DISCUSSION PAPER SERIES

IZA DP No. 8057

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March 2014

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zur Zukunft der Arbeit
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Discussion Paper No. 8057
March 2014

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IZA Discussion Paper No. 8057
March 2014

ABSTRACT

Opportunity Cost and the Incidence of a Draft Lottery*

Military conscription implicitly taxes draftees. Those who would have volunteered at the market wage may be forced to serve for lower wages, and those with higher opportunity costs may be forced to serve regardless, yet little is known about the distribution of this burden. We exploit the Danish draft lottery to estimate the causal effect of military service on labor earnings of young men across the cognitive ability distribution. We find that high ability men who are induced to serve face a 7 percent earnings penalty, whereas low ability men face none. Educational career disruption is an important channel.

JEL Classification: J24, J31, J45

Keywords: conscription, military service, earnings, draft lottery

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* We thank the Danish Ministry of Defense for providing us with the draft data. Bingley is grateful for funding from the Danish Strategic Research Council (DSF-09-070295). All errors, omissions, and interpretations are our own.

I Introduction

> *"When the author speaks of impressing ... by presenting to the mind one sailor only suffering a hardship ... he places against this private mischief the inconvenience to the trade of the kingdom. But if, as I suppose is often the case, the sailor who [is] pressed and obliged to serve for the defense of this trade at the rate of 25s. a month could [earn] 3l. 15s. in the merchant's service, you take from him 50s. a month." (Benjamin Franklin 1818).*[1]

> *"I got a letter from the government the other day. / I opened and read it, it said they were suckers. / They wanted me for their army or whatever. / Picture me giving a damn – I said never. / [...] / I wasn't with it but just that very minute it occurred to me: The suckers had authority." (Public Enemy 1989).*[2]

The inequity of the military conscription tax has long been recognized. Franklin emphasized the income loss of impressed sailors by comparing earnings in the navy and merchant fleets. Those who would have volunteered at the market wage are paid lower conscription wages. In the Vietnam-era, economists made important contributions to the debate about the merits of military conscription versus an all-volunteer force.[3] A salient feature of a military draft is that those who serve but would not have volunteered are paid a military

[1] Remarks written by Benjamin Franklin, with a pencil on the margin of a report by Judge Foster containing the judge's arguments in favor of the right of impressing seamen. Published posthumously in, Benjamin Franklin and William Temple Franklin "Memoirs of the Life and Writings of Benjamin Franklin" Volume 3, page 169.

[2] Lyrics from a rap song describing reluctance to join the army when drafted. From Public Enemy (1989) Black Steel in the Hour of Chaos, from the Album It Takes a Nation of Millions to Hold Us Back. Def Jam Records. Track 12, verse 1.

[3] Altman and Fletcher (1967), Altman and Barro (1971), Hansen and Weisbrod (1967) and especially Oi (1967) were influential in hearings of the Gates (1970) report that eventually led to the end of the draft in the US. Warner and Asch (2001) is an excellent overview. Recently, a number of countries, such as Sweden, France, and Germany have decided to abolish mandatory conscription. In November 2012 a majority in the Danish Parliament came to an agreement about keeping the lottery but to adjust the number of conscripts from about 5,000 in 2012 to about 4,200. Despite public discussion about whether the lottery should be abolished the final government decision was to keep it but reduce the number of conscripts. Keeping the lottery allows the military to adjust the number of conscripts to offset countercyclical volunteering.

wage below civilian opportunity cost. In this paper we measure an important part of the opportunity cost for draftees forced to serve – the distribution of subsequent earnings differences as civilians – and identify significant sources of heterogeneity. Our focus is on the subject of the second quote rather than the first.

Many males share the experience of military service. Galiani and co-authors (2011) show that mandatory military service exists in the majority of the world's countries and that the majority of those are not involved in any armed conflict. The training is often extensive and typically ranges from a couple of months to several years in some countries.[4]

Military service means an interruption in an important phase of the career of young males, where decisions about human capital investments and labor market entry are made. Albrecht and co-authors (1999) point out three reasons why such interruptions are important. First, labor market experience is lost and we know that wages tend to rise with experience. Second, anticipated interruptions may affect human capital investments and the choice of jobs. Third, time out of the civilian workforce may lead to human capital depreciation.

In this paper, we contribute to the literature on the labor market effects of military service in two ways. First, we provide new causal estimates of the effect of *peace-time* conscription on adult earnings. The Danish context provides us with an excellent opportunity to provide such estimates. Upon turning 18 years, it is mandatory for all Danish men to participate in the "Armed Forces Day", where they are subject to a variety of tests and examinations. Part of each cohort is then randomly assigned to serve. We exploit this random assignment to estimate the causal effect of peace-time conscription on labor earnings.

Second, we exploit an attractive feature of the Danish system, where the random assignment to serve takes place *after* the enlistment tests have taken place. This means that we have information on pre-conscription factors, such

[4] An overview of concription ages and length of military service across the world can be found in CIA's world fact book, see https://www.cia.gov/library/publications/the-worldfactbook/fields/2024.html.

as cognitive test scores and health indicators, from the enlistment tests. We can use this information to examine if the effect of conscription on earnings varies across the population. We conjecture that the opportunity cost of military service is greater for males with better labor market prospects. Using the data on cognitive test scores, we can test this by estimating the effect of conscription across the ability distribution.[5] In addition, we can investigate if conscription has offsetting beneficial effects for some men, as has been argued (Berger and Hirsch 1983; Magnum and Ball 1989). Serving in the army may for instance improve certain types of skills, such as discipline and team-work, that may especially benefit disadvantaged youth. We analyse if conscription has a beneficial effect for immigrants, men who grew up in out-of-home care, or in single-parent families.

We use unique data from the Danish military that includes full information on draft eligibility status, draft lottery outcome and military placement for the population of Danish men born between 1976 and 1983, in total 152,269. To this, we have linked longitudinal administrative register data on educational qualifications, labor market outcomes, health care usage, and criminal convictions. This data allows us to also investigate to what extent any earnings differences run through educational attainment, employment, health or criminal activity.

