Estimating Family Spillovers: Evidence from a Draft Lottery*

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Abstract

Within families, there is often a large degree of persistence in education, income, and occupational choices, partly reflecting the influence of shared genetics and environments. Similarities in behaviours could also reflect that family members directly influence each other, by providing important information on the costs and benefits of various actions. Such spillover effects are notoriously difficult to estimate, since family members share important and unobserved background characteristics and both affect and are affected by each other. In this paper, we estimate sibling spillovers in a decision that has life-long implications; conscription. By exploiting the random assignment of Danish men to military service we can credibly estimate sibling spillovers in conscription. We find that having an older brother inducted into the military increases younger brother's service probability by 8 percent. We find no spillovers from younger to older brothers. Our results provide new and rare evidence on the importance of family networks.

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I. Introduction

The effect of social interactions on individual behavior has since long been of interest for economists. This interest partly reflects a wish to better understand why people clustered together in groups such as class-rooms, workplaces, and families tend to behave similarily. Within families, there is often a large degree of persistence in education, income, and occupational choices across family members, reflecting both the influence of shared genetics and environments.[1] But similarities in behaviours could also reflect that family members directly influence each other. Siblings and parents can for instance provide important information on the costs and benefits of various actions and set behavior norms that are costly to deviate from.[2] Yet, little is known to what extent persistence within families reflects spillover effects across family members.[3]

There are two main obstacles in identifying spillover effects. First, family members share important and unobserved background characteristics, which makes it difficult to disentangle peer effects from that of unobserved shared factors. Second, family members both affect and are affected by each other. This so called reflection problem means that it is difficult to sort out who is actually influencing whom.[4]

We overcome these empirical challenges by exploiting a situation where siblings are randomly assigned to serve in a government program. The context is the Danish military service, which uses a lottery to assign males to conscription. By exploiting this lottery, we can credibly estimate the causal effect of having an older brother serving in the army on the younger brother's probability of also doing so. The randomization means that the probability

[1]For recent overviews see Black and Devereux (2011), Björklund and Salvanes (2010), and Holmlund et al. (2011)

[2]The potential presence of spillover effects is also of direct policy relevance. Such effects can be viewed as externalities in behavior within families, which means that their existence can reinforce the effect of various social policies. With large spillover effects, the effect of policies can be much greater than expected.

[3]A recent exception is Dahl et al. (2014), who estimate sibling spillovers in the take-up of paternity leave in Norway. Using a birth data eligibility cutoff, they find strong evidence of sibling spillovers in program take-up.

[4]See Manski (1993) for a classic overview of the methodological issues involved in the estimation of peer effects. More recent discussion are found in Manski (2000), Moffitt (2001), Hanushek et al. (2003), and Angrist (2013).

of being assigned to military service is unrelated to both observed and unobserved background characteristics. Moreover, from the institutional setup, we can be sure that the influence only runs from an older to a younger sibling.

We believe we are the first to estimate causal spillover effects in conscription.[5] Military service in some way or another exists in most of the countries in the world and constitutes one of the most compehensive existing social programs. The program typically lasts from a couple of months to several years in some countries such as Israel and recent evidence suggests that the opportunity cost of conscription in terms of earnings is substantial.[6] The decision to join military service is therefore not a trivial one and evidence of strong sibling spillovers would suggest a strong role of the family.

The Danish context provides an excellent opportunity for estimating sibling spillovers in conscription. Upon turning 18, all Danish males have to attend an Armed Forces Day (AFD), where they are subject to a battery of tests and medical check-ups. Those males declared eligible for military service then participate in the conscription lottery, which randomly assigns males to military service. Since the assignment is made after the test and check-ups have taken place, we can use these pre-conscription variables to check the validity of the randomization. Morever, to shed light on possible mechanisms behind the peer effects, we can run analyses by subgroups and by background characteristics.

We find strong evidence of sibling spillovers in conscription. The lottery strongly influences participation in conscription, and we find that having a

[5]To study peer effects in various contexts, previous research exploiting randomization include Sacerdote (2001), Katz et al. (2001), Ludwig et al. (2001), Duflo and Saez (2003), Cullen et al. (2006), Kling et al. (2007), Kremer and Levy (2008), Lalive and Cattaneo (2009), Bandiera et al. (2009; 2010), Hesselius et al. (2009), Angelucci et al. (2010), Carrell et al. (2011) and Kuhn et al. (2011). A sample of studies on peer effects using other designs to uncover peer effects include Case and Katz (1991), Evans et al. (1992), Glaeser et al. (1996), Hoxby (2000), Gaviria and Raphael (2001), Hanushek et al. (2003), Zimmerman (2003), Munshi (2003), Jacob and Lefgren (2004), Lefgren (2004),Lundborg (2006), Stinebricker & Stinebricker (2006), Maurin and Moschion (2009), Carrell et al. (2008), Mas and Moretti (2009), Carrell et al. (2009), Carrell et al. (2010), Imberman et al. (2012), and Rege et al. (2012).

[6]For studies on the cost of *wartime* conscription in terms of labor, educational and health outcomes, see Hearst et al. (1986), Angrist (1990), Angrist and Krueger (1994), Bedard and Deschenes (2006), Dobkin and Shabani (2009), Angrist et al. (2010), Angrist and Chen (2011), Angrist et al. (2011) and Autor et al. (2011). For evidence on the effect of *peace time* conscription, see Imbens and van der Klaauw (1995), Grenet et al. (2011), Bauer et al. (2012), Galiani et al. (2011), Card and Cardoso (2012), Albæk et al. (2013), and Bingley et al. (2014).

brother serving increases a younger brother's chance of doing so by about 3.3 percentage points. This finding corresponds to an 8 percent increase in the probability at the mean. Due to our instrumental variables design, this effect reflects a younger brother's response to having a brother who is forced to serve because of the lottery outcome but who otherwise would have chosen not to.

