Consequences of Banning Handedness Conversion

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Handedness Conversion

- Left-handed 6-10 % of the population ▸▸ Graph
- Left-handed were widely discriminated against; also, tools were rare (Hildreth, 1950; Thorpe, 2017)
- Handedness conversion was a widespread educational policy (Hildreth, 1949; Kushner, 2012)
- Cultural shift at the beginning of the 20^{th} century in the west
- Common practice much longer in many Asian, Arabic and African countries (Kushner, 2013; Sato et al., 2008; Singh et al., 2001; Zverev, 2006)
- Little evidence on psychological, social and economic costs

Left Handedness and Later Life Outcomes

Evidence on associations between outcomes and left-handedness:

- Lower cognitive skills (Goodman, 2014, JEP)
- Lower educational attainment (Goodman, 2014, JEP; Guber, 2019, LE)
- Lower employment and lower earnings (mixed results for male earnings) (Goodman, 2014, JEP; Guber, 2019, LE; Denny and O'Sullivan, 2007, JHR)

Handedness Conversion and Later Life Outcomes

Impaired development:

- Learning and language deficiencies such as stuttering, or dyslexia (Kushner, 2012; Porac and Searleman, 2002)
- Schizophrenia (Shimizu et al., 1985)
- Brain structure (Klöppel et al., 2010; Siebner et al., 2002)

Different later life outcomes:

- Switching is associated with different education and labor market outcomes (Guber, 2019)

Handedness Conversion and Later Life Outcomes

Contribution:

Evaluate an educational reform that abandoned handedness conversion of left-handed children.

Specifically, we examine the effects of the handedness conversion ban on later life outcomes of left-handers in Germany.

Change in Educational Policy

- Staggered implementation of policy that discourages handedness conversion in schools between 1962 and 1993 in most German federal states
- Some federal states revised the policy over time:

  Bavaria, 1981:

  "[...] weakly left-handed [...] can be encouraged to use their right hand. Strongly left-handed may not be forced to switch their writing hand."

  Bavaria, 2000:

  „The innate handedness may not be changed."

▸▸ Timing of the reform

German Socio-Economic Panel Study (SOEP, v36) - 1984-2019

Handedness: self-reported

Outcomes:

- **Educational attainment:**
  years of education, high school degree, more than lower secondary schooling, German and math grades
- **Labor market outcomes:**
  gross hourly wage (Euro), employment

Potential Channels:

- **Cognitive abilities:** ultra-short IQ tests
- **Personality traits:** Big Five

Handedness Definitions & Sample Restrictions

Types of handedness:

- Natural right-handers
- Natural left-handers (not retrained)
- "retrained" left-handers (natural left-handers who use the right hand for writing)

Drop ambiguous handedness measures:

- Equally left and right handed
- Change in handedness between waves

Sample size: 9,066 men and women in final sample

⏩ Sample Restrictions

Summary Statistics

	Pre-Reform				Post-Reform			
Handedness:	I L-L	II L-R	Diff (II-I) b	p	III L-L	IV L-R	Diff (IV-III) b	p
Employed	0.773	0.729	-0.043**	0.039	0.688	0.736	0.049	0.330
log of gross hourly wage	2.592	2.533	-0.059**	0.049	2.582	2.396	-0.186**	0.012
Education Years	12.288	12.017	-0.272	0.521	13.756	13.820	0.064	0.947
High School	0.309	0.181	-0.128*	0.053	0.541	0.499	-0.041	0.792
Year of Birth	1966.794	1957.406	-9.388***	0.000	1980.605	1974.404	-6.201**	0.019
Male	0.597	0.508	-0.088	0.257	0.553	0.529	-0.024	0.880
East German	0.138	0.208	0.070	0.205	0.070	0.001	-0.069*	0.054
Age	49.512	58.339	8.827***	0.000	36.785	43.524	6.739**	0.013
Migration Background	0.114	0.010	-0.105***	0.009	0.213	0.001	-0.212***	0.001
Grew-up in Village	0.321	0.449	0.128*	0.085	0.300	0.045	-0.255***	0.000
Parents Catholic	0.221	0.331	0.111*	0.098	0.237	0.500	0.262*	0.083
Observations	127	182			157	25		

Notes: N = 8,981 person-year-observations for employment participation; N = 6,771 person-year-observations for log of hourly wage. L-L: natural left-handed; L-R: switched left-handed.