Our paper relates to the broader literature that evaluates the effect of military service on various outcomes. In addressing the methodological challenge that males who self-select into military service are different from other males, a series of papers have exploited draft lotteries where individuals were randomized into conscription (Angrist 1990; Angrist and Kreuger 1994; Angrist and Chen 2011; Angrist et al. 2011). The estimates from these studies reflect both the effect of career interruption *and* the negative impact of going to war. In line with this, a number of studies have found negative effect of serving during a war on health outcomes (Hearst et al. 1986; Bedard and Deschenes 2006; Dobkin and Shabani 2009; Angrist et al. 2010; Autor, Duggan, and Lyle

[5] Berney (1969) is an early study of the distribution of opportunity costs of the draft. The focus of the paper is on progressivity of the draft tax. Tabulating civilian mean earnings by schooling attainment shows the tax is progressive but weighting by probability of serving shows that high school graduates face most of the burden.

2011).

Fewer studies have evaluated the effect of peace-time conscription. In this setting, lotteries have typically not been available and researchers have instead exploited alternative research designs to estimate the causal effect. Grenet et al. (2011) and Bauer et al. (2012) use a regression discontinuity design based on birth date cutoffs and find no effect of military service on earnings among British and German men. A *positive* effect among low-educated Portugese men was obtained by Card and Caruso (2012), who exploited information on pre-conscription earnings. In contrast, Imbens and van der Klauuw (1995) found a *negative* effect, exploiting policy-induced variation in enrollment rates across years in the Netherlands. The findings in this literature are as varied as the research designs and more evidence on the topic is clearly needed in order to understand the costs and benefits of conscription.[6]

Our results suggest a negative mean impact of military service on the earnings. On average, men conscripted and serving in the military who otherwise would not have volunteered earn about 2.5 percent less as young adults than they would if they had not served. This mean impact hides important heterogeneity. Allowing the effect to vary across the cognitive ability distribution, we find no effect among low-ability men but large effects for those with high-ability. At the top quartile of the ability distribution, we find that men who are assigned to serve earn 7 percent less compared to their peers who do not serve. The magnitude of this effect is similar to the effect of one additional year of schooling in Denmark.

We also show that part of the effect among high-ability males is likely to run through reduced educational attainment. Even at age 30, we find that men

[6] A related literature estimate the effect of conscription on other outcomes, such as educational outcomes and crime. Maurin and Xenogiani (2007) exploit the abolition of mandatory conscription in France and show that educational achievements fell after the abolition, as incentives to stay on in education for males weakened. Cipollone and Rosolia (2007) exploit an exemption from compulsory military service granted to a few cohorts of Italian men and show that the exemption increased boys' high-school graduation rates. Keller et al. (2010) use aggregate data from OECD countries and find that conscription is weakly associated with lower enrollment in higher education. Galiani et al. (2011) used the draft lottery in Argentina and found that conscription *increased* the risk of committing a crime. In contrast, Albæk et al. (2013), in parallel work to ours, also use the Danish conscription lottery and show that military service can reduce crime among youth offenders. Their data only includes a cohort of males born in 1964 and who resided in the Eastern part of Denmark.

assigned to serve have completed fewer years of schooling and are more likely to be enrolled in an ongoing education. In addition, we show that conscription reduces the risk of subsequent unemployment. We find no effect of conscription among potentially vulnerable subgroups: immigrants and those growing up in out-of-home care or lone parent households.

Our findings relate to the discussion about the merits of military conscription versus an all-volunteer force. The results suggest that conscription can lead to high costs, especially for high ability males. Such costs are not clearly revealed when focusing only on average effects. The paper proceeds as follows. In section II, we describe the institutional context in Denmark and the details of the conscription lottery. Section III explains the data we use and Section IV describes our empirical approach. In section V, we show the results and section VI concludes.

II Military Conscription in Denmark

Denmark re-introduced conscription after the Second World War. The inducement of young males for military service is randomly determined through a lottery at the "Armed Forces Day" (AFD). Participation in the AFD is mandatory for all men upon turning 18 years old.[7] The AFD is organized into sessions and depending of their birth date young males are called to present themselves to draft-board examinations in one of five regional centre for examination.

Before participating in the AFD, all prospective draftees submit a health questionnaire that forms the basis of a health assessment; a military physician can, if necessary, seek additional medical information from public health records.[8] About 10 to 15 percent of a cohort is declared unfit for military service and therefore ineligible for the draft in advance by sending physician

[7] Since 2004 all women are also invited to participate but they do not take part in the lottery.

[8] If the information in the health questionnaires implies that the person should be exempt from military service, the military will check the accuracy of the information from external sources, such as doctor and hospital records. If a high body mass index is claimed, the military will require the enlistee to get a verification of weight and height from a doctor. Claims of mental diseases will be checked from external sources and the doctor at the enlistment office will in addition make an assesment of his/her own. We thank Allan Meyer from the Danish Army for providing us with this information.

documentation of serious somatic or psychiatric disorders (Hageman, Pinborg, & Andersen, 2008). They are not called to the AFD.[9]

On the AFD, prospective draftees undergo a medical examination, a psychological evaluation, and take an IQ test.[10] Based on these assesments about 60 percent of each cohort are declared fit for military service and must participate in the draft lottery. They draw from a drum filled with lottery numbers ranging from 1 to 36,000.[11]

At the AFD the conscripts only know the range of " have-to-numbers" (very low numbers), "maybe numbers" and "free-numbers" (very high numbers). Later on, the Army announces the actual cutoffs depending on the number of individuals present, the number of volunteers and the needs of the Army. In the remainder of the paper we only consider those who were judged fit-for-service (eligible) and drew a lottery number at the end of the AFD. We refer to men who drew a number below the threshold as drafted, regardless of whether they served. We refer to men age 18-24 and who start military service as having served, regardless of whether they were drafted. In our sample of men declared fit for military service, and who participated in the draft lottery, 44.0 percent are drafted and 43.9 percent serve, but of those drafted, 26.8 percent do not serve in the end, and of those not drafted, 18.9 percent serve. Those who serve but were not drafted are volunteers.

For education purposes it is possible to delay the start of military service, but service has to be started before turning 32 years.[12] In our sample, 99.6 percent had completed their military service by age 25.

The length of the military service for most of our sample period is eight months.[13] Service is conducted in the army (82 percent), navy (7 percent), air

[9] Persons convicted for violent crimes or sentenced to at least 30 days imprisonment are also exempted from attending the AFD (Article 4 Law of Military Service).

[10] The test has been used since 1957 and it has been shown that the test is not undermined by lack of motivation or under-performance among the men taking the test (Teasdale 2009; Teasdale, Hartmann, Pedersen, & Bertelsen 2011). During our study period, there were 78 items and the total test score is the number of correct answers.

[11] A third party, TDC/ AS, previously Tele Danmark, is responsible for generating and delivering the lottery numbers.

[12] Article 25 (paragraph 2) Law of Military Service.

