0.078)	(0.016)	(0.039)	(0.018)
BOG × (YR-1996)	−0.025	−0.024	−0.025	−0.038	−0.015
	(0.004)	(0.016)	(0.003)	(0.008)	(0.004)
BOG × (YR-2001) × (YR ≥ 2002)	−0.013	−0.052	−0.008	−0.036	−0.004
	(0.006)	(0.026)	(0.006)	(0.013)	(0.006)
Outcome mean (1996)	0.904	2.263	0.730	1.538	0.503
Observations (Cell) × (Year)	2,862,513	310,987	2,551,526	883,832	1,321,309
Panel C. Dependent variable: annual disability income (DC + SSDI + SSI), 1998–2006					
BOG	874	1,076	847	1,214	782
	(12)	(41)	(13)	(24)	(16)
BOG × (YR-1998)	130	180	123	174	100
	(3)	(10)	(3)	(6)	(4)
BOG × (YR-2001) × (YR ≥ 2002)	229	330	217	281	176
	(4)	(14)	(4)	(8)	(5)
Outcome mean (1998)	1,626	2,205	1,552	2,115	1,239
Total income mean (1998)	54,500	38,885	56,494	40,178	60,625
Observations (Cell) × (Year)	2,142,029	232,540	1,909,489	660,866	988,801

Notes: This table reports estimates of equation (2) where the dependent variable is the outcome indicated in the panel heading. For panels A and B, each cell has one observation for each year between 1996 and 2007. For panel C, each cell has one observation for each year between 1998 and 2006. (YR-1996), (YR-1998), and (YR-2001) are linear time trends. All regressions include year fixed effects and fixed effects for each combination of (AFQT-quintile) × (year), (year of birth) × (year), and (race) × (year), where race is defined as white or nonwhite. Column 1 includes all veterans in our sample; all other columns restrict the sample to veterans in the specified group. Columns 1–3 group veterans with a missing AFQT score into a sixth AFQT category while columns 4–5 exclude veterans with missing AFQT scores. In panel C, mean annual disability payments are in 2014 dollars. All regressions weight each observation according to the number of veterans in the cell. Standard errors, clustered on cell, are reported in parentheses.

about 12 percent as large as the corresponding estimate for DC enrollment (compare column 1, panel A of Tables 4 and 5).[21] These results suggest that the Agent Orange policy spurred additional SSDI enrollment, which may in turn have magnified any reduction in labor force participation among eligible veterans.

The second panel of Table 5 reports analogous regressions for receipt of SSI. Here, the estimates point in the opposite direction: SSI enrollment was growing

[21] In estimates not displayed, we find similar impacts on SSDI receipt among the 1946–1948 and 1949–1951 cohorts.

more rapidly among NOG than among BOG veterans prior to 2001, and this trend accelerated after 2001, in all likelihood because the additional DC transfer income made some BOG veterans ineligible for means-tested SSI benefits. The magnitude of the estimated break in trend for SSI is only one-tenth as large as the corresponding estimate for SSDI, however.

The final panel of Table 5 estimates equation (2) for disability income combining benefits payments from all three federal disability programs: DC, SSDI, and SSI. These estimates only include data from 1998 through 2006 since we do not have DC data for 1996, 1997, and 2007. Inclusion of SSDI and SSI benefits with DC benefits raises the differential trend increase in benefits payments for BOG relative to NOG veterans by approximately an additional 15 to 20 percent (compare to panel D of Table 4). Across all veterans in our sample, combined disability benefits were rising by \$130 annually among BOG relative to NOG veterans prior to the 2001 Agent Orange policy change. Commencing in 2002, this differential trend rose to \$359 (\$130 + \$229). This average masks considerable heterogeneity. For veterans with high CDRs, DC benefits payments (which are not subject to federal taxation, as noted above) substantially exceed SSDI benefits for all but the highest (pre-disability) earners. Thus, the bulk of the impact of the Agent Orange policy on veterans' net transfer income accrues through the DC program.

V. Consequences for Labor Force Participation

We now consider impacts of the Agent Orange policy on veterans' employment and earnings. Applying equations (1) and (2) to labor market outcomes, we test whether the employment rates and earnings of BOG relative to NOG veterans declined differentially following the 2001 policy change. We again include data from 1996, 1997, and 2007 because of the longer sample window available for SSA outcomes.

A. *Impacts on Labor Force Participation*

Table 6 considers the impact of the Agent Orange policy on the percentage of living veterans in an SSA reporting cell who have positive labor earnings (also summarized in online Reference Figure 1), which we refer to as labor force participation (LFP) for brevity. The first column finds that LFP was slightly lower among BOG than NOG veterans in the baseline year of 1996: by 0.32 percentage points on a base of approximately 86 percent. This LFP gap was modestly expanding (i.e., becoming more negative) in the early part of our sample period, falling by an additional 0.81 points between 1996 and 2001. The expansion accelerated after 2001, however, with BOG relative to NOG LFP falling by an additional 2.02 percentage points between 2001 and 2007. Column 2 of Table 6, which fits the parameterized model in equation (2), shows the rate of LFP divergence between BOG and NOG veterans roughly doubled after the Agent Orange decision, from 0.15 percentage points per year to 0.33 percentage points (0.15 + 0.18) annually after 2001.

Coupled with the evidence in Table 3 on DC enrollments, the Table 6 estimates suggest that the differential increase in DC enrollment among BOG veterans

TABLE 6—LABOR FORCE PARTICIPATION IN THE BOG VERSUS NOG SAMPLES FROM 1996–2007
DEPENDENT VARIABLE: PERCENTAGE OF CELL WITH POSITIVE ANNUAL EARNINGS

	Panel A. All		Panel B. YOB: 1946–1948		Panel C. YOB: 1949–1951	
	(1)	(2)	(1)	(2)	(1)	(2)
BOG	−0.32	−0.33	0.00	0.02	−0.82	−0.87
	(0.07)	(0.07)	(0.09)	(0.09)	(0.10)	(0.10)
BOG × (YR-1996)		−0.15		−0.17		−0.14
		(0.01)		(0.02)		(0.02)
BOG × (YR-2001) × (YR ≥ 2002)		−0.18		−0.19		−0.18
		(0.02)		(0.03)		(0.03)
BOG × (YR97)	−0.16		−0.15		−0.16	
	(0.04)		(0.06)		(0.06)	
BOG × (YR98)	−0.31		−0.29		−0.33	
	(0.05)		(0.07)		(0.07)	
BOG × (YR99)	−0.45		−0.38		−0.52	
	(0.05)		(0.07)		(0.08)	
BOG × (YR00)	−0.77		−0.79		−0.75	
	(0.06)		(0.08)		(0.09)	
BOG × (YR01)	−0.81		−0.87		−0.76	
	(0.06)		(0.09)		(0.09)	
BOG × (YR02)	−1.01		−1.06		−0.96	
	(0.07)		(0.09)		(0.10)	
BOG × (YR03)	−1.34		−1.45		−1.23	
	(0.07)		(0.10)		(0.10)	
BOG × (YR04)	−1.74		−1.92		−1.55	
	(0.08)		(0.10)		(0.11)	
BOG × (YR05)	−2.15		−2.27		−2.03	
	(0.08)		(0.11)		(0.11)	
BOG × (YR06)	−2.43		−2.56		−2.29	
	(0.08)		(0.11)		(0.12)	
BOG × (YR07)	−2.83		−2.93		−2.73	
	(0.09)		(0.12)		(0.12)	
Outcome mean (1996)	85.70		86.56		84.80	
Observations (Cell) × (Year)	2,862,513		1,476,423		1,386,090	