We deal with a number of threats to our design. First, using an extensive set of predetermined variables, we show that none of these can predict assignment by the lottery. Second, we show that the lottery numbers are uncorrelated across brothers. Third, we find no effect of the older brother serving on the younger brother's AFQT scores, height, or probability of engaging in criminal behavior. Fourth, when we use the younger brother's lottery outcome as an instrument for his service, we show that no effect runs from a younger brother to an older brother.

To investigate possible channels behind the effects, we look for evidence of information transmission across brothers. A brother serving in the army may for instance provide important information about the opportunity cost of conscription. As we have shown in a previous paper (Bingley et al., 2014) , the opportunity cost in terms of foreogone earnings is greatest for high-ability males and we therefore look for differences in spillover effects across the AFQT score distribution. We find the effects to be of similar magnitude across the entire distribution, casting doubt on the information transmission mechanism hypothesis.

Our results also suggests some heterogeneity in the effects. The effects are greater among brothers having the same father or more closely spaced brothers who can be expected to interact more frequently. Moreover, we find that older brothers that have higher AFQT score than their younger brothers exhibit a stronger influence, perhaps reflecting a stronger interpersonal dominance.

The rest of the paper is organized as follows. Section II describes the institutional context in Denmark and the details of the draft lottery. Section III explains the data we use, Section IV describes our empirical approach, while Section V presents the results, and Section VI investigates alternative mechanisms. Section VII concludes.

II. Military Conscription in Denmark

In Denmark, conscription was reintroduced after World War II. The induction of young men for military service is randomly determined through a lottery held on the AFD. On their 18th birthday all men are called to attend an AFD on a date 3-9 months later.[7] The call is mandatory and refusal to participate results in imprisonment or a fine. There are 200 AFDs over the year and at each of the 6 regional military recruitment centers, 40-50 men are assessed during 5-6 hours.

The length of military service for most of our sample period is eight months.[8] Service is performed in the army (82 percent), navy (7 percent), air force (5 percent), civil defense, fire & rescue services (altogether 6 percent for the last three). In 2012 conscripts received accommodation and food, a monthly taxable salary of 7,421 DKK (1,337 USD) and a tax-free monthly allowance of 6,230 DKK (1,150 USD). [9]

A. Conscription Procedure

We illustrate the military conscription procedure in Figure 1. In the figure, the numbers inside the boxes refer to percentages of the full cohorts that reached the different stages, i.e. the unconditional percentages. The percentages between the boxes are conditional percentages, i.e. the fraction reaching the next stage given that one entered the previous stage of the conscription procedure.

Before participating in the AFD, all prospective draftees submit a health questionnaire that forms the basis of a health assessment. Based on this assessment, about 10 percent of a cohort is declared unfit for military service and therefore ineligible for the draft, in advance. Typical reasons for being declared ineligible is through documentation of serious somatic or psychiatric disorders (Hageman et al., 2008). Disability needs to be certified by a consultant physician at a regional public hospital.

For those males participating in the AFD, the test results and the health

[7]Since 2004 women have been invited to participate in the AFD, but not in the lottery. Among women, it is not mandatory to participate in the AFD.

[8]A small minority of army placements can last longer than 8 months, e.g., service with the Royal Guards lasts 12 months. At the end of our sample period, 336 men (0.2 percent) were subject to the new four month service requirement from 2006.

[9]For comparison, the minimum monthly wage in construction was 16,000 DKK (3,300 USD).

assesment form the basis for further selection. The tests involve a medical examination and assessment, a psychological evaluation, and an IQ test (Armed Forces Qualification Test, AFQT).[10] From these assessments, about 70 percent (63 percent of each cohort) are declared fit for military service and must participate in the draft lottery. The 27 percent that are declared unfit are done so on the grounds of low AFQT (10 percent), high BMI (10 percent) or low BMI (5 percent). The remaining 2 percent are unfit because of medical conditions, the top three being: ADHD, musculoskeletal disorders and asthma.

Among the males declared fit for service, a lottery is then used to decide who has to serve. Males draw from a drum filled with lottery numbers ranging from 1 to 36,000.[11] We refer to men who drew a number below the assignment threshold (”low draw” in figure 1) as *drafted*, regardless of whether they served or not. Note that the data we have access to is for those judged fit for service, and in our analysis we consider only those who were judged fit for service (eligible) and who drew a lottery number at the end of the AFD.[12]

[Figure 1 about here]

In the lottery, 44 percent draw a low number, meaning that they are drafted. This means that on average 28 percent of a cohort is drafted. Out of these 20 percent actually serve but 8 percent end up not serving in the army: 3 percent are conscientious objectors who are instead required to work for the local municipality in care facilities for children and the elderly, hospitals, libraries, etc. This civil service is of similar 8 months duration, and the rate of pay is the same. Of the remaining non-compliers, 4 percent do not serve on the grounds of subsequent poor health, 0.5 percent is excluded because of a criminal record[13], and 0.5 percent is sanctioned under the draft law, get a criminal record, and are fined or spend time in a correctional facility. Among the males who were not drafted, 21 percent, or 7 percent of a cohort, volunteer to the army.

[10]The test, in use since 1957, is not undermined by lack of motivation or underperformance among the men taking it (Teasdale, 2009; Teasdale et al., 2011). During our study period, it had 78 items.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]For the remainder of the paper we refer to men only because women do not particpate in the draft lottery

[13]For practical purposes, criminal background checks are only run after the lottery and for draftees and volunteers.

After the AFD, those that are drafted, or that volunteered will be called for military service beginning 7-18 months later. The service date may be delayed because of employment abroad or continuing an education, but service must commence before turning 32.[14] In our sample, 99.6 percent had completed their military service by age 25. We refer to men age 18-24 and who start military service as having *served*, regardless of whether they were drafted.