Identification Strategy:

- TWFE (Two way fixed effects)
- Treatment: ban on handedness conversion (staggered)
- Control group: *right* handed individuals
- Treatment group: *left* handed individuals

Identification Strategy - TWFE:

Treatment: ban on handedness conversion

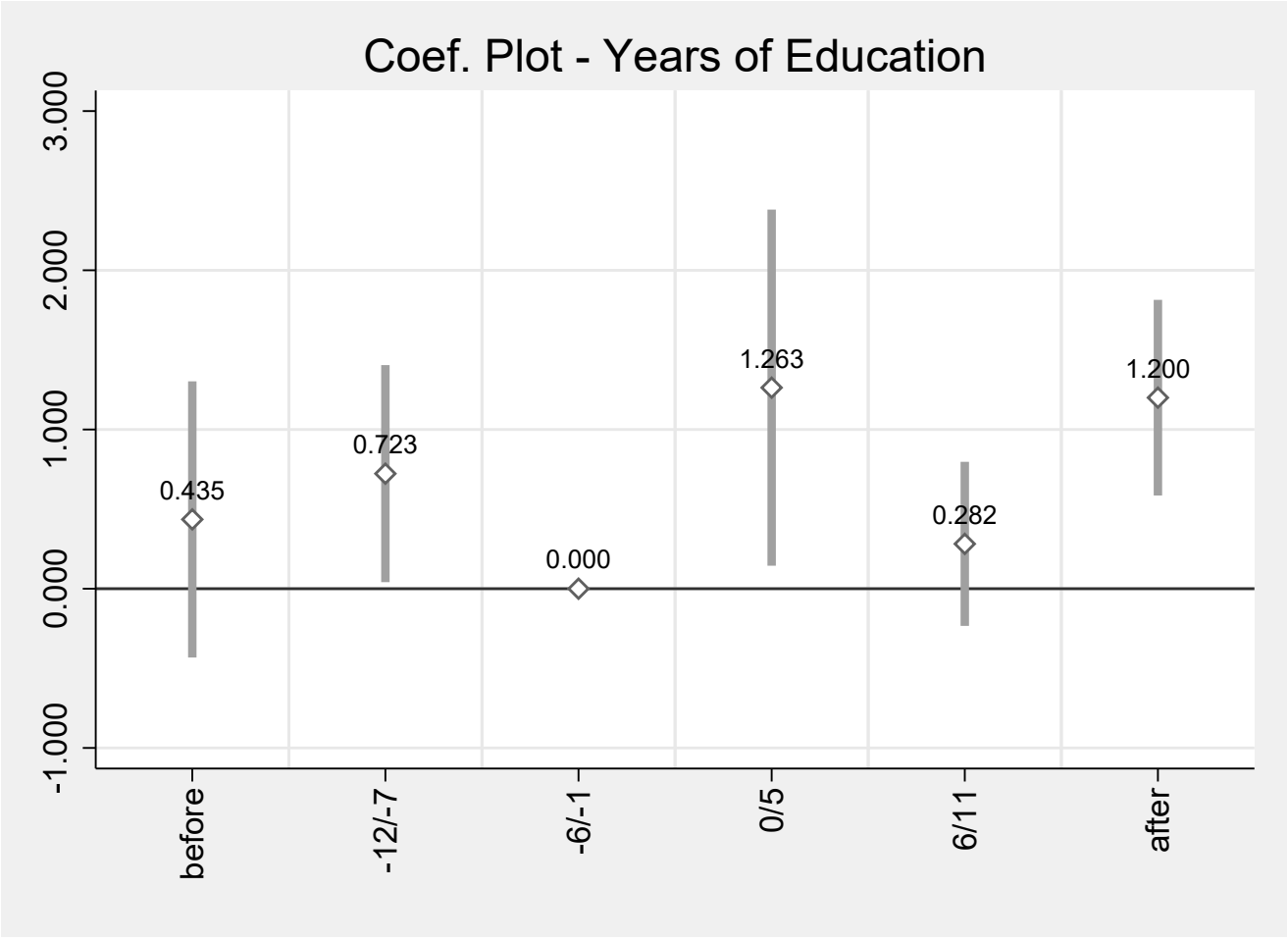
- Control group: *right* handed individuals
- Treatment group: *left* handed individuals

Empirical Specification:

$$y_{its} = \alpha + \beta D_{its} + \lambda YSE_t + \gamma state_s + \omega left_i + \varphi X_i + \epsilon_{its}$$

Y_{its}:	Outcomes of individual i in state s, entering elementary school at time t
D_{its}:	Indicator if a left handed individual i starts school after the reform (year school enrollment $\geq$ reform date)
YSE_t:	School cohort fixed effects
$state_s$:	Federal state fixed effects
$left_i$:	Left handed individual i
X_i:	Vector of additional controls

Time Event Study - Coefficient Plot



Wage Empl

First Stage

	(1) Switched	(2) Switched	(3) Switched	(4) Switched
Reform	-0.399***	-0.457***	-0.149***	-0.132***
	(0.000)	(0.000)	(0.007)	(0.008)
Cohort FE	-	-	+	+
State FE	-	+	-	+
Controls	+	+	+	+
Observations	491	491	491	491
R-squared	0.251	0.319	0.365	0.422
F-Test	71.234	110.067	9.364	9.320

p-values in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: Standard errors are clustered at the federal state level. Cohort FE: Cohort Dummies for each decade from 1940 to 1989. Source: SOEP v36, 1984-2019.