Notes: This table reports estimates of equations (1) and (2) where the dependent variable is the percentage of each cell with positive annual earnings. Panel A includes all veterans in our sample, and panels B and C restrict the sample to veterans in the specified group. (YR-1996) and (YR-2001) are linear time trends. All regressions include year fixed effects and fixed effects for each combination of (AFQT-quintile) × (year), (year of birth) × (year), and (race) × (year), where race is defined as white or nonwhite and veterans with a missing AFQT score are grouped into a sixth AFQT category. All regressions weight each observation according to the number of veterans in the cell. Standard errors, clustered on cell, are reported in parentheses.

spurred a reduction in their labor supply. A natural alternative interpretation, however, is that BOG veterans were in worse health than NOG veterans—perhaps due to the rigors of in-theater military service—leading to comparatively earlier retirements in the 2000s for reasons unrelated to the 2001 policy change. If so, the accelerating decline in LFP among BOG veterans after 2001 should primarily impact the oldest Vietnam veterans, with younger veteran cohorts exhibiting a similar LFP falloff as they approached these early retirement years in subsequent years.

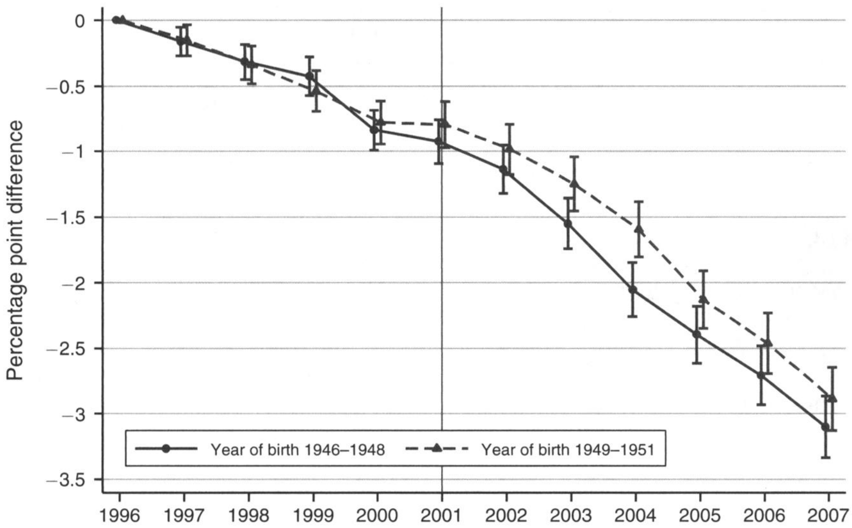

Figure 5. Evolution of Labor Force Participation among BOG Relative to NOG Veterans, 1996–2007: Birth Cohorts 1946–1948 and 1949–1951

Notes: This figure reports annual percentage point differences and 95 percent confidence intervals between BOG labor force participation (LFP) and NOG LFP for two veteran birth cohorts: 1946–1948 and 1949–1951. Each series is normalized to the BOG-NOG difference in LFP as of year 1996. The vertical line indicates the year of the Agent Orange policy change. Labor force participation is defined as the share of veterans in a cell with positive earnings.

Figure 5 and the remaining 2 panels of Table 6 explore these competing hypotheses by again subdividing the sample into 2 birth cohorts of average ages 54 and 51 years at the time of the policy change. Both the figure and the table reveal that labor force participation of BOG relative to NOG veterans for both sets of birth cohorts dropped sharply soon after the policy change. The year-over-year decline in BOG relative to NOG participation doubled after 2001 for both older (1946–1948) and younger (1949–1951) birth cohorts, rising from 0.17 to 0.36 percentage points (0.17 + 0.19) among the former group, and from 0.14 to 0.32 percentage points (0.14 + 0.18) among the latter group. This trend break in BOG relative to NOG labor force participation, occurring simultaneously across birth cohorts after 2001, suggests that benefits expansion rather than early retirements explains the sharp drop in BOG labor force participation following the Agent Orange decision. Notably, we do not observe any differential increase in mortality among BOG relative to NOG veterans in the years immediately following 2001, which further weighs against the possibility that the differential decline in BOG labor force participation after the policy change was due to a more rapid deterioration in health (see online Reference Tables 4 and 5).

The upper panel of Table 7 explores changes in LFP by race and AFQT subgroup. These results generally mirror uptake of DC across demographic groups. Consistent with the Table 4 findings for DC enrollment, the post-2001 fall in LFP among nonwhite and among low-AFQT BOG relative to NOG veterans is more pronounced

TABLE 7—LFP AND EARNINGS IN THE BOG VERSUS NOG SAMPLES FROM 1996–2007

	All (1)	Nonwhites (2)	Whites (3)	AFQT < 45 (4)	AFQT ≥ 45 (5)
Panel A. Dependent variable: percentage of cell with earnings > 0					
BOG	−0.33	−2.50	−0.05	−0.88	−0.92
	(0.07)	(0.24)	(0.07)	(0.13)	(0.09)
BOG × (YR-1996)	−0.15	−0.19	−0.15	−0.16	−0.11
	(0.01)	(0.04)	(0.01)	(0.02)	(0.02)
BOG × (YR-2001) × (YR ≥ 2002)	−0.18	−0.22	−0.18	−0.20	−0.15
	(0.02)	(0.07)	(0.02)	(0.04)	(0.03)
Outcome mean (1996)	85.70	78.18	86.67	81.70	89.08
Observations (Cell) × (Year)	2,862,513	310,987	2,551,526	883,832	1,321,309
Panel B. Dependent variable: 100 × ln(*cell mean earnings*)					
BOG	−2.59	−4.68	−2.30	0.02	−4.10
	(0.23)	(0.77)	(0.24)	(0.41)	(0.29)
BOG × (YR-1996)	−0.23	−0.33	−0.21	−0.27	−0.13
	(0.04)	(0.13)	(0.04)	(0.07)	(0.04)
BOG × (YR-2001) × (YR ≥ 2002)	−0.45	−0.77	−0.41	−0.40	−0.27
	(0.06)	(0.22)	(0.06)	(0.12)	(0.08)
Outcome mean (1996)	1,067.44	1,033.86	1,071.73	1,039.92	1,082.06
Earnings mean (1996)	50,658	36,025	52,530	37,252	56,614
Observations (Cell) × (Year)	2,855,305	308,923	2,546,382	879,962	1,320,155
Panel C. Dependent variable: 100 × ln(*percentage of cell with earnings* > 0)					
BOG	−0.29	−3.57	0.13	−1.20	−1.14
	(0.10)	(0.36)	(0.10)	(0.20)	(0.12)
BOG × (YR-1996)	−0.21	−0.31	−0.20	−0.24	−0.16
	(0.02)	(0.07)	(0.02)	(0.04)	(0.02)
BOG × (YR-2001) × (YR ≥ 2002)	−0.36	−0.52	−0.35	−0.44	−0.29
	(0.03)	(0.12)	(0.03)	(0.07)	(0.04)
Outcome mean (1996)	−17.85	−28.26	−16.51	−23.28	−13.25
Observations (Cell) × (Year)	2,855,305	308,923	2,546,382	879,962	1,320,155