B. Representativeness of the draft sample

The fit-for-service criteria obviously mean that men entering the draft lottery are not fully representative of the general population. Our inference is therefore based on the random assignment of males who were declared fit for service.

For recent cohorts we can compare AFQT *pass rates* with mandatory 9th grade test scores. The pass rate increases rapidly from 60 percent in the bottom quartile to 90 percent in the top quartile (see appendix figure A2). This strong association between academic achievement and passing the cognitive ability test is supportive of the validity of AFQT-taking.

We can also study the relationsip between AFD attendance and Grade Point Average (GPA) scores in mandatory 9th grade tests taken at the end of compulsory schooling. Average AFD attendance is 96 percent for those with a 9th grade test score, rising from 93 percent in the bottom GPA quartile to 98 percent in quartiles 2-4 (see appendix figure A1). This gradient in AFD attendance by GPA suggests that learning difficulties, rather than outsmarting the draft board, are the main cognitive grounds for not attending the AFD.

III. Data

In our analyses, we combine data from different sources. First, we use administrative records from the DAF, which includes information on eligible conscripts from 1994 through 2010. The data includes the results from the ability (AFQT) and physical tests, eligibility status, health profile, occupation, education level (years of schooling), height, and the lottery number and cutoffs for each year since 1994, as well as whether the conscripts had volunteered or not, the conscription year (the AFD year), the starting year for their military

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

service and the unit in which they served. All variables are measured in the AFD year (see table 1 for descriptives).

[Table 1 about here]

Through the Danish civil registration number, we have linked the military records to a variety of registers from which we obtain demographic characteristics, education, social affiliation, health and medical care, death and cause of death, migration, employment, unemployment, income, and criminal records from Statistic Denmark. This information is available from 1980 for conscripts, their parents or those who raised them, their partners, their children or those of their partners, and their siblings.

In our analyses, we require that at least two brothers are observed during our observation window. As we have data on males born 1976-1983, we observe only brothers whose birth spacing does not exceed 7 years. This criterion gives us a sample of 13,124 brother pairs. Importantly, as ineligible males are not included in the military records, we observe only brother pairs in which both are eligible to serve.[15]

Given that the tests at the AFD are performed before the lottery, we can use the test information to assess the randomness of the lottery. Moreover, we can use our extensive information on other background factors for the same purpose. If the assignment is truly random, predicting assignment based on the test results and background factors should not be possible. In Table 2, we show a regression on assignment by the lottery as a function of test results and other background variables. As expected, cognitive test scores, height, being raised in a single-parent family, ethnicity, being placed in out-of-home care, birth weight, parental income, parental education, health factors, and crime do not predict assignment.

In the left column of Table 2, we do not include birth weight, parental income, or parental education, because by including them we lose some observations. We instead include these variables in the right column, and the randomization still works. In our main regression specifications, we check the results both with and without this extended set of controls. The regressions in Table 2 also control for birth year, birth month, and other variables capturing the timing of the AFD lottery.

[Table 2 about here]

[15] The two first eligible brothers born within the window 1976-1983.

IV. Method

We are interested in the effect of having an older brother joining military service on a younger brother's propensity to join, which we model as follows:

$$y_i = \pi_0 + \pi_1 BROTHER\_MILITARY_i + X_i\pi_2 + \upsilon_{it},$$

where y_i is a binary indicator taking the value 1 if an individual i joins military service, $BROTHER\_MILITARY$ is an indicator of whether the older brother joined the army, and X is a set of control variables. A standard OLS estimate of π_1 would be biased because the decision of an older brother to join the army may be correlated with unobserved factors shared by a younger brother, such as family norms and other hard-to-measure background characteristcs. To deal with the non-randomness of the older brother's decision, we exploit the military enlistment lottery and instrument $BROTHER\_MILITARY$ according to:

$$BROTHER\_MILITARY_i = \delta_0 + \delta_1 LOTTERY_i + X_i\delta_2 + \eta_i.$$

where, $LOTTERY_i$ indicates being assigned by the lottery to join military service. As the lottery randomly assigns individuals to military service, we do not need to include control variables other than to gain precision. In our empirical analysis, we will also check for signs of violations of the randomization by comparing estimates of π_1 obtained with different sets of control variables.

The outcome of the lottery will not influence every male's decision to join the DAF: some choose to volunteer for military service, and a few resist serving[16], irrespective of the lottery outcome. Our IV estimator therefore provides a Local Average Treatment Effect (LATE) that reflects the effect of military service among the group of compliers. In our context, this is the group of males that would serve if they had been randomly assigned to do so but that would otherwise not have served.

The opportunity cost of serving among the group of compliers is greater

[16]However, conscientious objectors have to carry out civil service of similar 8 months duration by working for the local municipality in care facilities for children and the elderly, hospitals, libraries, etc.

than that among the group of volunteers. We must keep this in mind when interpreting the effect of having an older brother serving on the younger brother's probability of doing so. Given that the lottery outcome is uncorrelated across brothers, any positive (negative) estimated brother influence should be interpreted as an increased (decreased) likelihood of a younger brother deciding to volunteer when an older brother is forced to serve.[17] This situation is a quite different scenario from those used in other peer effects studies, which often exploit situations in which people are incentivized to take a particular action but in which the decision itself is ultimately voluntary.

The data to which we have access allows us to conduct a number of specification checks and extensions. First, as all brothers in a family are exposed to the lottery, we can run placebo regressions checking for an effect of having a younger brother serving on an older brother's probablity of serving. If our method is valid, there should of course be no such effect in the "wrong" direction. *If* such an "effect" exists, however, it would suggest that the lottery is not truly random and that men in certain families for some reasons have a higher or lower chance of being assigned to serve. Second, we can look for any correlation in the lottery outcome across brothers. With true randomness, the correlation should essentially be zero. Third, we can exploit the test results and background data to examine whether the strength of the sibling spillovers depends on how close in characteristics the brothers are. For example it appears intuitive that the closer the brothers are in characteristcs, the stronger the effects should be.