- Only left-handed individuals
- Outcome: Dummy for retrained/switched individuals

Reform Effect on Education

	Education Years			High School			> Lower Sec.		
	(1) TWFE	(2) TWFE	(3) Borusyak	(4) TWFE	(5) TWFE	(6) Borusyak	(7) TWFE	(8) TWFE	(9) Borusyak
Reform	0.612***	0.396***	0.397***	0.047**	0.014	0.013	0.116***	0.097***	0.098***
	(0.000)	(0.005)	(0.000)	(0.045)	(0.617)	(0.547)	(0.000)	(0.000)	(0.000)
Left	-0.187	-0.207*	-0.209*	-0.020	-0.020	-0.020	-0.056***	-0.051***	-0.052***
	(0.193)	(0.095)	(0.071)	(0.452)	(0.379)	(0.363)	(0.002)	(0.007)	(0.002)
State FE	+	+	+	+	+	+	+	+	+
Cohort FE	+	+	+	+	+	+	+	+	+
Controls	-	+	+	-	+	+	-	+	+
Observations	9066	9066	9066	9066	9066	9066	9066	9066	9066
R-squared	0.027	0.181		0.049	0.173		0.080	0.130	

p-values in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: Standard errors are clustered at the federal state level. Source: SOEP v36, 1984-2019.

- Increase in years of education by 0.4 years.
- Probability of achieving more than lower secondary education increases by almost 10 percentage points.

Potential Channels: Personality Traits

	Openness		Conscientiousness		Extraversion		Agreeableness		Neuroticism	
	(1) TWFE	(2) Borusyak	(3) TWFE	(4) Borusyak	(5) TWFE	(6) Borusyak	(7) TWFE	(8) Borusyak	(9) TWFE	(10) Borusyak
Reform	0.138*	0.138***	-0.020	-0.016	0.074	0.075	0.063	0.067	-0.026	-0.027
	(0.088)	(0.002)	(0.865)	(0.807)	(0.608)	(0.183)	(0.530)	(0.224)	(0.730)	(0.501)
Left	-0.013	-0.013	-0.142**	-0.143**	-0.123**	-0.124**	-0.100*	-0.101**	0.140***	0.141***
	(0.758)	(0.757)	(0.036)	(0.021)	(0.021)	(0.011)	(0.066)	(0.047)	(0.005)	(0.001)
State FE	+	+	+	+	+	+	+	+	+	+
Cohort FE	+	+	+	+	+	+	+	+	+	+
Controls	+	+	+	+	+	+	+	+	+	+
Observations	9066	9066	9066	9066	9066	9066	9066	9066	9066	9066
R-squared	0.037		0.031		0.023		0.048		0.065	

p-values in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

- Increase in openness by 0.14 standard deviations.
- No effect on neuroticism (but sign in line with hypothesis).

Potential Channels: Ability, School Grades, Health and Preferences (Sub-samples)

	(1) SCT	(2) WFT	(3) German	(4) Math	(5) Mental Health	(6) Physical Health	(7) Risk	(8) Patience
Reform	0.174**	0.379	-0.203**	-0.129	0.025	0.051	0.072	0.033
	(0.041)	(0.165)	(0.011)	(0.372)	(0.760)	(0.305)	(0.213)	(0.747)
Left	-0.070	-0.032	0.128***	0.125**	-0.084***	-0.013	-0.098***	-0.037
	(0.313)	(0.849)	(0.009)	(0.016)	(0.009)	(0.656)	(0.002)	(0.441)
State FE	+	+	+	+	+	+	+	+
Cohort FE	+	+	+	+	+	+	+	+
Controls	+	+	+	+	+	+	+	+
Observations	4629	1426	6374	6371	9066	9066	9066	8622
R-squared	0.078	0.114	0.127	0.035	0.032	0.034	0.083	0.011

p-values in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: TWFE-Regressions. SCT: Symbol Correspondence Test (fluid mechanics). WFT: Word Fluency Test (crystallized pragmatics). German: Last grade in German (1: best / 6: worst). Math: Last grade in Math (1: best / 6: worst). Mental Health: Summary Scale Mental (NBS). Physical Health: Summary Scale Physical (NBS). Source: SOEP v36, 1984-2019.