Notes: This table reports estimates of equation (2) where the dependent variable is the outcome indicated in each panel heading. Each cell has one observation for each year between 1996 and 2007. Panels B and C exclude cells with 0 mean annual earnings. All earnings outcomes are in 2014 dollars. (YR-1996) and (YR-2001) are linear time trends. All regressions include year fixed effects and fixed effects for each combination of (AFQT-quintile) × (year), (year of birth) × (year), and (race) × (year), where race is defined as white or nonwhite. Column 1 includes all veterans in our sample and columns 2–5 restrict the sample to veterans in the specified group. Columns 1–3 group veterans with a missing AFQT score into a sixth AFQT category, while columns 4–5 exclude veterans with missing AFQT scores. All regressions weight each observation according to the number of veterans in the cell. Standard errors, clustered on cell, are reported in parentheses.

than among white and higher AFQT veterans, though these differences are not statistically significant.

B. Impacts on Labor Market Earnings

Alongside reducing LFP, receipt of DC benefits may spur veterans to reduce their work hours or switch from full-time to part-time employment, thus lowering annual earnings among those remaining in the labor force. We explore the effect of the Agent Orange policy on labor force earnings by estimating equation (2) for the log of cell mean earnings, excluding (of necessity) cells where all veterans have exited the labor force.[22] Panel B of Table 7 shows that earnings were about 2.6 log points lower on average among BOG than NOG veterans in our baseline year, and this gap was expanding by about 0.2 log points per year through 2001. The panel B estimates indicate that the earnings gap grew significantly more rapidly—by about 0.7 log points annually (0.23 + 0.45)—following the 2001 policy change, a pattern that is also visible in Appendix Figure 1. Once again, the effects are larger for nonwhite and low-AFQT veterans.

Since these total earnings impacts combine extensive margin (participation) and intensive margin (hours and wage) responses, we cannot directly infer whether they reflect changes in earnings among incumbents or merely a reduction in the number of veterans working. The evidence in panel A of Table 7 suggests, however, that minority and low-AFQT veterans were particularly likely to exit the labor force upon receiving DC benefits. If we hypothesize more generally that veterans with lower potential earnings are most likely to exit the labor force in response to increased transfer income, we can compare extensive margin and total earnings responses to assess evidence for intensive margin responses. Concretely, suppose that earnings among those dropping out of the labor force are below the average of those still working within the cell—that is, income effects are larger for low earnings workers. In this case, the decline in log cell earnings will be smaller than the decline in log cell labor force participation. Conversely, if the decline in log cell earnings exceeds the decline in log cell participation, this indicates that either earnings are also falling on the intensive margin or, contrary to our assumption, higher earning workers are disproportionately exiting employment.

To facilitate earnings and employment comparisons, panel C of Table 7 reports estimates where the dependent variable is the log of the fraction of veterans in a cell working (rather than simply the percentage working, as in panel A). Comparing across panels B and C reveals that the decline in relative earnings of BOG versus NOG veterans after 2001 is, in most cases, slightly larger than the relative decline in labor force participation. In column 1, for example, the relative decline in log earnings of BOG relative to NOG veterans expands by 0.45 log points per year after 2001 (panel B) whereas the relative decline in log LFP increases by only 0.36 log points per year (panel C). This pattern also holds for black and white veterans considered separately, though it does not hold for lower and higher AFQT veterans. We infer that the Agent Orange policy likely induced a mixture of labor force exit and earnings reductions among beneficiaries, though the evidence on the latter margin is not clear cut.[23]

[22] We use the log of the mean rather than the mean of the log because of the cell-level aggregation of our earnings data. We do not, however, adjust cell means for nonparticipation; if a cell contains 5 veterans each earning $25,000 annually and one leaves the labor force, mean cell earnings falls to $20,000. Thus, this measure incorporates intensive and extensive margin adjustments.

[23] For completeness, Appendix Table 4 also presents a set of comparison specifications using mean and median cell earnings in place of the log of mean cell earnings used above. Substantial variance in annual earnings measured in levels makes point estimates too imprecise to draw any strong inferences. To reduce the influence of outliers, panel B uses a trimmed sample that excludes all cells that have mean annual earnings in any year that exceeds the ninety-fifth percentile of cell earnings in the respective year. As a further check on the influence of outliers, panel C uses cell median earnings as the outcome variable. For both trimmed mean and median earnings, we find a significant increase in the trend earnings divergence between BOG and NOG veterans after 2001.

To what degree is this causal effect driven by changes in labor force participation among incumbent DC recipients—many of whom received higher combined disability ratings and corresponding benefit increases as a consequence of the Agent Orange policy—rather than by changes in participation among new enrollees? Appendix Table 5 probes this question by comparing the evolution of CDRs among veterans according to DC enrollment status as of 1998. Among veterans enrolled in DC by 1998 (incumbents), we find that the growth in CDRs for BOG incumbents was substantially larger than the growth for NOG incumbents prior to the policy change, a trend that increased only modestly after 2001. In contrast, the acceleration among new BOG entrants after 2001 was much larger than the acceleration observed among BOG incumbents relative to their NOG counterparts. This pattern suggests that labor supply impacts are also likely to be driven primarily by new DC entrants.

Panel B of Appendix Table 5 complements this evidence by comparing labor force participation trends between cells with a high density of DC incumbents and those with a low density of DC incumbents.[24] Following the 2001 policy change, the rate of divergence among BOG relative to NOG veterans actually attenuated slightly for cells with a high initial density of incumbents, but nearly tripled for cells with a low initial density of incumbents. This pattern again suggests that the differential decline in labor force participation among BOG relative to NOG veterans after 2001 was driven primarily by veterans induced to enroll in DC by the Agent Orange policy rather than by policy-induced changes in behavior among incumbent recipients.

VI. Comparing Labor Supply and Enrollment Impacts: Instrumental Variable Estimates

Motivated by the evidence that the Agent Orange policy both raised DC enrollment and lowered earnings among eligible veterans, we now use the Agent Orange policy as an instrumental variable for receipt of DC benefits. This provides a valid approach for estimating the causal effect of DC benefits on labor supply under the assumption that the Agent Orange policy only affects employment and earnings through its impact on benefits enrollment and transfer payments. While untestable, the panoply of findings above confers credibility that our approach is in step with the exclusion restriction. We find a sharp rise in DC receipt, DC payments, and total disability income among BOG relative to NOG veterans following adoption of the Agent Orange policy. Moreover, the rise in take-up was equally steep and pronounced among younger and older veterans, and was greatest among nonwhite and low-AFQT veterans. In all cases, take-up responses are paralleled by differential employment and earnings drops among BOG relative to NOG veterans that occur among both older and younger veterans, and which are slightly more pronounced among nonwhite and low-AFQT vets.