V. Results

We start by reporting first stage results. Table 3 shows the estimates, in which military service of the older brother is regressed on his lottery cutoff. The sample consists of all cases in which for each family we observe two brothers, born between 1976-1983, who were eligible for military service. In column 1, we report estimates of the lottery cutoff, with the basic covariates, including birth year, birth month and dummies indicating the timing of the enlistment. We then add various sets of covariates in columns 2 and 3. If the lottery is truly random, we do not expect to see any important changes. In addition, the covariates serve to increase the precision of our estimates.

[17] The correlation is zero. Draft Status: 0.00 (p-value=0.72) and lottery draw 0.01 (p-value=0.20).

[Table 3 about here]

In the first column, we see that the impact of drawing a lottery number below the threshold increases the probability of military service by 52.3 percentage points. The coefficient of the cutoff is highly significant, and the F-statistic is well above the rule of thumb of 10. In column 2, adding our first set of control variables, including AFQT, height (and the square of AFQT and height) barely changes the coefficient of the cutoff (52.3 percentage points). We finally add an extended set of controls in column 3, including being a native Dane, growing up in a single-parent family, and being placed in out-of-home care, and having been convicted of a crime, as well as birth weight, parental income, parental schooling, and health indicators. Again, adding these covariates has very little impact on the estimated effect of the cutoff. Indeed, these results are expected, as with proper randomization these controls should not matter other than to increase the precision of the estimates.

[Table 4 about here]

We next focus on our main IV estimates. In Table 4, we report these estimates, using the same specifications as in Table 3. The first column shows a positive and significant effect of having a brother serving. The magnitude of the estimate suggests that having a brother serving increases the probability that a younger brother serves by 3.3 percentage points—about an 8 percent increase in the probability at the mean. The brother effect measures volunteering by the younger brother as a function of having an older brother being forced to serve. The estimated effects remain much the same in columns 2 and 3, even when we add the various sets of covariates. In Table 5, we show results for OLS and reduced forms. In panel A, the service coefficient is remarkably stable across specifications, showing that having a older brother serving increase the younger brother probability of service by 9 percentage points. Panels B shows reduced form coefficients on an indicator for older brother draft status. The draft coefficient shows that having a older brother drafted increases the younger brother probability of service by 2 percentage points.

[Table 5 about here]

Our estimates suggest a strong influence of having an older brother serving. A powerful placebo-like test in this context is to look for an effect of having a younger brother serving on the probability that an older brother serves. Such a test would address Manski's (2000) threat in estimations of peer effects: the "reflection problem", i.e., while I affect my peer, my peer also affects me. Table 6 shows the results from this test, where we run our main analysis but now the other way around. We use the same specifications as before but now instrument the younger brother's military service with his lottery outcome. This specification appears to rule out the reflection problem: the estimates are small and insignificant across the line. Given that the older brother attends his AFD earlier than the younger brother—i.e., having the military outcome of the older brother precede that of the younger brother—this result is expected.[18]

[Table 6 about here]

Our estimates thus far are average effects. However, the strength of sibling spillovers may depend on several factors. If one mechanism behind the sibling effects is the provision of information, we expect stronger effects when conscription entails large opportunity costs. Moreover, we expect that the closer the brothers are in characteristics, the stonger the interaction and the greater the influence on one another. We now explore these issues in more details.

VI. Extensions and mechanism

A. Information transmission

An often-mentioned mechanism behind peer effects is information transmission. In our context, having an older brother serving means that important information about both the consequences and the content of conscription, is easily accessible. One particularly important source of information concerns the opportunity cost of conscription, as males spend on average eight months in the DAF—time that could have been spent studying or at work. In Bingley, Lundborg and Lyk-Jensen (2014) we show that Danish conscripts face substantial opportunity costs: on average, those being forced to serve face a 2.5 percentage earnings penalty. This finding hides important heterogeneity,

[18] In principle, some scope exists for a younger brother to affect an older brother's decision. An older brother who was not assigned to serve by the lottery may later decide to volunteer, in principle possibly a function of the younger brother's conscription. However, the scope for such effects is small. The average birth spacing is three years, and most males serve at age 20. As almost 100 percent of the males have served by age 25, only a small window exists for the an older brother to act on the younger brother's conscription.

i.e., males scoring high on the AFQT face much higher costs, amounting to about a 7 percent earnings penalty. If this information is more accessible from having a brother serving, we expect sibling spillovers to be different for this subgroup, perhaps even negative. We investigate this hypothesis by running our main analysis by quartiles of the ability distribution, as indicated by the results on the AFQT.

[Table 7 about here]

Table 7 shows the results by quartile. To maximize the number of observations, we use the specification from column 2 of Table 4. Two results stand out. First, precision is lower when we slice the sample across the ability distribution, and none of the estimates are statistically significant. Second, the point estimates are remarkable similar across the distribution, ranging from a 3 percentage point increase to a 3.7 percentage point increase at the third quartile. We thus find no evidence that the group facing larger opportunity costs from conscription react any differently than other groups. This result suggests that the estimates are not primarily reflecting information about the costs on conscription, as would be expected if information on the opportunity cost is well known or easily accessible.

B. Household resources

Spillover effects may also work indirectly. When an older brother leaves the household for an extended period, a younger brother might gain in terms of parental inputs, such as attention, help with home-work etc, during this period. If so, we can look for positive effects on a younger brother's education and income when an older brother gets drafted. As we see in Table 8, we obtain no evidence for this mechanism however. The point estimates are negative, but small and insignificant (third quartile only significant at 10 percent).