Bad Controls

Labor Market Outcomes

- No effect on employment and wages overall ⏩ Labormarket Outcomes
- Heterogeneous Effects by Manual/Non-Manual Professions:

	All		Male		Female	
	(1) Employed	(2) ln wage	(3) Employed	(4) ln wage	(5) Employed	(6) ln wage
Left	-0.014	-0.026	0.006	-0.039	-0.032	-0.012
	(0.494)	(0.463)	(0.798)	(0.361)	(0.281)	(0.823)
Reform	0.024	0.073	0.003	0.158**	0.027	-0.010
	(0.437)	(0.204)	(0.938)	(0.037)	(0.555)	(0.901)
Reform x Manual Worker	-0.043	-0.203*	0.021	-0.290**	-0.079	-0.128
	(0.540)	(0.055)	(0.772)	(0.025)	(0.545)	(0.468)
Male	+	+	-	-	-	-
State FE	+	+	+	+	+	+
Cohort Runnning Variable	+	+	+	+	+	+
Controls	+	+	+	+	+	+
Observations	108838	82696	50680	42148	58158	40548
R-squared	0.169	0.284	0.099	0.298	0.165	0.209

p-values in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

⏩ Change in Preferences

Robustness Checks

- Pseudo reform t-3, t-5
- Pseudo reform t+3, t+5
- Drop never treated state (Hesse)
- Absolute ban rather than mention
- Control for expansion of compulsory schooling expansion
- Drop East Germany
- Drop school cohorts before year 1960
- Drop non-natives and individuals with migration background

Table

Summary

Effects of the reform:

- Positive effects on innate cognitive abilities and German language grades
- Positive effect on personality trait openness
- Moderate increase in years of education
- No effect on wages on average

Summary

Conclusion:

- Contrary to literature no strong / statistically significant effect on mental health
- Left-handed individuals in manual professsions could likely benefit if workplaces are more inclusive in terms of specialized tools, machinery and production lines

Thank you!

Questions, comments?

Appendix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Sample Restrictions

Further restrictions:

- Main working age: 25-65 years
- Birth cohorts: 1944-1989
- Drop individuals that attended school abroad
- Drop individuals with missing information of state of school attendance

Sample size: 9,066 men and women in final sample Back

Heterogeneous Effects Education Outcomes (I)

	(1) Years Edu.	(2) > Lower Sec.
Left	-0.269	-0.052
	(0.138)	(0.102)
Reform	0.454*	0.107**
	(0.087)	(0.031)
Reform x Male	0.247	-0.016
	(0.594)	(0.819)
Observations	9066	9066
R-squared	0.048	0.082

p-values in parentheses

Simple DiD regression. Clustered at state level. Controls: state FE, cohort running variable, migration background, grew-up in village / missing, parents are catholic / missing, > Lower Sec.: more than lower secondary education. Parents Lowersec: Dummy for parents with a lower secondary school degree or missing information in the biography questionnaire.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

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Heterogeneous Effects Education Outcomes (II)

	All		Male		Female	
	(1) Years Edu.	(2) > Lower Sec.	(3) Years Edu.	(4) > Lower Sec.	(5) Years Edu.	(6) > Lower Sec.
Reform	0.947**	0.112***	1.367*	0.191**	0.577	0.037
	(0.033)	(0.002)	(0.099)	(0.013)	(0.315)	(0.397)
Reform x P. Lowersec.	-0.721	-0.037	-1.061	-0.159*	-0.359	0.094
	(0.235)	(0.365)	(0.240)	(0.099)	(0.696)	(0.285)
Male	+	+	-	-	-	-
Observations	9066	9066	4246	4246	4820	4820
R-squared	0.171	0.142	0.162	0.131	0.193	0.153

p-values in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Notes: Simple DiD regression. Clustered at state level. Controls: state FE, cohort running variable, migration background, grew-up in village / missing, parents are catholic / missing, > Lower Sec.: more than lower secondary education. Parents Lowersec: Dummy for parents with a lower secondary school degree or missing information in the biography questionnaire.
Source: SOEP v36, 1984-2019.

Back

Pseudo Reform - Education Outcomes (I)

	Pseudo reform t-3			Pseudo reform t-5		
	(1) Educ. Years	(2) > Lower Sec.	(3) High School	(4) Educ. Years	(5) > Lower Sec.	(6) High School
Reform	0.276	0.041	0.053	0.118	0.013	0.037
	(0.218)	(0.251)	(0.112)	(0.619)	(0.699)	(0.275)
Observations	9066	9066	9066	9066	9066	9066
R-squared	0.006	0.005	0.019	0.006	0.004	0.019

p-values in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Notes: Standard errors are clustered at the federal state level. Pseudo reforms include t-3 or t-5 in post treatment group. > Lower Sec.: Probability of obtaining more than lower secondary education.
Source: SOEP v36, 1984-2019.

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Pseudo Reform - Education Outcomes (II)

	Pseudo reform t+3			Pseudo reform t+5		
	(1) Educ. Years	(2) > Lower Sec.	(3) High School	(4) Educ. Years	(5) > Lower Sec.	(6) High School
Reform	0.154	0.099*	-0.020	0.319	0.094**	0.012
	(0.444)	(0.099)	(0.543)	(0.134)	(0.037)	(0.712)
Observations	9066	9066	9066	9066	9066	9066
R-squared	0.005	0.005	0.013	0.004	0.005	0.011

p-values in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Notes: Standard errors are clustered at the federal state level. Pseudo reforms include t+3 or t+5 in pre treatment group. > Lower Sec.: Probability of obtaining more than lower secondary education.
Source: SOEP v36, 1984-2019.