[13] A small minority of army placements can last longer than 8 months, for example service with the royal guards lasts 12 months. At the end of our sample period 336 men (0.2%) were subject to the new four month service requirement.

force (5 percent), civil defence, fire & rescue services (together 6 percent). The conscripts are provided with housing and military uniforms free of charge and to cover costs of food etc., in 2012 they received a monthly allowance of 6,230 DK (1,150 USD). In addition, conscripts receive a monthly taxable salary of 7,421 DK (1,337 USD).

III Data

The dataset comprises administrative records from the Danish Defense. The military register dataset contains information on 155,570 fit-to-service conscripts for birth cohorts 1976-1983. The data we have access to is for cognitive ability (IQ) tests, eligibility status, height, lottery number and the conscription-year (the AFD year) and the starting-year for their military service (see Table 1 for descriptives).

Thanks to the Danish civil registration number, military records are linked to administrative registers containing information on demographic characteristics, education, health care usage, employment, earnings, and criminal records at Statistic Denmark.

Our main outcome measure is annual labour income from employment and self-employment, including sickness benefits and paternity leave benefits. The source of the earnings measure is employer reports of annual labour income for employees and self-employed. Reports are sent to the tax authorities and employees each January for earnings paid in the previous calendar year. We observe the sum of labour earnings during the year from all employments that the individual may have had.[14] In our sensitivity analysis we will try an alternative income measure that excludes sickness and leave benefits. Due to the age distribution in our sample, we focus on income measured between the ages 25 to 35. In total, we observe 152,269 men without missing earnings.

Another important outcome variable in our analysis is schooling. Data on years of schooling is based on register information on education enrollment and qualifications obtained. This information is reported directly from educational

[14]The income measure excludes occupational pension contributions made by employers and employees. The reason is that tax payment is deferred until the pension is drawn.

institutions to the ministry of education. Statistics Denmark calculates highest completed education from the qualifications awarded to date and we use this to impute number of years of schooling.

Since the tests at the Armed Forces Day are performed prior to the lottery, we can use this test information to assess whether the lottery randomization is balanced. If the assignment is truly random, it should not be possible to predict assignment based on the test results. In addition, we can exploit other background variables, such as family background and ethnicity, in our checks. In the first column of Table 2, we show regressions on assignment by the lottery as a function of test results and other background variables. As expected, cognitive test scores, height, being raised in out-of-home care or a single-parent family and ethnicity do not predict assignment. These regressions also control for birth year, birth month, and timing of the AFD lottery. In all cases, the coefficients are small and insignificant, confirming that the lottery works as expected. In the second column, we add an extended set of controls, including birth weight from the medical birth register, household income when aged 15, and parental years of schooling. This reduces the sample size as some individuals lack information on these characterstics. Again, we find no evidence that such characteristics affect the probability of being assigned to military service. To further check the randomness of the lottery, we will also perform our main regressions with and without different sets of controls.

IV Method

We are interested in the effect of military service on adult earnings, which we model as follows:

$$y_{it} = \pi_0 + \pi_1 MILITARY_i + X_i\pi_2 + \upsilon_{it},$$

where y_{it} refers to the adult earnings of individual i at time t, $MILITARY$ is an indicator of participating in military service, and X is a set of control variables. Since we have repeated observations on income between age 25-35 for each individual, we pool the observations and cluster the standard errors

at the individual level. A standard OLS estimate of π_1 would be biased, however, since the presence of volunteers and resisters make the decision to join the military endogenous. In order to deal with this, we exploit the lottery and instrument $MILITARY$ according to:

$$MILITARY_i = \delta_0 + \delta_1 LOTTERY_i + X_i\delta_2 + \eta_i.$$

Here, $LOTTERY_i$ refers to an indicator variable for drawing a lottery number below the threshold and thus being assigned to military service. Note that since the lottery randomly assigns individuals to military service, there is in principle no need to include control variables, other than to increase precision. In order to check if the randomization works out properly, however, we compare estimates obtained with and without the controls.

Our IV estimator provides a Local Average Treatment Effect (LATE) that reflects the effect of military service among the group of compliers. In our case, this is the group of males that would serve if being randomly assigned to do so but that would otherwise not have volunteered to serve. The LATE is precisely the parameter of interest in our study, since this is the group of males who would not have self-selected into service and who are forced to serve. By a revealed preferences argument the opportunity cost of serving for this group is greater than the opportunity cost among the group of volunteers. In order to understand the cost of forced conscription, the effect on the former group is of prime interest.

Since we are interested in the effect of conscription across the ability distribution, we will also perform separate regressions by pre-service ability test scores. For this, we will slice the sample into different ability groups and perform the IV regressions separately for these different slices.

V Results

First-stage results

In Table 3, we report first-stage estimates, where an indicator of participating in military service is regressed on a dummy variable for a lottery draw below the cutoff and thereby being conscripted to serve. In column 1, we report estimates of the lottery cutoff, including only the set of basic covariates including birth year, birth month, and other variables capturing the timing of the AFD. Here, the impact of drawing a lottery number below the threshold is to increase the probability of military service by 51.8 percentage points. The coefficient of the cutoff is highly significant and the F-statistic is way above the rule of thumb of 10.

The second column shows the first-stage estimates where we in addition control for cognitive test scores, and height (and the square of test score and height). The coefficient of the cutoff is unchanged. In column 3, we then add an extended set of controls on family background; growing up in a single-parent family, placed in out-of-home care, and being a native Dane. Again, the first-stage coefficient remains the same. Finally, the fourth columns uses the restricted sample where we have information on birth weight, parental income at age 15, and parental education. Again, the results are essentially unchanged. These results are expected, since with proper randomization, these controls should not matter, other than to perhaps increase the precision of the estimates.

A IV results

In Table 4, we report IV results of the effect of military service on labor earnings at ages 25-35 from different specifications. The first column shows the results including only the basic set of controls, corresponding to column 1 of Table 3, and columns 2-4 once again add various sets of control variables. In all specifications, military service is found to decrease earnings. In columns 1-3, the effect ranges from 2.5 to 2.6 percent. In the fourth column, the effect is somewhat larger at 2.9, but one should keep in mind that the sample com-

position also changes somewhat here, because not everybody has information on the control variables included in this specification. The general picture one gets from these estimates is that impact of peace-time military service on earnings is negative and sizable among Danish males.