Table 8 presents instrumental variables estimates of equation (2) for the impact of DC participation on labor force participation, where the endogenous variable in

[24] Because labor force participation rates are measured at the cell level and cells are not stratified on DC enrollment, we cannot fully distinguish labor force participation effects among DC incumbents versus DC entrants.

TABLE 8—2SLS ESTIMATES OF DC RECEIPT AND ANNUAL DISABILITY BENEFITS ON LFP AND EARNINGS

	All (1)	Nonwhites (2)	Whites (3)	AFQT < 45 (4)	AFQT ≥ 45 (5)
Panel A. DV: Percentage of cell with positive earnings, endogenous variable: percentage of cell enrolled in DC					
DC enrollment	−0.18	−0.25	−0.17	−0.20	−0.17
	(0.03)	(0.07)	(0.03)	(0.04)	(0.05)
Outcome mean (1998)	84.7	77.1	85.7	80.5	88.3
Observations (Cell) × (Year)	2,142,029	232,540	1,909,489	660,866	988,801
Panel B. DV: Percentage of cell with positive earnings, endogenous variable: (disability benefits)/1,000					
(Disability benefits)/1,000	−0.79	−0.96	−0.76	−0.83	−0.81
	(0.12)	(0.27)	(0.13)	(0.18)	(0.21)
Outcome mean (2001)	81.9	73.4	83.0	77.1	85.9
Earnings mean (2001)	50,994	35,080	53,018	36,313	57,506
Observations (Cell) × (Year)	2,142,029	232,540	1,909,489	660,866	988,801
Panel C. DV: 100 × ln(*earnings* + *disability income*), *endogenous variable: percentage of cell enrolled in DC*					
DC enrollment	0.52	0.83	0.47	0.73	0.42
	(0.06)	(0.15)	(0.07)	(0.09)	(0.10)
Outcome mean (1998)	1,076	1,045	1,080	1,050	1,089
Earnings mean (1998)	52,875	36,680	54,943	38,063	59,386
Observations (Cell) × (Year)	2,137,665	231,235	1,906,430	658,480	988,152
Panel D. DV: Cell mean earnings, endogenous variable: disability benefits [trimmed sample]					
Disability benefits	−0.26	−0.13	−0.29	−0.21	−0.18
	(0.09)	(0.17)	(0.11)	(0.11)	(0.19)
Outcome mean (1998)	44,729	35,395	46,044	36,962	50,371
Observations (Cell) × (Year)	1,923,250	228,311	1,694,939	649,531	856,757

Notes: Panels A and B of this table report 2SLS estimates of the effects of DC receipt on labor force participation (panel A) and annual disability benefits on labor force participation (panel B). Panel C reports 2SLS estimates of the effects of DC receipt on 100 times the natural log of each cell's mean annual earnings plus disability income from DC, SSDI, and SSI. Panel D reports 2SLS estimates of the effects of an additional dollar in disability income on earnings levels for the trimmed sample, which excludes any cell that ever has a mean annual earnings level that exceeds the ninety-fifth percentile of annual cell mean earnings in any year between 1996 and 2007. The instrument for all estimates is a (BOG) × (year − 2001) × 1(year ≥ 2002) time trend. All regressions include a main effect for (BOG), a (BOG) × (year − 1998) time trend, year fixed effects, and fixed effects for each combination of (AFQT-quintile) × (year), (year of birth) × (year), and (race) × (year). Earnings and disability benefits are in 2014 dollars. Each cell has one observation for each year between 1998 and 2006 and all regressions weight each observation according to the number of veterans in the cell. Standard errors, clustered on cell, are reported in parentheses.

panel A is the percentage of a cell enrolled in DC.[25] The 2SLS estimate in column 1 finds that each percentage point increase in DC enrollment reduces the fraction of veterans working by 0.18 points—that is, approximately one veteran exits the labor force for every five veterans newly awarded DC benefits. Comparing across rows of this table, we find slightly larger employment effects for nonwhite and low-AFQT veterans, consistent with our maintained hypothesis that participation among these groups is more elastic.

[25] We limit the sample to the years 1998 through 2006 for which DC measures are available, rather than the longer sample window of 1996 through 2007 for which SSA earnings data are available. The instrumental variable for DC enrollment is $BOG_j \times (t - 2001) \times 1[t \geq 2002]$.

By specifying DC participation as the endogenous variable, panel A estimates do not account for policy-induced increases in DC benefits along the intensive margin—higher benefits among incumbents and greater potential benefits among new enrollees. We relax this restriction in panel B by making our endogenous variable the sum of disability income (DC, SSDI, and SSI benefits). This variable captures changes in transfer payments among both new enrollees and incumbents. Because many cells receive no disability payments in a given year, we specify the disability payment measure in real dollars rather than taking the logarithm.

The panel B estimates find that each thousand dollars in disability benefits payment reduces the probability of a veteran working by approximately 0.79 percentage points, with slightly larger impacts among nonwhite veterans (0.96 points). Scaling these estimates by the mean rate of labor force participation in 2001 (81.9 points) and mean year 2001 earnings (in constant \$2014 dollars) of \$51.0K implies an elasticity of labor force participation with respect to total income of −0.49.[26] This elasticity substantially exceeds those found in lottery studies (Imbens, Rubin, and Sacerdote 1999; Cesarini et al. 2015), though it is similar in magnitude to the findings of Boyle and Lahey (2010), who study the labor supply of a relatively comparable set of veterans who were nearing retirement in the mid-1990s.[27]

There are three likely reasons why our elasticity estimates exceed those for lottery winners. First, at the inception of the Agent Orange policy in 2001, Vietnam-era veterans were already near elderly (ages 50 to 55). Moreover, those veterans induced to enroll by the policy were likely to be in relatively poor health. Thus, we would expect their labor force participation to be relatively elastic as compared to a working age population. Second, distinct from lump sum cash payments, DC benefits are structured as an annuity—a stream of cash payment that, barring an unprecedented change in national policy, will persist (and generally rise) until mortality. This insurance component of DC (i.e., against the financial risk of unanticipated longevity) should generate a larger labor force participation response than a nominally equivalent lump sum cash payment.[28] Finally, we cannot rule out that the

[26] Specifically, the elasticity we calculate is an elasticity of labor force participation with respect to total income, $\frac{\%\Delta LFP}{\%\Delta Total\ Income}$, where the percent change in total income is calculated as the ratio of additional unearned income from disability benefits relative to mean labor income in 2001. A 0.79 percentage point drop in labor force participation roughly equals a 0.964 percent decrease in LFP relative to the mean LFP rate in 2001 $\left(\frac{-0.79}{81.9} \times 100 = -0.964\right)$. Likewise, a \$1,000 increase in disability income is akin to a 1.961 percent increase in total income, relative to mean annual earnings in 2001 $\left(\frac{1{,}000}{51{,}000} \times 100 = 1.961\right)$. Dividing −0.964 by 1.961 yields an elasticity of −0.49.