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Robustness Checks - Education Outcomes (I)

	Dependent Variable			
	Educ. Years (1)	High School (2)	> Lower Sec. (3)	N
	A. Baseline			
Reform	0.397***	0.013	0.098***	9,066
p-value	(0.000)	(0.547)	(0.000)	
	B. Only Use Explicit Ban on Conversion			
Reform	0.009	0.010	0.052***	9,066
p-value	(0.921)	(0.355)	(0.003)	
	C. Drop Individuals without German Citizenship and with Migration Background			
Reform	0.389***	0.002	0.085***	7,854
p-value	(0.000)	(0.941)	(0.000)	
	D. Limit Birth Cohorts to after 1960			
Reform	0.072	-0.032	0.056***	6,612
p-value	(0.630)	(0.278)	(0.001)	

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Robustness Checks - Education Outcomes (II)

	Dependent Variable			
	Educ. Years	High School	> Lower Sec.	N
	(1)	(2)	(3)	
	E. Entropy Balancing			
Reform	0.556***	0.014	0.130***	9,066
p-value	(0.000)	(0.476)	(0.000)	
	F. Drop Never Treated State Hesse			
Reform	0.404***	0.000	0.096***	8,387
p-value	(0.000)	(0.991)	(0.000)	
	G. Control for Compulsory Schooling Expansion			
Reform	0.393***	0.012	0.098***	9,066
p-value	(0.000)	(0.582)	(0.000)	
	H. West German States only, without East Berlin			
Reform	0.280***	0.016	0.076***	7,053
p-value	(0.000)	(0.446)	(0.000)	

Back

Robustness Checks - Labor Outcomes (I)

	Dependent Variable / Number of Observations		
	Employed (1)	ln wage (2)	N (Employment / ln wages)
	A. Baseline		
Reform	0.007	0.010	108,838 / 82,696
p-value	(0.765)	(0.799)	
	B. Only Use Explicit Ban on Conversion		
Reform	-0.022*	-0.087***	108,838 / 82,696
p-value	(0.088)	(0.000)	
	C. Drop Individuals without German Citizenship and with Migration Background		
Reform	0.003	0.022	93,196 / 71,173
p-value	(0.920)	(0.601)	
	D. Limit Birth Cohorts to after 1960		
Reform	0.011	-0.037	81,791 / 65,310
p-value	(0.679)	(0.420)	

Robustness Checks - Labor Outcomes (II)

	Dependent Variable / Number of Observations		
	Employed (1)	ln wage (2)	N (Employment / ln wages)
	E. Entropy Balancing		
Reform	0.020	0.038	108,838 / 82,696
p-value	(0.395)	(0.380)	
	F. Drop Never Treated State Hesse		
Reform	0.005	-0.003	101,198 / 76,920
p-value	(0.839)	(0.944)	
	G. Control for Compulsory Schooling Expansion		
Reform	0.007	0.011	108,838 / 82,696
p-value	(0.759)	(0.791)	
	H. West German States only, without East Berlin		
Reform	0.018	0.021	83,676 / 63,949
p-value	(0.484)	(0.627)	

Back

Bad Controls

	Education Years				
	(1)	(2)	(3)	(4)	(5)
Reform	0.687**	0.601*	0.520	0.609*	0.085
	(0.046)	(0.079)	(0.149)	(0.079)	(0.667)
SCT		0.678***			0.578***
		(0.000)			(0.000)
German			-0.914***		-0.768***
			(0.000)		(0.000)
Math				-0.499***	-0.254***
				(0.000)	(0.000)
Observations	3702	3702	3702	3702	3702
R-squared	0.183	0.224	0.245	0.213	0.285

p-values in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Notes: Standard errors are clustered at the federal state level. Controls: left, state FE, cohort FE, male, migration background, father high school / missing, mother high school / missing, grew-up in village / missing, parents are catholic / missing. Source: SOEP v36, 1984-2019.

Back

Reform Effect on Labor Market Outcomes

	Empl			ln Wage		
	(1) TWFE	(2) TWFE	(3) Borusyak	(4) TWFE	(5) TWFE	(6) Borusyak
Reform	0.009	0.007	0.007	-0.005	0.011	0.010
	(0.792)	(0.807)	(0.765)	(0.926)	(0.837)	(0.799)
Left	-0.015	-0.012	-0.012	0.026	0.014	0.014
	(0.462)	(0.512)	(0.507)	(0.405)	(0.656)	(0.654)
Exp/Exp2	-	+	+	-	+	+
Cohort FE	+	+	+	+	+	+
State FE	+	+	+	+	+	+
Controls	+	+	+	+	+	+
Observations	108838	108838	108838	82696	82696	82696
R-squared	0.080	0.175		0.110	0.202	

p-values in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Notes: Standard errors are clustered at individual level. Additional controls: male, East German. Source: SOEP v36, 1984-2019.