We can relate our finding to the other recent estimates of the effect of peace-time military service in the literature. In a qualitative sense, our estimate is closest to Imbens and van der Klaauw (1995) who found a 5 percent earnings penalty among Dutch men. Using the abolition of compulsory military service as a natural experiment, Grenet et al. (2011) and Bauer et al. (2013) found no effect, and Card and Carduso (2012) only found a positive effect among low-educated men.

We next look for heterogeneous effects across the ability distribution. The results are presented in two ways. In Figure 1, we plot the estimated effects by centiles of the AFQT test. We also show the estimates across quartiles of the ability distribution in Table 5, using specification (2) from Table 4. The figure and the estimates clearly illustrate that the effect varies across the ability distribution. At the lower end, the impact is essentially zero. The F-statistics are high across all regressions and the first-stage coefficients are very similar.[15] We thus obtain no evidence that low-ability males, with poor labor market prospects, would gain by being assigned to military service. The figure does reveal, however, that males at the higher end of the ability distribution face a penalty of being assigned to serve. Moreover, the penalty is large, as shown in column 4 of Table 5, where males in the top quartile of the distribution face a 7 percent earnings penalty from serving. Those at the third quartile face a penalty of about 3 percent.

It is likely that cognitive test scores are positively correlated with other background characteristics, such as parental income and education. Such background characteristics could also be used to define differences in opportunity costs of serving across individuals. In Table A1 in the Appendix, we examine the effect of serving across quartiles of parental income, parental education, birth weigth, and height. As shown in panel A, we obtain similar results

[15] The first-stage coefficient of the cutoff ranges from the 0.50, at the lowest quartile, to 0.52 at the highest quartile. The results are available on request.

when looking across quartiles of parental income. Again, we find the greatest penalty, 7 percent, at the upper quartile of the income distribution. We also obtain similar results for parental education, as shown in panels B and C. In Panels D and E, we focus on health measures; birth weight and height. Greater values signal better health and we again find that the opportunity costs are highest for the most healthy individuals. These results suggest that our main results are robust to other ways of distinguishing between individuals with high and low opportunity costs.

Our results so far concerns earnings at ages 25-35. We can also look at younger ages and study the immediate/contemporaneous costs of serving. At these ages, we expect high ability males to be in school if not serving, whereas low ability guys would be working instead. Hence, during these ages one might expect that low ability males pay the highest contemporaneous cost. As we show in Table A2, this is indeed the case, where there is a 6 percent penalty in the two lowest cognitive test score quartiles but no penalty in the two highest quartiles. The pattern of opportunity costs is thus reversed at these young ages.

The results presented so far suggest that there is large heterogeneity in the effects of conscription. The heterogeneity is also in the expected direction, where males with favorable civilian labor market prospects suffer a high opportunity cost of serving, whereas those with less favorable prospects are less hurt. The size of the penalty for high-ability males is large. The magnitude of the effect is similar to the return to one additional year of schooling in Denmark, see for instance Pedersen et al. (1990) and Asplund et al. (1996). This result suggests that the cost of forcing high-ability men to serve in the military is high.

B Channels

Several mechanisms may explain the estimated effects across the ability distribution. We first consider the effect of military service on years of schooling attained at different ages. Serving in the army could mean that studies are interrupted, not started, or that students drop out. Panel A of Table 6 shows

the effect of serving, this time replacing earnings with attained years of schooling at age 25. In Panel B, we repeat this exercise at age 30. Serving has a negative and significant impact on years of schooling at all quartiles but the effect is strongest for those at the upper quartile of the ability distribution. The smallest effect, a reduction of years of schooling by 0.13 years, is obtained for low-ability males and this effect is reduced to 0.01 at age 30. Among high-ability males, a signficant and negative effect remains at age 30 but it is now much smaller, amounting to a 0.08 decrease. For other groups, no significant effect remains at age 30.

These results suggest that the large earnings penalty for serving among high-ability men cannot be fully explained by reduced educational attainment because by age 30 most have largely caught up on their interupted studies. Given the estimated returns to schooling in Denmark of about 6 percent, a tenth of a year of lost schooling explains very little of the earnings penalty among the high-ability males.

Another potential explanation for the earnings penalty is that some males are still studying when we measure their earnings. This means that they would have zero or low earnings which may explain part of the earnings penalty.[16] Note however that since we use log earnings in our main specification, those with zero earnings drop out of the analysis.[17]

Since many Danish students have part-time jobs while studying, another explanation for the earnings penalty may be that serving increases the likelihood of studying rather than embarking on a career job during the late 20's, and thus having low, but non-zero, recorded earnings. In our sample, we observe 13 percent studying at age 25, 8 percent at 28, 4 percent at 30, and 1 percent at 35.

In Table 7, we show the effect of military service on the probability of

[16] Study grants and study loans are not included in the earnings measure we use.

[17] Throwing the zeros out might be problematic if serving is related to the chance of having zero recorded earnings. As it turns out, only 3481 observations, or 2 percent, have missing data on earnings. We have run regressions on the effect of serving on the probability of having zero recorded earnings on serving, where we use the lottery outcomes as our instrument. At the upper quartile of the ability distribution, where most of the earnings penalty is obtained, serving is never a significant predictor of having missing earnings. At the lower quartile, serving is significant at some ages, mostly at the 10 percent level, and insignificant at other ages. Results are available on request.

being enrolled in education at different ages. The average effect is small but significant, with a 2.5 percent greater likelihood of studying at age 25, falling to a 1.1 percent greater likelihood of studying at age 30. As shown in Table 8, these average estimates hide quite some heterogeneity across the ability distribution. With age, educational enrolment effects become concentrated among those with high ability. For top quartile ability men, service makes them 3.9 percent more likely to be enrolled in education at age 25, and they are still 2.3 percent more likely to be enrolled at age 30. These results suggest that part of the earnings penalty among the high-ability group reflects that schooling is delayed, resulting in lost earnings and labour market experience.

C Sensitivity analysis

We next address the sensitivity of our results with respect to certain choices we made about sample inclusion and measurement. First, since our main earnings measure includes sickness and leave benefits, we test an alternative measure excluding these benefits. As shown in Table 8, excluding these benefits has little consequence for our estimation results. This result is not surprising, since sickness absence is rather uncommon among the age groups we consider.

In our main specification, we imposed no restriction on the age at which the person actually served. This is of little consequence as only 663 persons, or 0.4 percent of the sample, had not yet served when we started to measure earnings at age 25. We kept these observations in the analysis so as not to undo the lottery randomization by selecting on subsequent behavior. Our results are unaffected however when we restrict the sample to only those having served by age 25.