[27] Imbens, Rubin, and Sacerdote (1999), a working paper version of Imbens, Rubin, and Sacerdote (2001), reports income elasticities of participation ranging from 0 to −0.14. Table 4 of Cesarini et al. (2015) indicates that winning 1M in SEK reduces LFP by 2.07 percentage points. Scaling this estimate by a mean of 88.8 and mean earnings of 213 SEK (reported in Table A3.2) reveals an elasticity of $-0.005\left(\frac{-2.07}{88.8}/\frac{1{,}000{,}000}{213{,}000} = -0.005\right)$. See Blundell and MaCurdy (1999) for a broad review of labor supply elasticities and McClelland and Mok (2012) for more recent evidence.

[28] A nominally equivalent lump sum payment would correspond to the annual DC benefit amount multiplied by expected life years remaining, discounted to the present to account for the staggered payment structure. One can translate annuity values into conventional PDVs by applying assumptions on future mortality at the time of award. For our purposes, it is sufficient to note that veterans likely face substantial uncertainty about expected longevity and hence the annuity component of DC benefits offers economic value beyond the lump sum value.

participation elasticity estimate incorporates both pure (non-incentive) income effects from increased transfer income and additional incentive effects stemming from the potential availability of IU and SSDI benefits.

Since the Agent Orange policy precipitated a rise in transfer payments and a decline in employment and earnings among eligible veterans, its net impact on incomes of BOG relative to NOG veterans is ambiguous. Panel C of Table 8 therefore reports estimates of the net impact of DC enrollment on total income, where DC enrollment is instrumented with the Agent Orange policy. The outcome variable for these estimates is 100 times the log of cell total income—earnings plus disability benefits—and the endogenous variable is again the percentage of the cell enrolled in DC. The point estimate of 0.52 for the full sample implies that if, for example, a cell increased from 0 to 20 percent enrolled in DC, then average total income in the cell would increase by about 10.4 percent. These impacts are substantially larger for nonwhite and low-AFQT veterans, with point estimates of 0.83 and 0.73, respectively.[29] In interpreting these sizable impacts, note that we found above that only 1 in 5 (18 percent) of newly enrolled veterans exited the labor force as a consequence of the Agent Orange policy. For the remaining four-fifths, enrollment in DC raised transfer income while generating only minimal offsetting reductions in labor income, thus unambiguously raising total income.

To further characterize these labor supply impacts, we use the benefits variation generated by the policy change to estimate veterans' marginal propensity to reduce earnings per dollar of non-labor income (MPE). Here, we use cell mean labor earnings (in dollars) as the outcome variable and use total disability benefits (also in dollars) as the endogenous variable, instrumented by the Agent Orange policy change. To reduce the influence of outliers in these estimates, we use a trimmed sample that excludes all cells that have mean annual earnings in any year that exceeds the ninety-fifth percentile of cell earnings in the respective year.[30]

Estimates in the bottom panel of Table 8 indicate an MPE of −0.26 overall. Estimates for subgroups are in all cases negative, though heterogeneous and relatively imprecise. As with our labor force participation elasticity estimates above, the MPE estimates for Vietnam-era veterans substantially exceed those in the literature estimated using prime age lottery samples (for example, −0.12 in Imbens, Rubin, and Sacerdote 2001; and −0.11 in Cesarini et al. 2015). Though we cannot rule out that these large behavioral responses for veterans reflect the combined impact of income and incentive effects and the relatively advanced age and marginal health of the Vietnam-era veteran population, in combination with the annuity structure of the DC benefit program, it is plausible that much of the labor supply response is accounted for by income effects.

[29] Recall that post policy-change increment to disability benefits for nonwhite and low-AFQT veterans exceeded by 50 to 60 percent those of white and high-AFQT veterans (Table 5 panel C), while earnings for nonwhite and low-AFQT veterans were substantially below those of white high-AFQT veterans (Table 7 panel B). Our data further imply the Agent Orange policy resulted in substantially higher net income for low-AFQT BOG veterans than low-AFQT NOG veterans, consistent with the findings of Angrist, Chen, and Frandsen (2010) for low-education veterans.

[30] See the comparison of mean, trimmed mean, and median estimates found in Appendix Table 4 and discussed in footnote 23.

VII. Discussion

This paper provides evidence that the policy-induced increase in enrollment in the Veteran Administration's Disability Compensation program had a significant effect on the labor supply of Vietnam-era veterans. In net, we estimate that 18 percent of individuals who became eligible for the DC program as a result of the policy change dropped out of the labor force. This effect is roughly two-thirds as large as analogous estimates for the impact of SSDI receipt on labor force participation (Maestas, Mullen, and Strand 2013; French and Song 2014). Given that the DC program is intended to compensate veterans for their service-connected disabilities without affecting their incentives for labor force participation whereas the SSDI program provides strong non-work incentives, it is noteworthy that their impacts on labor force participation are relatively comparable. Combining policy-induced increases in transfer income and reductions in labor force participation and earnings, we estimate an income elasticity of labor force participation of −0.49 and a marginal propensity to reduce earnings per dollar of non-labor income of −0.26. These estimates are substantially larger than estimates from studies of lottery winners, though not implausible considering that, first, DC benefits are akin to an annuity policy rather than a lump sum transfer like lottery winnings, and because the Agent Orange policy change affected a near-elderly population of Vietnam-era veterans in diminished health.

To provide a rough accounting of the economic and fiscal costs of this policy, we note that our estimates imply that the Agent Orange policy increased DC enrollment by about 1 percentage point per year after 2001 among Vietnam veterans who served in-theater. If one assumes the same effect for other Vietnam veterans (e.g., those not in the Army or born outside of our 1946–1951 window), this would suggest that by 2007 there were about 210,000 (0.06×3.5 million) additional induced DC recipients. Given an average annual benefit of about \$14,000, this suggests a \$3 billion increment to annual DC expenditures and—while the available data are limited—a corresponding increase of about \$1 billion in VA health expenditures. Adding to this sum the loss in tax revenue from diminished veterans' labor supply and the increase in their SSDI payments brings the annual total to \$5 billion. Assuming, conservatively, that the labor supply effect of DC enrollment is entirely driven by (non-incentive) income effects—and is thus a transfer—there still remains the well-known efficiency cost of raising the public funds to offset these expenditures. Applying a dead weight loss per dollar of tax revenue of 0.3, this efficiency cost is about \$1.5 billion per year in the first 5 to 6 years after the policy change, and the effects appear to have continued beyond our sample window (Coile, Duggan, and Guo 2015).