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Change in Occupational Preferences Due to Reform

	Manual Occupation		
	(1) TWFE	(2) TWFE	(3) Borusyak
Reform	0.041	0.045	0.046**
	(0.207)	(0.140)	(0.048)
Controls	-	+	+
Observations	9066	9066	9066
R-squared	0.021	0.153	

p-values in parentheses

Standard errors clustered at state level. Controls: left, state FE, cohort FE, male, migration backround, father high school / missing, mother high school / missing, grew-up in village / missing, parents are catholic / missing, > Lower Sec.: more than lower secondary education

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Back

Employment Status Male

	.									
Employed	1	2	3	4	5	6	7	8	9	11	Total
0	0	0	234	833	284	1	8	54	7073	11	8498
1	40365	1438	0	0	0	0	0	0	0	0	41803
Total	40365	1438	234	833	284	1	8	54	7073	11	50301

Male individuals. [1] Voll erwerbstaetig, [2] Teilzeitbeschaeftigung, [3] Ausbildung/Lehre
[4] Geringfuegig erwerbstaetig, [5] Altersteilzeit mit Arbeitszeit Null, [6] Freiwilliger Wehrdienst
[7] FSJ/FOeJ/BFD, [8] Werkstatt fuer Behinderte, [9] Nicht erwerbstaetig
[11] Wehrpflicht/Zivildienst

Employment Status Female

	.								
Employed	1	2	3	4	5	7	8	9	Total
0	0	0	197	4066	238	7	50	16082	20640
1	20116	16885	0	0	0	0	0	0	37001
Total	20116	16885	197	4066	238	7	50	16082	57641

Female individuals. [1] Voll erwerbstaetig, [2] Teilzeitbeschaeftigung, [3] Ausbildung/Lehre
[4] Geringfuegig erwerbstaetig, [5] Altersteilzeit mit Arbeitszeit Null, [6] Freiwilliger Wehrdienst
[7] FSJ/FOeJ/BFD, [8] Werkstatt fuer Behinderte, [9] Nicht erwerbstaetig
[11] Wehrpflicht/Zivildienst

Multiple Hypotethis Testing Main Outcomes

outcome	coef	stderr	p	pwyoung	pbonf	psidak
Employment	0.007	0.029	0.807	0.911	1.000	0.964
ln Wage	0.011	0.054	0.837	0.911	1.000	0.964
Years of Education	0.377	0.106	0.003	0.007	0.010	0.010
High School	0.012	0.028	0.671	0.911	1.000	0.964
$>$ Lower Sec.	0.096	0.016	0.000	0.000	0.000	0.000

Adjusted p-values of main results via step-down re-sampling of Westfall and Young (Jones et al., 2019), Bonferroni-Holm and Sidak-Holm

Reform Effect on Years of Education for Different Handedness Definitions

	Strict		Average				Loose			
	(1) TWFE	(2) Borusyak	(3) TWFE	(4) TWFE	(5) Borusyak	(6) Borusyak	(7) TWFE	(8) TWFE	(9) Borusyak	(10) Borusyak
Effect	0.396***	0.397***	0.292***	0.287***	0.286***	0.285***	0.272**	0.269**	0.264***	0.272***
	(0.005)	(0.000)	(0.008)	(0.009)	(0.001)	(0.001)	(0.021)	(0.022)	(0.002)	(0.002)
Left	-0.207*	-0.209*	-0.121	-0.104	-0.117	-0.115	-0.121	-0.105	-0.117	-0.145
	(0.095)	(0.071)	(0.207)	(0.310)	(0.196)	(0.267)	(0.138)	(0.261)	(0.126)	(0.167)
Weirdies				-0.050		-0.007		-0.033		0.061
				(0.620)		(0.945)		(0.757)		(0.627)
State FE	+	+	+	+	+	+	+	+	+	+
Cohort FE	+	+	+	+	+	+	+	+	+	+
Controls	+	+	+	+	+	+	+	+	+	+
Observations	9066	9066	9516	9516	9516	9516	9516	9516	9516	9516
R-squared	0.181		0.182	0.182			0.182	0.182		

p-values in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

- The effect size of the reform on education becomes smaller the more loosely left-handedness is defined. Controlling for weirdies reduces the effect size in all specifications slightly, except for the very loose left-handedness definition, where the effect size increases.

