The Causal Effect of Serving in Army on Health: Evidence from Regression Kink Design and Russian Data

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Our paper

- Analysis of the effect of compulsory military service on health based on Russian micro-level data
- Contribute to the growing literature that studies consequences of conscription in different countries
  - New evidence came from quasi-natural experiment (Gorbachev’ demilitarization reform)
- Contribute to the analysis of health consequences of military service: first evidence from peaceful-era drafts
- Apply RKD
Literature: Consequences of Compulsory Service in Army in Economics Literature

- Effect on
  - Earning (Angrist, 1990, Angrist, Chen, and Song, 2011); Health (Hearst et al. 1986, Autor et al., 2011); Education (Angrist and Chen, 2011, Card and Lemieux 2010); Household Stability (Conley and Heerwig, 2011); Crime (Galiani et al., 2011)

- Evidence from different countries
  - Recent elimination of compulsory service in many countries + new data/methods available renewed interest to this question
Most studies find negative effect

Death rates, suicides, car accidents: Hearst et al. 1986, Vietnam War veterans

Mortality, smoking and related to smoking diseases (lung cancer) for World War II and Korean War veterans: Bedard and Deschenes, 2006

Post traumatic syndrome, stress

Decrease in employment and rise of disability welfare transfers for Vietnam War veterans: Autor et al., 2011

No effect: Angrist et al, 2010

Negative but insignificant effect: Dobkin and Shabani, 2009

Previous studies: Mainly evidence from war era drafts, Our paper: evidence from peaceful draft
Our paper

Use Russian micro level data (RLMS survey, 1994-2012)
Find strong effect of compulsory military service on smoking, alcohol consumption and related to smoking and alcohol diseases
Serving in army results in
- increase in daily alcohol consumption (in days when drinks) by 45 ml (of pure alcohol)
- increase in daily cigarettes consumption by 5 cigarettes
- 13% higher chance of getting tuberculosis / hepatitis / chronic lung or liver
- 13% higher chance of having general health problems
Our paper: why Russia?

- Rich data, can expect some other interesting results
- Provides quasi-natural experiment that can answer many interesting questions
- Demilitarization reform started in 1988 with the end of Cold War
  - In December 1988, in the UN General Assembly, Gorbachev announced a unilateral reduction of Soviet armed forces to 500 thousands Man, 10 thousands Tanks, 8,500 artillery pieces and 800 combat aircraft
  - In 1989 Mikhail Gorbachev and George Busch signed arms control treaty and Soviet troops withdrew from Afghanistan
- Next decade: gradual decrease in chance of being conscripted
There is clear kink in probability of being conscripted

Regression Kink Design: use kink to identify causal relationship between serving in army and health
Alcohol and Smoking

- Log (daily hard alcohol intake)
- # of cigarettes per day
- Share of smokers: 30 yo − 17 yo

Data from: David Card and Evgeny Yakovlev, "The Causal Effect of Serving in Army on Health: Evidence from Regression Kink Design and Russian Data"
Serving in army and health: How to identify causal relationship?

- **Selection:**
  - those who go to army are selected based on health status, so generally healthier
  - those who go to army usually from poor families and so easier involved in risky behavior (smoking, alcohol consumption, drugs)

- **Ideal case:**

- **In absence of randomization**
  - IV: Bedard and Deschenes (2006) and Dobkin and Shabani (2009)
  - RKD: our paper
Idea behind RKD

- Similar to regression discontinuity intuition
- Look on date-of-birth profile
- Look on change in slope before and after threshold
- Under assumption that other factors change smoothly in neighborhood of kink (with respect to assignment variable), we identify causal relationship
(Fuzzy) RK estimand

- $Y$: outcome
  - alcohol consumption, smoking, related chronic diseases, hepatitis, tuberculosis
- $A$ is a dummy variable indicating whether individual $i$ went to compulsory military service
- $v = a18 - 1989$, where $a18$ is a date ($year + \frac{month}{12} + \frac{day}{365}$) when person turned 18
- RK estimand
  \[
  \lim_{v_0 \to 0^+} \left[ \frac{dE(Y|v)}{dv} \right]_{v=v_0} - \lim_{v_0 \to 0^-} \left[ \frac{dE(Y|v)}{dv} \right]_{v=v_0} - \lim_{v_0 \to 0^+} \left[ \frac{dE(A|v)}{dv} \right]_{v=v_0} + \lim_{v_0 \to 0^-} \left[ \frac{dE(A|v)}{dv} \right]_{v=v_0}
  \]
- see Card, Lee, Pei, and Weber, 2015
Use females as a control group

If some factors that 1) affect young people more than old people and can persist till today; 2) change non-smoothly around kink then problem

⇒ Use females as a control group

Hepatitis, tuberculosis, chronic diseases are rare events

⇒ Global polynomial approximation

Repeat analysis for smoking & alcohol with local polynomial approximation
Estimation (Main specification)