C. Heterogeneity

We investigate heterogeneous effects across differences between younger and older brothers. We look at difference in height, AFQT, spacing between brothers and family composition (having the same father).

Table 9 shows the results. These are greater among brothers having the same father or more closely spaced brothers who can be expected to interact more frequently. Moreover, we find that older brothers that have higher

AFQT score than their younger brothers exhibit a stronger influence, perhaps reflecting a stronger interpersonal dominance.

VII. Conclusions

Social interaction effects are of great interest to economists but at the same notoriously difficult to estimate. For family interactions, the key challenge is to separate within-family member similarities caused by shared but unobserved factors and family members influencing one another. Consequently, very few studies provide causal estimates of family spillovers. We contribute to this literature by exploiting a unique situation wherein family members are randomized into conscription.

Our results suggest that social influences within families are strong. Having an older brother serving in the army increases a younger brother's probability of serving by about 8 percent. This estimate reflects a decision of the younger brother to volunteer as a function of having an older brother being forced into conscription.

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VIII. Tables and Figures

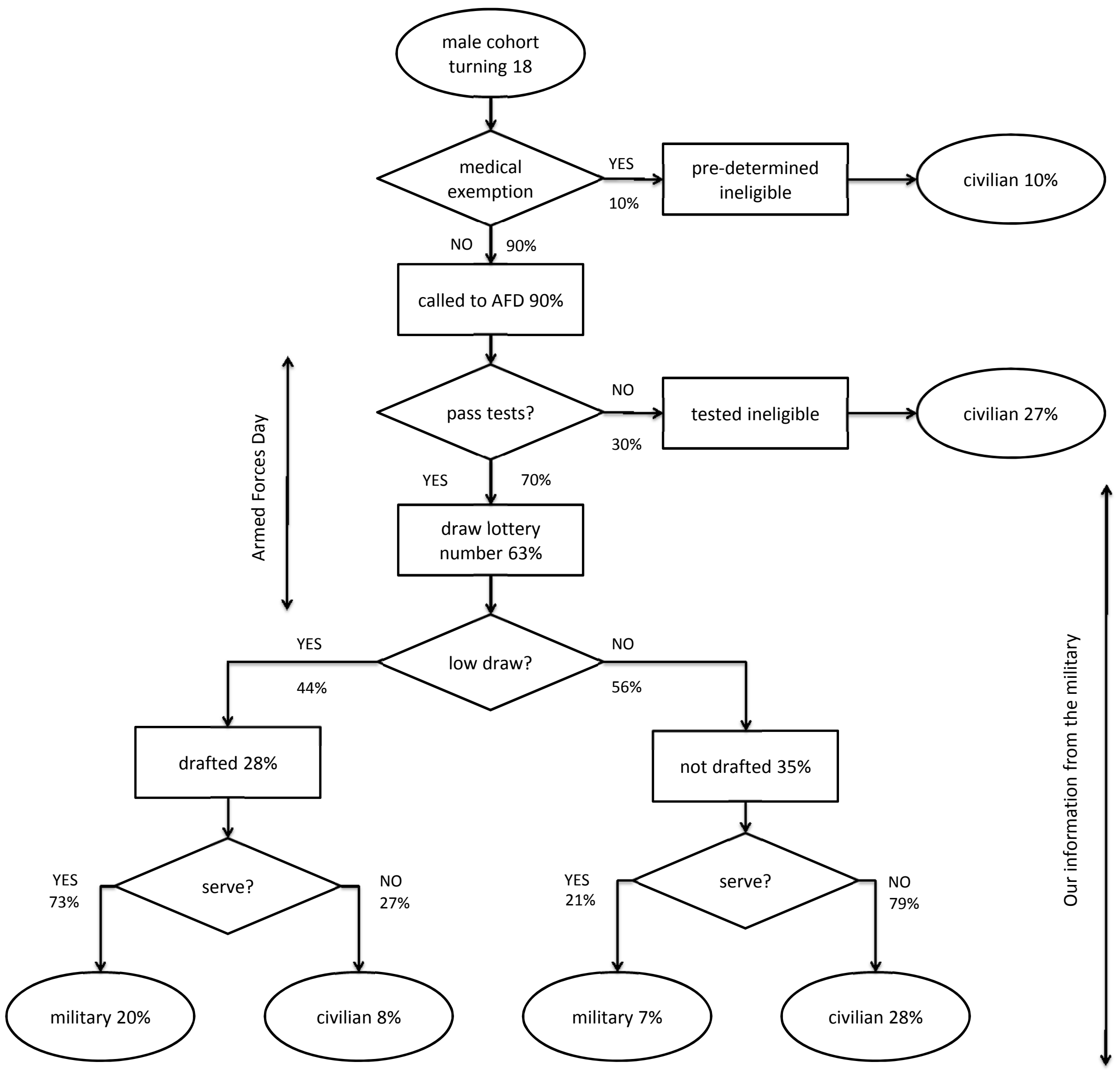

Figure 1. Flow chart of the conscription process

Notes: Numbers inside the shapes denote average percentages of our birth cohorts 1976-83. Numbers beside the arrows denote average percentages taking each route conditional on reaching the junction. The AFD includes test taking and drawing lottery numbers. Our estimation dataset contains information on all those who drew a lottery number. See Section 2.2 for a more detailed description of conscription enforcement.