While this calculation assumes DC payments have no distortionary incentive effects, it appears plausible that the pure income effect of DC benefits on veterans' employment and earnings is augmented by the interaction between DC enrollment and veterans' potential eligibility for Individual Unemployability (IU) and SSDI benefits, both of which provide strong incentives against gainful employment. Consistent with this hypothesis, we find that the Agent Orange decision increased enrollment in SSDI by approximately one recipient for every eight veterans newly enrolled in

DC. While 14 percent of DC beneficiaries in our sample had received IU status by 2006, this share was 20 percent among BOG veterans who enrolled in DC in the year after the Agent Orange policy. Since IU benefits are only available to veterans with earnings at or below the poverty threshold for a single individual, the rapid growth of IU designations among newly enrolled DC beneficiaries underscores the potential for the graduated DC benefit program to generate unintended labor supply impacts.

Using estimates from Maestas, Mullen, and Strand (2013), we benchmark the size of these incentive impacts. We assume that (i) the incentive effect of the DC program is restricted to veterans with IU status; and (ii) veterans who were induced to receive benefits at the 100 percent level are comparable to SSDI applicants. Panel C of Table 4 indicates that the policy change induced a 0.20 annual percentage point increase in BOG relative to NOG receipt of IU status, which accounts for roughly 20 percent of the overall increase in BOG relative to NOG DC receipt after 2001. Multiplying 20 percent by 28 percentage points, the reduction in labor supply estimated by Maestas, Mullen, and Strand (2013), suggests that roughly 31 percent of the decline in labor force participation following the policy change was the result of distortionary incentives ($0.20 \times 28 = 5.6$, which is 31 percent of 18).

This back-of-the-envelope calculation for the incentive component of the observed behavioral response to provisions of DC benefits is potentially an over-estimate because: SSDI reduces labor force participation through both income and incentive effects; the income effect of the IU benefit, which typically results in higher monthly payments than SSDI benefits and does not terminate at age 65, is likely much stronger than the income effect of SSDI receipt; and the calculation ignores the possibility of income effects among DC beneficiaries who receive disability ratings of less than 100. Conversely, if some veterans reduce labor force participation to seek higher disability ratings, our calculations will fail to account for this behavioral distortion. In short, our calculation is unlikely to capture all aspects of the DC program that alter incentives for employment and earnings. Analyzing the dynamic interaction between these incentive and non-incentive effects of the Veterans Disability Compensation program (as in Autor, Kostøl, and Mogstad 2015, for Norway's Disability Insurance program) remains a goal for further research.

Data Appendix

A. *Construction of Cells in the BOG and NOG Samples*

To construct cells for matching individuals in the BOG and NOG samples with SSA data, we group individuals based on predetermined demographics characteristics including sex, race, year of birth, and so forth. The list of variables used to form cells, ranked in the order in which the grouping occurred, is:

1. Sex (male or female),

2. Race (white or nonwhite),

3. Death year (e.g., 1985),

4. Year-of-birth (e.g., 1946),

5. Start year (e.g., 1966),

6. Education at entry (e.g., 0, 1, 2, 3, 4 for hsd, hsg, smc, clg, clg-plus),

7. AFQT score quintile (e.g., 2),

8. Loss year (e.g., 1972),

9. Region of residence (e.g., Northeast).

Before forming cells, we determined which individuals could be verified upon matching to the SSA data. A match would be verified if the social security number, date of birth, and at least six letters of the last name could be matched in the two data sets. We construct cells from the verified BOG and NOG samples so that there are between five and nine individuals in each cell. Each cell consists only of BOG or NOG veterans. The number of variables used in the grouping varies across cells: in some cases, a cell reaches a size of five to nine after matching on a relatively small number of variables. If, after matching on a given variable in the above hierarchy, a cell obtains a size of 10 to 29 individuals, we do not further subdivide using the next matching variable, but instead we split the cell into the maximum number of cells with size 5 or more. (We sort, however, on the next matching variable to maximize similarity within the cells.) If a cell has fewer than five individuals after matching, we then re-merge it with an adjacent cell. If a cell with fewer than five individuals is merged with an adjacent cell to form a new cell with more than nine individuals, the merged cell is split in two.

The distribution of the cell size for the verified NOG sample is:

In cell of size	Frequency	Percentage
5	1,388,440	58.86
6	657,696	27.88
7	171,269	7.26
8	70,048	2.97
9	71,271	3.02
Total	2,358,724	100.00

The corresponding distribution for the verified BOG sample is:

In cell of size	Frequency	Percentage
5	942,415	65.19
6	328,338	22.71
7	92,785	6.42
8	41,120	2.84
9	40,878	2.83
Total	1,445,536	100.00

The frequency distribution for the number of variables used in the BOG and NOG cell formation is as follows (thus 206,780 in the BOG matched on variables 1 through and including 8):

Number of Vars	Number in NOG	Number in BOG
1	0	0
2	89	61
3	3,391	4,149
4	38,087	30,716
5	86,671	62,807
6	80,909	65,140
7	174,281	162,909
8	397,667	206,780
9	1,577,629	912,974
Total	2,358,724	1,445,536

B. *Construction of the Analysis Sample*

Online Reference Figure 2 diagrams the construction of the sample used in our analysis. The "loss year" file and the Vietnam file combine to form our baseline OEMA sample of 4.1 million veterans. After merging the OEMA sample to VA disability data, the SSA Death Master File, and SSA earnings information, we restrict our sample to 3.8 million veterans who had valid SSA earnings data. As reported in online Reference Table 1, the number of BOG veterans in our database is largest in the 1966 through 1971 start years; veterans who began their service after 1971 tended not to serve in the Vietnam theater. Those entering before 1966 are much less likely to be included in our sample since many had exited the Army prior to 1968, the first year of our "loss year" file. We therefore restrict both the BOG and NOG samples to veterans who have a start year between 1966 and 1971 inclusive, which reduces our sample to 1.9 million veterans.[31] We further restrict attention to individuals born between 1946 and 1951 inclusive, with 1.5 million veterans remaining. We next exclude approximately 150,000 veterans who have missing loss years, loss years before 1968, or loss years after 1985.[32] We finally drop an additional 8,000 veterans who are in SSA cells where not all veterans have the same birth year, at least one veteran in the cell has a start year before 1966 or after 1971, or at least one veteran in the cell has a loss year before 1968 or after 1985. Our final sample includes 1.351 million veterans of the US Army who began their service between 1966 and 1971 and were born between 1946 and 1951. For the analysis, we

[31] For the nearly 200,000 veterans with missing start years, we imputed their start year based on the median start year for other veterans in the sample with the same date of birth. This has little bearing on our final sample as nearly all veterans with missing start years have missing loss years and are therefore excluded from our analysis.

[32] Veterans found in the "loss year" file and the Vietnam file are in the BOG sample while veterans found in the "loss year" file but not the Vietnam file are assigned to the NOG sample. The Vietnam file contained loss year information for about 25 percent of veterans, which explains why a small fraction of the BOG sample has a loss year before 1968 or after 1985. Our final analysis sample contains a few veterans who were in the Vietnam file but not in the "loss year" file. This group comprises only 1.25 percent of our final sample and our results are nearly identical when we exclude them from our analysis. The "loss year" file does not include service members who died during service. US government archives record 38,224 Army service members who were killed in action in Vietnam.