As noted in the description of the Danish enlistment, there was a change in the length of the period serving in 2006. We expect the effect of serving to be less after 2006 since the period was halved for most males. Only 336 males in our sample (0.2 percent) served after 2006, however, and when interacting the service indicator with an indicator of serving post 2006, the interaction effect was small and negative but insignificant.

D Extensions

We extend our analysis in this section by looking at the effect of military service on a range of alternative outcomes, including unemployment, crime, bank holdings, and health, with the purpose of shedding light on possible mechanisms behind our main results. In addition, we consider the effect among a number of subgroups, including non-ethnic Danes and those raised in single-parent families and in out-of-home care.

Table 9 summarizes the findings of the effect of conscription on a number of alternative outcomes. In panel A, the outcome measures the proportion of the year during which unemployment insurance benefits were received (at age 26).[18] The estimates suggest that conscription does reduce unemployment risk and that the effects are most pronounced at the lower and upper quartiles. It should be noted, however, that the effect is rather modest. Moreover, these estimates show that the large negative effect of conscription on earnings at the upper quartile of the ability distribution cannot be explained by unemployment.

Panel B shows results for bank holdings at age 26, calculated as bank assets minus bank debt.[19] This information is obtained from financial institution reports to the tax authorities. Here, we find a positive average effect which is significant at the 10 percent level. The clearest effect is seen at the upper quartile, where serving leads to an increase in bank holdings by 8,880 DK (about 1,640 USD). One explanation may be that some males manage to save some money during their conscription as housing is provided for free of charge and since they receive a monthly allowance and a salary during military service.[20]

In Panel C, we show results for crime. The outcome variable measures whether or not the individual has been convicted for any type of crime, excluding traffic offences, from age 25. The data on criminal convictions orginates from the Central Crime Register which collects criminal court proceedings and

[18] Note that unemployment insurance in voluntary and those in receipt of social assistance (because they chose not to self-insure, their insured period was not long enough to grant benefit eligibility, or their benefit period has expired) will not be registered as unemployed.

[19] Mortgage debts and value of stocks and bonds are excluded from this measure.

[20] For bank holdings, crime, and health outcomes, we include the pre-conscription values of these variables as controls. As expected, none of these predict assignment to military service.

report to the ministry of justice. The effects are small and insignificant across the distribution. In this respect our paper contrasts to the findings of Galiani et al. (2011) who finds large and positive effects on crime.[21]

In panels D to G, we focus on a number of health outcomes. First, we consider the probability of experiencing hospitalization. We obtain the data on hospitalizations from the national hospital discharge register which collects reports from local health authorities to the national board of health. We consider all admissions to somatic and psychiatric hospitals, including patients staying only over the day. A significant effect is obtained at the second quartile of the abiliy distribution, where conscription is found to increase the risk of experiencing hospitalization (panel D). We find no effects on the probability of using prescription medicine for psychiatric problems or being diagnosed with a psychiatric illness (panels E and F).[22] We do find a significant (10 percent level) military service effects reducing (treatment for) addiction problems but this effect is restricted to the second quartile of the ability distribution. Note that we do not find any health effects at the higher end of the ability distribution and they therefore cannot explain the large earnings penalties experienced by these groups.

Finally, we look for heterogeneity across other dimensions than ability. The results are reported in Table 10. An interesting question is whether those with another ethnic background gain from military service, for instance by forming networks with native Danes. Indeed, we find a positive earnings premium for first and second-generation immigrants of almost 3 percent but the estimate is not significant.[23] It should be noted however that the sample size is now much smaller resulting in less precision. For those raised in out-of-home care, and thus coming from a disadvantaged background, we find a positive and large 7.6 percent premium but the estimate is again insignificant.[24] We have

[21] Albaek et al. (2013) found that conscription reduded violent and property crime. Checking specific types of crime is beyond the scope of our paper.

[22] We obtain data on the purchase of mental-health related medicine, prescribed by GPs from the Danish Medicines Agency. Data on diagnoses for psychiatric problems and treatments for addiction problems are obtained from the hospital discharge register.

[23] These definitions are based on Statistics Denmark's classification of the population into native Danes and immigrants (first and second generation). Native Danes are defined as individuals born in Denmark and having at least one parent who was also born in Denmark.

[24] The variable indicates whether the person was placed in out-of-home care before the

also checked if the effect is different across the ability distribution but found no evidence of this. When we focus on those raised in single-parent families, we find negative and insignificant estimates result.[25] The magnitude of the coefficent is similar to that in our main specification, however.

VI Conclusions

In the Vietnam era, economic analysis made important contributions to the debate that lead to the move from military conscription to an all-volunteer force. To recruit a force of equal size under a draft lottery, average opportunity costs for those serving would be higher than with all volunteers. Some high opportunity cost men would not volunteer at the all-volunteer wage rate, but they would be forced to serve anyway under the draft. Angrist (1990) estimated the mean effect on civilian earnings of veteran status induced by the draft lottery to be a loss of about 15 percent 10 years after service.

Most countries still have some form of military conscription and recent papers use quasi-experimental variation to estimate the effect of peace-time military service on earnings and other outcomes. Our paper revisits the original question about the distribution of opportunity costs under a draft by using the original research design to estimate heterogeneous effects from the Danish draft lottery.

For men who are drafted and serve in the military but otherwise wouldn't have volunteered we find a mean earnings loss of 2.5 percent for ages 25-35 compared to if they hadn't served. We identify the Local Average Treatment Effect for precisely the population of interest who would not have served in the absence of the draft. This mean impact hides important heterogeneity. For low-ability men who are drafted and induced to serve there is no earnings effect, but for high-ability men the costs are high. Men in the top ability quartile suffer a 7 percent earnings penalty if they are drafted and induced to serve. This is similar in size to the return to a year of schooling in Denmark.

age of 18. This includes foster care and residential care homes. Registered stays range from one week to several years.

[25] The measure takes on the value 0 if the person lived together with both legal parents on his 17th birthday according to the central person register.

The main channel for measured earnings losses appears to be educational career disruption for the top ability quartile, with later enrolment and completion of studies. There are no effects on criminal convictions or measures of health, either at the mean or across ability. The gradient of earnings effects is remarkably similar across other pre-treatment measures of labor market prospects, from birth weight and height to parental schooling and income.

Our findings relate to only part of the opportunity cost of serving when drafted, as measured by subsequent civilian outcomes in the age range 25-35. Nevertheless we find significant mean earnings losses which are driven by large losses for high-ability men with good labor market prospects who would not have volunteered. If technical change in the military requires fewer but higher-ability personnel, and if they were encouraged to volunteer, this could significantly benefit high ability men everywhere currently facing a draft.