Table 1—Summary Statistics

	Full sample mean	Served mean	Not served mean
Height (cm)	180.42	180.42	180.43
	(6.57)	(6.49)	(6.64)
AFQT	45.25	45.10	45.37
	(8.28)	(8.03)	(8.47)
Birth year	1979.36	1979.30	1979.41
	(2.20)	(2.28)	(2.14)
Birth month	6.38	6.41	6.35
	(3.35)	(3.30)	(3.39)
Raised in single-parent family	0.15	0.16	0.15
	(0.36)	(0.37)	(0.36)
Placed in out-of-home care	0.03	0.04	0.03
	(0.18)	(0.20)	(0.16)
Dane	0.96	0.96	0.95
	(0.20)	(0.19)	(0.21)
Birth weight (gr)	3420	3407	3430
	(637)	(651)	(627)
Household income at age 15 (DKK)	130715	129177	131893
	(57119)	(57945)	(56453)
Mother's years of schooling	11.83	11.73	11.91
	(2.88)	(2.85)	(2.90)
Father's years of schooling	12.24	12.12	12.33
	(3.12)	(3.09)	(3.14)
Criminal conviction before age 18	0.04	0.04	0.03
	(0.19)	(0.19)	(0.18)
Psychiatric diagnosis before age 18	0.01	0.01	0.01
	(0.08)	(0.08)	(0.07)
Mental health medication before age 18	0.00	0.00	0.00
	(0.05)	(0.06)	(0.04)
Treatment for addiction before age 18	0.00	0.00	0.00
	(0.01)	(0.01)	(0.01)
Hospital admissions before age 18	0.78	0.77	0.78
	(0.42)	(0.42)	(0.41)
Bank balance before age 18	9435	8588	10083
	(26709)	(25225)	(27774)
Unemployment before age 18	0.00	0.00	0.00
	(0.01)	(0.00)	(0.01)
Military service	0.43	1.00	0.00
	(0.50)	(0.00)	(0.00)
Observations	26248	11377	14871

Note: For the variables birth weight, household income at age 15, mother's and father's years of schooling, the sample size is 25,259.

Table 2—Randomization balance check: Effect of pre-determined characteristics on the probability of drawing a lottery number above the cutoff

	(1)	(2)
Height (cm)	-0.00050	-0.00074*
	(0.00043)	(0.00045)
AFQT	0.00053	0.00037
	(0.00035)	(0.00037)
Dane	0.01486	0.00608
	(0.01418)	(0.01998)
Raised in single-parent family	-0.00196	-0.00114
	(0.00770)	(0.00791)
Placed in out-of-home care	0.01617	0.01795
	(0.01588)	(0.01636)
Criminal conviction before age 18	0.01480	0.01377
	(0.01474)	(0.01524)
Psychiatric diagnosis before age 18	-0.04073	-0.04359
	(0.03478)	(0.03568)
Mental health medication before age 18	0.03525	0.03742
	(0.05648)	(0.05750)
Treatment for addiction before age 18	0.06843	0.08474
	(0.12201)	(0.12667)
Hospital admissions before age 18	0.00172	0.00339
	(0.00802)	(0.00836)
Bank balance before age 18	-0.00000	-0.00000
	(0.00000)	(0.00000)
Unemployment before age 18	0.08108	-0.01811
	(0.26280)	(0.17541)
Birth weight (gr)		0.00000
		(0.00000)
Household income at age 15 (DKK)		0.00000
		(0.00000)
Mother's years of schooling		0.00155
		(0.00112)
Father's years of schooling		-0.00061
		(0.00103)
Observations	26248	25259
F-test of covariates	1.08	1.00

Note: Standard errors in parentheses.* p<0.10, ** p<0.05, *** p<0.010.

Table 3—First-stage regressions. The effect of the older brother lottery cutoff on the probability that he participates in military

	(1)	(2)	(3)
Older brother cutoff	0.523***	0.523***	0.520***
	(0.00759)	(0.00759)	(0.00775)
Basic controls	Y	Y	Y
Extended controls I	N	Y	Y
Extended controls II	N	N	Y
Extended control III	N	N	Y
Observations	13124	13124	12644
Adjusted R^2	0.274	0.275	0.274
Angrist Pischke F-stat	4736	4737	4499

Note: Standard errors in parentheses.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$.

Table 4—IV estimates of the effect of the older brother doing military on a younger brother's probability of doing military service.

	(1)	(2)	(3)
Older brother service	0.0329**	0.0336**	0.0299**
	(0.0143)	(0.0143)	(0.0147)
Basic controls	Y	Y	Y
Extended controls I	N	Y	Y
Extended controls II	N	N	Y
Extended control III	N	N	Y
Observations	13124	13124	12644

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$.

Table 5—OLS and Reduced form.

	(1)	(2)	(3)
A. OLS regression: outcome younger brother service			
Older brother service	0.0910***	0.0907***	0.0857***
	(0.00840)	(0.00840)	(0.00856)
Adjusted R^2	0.080	0.081	0.082
B.Reduced form regression: outcome younger brother service			
Older brother cutoff	0.0198**	0.0202**	0.0174**
	(0.00846)	(0.00845)	(0.00860)
Adjusted R^2	0.072	0.073	0.075
Basic controls	Y	Y	Y
Extended controls I	N	Y	Y
Extended controls II	N	N	Y
Extended control III	N	N	Y
Observations	13124	13124	12644

Note: Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$.

Table 6—IV placebo estimates of the effect of the younger brother doing military on an older brother's probability of doing military service.

	(1)	(2)	(3)
Younger brother service	0.00228	0.00216	-0.00128
	(0.0144)	(0.0144)	(0.0148)
Basic controls	Y	Y	Y
Extended controls I	N	Y	Y
Extended controls II	N	N	Y
Extended control III	N	N	Y
Observations	13124	13124	12571

Note: Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$.

Table 7—Effect of an older brother's military service on the probability that a younger brother does military service. Estimates across quartiles of the ability distribution of the younger brother.