Reform Effect on > Lower Sec. for Different Handedness Definitions

	Strict		Average				Loose			
	(1) TWFE	(2) Borusyak	(3) TWFE	(4) TWFE	(5) Borusyak	(6) Borusyak	(7) TWFE	(8) TWFE	(9) Borusyak	(10) Borusyak
Effect	0.097***	0.098***	0.049***	0.048***	0.050***	0.051***	0.054***	0.053***	0.055***	0.058***
	(0.000)	(0.000)	(0.003)	(0.005)	(0.003)	(0.003)	(0.003)	(0.004)	(0.000)	(0.000)
Left	-0.051***	-0.052***	-0.030*	-0.025	-0.030*	-0.031*	-0.032**	-0.029	-0.033***	-0.043**
	(0.007)	(0.002)	(0.091)	(0.223)	(0.069)	(0.097)	(0.021)	(0.153)	(0.009)	(0.015)
Weirdies				-0.014		0.004		-0.006		0.022
				(0.504)		(0.837)		(0.801)		(0.363)
State FE	+	+	+	+	+	+	+	+	+	+
Cohort FE	+	+	+	+	+	+	+	+	+	+
Controls	+	+	+	+	+	+	+	+	+	+
Observations	9066	9066	9516	9516	9516	9516	9516	9516	9516	9516
R-squared	0.130		0.128	0.128			0.128	0.128		

p-values in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

- Probability of achieving more than lower secondary education is pretty stable in all specifications

Reform Effect on SCT for Different Handedness Definitions

	Strict		Average				Loose			
	(1) DiD	(2) Borusyak	(3) DiD	(4) DiD	(5) Borusyak	(6) Borusyak	(7) DiD	(8) DiD	(9) Borusyak	(10) Borusyak
Effect	0.174**	0.179**	0.116	0.113	0.120**	0.122**	0.131**	0.126**	0.133***	0.132***
	(0.041)	(0.015)	(0.102)	(0.127)	(0.029)	(0.035)	(0.025)	(0.033)	(0.001)	(0.003)
Left	-0.070	-0.071	-0.088	-0.078	-0.089*	-0.094	-0.069*	-0.050	-0.070*	-0.067
	(0.313)	(0.290)	(0.112)	(0.251)	(0.091)	(0.132)	(0.082)	(0.389)	(0.063)	(0.242)
Weirdies				-0.028		0.014		-0.039		-0.005
				(0.656)		(0.801)		(0.609)		(0.950)
State FE	+	+	+	+	+	+	+	+	+	+
Cohort FE	+	+	+	+	+	+	+	+	+	+
Controls	+	+	+	+	+	+	+	+	+	+
Observations	4629	4629	4885	4885	4885	4885	4885	4885	4885	4885
R-squared	0.078		0.074	0.074			0.074	0.074		

p-values in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

- There is an effect in all Borusyak specifications

Reform Effect on German for Different Handedness Definitions

	Strict		Average				Loose			
	(1) DiD	(2) Borusyak	(3) DiD	(4) DiD	(5) Borusyak	(6) Borusyak	(7) DiD	(8) DiD	(9) Borusyak	(10) Borusyak
Effect	-0.203**	-0.203***	-0.133**	-0.133**	-0.134***	-0.136***	-0.148***	-0.151***	-0.150***	-0.155***
	(0.011)	(0.000)	(0.026)	(0.026)	(0.000)	(0.001)	(0.002)	(0.003)	(0.000)	(0.000)
Left	0.128***	0.128***	0.062**	0.063	0.062**	0.068*	0.067**	0.076*	0.067**	0.086*
	(0.009)	(0.003)	(0.045)	(0.111)	(0.030)	(0.095)	(0.027)	(0.070)	(0.013)	(0.059)
Weirdies				-0.006		-0.022		-0.022		-0.043
				(0.939)		(0.800)		(0.778)		(0.647)
State FE	+	+	+	+	+	+	+	+	+	+
Cohort FE	+	+	+	+	+	+	+	+	+	+
Controls	+	+	+	+	+	+	+	+	+	+
Observations	6374	6374	6673	6673	6673	6673	6673	6673	6673	6673
R-squared	0.127		0.122	0.122			0.122	0.122		