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VIII Tables

Table 1: Summary statistics.

	Full sample	
	Mean	Sd
Height	180.376	6.591
AFQT. Cognitive test score	44.609	8.322
Birth year	1979.283	2.256
Birth month	6.400	3.342
Raised in single-parent family	0.178	0.382
Placed in out-of-home care	0.039	0.193
Native Dane	0.960	0.195
Birth weight	3371	653
Household income at age 15	134047	57582
Mother's years of schooling	11.672	2.880
Father's years of schooling	12.041	3.171
Observations	152269	

Note: Raw cognitive test score on test taken on AFD is correct problems solved out of 78. Height in cm measured on AFD. Birth weight in grams measured by midwife at birth. Raised in single-parent-family is an indicator variable taking the value one if recorded in the population register as living with one parent only on 17th birthday. Placed in out-of-home care is an indicator variable taking the value one if has lived in out-of-home (institutions or foster home) care at any time age 0-17. Household income at 15 is equivalized according to the formula (sum of income in the household plus transfers minus taxes)/(1*first_adult+0.7*second_adult+0.5 number_of_children) and reflated to 2012 prices by the CPI. Mothers and fathers schooling are measured when offspring is age 15.

Table 2: Randomization check. Correlations between pre-draft characteristics and draft status.

	(1)	(2)
Height	-0.00000268	-0.0000125
	(0.000178)	(0.000188)
AFQT. Cognitive test score	0.000233	0.000212
	(0.000143)	(0.000152)
Native Dane	0.00545	0.000162
	(0.00603)	(0.00886)
Raised in single-parent family	-0.00414	-0.00352
	(0.00304)	(0.00312)
Placed in out-of-home care	-0.00116	-0.000941
	(0.00605)	(0.00627)
Birth weight		0.000000844
		(0.00000189)
Household income at age 15		2.89e-08
		(2.30e-08)
Mother's years of schooling		-0.0000310
		(0.0000392)
Father's years of schooling		0.0000234
		(0.0000351)
Observations	152269	146033
Adjusted R^2	0.173	0.173

Note: The columns contain coefficients from two different OLS regressions. The dependent variable is an indicator taking the value one if the lottery draw was below the threshold and the individual was drafted. Standard errors in parentheses.

$^{*}p < 0.10,\ ^{**}p < 0.05,\ ^{***}p < 0.01$

Table 3: First stage regressions. The effect of draft status on service status.

Outcome: Service status=1	(1)	(2)	(3)	(4)
Draft status=1	0.518***	0.518***	0.518***	0.517***
	(0.00254)	(0.00253)	(0.00253)	(0.00258)
N	1068599	1068599	1068599	1026441
No. of clusters	152269	152269	152269	145663
adj. R^2	0.272	0.276	0.277	0.276
First stage F-test	41693.03	41894,60	41926,67	40104,96
Basic controls	YES	YES	YES	YES
Extended controls I	NO	YES	YES	YES
Extended controls II	NO	NO	YES	YES
Extended controls III	NO	NO	NO	YES

Note: Each column contains the coefficient of interest from a different OLS regression. The dependent variable is an indicator taking the value one if the individual served in the military. The explanatory of interest is an indicator taking the value one if the individual is drafted. Columns differ according to the set of other explanatory variables included. Column 1 includes in the regression controls for birth year, birth month, and the timing of the draft lottery. Column 2 also includes cognitive test score and height and their square. Column 3 also includes controls for raised in single-parent family, foster home and being a native Dane. The fullest specification, column 4, also includes birth weight, household income at age 15, mother's years of schooling and father's years of schooling. Standard errors in parentheses.
$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table 4: Instrumental variables regressions. The effect of military service on earnings

Outcome: log earnings	(1)	(2)	(3)	(4)
Service status=1	-0.0249***	-0.0247***	-0.0261***	-0.0289***
	(0.00808)	(0.00806)	(0.00803)	(0.00813)
N	1068599	1068599	1068599	1026441
No. of clusters	152269	152269	152269	145663
adj. R^2	0.000	0.045	0.049	0.051
Basic controls	YES	YES	YES	YES
Extended controls I	NO	YES	YES	YES
Extended controls II	NO	NO	YES	YES
Extended controls III	NO	NO	NO	YES

Note: Each column contains the coefficient of interest from a different IV regression, corresponding to first stages presented in Table 3. The dependent variable is log annual labor earnings during the period 2001-2011 in age range 25-35, reflated to 2012 Danish Kroner. The explanatory of interest is an indicator taking the value one if the individual is served in the military. Standard errors are adjusted for multiple (on average 7) observations per person. Standard errors in parentheses.

$^{*}p < 0.05,\ ^{**}p < 0.01,\ ^{***}p < 0.001$

Table 5: Effect of military service on earnings across quartiles of the cognitive ability distribution.

	1st quartile	2nd quartile	3rd quartile	Top quartile
Service status=1	0.0132	-0.0137	-0.0288*	-0.0706***
	(0.0165)	(0.0157)	(0.0162)	(0.0160)
N	291453	277032	234842	265272
No. of clusters	41983	39371	33156	37759
adj. R^2	0.013	0.033	0.063	0.105
First stage F-test	10156,14	11138,70	10018,40	10870,11

Note: Each of the four columns contains coefficient of interest from a different second stage regression, according to quartiles of the cognitive test score distribution for those who drew a lottery number on AFD. The dependent variable is log annual labor earnings including sickness and leave benefits. The explanatory of interest is an indicator taking the value one if the individual is served in the military. The specification is as in column 2 of tables 3 and 4, namely including controls for birth year, birth month, timing of the AFD lottery, cognitive test score, height and their square. Standard errors are clustered for multiple observations per person. Standard errors in parentheses.
*p<0.10, **p<0.05, ***p<0.01

Table 6: Effect of military service on years of schooling at ages 25 and 30, across quartiles of the ability distribution.