- Two groups of population, females ($j = 0$) and males ($j = 1$)
- System of two equations with group-specific coefficients

$$
y_{it} = A_i \delta_j + f_j(a_{18i}) + D_{1988} g(a_{18i}) + X_{it} \alpha_j + u_{it}
$$
$$
A_i = h_j(a_{18i}) + D_{1988} k_j(a_{18}) + X_{it} \gamma_j + \varepsilon_{it}
$$

Note: $g()$ is not gender-specific; $k_j()$ is gender-specific

- $y_{it}$ health outcomes; $A_i$ is a indicator that person went to army; $a_{18i}$ is a date when person turned 18
- $D_{1988}$ is Dummy for person turned 18 in or after 1988
- $f(), g(), k(), h()$ are smooth function (polynomials)
- $X_{it}$ set of observable characteristics: smooth function of age, $l(\text{live in city})$, income, marital status, $\delta_t, \delta_r$
## Regression results

<table>
<thead>
<tr>
<th></th>
<th>hard alcohol intake</th>
<th>Log hard alcohol intake</th>
<th># of cigarettes per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>$l(\text{served})$</td>
<td>47.0***</td>
<td>54.6***</td>
<td>4.921***</td>
</tr>
<tr>
<td></td>
<td>[10.836]</td>
<td>[8.564]</td>
<td>[1.435]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>start smoking at 18-21</th>
<th>hep/tub/chronic diseases</th>
<th>Health problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>$l(\text{smokes})$</td>
<td>0.103</td>
<td>0.199***</td>
<td>0.130**</td>
</tr>
<tr>
<td></td>
<td>[0.075]</td>
<td>[0.052]</td>
<td>[0.053]</td>
</tr>
<tr>
<td>$l(\text{served})$</td>
<td></td>
<td></td>
<td>0.131***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[0.044]</td>
</tr>
</tbody>
</table>
Deal with panel data, clustered errors
Bandwidth may be too small if work with pooled data
Start with data on averages within a18 X gender cells
Choose bandwidths according to CCT (Calonico, Cattaneo and Titiunik, 2015), and IK (Imbents, Kalyanaraman, 2012)
Local linear regressions
<table>
<thead>
<tr>
<th></th>
<th>hard alcohol intake</th>
<th>hard alcohol intake</th>
<th>Smokes? per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>l(served)</td>
<td>48.9***</td>
<td>57.2***</td>
<td>0.213**</td>
</tr>
<tr>
<td></td>
<td>[11.2]</td>
<td>[9.1]</td>
<td>[0.07]</td>
</tr>
<tr>
<td>BW</td>
<td>lK for first stage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BW size</td>
<td>9.7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Local Polynomials: Starting from bw=3-5 years most results are similar

**Figure**: RK Estimates with Varying Bandwidths

<table>
<thead>
<tr>
<th>Variable</th>
<th>Graph</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily alcohol intake</td>
<td><img src="#" alt="Graph" /></td>
</tr>
<tr>
<td>Daily hard alcohol intake</td>
<td><img src="#" alt="Graph" /></td>
</tr>
<tr>
<td>Share of hard drinks</td>
<td><img src="#" alt="Graph" /></td>
</tr>
<tr>
<td>Log (daily hard alcohol intake)</td>
<td><img src="#" alt="Graph" /></td>
</tr>
<tr>
<td>Liver/lung ch.dis./hep./tub.</td>
<td><img src="#" alt="Graph" /></td>
</tr>
<tr>
<td>Health problems last month?</td>
<td><img src="#" alt="Graph" /></td>
</tr>
<tr>
<td>Start smoking when 18–21</td>
<td><img src="#" alt="Graph" /></td>
</tr>
<tr>
<td># of cigs per day</td>
<td><img src="#" alt="Graph" /></td>
</tr>
</tbody>
</table>
Alcohol and Smoking

Why more smoking & alcohol?
- Initiating (facilitation) smoking & alcohol in army: cigarettes subsidies, peer influence
- Post traumatic stress syndrome, depression
- worse labor market conditions/family outcomes etc...

[Graph showing the trend of smoking initiation in relation to age at turning 18, with two lines indicating different smoking behaviors: starting smoking when 18–21 years old and before 18 or after 21 years old.]
Robustness: Dif-in-Dif around Age 20, Young males

AGE PROFILE, YOUNG MALES:
Increase in alcohol consumption and smoking after compulsory service

Note: date fixed effects are excluded from # of cigarettes and alcohol consumption.