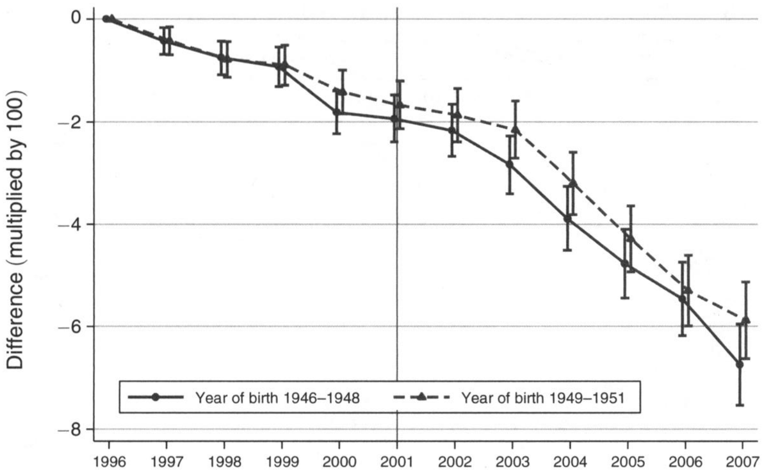

FIGURE A1. EVOLUTION OF LN(*cell mean earnings*) AMONG BOG RELATIVE TO NOG VETERANS, 1996–2007: BIRTH COHORTS 1946–1948, 1949–1951

Notes: This figure reports annual differences and 95 percent confidence intervals between the natural log of BOG earnings and the natural log of NOG earnings (multipled by 100) for 2 veteran birth cohorts: 1946–1948 and 1949–1951. The vertical line indicates the year of the Agent Orange policy change. Each series is normalized to the BOG-NOG difference in log earnings as of year 1996.

TABLE A1—PERCENTAGE OF DC RECIPIENTS AND AVERAGE ANNUAL BENEFIT BY CDR AND SERVICE ERA IN 2006

CDR	Panel A. All veterans			Panel B. CDR distribution by service era				
	Recipients	Payments (2014 $ millions)	Mean annual benefit	Gulf	Vietnam	Korea	WWII	Peacetime
0%	14,291	$15	$1,046.32	0.1%	0.3%	2.4%	1.4%	0.4%
10%	775,346	$1,232	$1,588	27.3%	21.8%	30.6%	33.0%	37.3%
20%	417,721	$1,296	$3,102	17.8%	13.3%	13.0%	12.5%	17.8%
30%	334,931	$1,770	$5,286	15.3%	10.6%	12.4%	13.1%	11.0%
40%	259,834	$1,988	$7,652	12.5%	9.0%	8.2%	8.1%	8.0%
50%	161,568	$1,737	$10,749	7.2%	5.9%	5.4%	5.8%	4.7%
60%	184,264	$3,289	$17,849	7.0%	7.0%	7.6%	7.1%	5.7%
70%	165,257	$4,333	$26,218	4.8%	8.5%	5.5%	5.4%	4.2%
80%	113,404	$3,305	$29,143	3.4%	5.7%	4.1%	4.1%	2.7%
90%	60,546	$1,926	$31,818	1.7%	3.1%	2.3%	2.3%	1.4%
100%	238,662	$9,198	$38,541	3.0%	14.7%	8.5%	7.2%	7.0%
Average			$11,038					
Total	2,725,824	$30,089		694,813	947,598	159,804	328,044	595,565

Notes: Data in the first three columns, from the US Department of Veterans Affairs 2006 Annual Benefits Report, provides the number of DC recipients, the total amount paid, and the average annual benefit payment (in 2014 dollars) by combined disability rating (CDR) in September 2006. Data in panel B provide the share of DC recipients from each service era with each value of the CDR. Panel B data were obtained from the Department of Veterans Affairs following an email request.

converted this final sample into a 1996–2007 panel of 15.2 million (year) × (individual) observations, or 2.9 million (year) × (cell) observations.[33]

[33] A veteran who dies in year *t* is dropped from the analysis sample in year *t* and in all subsequent years. Because year-of-death is one of the variables used when constructing cells, typically all members of a cell die in the same year (if any die). The number of surviving cells falls by approximately 4.8 percent from 1996 to 2007.

TABLE A2—EVOLUTION OF DISABILITY COMPENSATION (DC) BENEFITS BY YEAR OF DC ENROLLMENT

Year of enrollment	Outcome year							
	1999 (1)	2000 (2)	2001 (3)	2002 (4)	2003 (5)	2004 (6)	2005 (7)	2006 (8)
Panel A. Mean combined disability rating								
1999	41.8	45.5	49.7	53.5	57.7	60.3	62.3	63.6
2000		44.1	50.0	55.0	59.4	62.3	64.6	66.3
2001			41.2	46.2	52.3	56.6	60.6	62.6
2002				38.7	46.0	50.9	54.8	57.6
2003					41.8	47.8	52.2	55.2
2004						43.0	48.5	51.5
2005							41.3	45.1
2006								39.1
Panel B. Mean annual DC payment								
1999	10,948	12,781	14,622	15,989	17,606	18,645	19,393	20,143
2000		11,904	14,527	16,351	18,044	19,230	20,120	21,037
2001			10,883	12,807	15,234	16,987	18,626	19,630
2002				9,766	12,634	14,601	16,136	17,431
2003					10,822	13,218	14,974	16,360
2004						11,295	13,437	14,756
2005							10,503	12,116
2006								9,746
Panel C. Percentage receiving IU award or 100 *CDR*								
1999	15.3	20.9	26.4	31.3	36.7	40.5	43.2	44.7
2000		17.6	25.2	31.3	37.1	41.5	44.6	46.5
2001			15.3	20.8	28.0	33.5	38.6	40.7
2002				12.3	20.1	25.9	30.4	33.2
2003					15.1	21.9	27.0	30.0
2004						16.8	22.5	25.6
2005							14.4	17.7
2006								11.5
Panel D. Percentage receiving compensation for diabetes								
1999	0.8	1.1	2.5	7.9	11.0	12.4	13.8	14.8
2000		0.5	2.3	9.4	12.1	13.4	14.6	15.8
2001			15.3	37.6	38.6	39.4	39.9	40.4
2002				58.5	59.0	59.5	59.7	59.9
2003					48.6	49.1	49.6	50.1
2004						42.7	43.7	44.5
2005							39.9	40.8
2006								40.9

Notes: This table reports the progression of DC benefits for veterans in the sample described in Section III and the Data Appendix. Each row corresponds to a DC enrollment cohort. Each column corresponds to a particular year. In panel A, veterans with an IU award are given a CDR of 100. In panel B, mean annual DC payments are in 2014 dollars. Although our data codes DC receipt in each year from 1998 through 2006, we can only determine the year a veteran enrolls in DC if the veteran is observed not receiving DC in a prior year. We thus identify DC enrollment cohorts from 1999 forward, but not 1998.