	Full sample	1st quartile	2nd quartile	3rd quartile	Top quartile
		Panel A. Years of schooling at age 25.			
Service status=1	-0.170***	-0.128***	-0.163***	-0.199***	-0.201***
	(0.0165)	(0.0351)	(0.0316)	(0.0326)	(0.0310)
N	152269	41983	39371	33156	37759
adj. R^2	0.095	0.035	0.015	0.013	0.014
First stage F-test	46007.28	11450.03	12056.26	10744.58	11923.64
		Panel B. Years of schooling at age 30.			
Service status=1	-0.0344	-0.0143	-0.0423	-0.0242	-0.0802*
	(0.0219)	(0.0407)	(0.0418)	(0.0468)	(0.0452)
N	152269	41983	39371	33156	37759
adj. R^2	0.162	0.042	0.019	0.015	0.037
First stage F-test	46007.28	11450.03	12056.26	10744.58	11923.64

Note: Each coefficient comes from a different second stage regression. The dependent variable is years of educational attainment by a certain age— 25 in Panel A and 30 in Panel B. The sample is split into four columns according to quartile of the AFQT distribution. The explanatory of interest is an indicator taking the value one if the individual is served in the military. The specification is as in column 2 of tables 3 and 4, namely including controls for birth year, birth month, timing of the AFD lottery, cognitive test score, height, and their square. Standard errors are clustered for multiple observations per person. Standard errors in parentheses.

$^{*}p < 0.10,\ ^{**}p < 0.05,\ ^{***}p < 0.01$

Table 7: Effect of military service on the probability of being under study at various ages. Results by quartiles of the ability distribution.

	Full sample	1st quartile	2nd quartile	3rd quartile	Top quartile
			Panel A. Studying at age 25.		
Service status=1	0.0250***	0.0121*	0.0284***	0.0166	0.0393***
	(0.00454)	(0.00636)	(0.00855)	(0.0105)	(0.0106)
N	152269	41983	39371	33156	37759
adj. R^2	0.127	0.025	0.035	0.038	0.044
First stage F-test	46007.28	11441.26	12049.77	10743.02	11932.29
			Panel B. Studying at age 28.		
Military service	0.0210***	0.00604	0.0165**	0.0299***	0.0312***
	(0.00395)	(0.00556)	(0.00728)	(0.00903)	(0.00949)
N	152269	41983	39371	33156	37759
adj. R^2	0.049	0.016	0.013	0.011	0.015
A-P-F-test (1)	46007.28	11441.26	12049.77	10743.02	11932.29
			Panel C. Studying at age 30.		
Military service	0.0110***	0.00660	0.00719	0.00646	0.0232***
	(0.00324)	(0.00473)	(0.00599)	(0.00719)	(0.00780)
N	152269	41983	39371	33156	37759
adj. R^2	0.022	0.008	0.007	0.004	0.008
First stage F-test	46007.28	11441.26	12049.77	10743.02	11932.29

Note: Each cell represents the coefficient of interest from the second stage of a separate instrumental variables two stage least squares regressions. First and second stage specifications are identical to those of Table 6, but the outcome here is an indicator variable taking the value one for enrolment in education at the age shown in the column header, and zero otherwise. Standard errors in parentheses.
*p<0.10, **p<0.05, ***p<0.01

Table 8: Effect of military service on earnings across quartiles of the ability distribution. Income measure excluding taxable benefits.

	1st quartile	2nd quartile	3rd quartile	Top quartile
Service status=1	-0.00222	-0.0180	-0.0251*	-0.0709***
	(0.0121)	(0.0120)	(0.0132)	(0.0134)
N	280673	267042	226050	253769
adj. R^2	0.022	0.048	0.083	0.129

Note: Each cell represents the coefficient of interest from the second stage of a separate instrumental variables two stage least squares regressions. Specification is the same as for Table 5, except here the earnings measure excludes sickness and leave benefits. Standard errors in parentheses.
*p<0.10, **p<0.05, ***p<0.01

Table 9: Effect of military service on various outcomes.

	Full sample	1st quartile	2nd quartile	3rd quartile	Top quartile
			Panel A. Unemployment.		
Service status=1	-0.00408***	-0.00698**	-0.00218	-0.00241	-0.00425*
	(0.00135)	(0.00314)	(0.00263)	(0.00265)	(0.00226)
N	152269	41983	39371	33156	37759
			Panel B. Bank holdings.		
Service status=1	4244.7*	7193.9*	-1628.8	1999.7	8880.3**
	(2169.8)	(4294.3)	(4365.0)	(4529.7)	(4167.7)
N	152269	41983	39371	33156	37759
			Panel C. Crime.		
Service status=1	0.000559	0.000774	-0.00415	0.00451	0.00322
	(0.00214)	(0.00536)	(0.00426)	(0.00387)	(0.00302)
N	152269	41983	39371	33156	37759
			Panel D. Hospitalization.		
Service status=1	0.00422	0.00178	0.0192**	-0.00814	0.00229
	(0.00465)	(0.00853)	(0.00893)	(0.00993)	(0.00983)
N	152269	41983	39371	33156	37759
			Panel E. Medicine.		
Service status=1	-0.000925	0.00784	-0.00815	-0.000678	-0.00224
	(0.00362)	(0.00815)	(0.00713)	(0.00711)	(0.00628)
N	152269	41983	39371	33156	37759
			Panel F. Psychiatric diagnosis.		
Service status=1	-0.00211	-0.000700	-0.00320	-0.00305	-0.000557
	(0.00210)	(0.00499)	(0.00406)	(0.00395)	(0.00352)
N	152269	41983	39371	33156	37759
			Panel G. Addiction.		
Service status=1	-0.00181*	-0.00147	-0.00354*	-0.000742	-0.000856
	(0.00104)	(0.00284)	(0.00203)	(0.00177)	(0.00118)
N	152269	41983	39371	33156	37759