Dif-in-Dif estimates: Serving in army increases chance of smoking on 8%; consumption of hard alcohol by 22% and consumption of cigarettes by 1.35 cigarettes per day
Robustness

RD around 1st January
FALL DRAFT dates November - December 31
Quite similar point estimates, (noisy for alcohol consumption)

Table: RD around January 1st

<table>
<thead>
<tr>
<th>Served in Army</th>
<th>alcohol intake</th>
<th>hard alcohol intake</th>
<th># of cigarettes per day</th>
<th>I(smokes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Served in Army</td>
<td>77.10</td>
<td>53.65</td>
<td>10.02</td>
<td>0.192</td>
</tr>
<tr>
<td>robust se</td>
<td>[72.60]</td>
<td>[59.90]</td>
<td>[9.596]</td>
<td>[0.443]</td>
</tr>
<tr>
<td>se</td>
<td>[35.48]</td>
<td>[30.35]</td>
<td>[3.274]</td>
<td>[0.140]</td>
</tr>
<tr>
<td>I(after NY)</td>
<td></td>
<td></td>
<td></td>
<td>-0.077***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>[0.0280]</td>
</tr>
<tr>
<td>BW size</td>
<td>2 months</td>
<td>2 months</td>
<td>2 months</td>
<td>2 months</td>
</tr>
<tr>
<td></td>
<td>2 months</td>
<td>2 months</td>
<td>2 months</td>
<td>2 months</td>
</tr>
</tbody>
</table>

Note: Robust st.errors clustered at age18 level
Robustness

- Sample of 2000-2011 dates only: similar results
- Look only on males: results are higher in magnitude
- Look on averages within (gender)*a18 cells rather than on individual level data: same results
- Add national averages of alcohol (beer, vodka, and ratio of beer to vodka) and cigarettes consumption at age 18 (with gender-specific coefficients): similar results (higher in magnitude)
- Add national GNP per capita, death rates etc at age 18 (with gender-specific coefficients): similar results
- Look only males who become 18 age old before 1998 (Expansion of beer industry): similar results with smaller magnitude and bigger standard errors
- RKD within 3-years neighborhood of kink: similar - with higher in magnitude results
Identification assumption: Placebo for kink

Placebo for kink: moving 20-year window of year-turned-18 profile

\[ y_{ij} = \beta_0 + \beta_1 a18_i + \xi(D_{central\ year_k}(a18_i - central\ year_k)) + \beta_2 \text{age} + \beta_3 \text{age}^2 + I(Male)(\alpha_0 + \alpha_1 a18_i + \theta(D_{central\ year_k}(a18_i - central\ year_k)) + u_{it} \]

- Kink in risk of conscription around 1989

[Graph showing the trend of served in army over years from 1975 to 2000]
No kinks in pre-determinant characteristics (parents demographics, education, location, height, early age diseases)

No discontinuity in distribution of pre-determinant character-
cs
Indeed for females we do not observe kinks
Alcohol consumption profiles

Males: daily alcohol intake

Females: daily alcohol intake

Males–Females: daily alcohol intake

The Causal Effect of Serving in Army on Health: Evidence from Regression Kink Design and Russian Data
Hard Alcohol Consumption

Males: daily hard alcohol intake

Females: daily hard alcohol intake

Males–Females: daily hard alcohol intake

The Causal Effect of Serving in Army on Health: Evidence from Regression Kink Design and Russian Data
Smoking

Males: # of cigarettes per day

Females: # of cigarettes per day

Males–Females: # of cigarettes per day

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Conclusion

- Analysis of the effect of compulsory military service on health
  - New evidence came from natural experiment (Russian/USSR Demilitarization Reform)
- Contribute to the analysis of health consequences of military service: first evidence from peaceful-era drafts
  - Strong effect on alcohol consumption, smoking, and related diseases
- Introduce new method (RKD) in health (and development) economics
\[ y_{it} = A_i \delta + f(a18)_i + X_{it} \alpha + u_{it} \]

- \( y_{it} \) is a outcome (health outcomes)
- \( A_i \) is a indicator that person went to compulsory military service
- \( f(a18) \) is a smooth function (polynomial) representing the date-turned-18 profile of the outcome \( y \)
- \( X_{it} \) set of observable characteristics (smooth function of age, \( I(\text{live in city}) \), income, marital status, time&regional FE)
- \( a18_i \) is a date (year+month/12+day/365) when person turned eighteen
First stage

$A_i$ is endogenous

Use kink (in year 1988) as an instrument for $A_i$

\[
A_i = k(a_{18i}) + (D_{1988}g(a_{18}))_i + X_{it}\alpha + \varepsilon_{it}
\]

$D_{1988}$ indicator that person turned 18 years in or later than 1988

$k(a_{18i}), g(a_{18})_i$ smooth functions of date when person turned 18,

$g(1988) = 0$

$D_{1988}g(a_{18})_i$ captures the kink
2 stage (fuzzy) RKD

- \( y_{it} = A_{it}\delta + X_{it}\alpha + f(a18) + \delta_t + \delta_r + u_{it} \)
- \( A_{it} = X_{it}\alpha + f(a18) + (D_{1988}g(a18))_{it} + \delta_t + \delta_r + \varepsilon_{it} \)
Figure: Date-turned-18 profile of ratio of Males to Females