	1st quartile	2nd quartile	3rd quartile	4th quartile
Older brother service	0.0333	0.0300	0.0374	0.0324
	(0.0290)	(0.0286)	(0.0288)	(0.0279)
Observations	3434	3392	2948	3350
First stage F-test	1113	1176	1231	1208

Standard errors in parentheses.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$.

Table 8—Effect of an older brother's military service on a younger brother years of schooling and earnings. Full sample and estimates across quartiles of the ability distribution of the younger brother.

	(1)	(2)	(3)	(4)	(5)
	Full sample	1st quartile	2nd quartile	3rd quartile	Top quartile
Panel A.Years of schooling at age 25					
Older brother service	-0.0839	-0.0989	-0.000714	-0.168*	-0.0454
	(0.0515)	(0.111)	(0.101)	(0.0990)	(0.0941)
Panel B.Years of schooling at age 30					
Older brother service	-0.0949	-0.130	0.0420	-0.261*	0.0122
	(0.0692)	(0.132)	(0.134)	(0.141)	(0.139)
Observations	13124	3434	3392	2948	3350
First stage F-test	4737	1113	1176	1231	1208
Panel C. Earnings at age 18-35					
Older brother service	0.0000	0.0109	0.0415	-0.0248	-0.0287
	(0.0182)	(0.0368)	(0.0354)	(0.0362)	(0.0370)
Observations	200576	52296	52484	45433	50363
First stage F-test	4550	1059	1150	1228	1179
N. clusters	13120	3433	3390	2948	3349
Panel D. Earnings at age 25-35					
Older brother service	-0.0196	-0.0137	0.0254	-0.0438	-0.0441
	(0.0263)	(0.0542)	(0.0504)	(0.0515)	(0.0527)
Observations	71679	18521	18706	16207	18245
First stage F-test	4182	938	1033	1169	1158
N. clusters	12818	3341	3308	2890	3279

Standard errors in parentheses. Clustered at individual levels for earnings

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

Table 9—Effect of an older brother's military service on a younger brother doing military service across the distribution of background characteristics of the two brothers.

Panel A. By older brother's AFQT	(1) Lower	(2) Higher or equal		
Older brother service	0.0187	0.0425**		
	(0.0214)	(0.0192)		
Observations	5851	7273		
First stage F-test	2171	2676		
Panel B. By older brother's height	**(1) Smaller**	**(2) Taller or equal**		
Older brother service	0.0679***	-0.0006		
	(0.0204)	(0.0200)		
Observations	6232	6892		
First stage F-test	2378	2475		
Panel C. By father	**(1) Different fathers**	**(2) Same fathers**		
Older brother service	0.0656	0.0330**		
	(0.0859)	(0.0145)		
Observations	603	12521		
First stage F-test	114	4758		
Panel D. Quartiles of spacing	**(1) 1st quartile**	**(2) 2nd quartile**	**(3) 3rd quartile**	**(4) Closest spacing**
Older brother service	0.0007	0.0235	0.0730**	0.0414
	(0.0288)	(0.0277)	(0.0298)	(0.0290)
Observations	3290	3279	3287	3268
First stage F-test	1194	1375	1051	1154

Standard errors in parentheses.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

Appendix for online publication

A. Additional tables and figures

Table A.1—Effect of an older brother's military service on younger brother outcomes

AFQT as outcome	(1)	(2)	(3)
Older brother service	-0.0778	-0.0719	0.0249
	(0.271)	(0.269)	(0.264)
Height as outcome	(1)	(2)	(3)
Older brother service	-0.0263	-0.0146	-0.0204
	(0.223)	(0.222)	(0.219)
Crime before service as outcome	(1)	(2)	(3)
Older brother service	0.00399	0.00357	0.00326
	(0.00637)	(0.00635)	(0.00634)
Basic controls	Y	Y	Y
Extended controls I	N	Y	Y
Extended controls II	N	N	Y
Extended control III	N	N	Y
Observations	13124	13124	12644

Standard errors in parentheses.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

Table A.2—Effect of an older brother's military service on the probability that a younger brother does military service. Estimates across quartiles of the ability and height distribution of the older brother

Older brother's AFQT quartiles	(1) 1st quartile	(2) 2nd quartile	(3) 3rd quartile	(4) Top quartile
Older brother service	0.00635	0.0282	0.0500*	0.0466*
	(0.0304)	(0.0281)	(0.0301)	(0.0265)
Observations	3065	3323	3002	3734
First stage F-test	1016	1296	1078	1416
Older brother's height quartiles	**(1) 1st quartile**	**(2) 2nd quartile**	**(3) 3rd quartile**	**(4) Top quartile**
Older brother service	0.0535**	0.0331	0.0248	0.0115
	(0.0256)	(0.0298)	(0.0273)	(0.0335)
Observations	3589	3146	3622	2767
First stage F-test	1478	1103	1306	836

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

Table A.3—Effect of an older brother's military service on the probability that a younger brother is never taker. Estimates across quartiles of the ability distribution of the younger brother

	(1) Full sample	(2) 1st quartile	(3) 2nd quartile	(4) 3rd quartile	(5) Top quartile
Older brother service	-0.0198*	-0.0220	0.00508	-0.0377*	-0.0194
	(0.0101)	(0.0208)	(0.0201)	(0.0196)	(0.0199)
Observations	13124	3434	3392	2948	3350
First stage F-test	4736.7	1113.0	1176.3	1231.2	1208.1

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

Table A.4—Effect of an older brother's military service on the probability that a younger brother is always taker. Estimates across quartiles of the ability distribution of the younger brother

	(1) Full sample	(2) 1st quartile	(3) 2nd quartile	(4) 3rd quartile	(5) Top quartile
servedbigbro	0.0138	0.0113	0.0351*	-0.000329	0.0129
	(0.0102)	(0.0203)	(0.0207)	(0.0211)	(0.0195)
Observations	13124	3434	3392	2948	3350
First stage F-test	4736.7	1113.0	1176.3	1231.2	1208.1