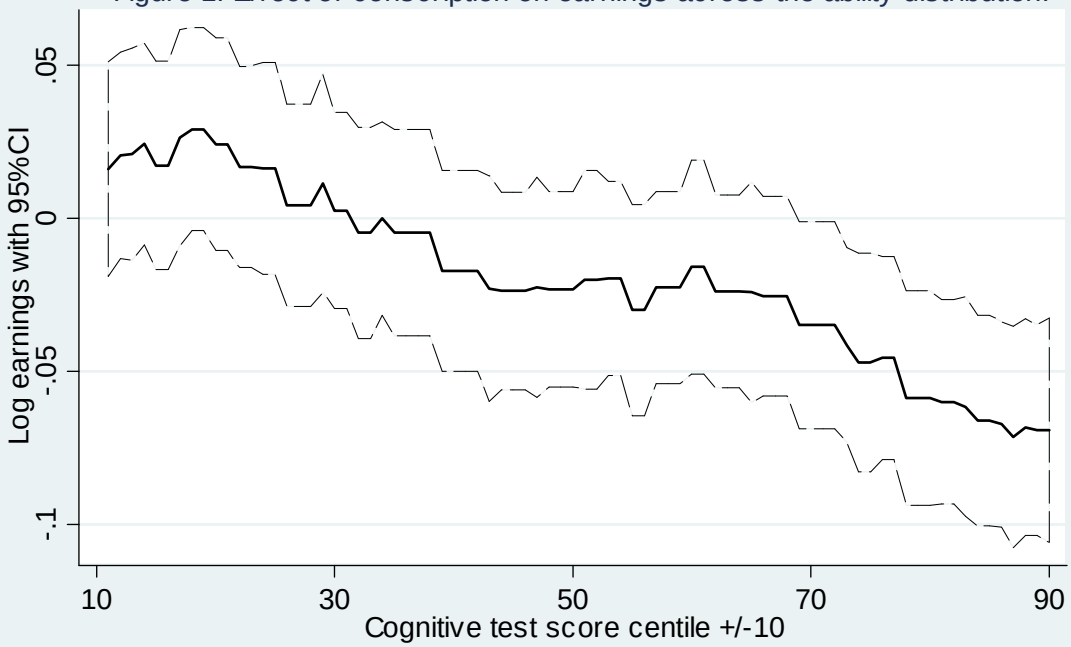
Note: Each cell contains coefficient of interest from separate second stage regressions. The explanatory variable of interest is always military service. Specification is always as in Table 4, namely including controls for birth year, birth month, timing of the lottery, cognitive test scores, height, and their square. The first column is for the whole sample, columns 2 through 5 are for quartiles of the ability distribution. Each panel corresponds to a different dependent variable. Panel A has proportion of the year in unemployment at age 26. Panel B has bank balance at December 31 of the year turning 26 in Danish kroner reflated to 2012 prices by the CPI. Panel C has an indicator variable taking the value one if convicted for non-vehicle related crime age 26-35. Panel D has an indicator variable taking the value one if admitted to hospital, including as a day patient, age 26-35. Panel E has an indicator variable taking the value one if prescribed psychotropic medicine is purchased from a high street pharmacy, age 26-35. Panel F has an indicator variable taking the value one if discharged form a hospital with a psychiatric diagnosis, age 26-35. Panel G has an indicator variable taking the value one if treated for substance abuse, age 26-35. Standard errors in parentheses. *p<0.10, **p<0.05, ***p<0.01.

Table 10: Effect of military service on earnings in various subgroups.

	Immigrants	Out-of-home care family	Single-parent family
Service status=1	0.0284	0.0763	-0.0228
	(0.0439)	(0.0587)	(0.0212)
N	37577	38427	184685
adj. R^2	0.042	0.019	0.037

Note: Each column contains the coefficient of interest from a second stage regression on different potentially vulnerable samples. The dependent variable is log annual earnings. The explanatory of interest is an indicator taking the value one if the individual served in the military. The specification is as in column 2 of tables 3 and 4, namely controls for birth year, birth month, timing of the ADF lottery, cognitive test score, height, and their square. Standard errors in parentheses.
*p<0.10, **p<0.05, ***p<0.01.

Figure 1. Effect of conscription on earnings across the ability distribution.



Note: solid line represents coefficients from separate second stage regressions. The dependent variable is log annual labor earnings during the period 2001-2011 in age range 25-35, reflated to 2012 Danish Kroner. The explanatory of interest is an indicator taking the value one if the individual is served in the military. Each regression corresponds to a range of (plus/minus 10) centiles of the cognitive distribution, centered around centile given on the horizontal axis. 95 percent confidence bands are shown in dashed lines and are adjusted for multiple observations per person.

Table A1. Effects across quartiles of the distribution of background characteristics.

	1st quartile	2nd quartile	3rd quartile	Top quartile
		Panel A. Parental income		
Service status=1	0.0172	-0.0379**	-0.0105	-0.0696***
	(0.0167)	(0.0159)	(0.0154)	(0.0164)
N	272079	278709	266739	249045
adj. R^2	0.030	0.038	0.055	0.082
		Panel B. Father's education		
Service status=1	0.00341	-0.0222	-0.0160	-0.0617***
	(0.0164)	(0.0148)	(0.0165)	(0.0166)
N	279451	301072	226083	259966
adj. R^2	0.026	0.045	0.033	0.100
		Panel C. Mother's education		
Service status=1	-0.000529	-0.0180	-0.0180	-0.0692***
	(0.0164)	(0.0151)	(0.0151)	(0.0170)
N	273937	262599	275408	254628
adj. R^2	0.025	0.038	0.051	0.090
		Panel D. Birth weight		
Service status=1	-0.0141	-0.00447	-0.0505***	-0.0346**
	(0.0133)	(0.0219)	(0.0159)	(0.0176)
N	378960	143105	276368	230500
adj. R^2	0.047	0.039	0.050	0.049
		Panel E. Height		
Service status=1	-0.0213	-0.00919	-0.0212	-0.0528***
	(0.0151)	(0.0163)	(0.0154)	(0.0180)
N	295206	253177	292512	227704
adj. R^2	0.037	0.047	0.051	0.056

Note: Each cell contains coefficient of interest from separate second stage regressions. The explanatory variable of interest is always military service. Specification is always as in Table 5, namely including controls for birth year, birth month, timing of the lottery, cognitive test scores, height, and their square.
Each panel corresponds to a different background characteristic. Panel A show estimates across quartiles of parental income at age 15. Panel B and C show results across quartiles of parental education. Panel D and E show results across quartiles of birth weight and height at AFD. Standard errors in parentheses.
*p<0.10, **p<0.05, ***p<0.01.

Table A2. Effect of military service on earnings at ages 19-24.

	Full sample	1st quartile	2nd quartile	3rd quartile	Top quartile
Service status=1	-0.0344***	-0.0598***	-0.0558***	0.00713	-0.0196
	(0.00756)	(0.0145)	(0.0146)	(0.0158)	(0.0156)
N	854972	237168	223032	186464	208308
adj. R^2	0.085	0.071	0.073	0.066	0.044
First stage F-test	45096.52	11432.68	11847.08	10493.16	11515.68

Note: Each column contains the coefficient of interest from a different IV regression, corresponding to the specification of first stages presented in Table 3. The dependent variable is log annual labor earnings during the period 2001-2011 in age range 19-24, reflated to 2012 Danish Kroner. The explanatory of interest is an indicator taking the value one if the individual is served in the military. Standard errors are adjusted for multiple (on average 6) observations per person. Standard errors in parentheses. *p<0.10, **p<0.05, ***p<0.01.