TABLE A3—COMPARISON OF CENSUS AND ARMY/SSA DEMOGRAPHICS AND EARNINGS DATA FOR YEAR 1999

	Panel A. Army/SSA verified sample (1999)			Panel B. Vietnam veterans born 1946–1951: 2000 census		
	All	Whites	Nonwhites	All	Whites	Nonwhites
	(1)	(2)	(3)	(1)	(2)	(3)
Age in 1999	50.5	50.5	50.3	50.7	50.7	50.5
	(1.5)	(1.5)	(1.5)	(1.6)	(1.6)	(1.6)
Race						
White	88.7	100.0	0.0	86.7	100.0	0.0
Nonwhite	11.3	0.0	100.0	13.3	0.0	100.0
Education						
HS dropout	27.3	26.9	30.7	5.2	4.7	8.3
HS grad.	43.6	42.9	49.2	39.3	39.1	41.0
Some college	14.7	15.3	10.4	29.7	29.1	33.4
College grad.	6.9	7.5	2.4	15.9	16.6	11.3
More than college	0.4	0.5	0.1	9.9	10.5	6.0
Percent positive earnings	84.1	85.0	76.5	82.2	83.1	76.3
Annual earnings (2014 dollars)						
Mean (full sample)	53,365	55,457	36,969	59,436	61,897	43,395
	(78,099)	(82,212)	(25,054)	(66,283)	(68,203)	(49,121)
Mean (if > 0)	62,043	63,919	47,322	72,313	74,493	56,842
	(81,670)	(85,973)	(27,650)	(66,438)	(68,263)	(48,951)
Median (full sample)	46,270	47,889	34,428	49,734	50,019	36,946
Observations	1,286,921	1,141,340	145,581	203,781	178,601	25,180

Notes: This table reports summary statistics for veterans in the SSA verified sample and veterans in the 2000 census. Panel A maintains the same sample restrictions described in the data appendix and further restricts to veterans who were still alive as of 1999. All statistics in panel A are from 1999. Panel B reports summary statistics for veterans in the 5 percent 2000 Census IPUMS extract who were born between 1946 and 1951.

Table A4—Earnings Contrasts between BOG and NOG Veterans, 1996–2007: Mean Cell Earnings and Median Cell Earnings

	Panel A. DV: Mean earnings		Panel B. DV: Mean earnings [trimmed sample]		Panel C. DV: Median earnings	
	(1)	(2)	(1)	(2)	(1)	(2)
BOG	−3,229	−3,759	139	156	−1,515	−1,527
	(161)	(345)	(73)	(74)	(100)	(101)
BOG × (YR-1996)		−25		−70		−122
		(244)		(11)		(15)
BOG × (YR-2001) × (YR ≥ 2002)		−31		−71		−68
		(438)		(17)		(25)
BOG × (YR97)	−295		−46		−112	
	(128)		(29)		(43)	
BOG × (YR98)	−660		−102		−274	
	(168)		(37)		(54)	
BOG × (YR99)	−919		−178		−408	
	(317)		(43)		(62)	
BOG × (YR00)	−3,500		−305		−530	
	(2,022)		(47)		(67)	
BOG × (YR01)	−540		−388		−661	
	(207)		(51)		(73)	
BOG × (YR02)	1,758		−457		−782	
	(3,277)		(56)		(80)	
BOG × (YR03)	−431		−570		−952	
	(192)		(59)		(87)	
BOG × (YR04)	−572		−698		−1,105	
	(209)		(63)		(91)	
BOG × (YR05)	−778		−912		−1,411	
	(277)		(66)		(95)	
BOG × (YR06)	−1,337		−1,074		−1,562	
	(313)		(68)		(99)	
BOG × (YR07)	−1,406		−1,195		−1,808	
	(260)		(71)		(102)	
R^2	0.003	0.003	0.173	0.173	0.167	0.167
Outcome mean (1996)	50,658		43,326		45,218	
Outcome standard deviation	275,309		18,353		27,209	
Observations (Cell) × (Year)	2,862,513		2,536,488		2,862,513	

Notes: This table reports estimates of equations (1) and (2) where the dependent variable is the outcome indicated in each panel heading. Earnings values are in 2014 dollars. The trimmed sample in panel B excludes any cell that ever has a mean annual earnings level that exceeds the ninety-fifth percentile of annual cell mean earnings in any year between 1996 and 2007. (YR-1996) and (YR-2001) are linear time trends. All regressions include year fixed effects and fixed effects for each combination of (AFQT-quintile) × (year), (year of birth) × (year), and (race) × (year), where race is defined as white or nonwhite and veterans with a missing AFQT score are grouped into a sixth AFQT category. All regressions weight each observation according to the number of veterans in the cell. Standard errors, clustered on cell, are reported in parentheses.

Table A5—DC Progression and LFP for Pre-Existing Beneficiaries and New Beneficiaries

	Panel A. CDR (individual level)			Panel B. LFP (cell level)		
	All veterans	Enrolled in DC by 1998	Not enrolled in DC by 1998	All veterans	High DC_98 Cell	Low DC_98 Cell
	(1)	(2)	(3)	(1)	(2)	(3)
BOG	2.87	2.55	−0.01	−0.66	−0.73	0.21
	(0.03)	(0.20)	(0.00)	(0.07)	(0.32)	(0.07)
BOG × (YR-1998)	0.34	0.84	0.22	−0.14	−0.33	−0.10
	(0.01)	(0.03)	(0.00)	(0.02)	(0.08)	(0.02)
BOG × (YR-2001)	0.66	0.26	0.73	−0.20	0.01	−0.22
× (YR ≥ 2002)	(0.01)	(0.04)	(0.01)	(0.03)	(0.11)	(0.03)
Outcome mean (1998)	3.96	38.21	0.00	84.68	77.23	85.58
Observations	11,376,787	1,165,699	10,211,088	2,374,577	245,297	2,129,280
Years	1998–2006	1998–2006	1998–2006	1998–2007	1998–2007	1998–2007

Notes: This table reports estimates of equation (2) where the dependent variable is a veteran's Combined Disability Rating (panel A) or the percentage of each cell with positive annual earnings (panel B). In panel A, column 1 includes all veterans in the sample, column 2 only includes veterans who initially enrolled in DC in 1998 or earlier, and column 3 only includes vetearns who were not enrolled in DC as of 1998. Veterans with an IU award are given a CDR of 100. In panel B, column 1 includes all cells, column 2 only includes cells where at least one-third of veterans in the cell were enrolled in DC as of 1998, and column 3 includes cells where fewer than one-third of veterans in the cell were enrolled in DC as of 1998. All regressions in panel A are at the individual level while regressions in panel B are at the cell level and are weighted by the number of veterans in a cell in a particular year. (YR-1998) and (YR-2001) are linear time trends. All regressions include year fixed effects and fixed effects for each combination of (AFQT-quintile) × (year), (year of birth) × (year), and (race) × (year), where race is defined as white or nonwhite and veterans with a missing AFQT score are grouped into a sixth AFQT category. Standard errors are reported in parentheses.

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