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

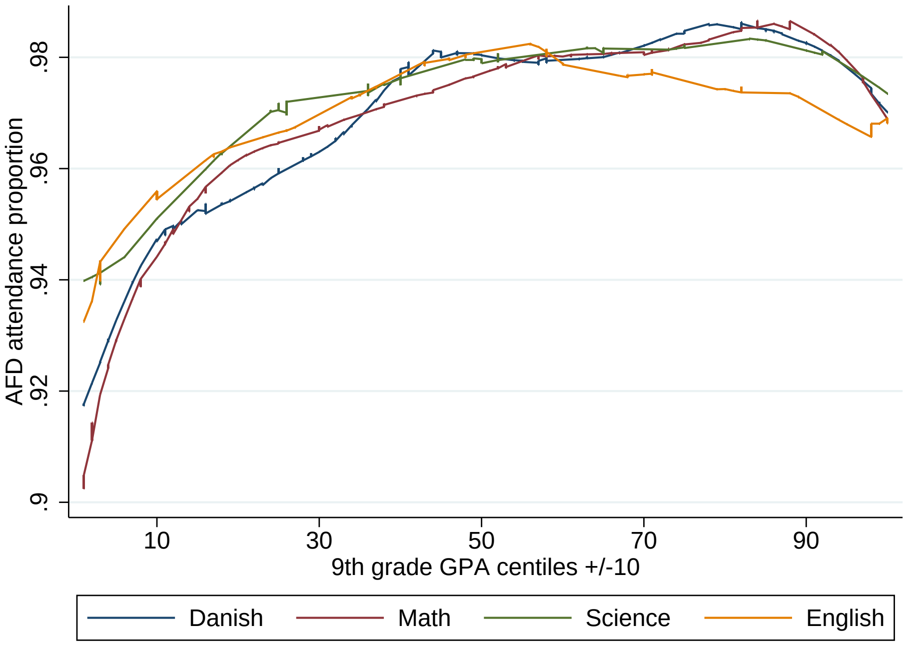

FIGURE A.1. AFD ATTENDANCE PROPORTION BY GRADE POINT AVERAGE AT 9TH GRADE.

Notes: Attendance rate at the AFD is calculated as the proportion with an AFQT score among those in a 20 percent window of 9th grade test scores in the mandatory subjects. Birth cohorts 1988-90 are the first with AFQT scores for all AFD participants and overlap with the last three years with a 13-point GPA grading scale.

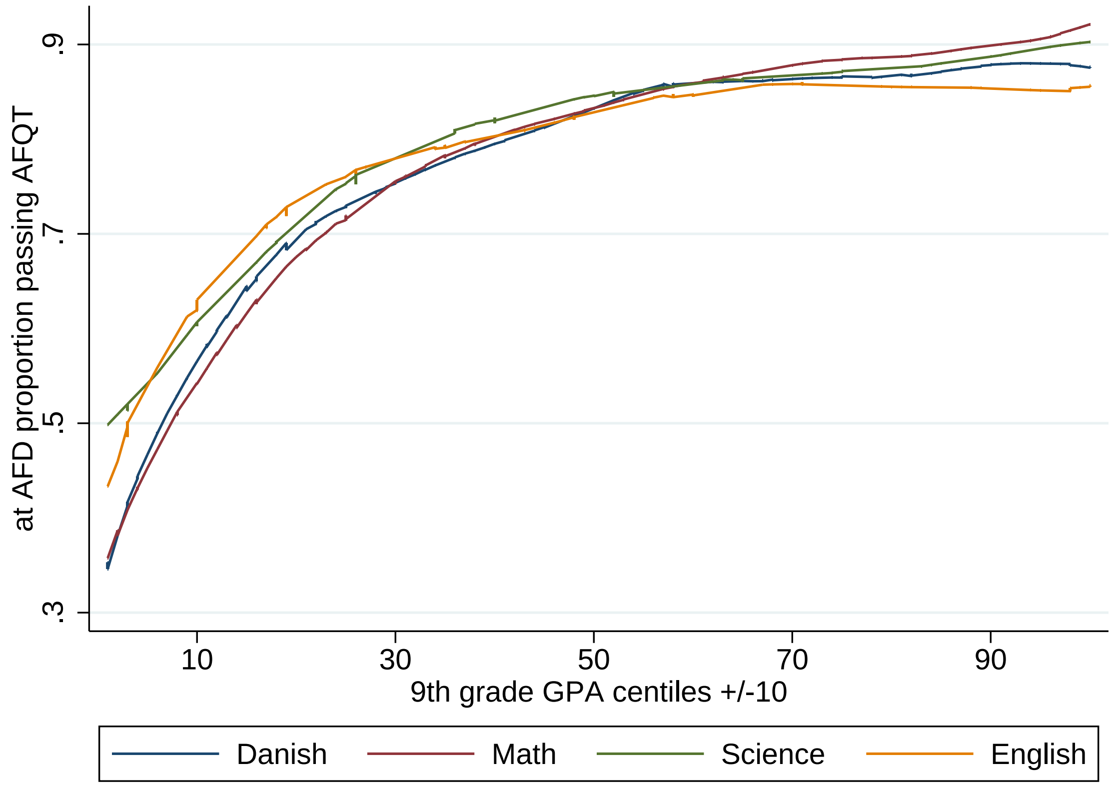

FIGURE A.2. AFQT PASS RATE AT AFD BY GRADE POINT AVERAGE AT 9TH GRADE.
Notes: Pass rate at the AFD is calculated as the proportion with an AFQT score above the fit-for-service cutoff, among those in a 20 percent window of 9th grade test scores in the mandatory subjects.