p-values in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

- There is an effect in all specification

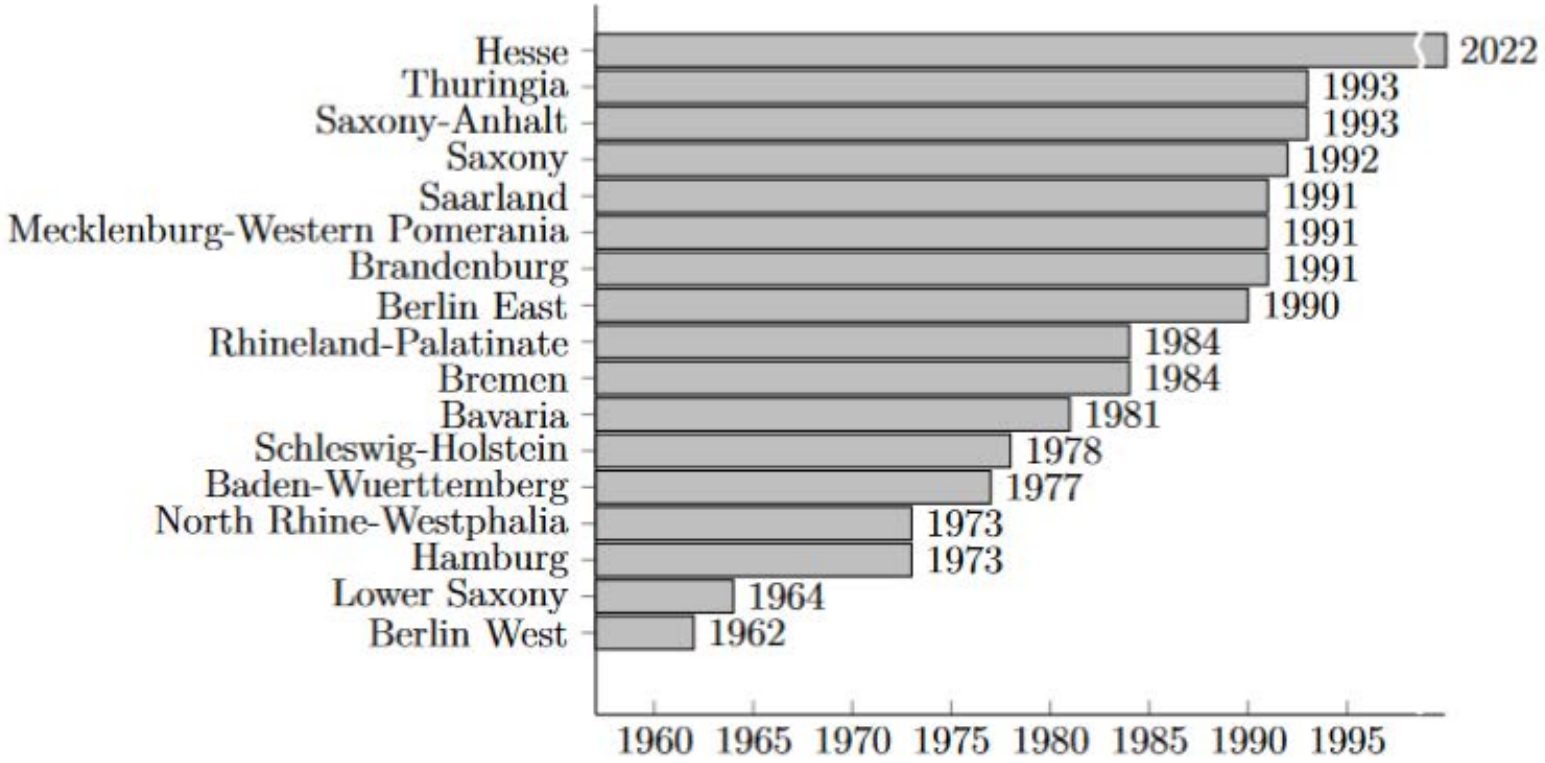
Reform effect on Labor Market Outcomes Male for Different Handedness Definitions

	Strict		Average				Loose			
	(1) Employed	(2) ln wage	(3) Employed	(4) Employed	(5) ln wage	(6) ln wage	(7) Employed	(8) Employed	(9) ln wage	(10) ln wage
Left	0.006	-0.039	-0.019	-0.011	-0.040	-0.022	-0.018	-0.004	-0.052	-0.022
	(0.798)	(0.361)	(0.386)	(0.601)	(0.223)	(0.523)	(0.397)	(0.854)	(0.116)	(0.559)
Effect	0.003	0.158**	0.021	0.017	0.094	0.086	0.019	0.014	0.092	0.083
	(0.938)	(0.037)	(0.517)	(0.581)	(0.106)	(0.133)	(0.556)	(0.652)	(0.123)	(0.158)
Effect x Manual Worker	0.021	-0.290**	-0.040	-0.041	-0.134	-0.137	-0.042	-0.041	-0.151	-0.151
	(0.772)	(0.025)	(0.446)	(0.443)	(0.163)	(0.159)	(0.455)	(0.463)	(0.139)	(0.138)
Weirdies				-0.021		-0.054		-0.023		-0.053
				(0.373)		(0.137)		(0.382)		(0.203)
State FE	+	+	+	+	+	+	+	+	+	+
Cohort Running V.	+	+	+	+	+	+	+	+	+	+
Controls	+	+	+	+	+	+	+	+	+	+
Observations	50680	42148	54249	54249	45059	45059	54249	54249	45059	45059
R-squared	0.099	0.298	0.096	0.096	0.301	0.301	0.096	0.096	0.301	0.301

p-values in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Handedness Conversion as Practiced across Federal States



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Event Study Plot - Test of Parallel Trends

$$Y_{it} = \alpha + \gamma Left_i + \lambda TimeTil_t + \beta(Left_i \cdot TimeTil_t) + \epsilon_{it}$$

Y_{it}:	Outcomes of individual i entering elementary school at time t
$Left_i$:	Dummy indicating naturally left handed individual i
$TimeTil_t$:	Binned leads and lags to and from reform time
-	(reference category -6 to -1 before policy change)
β:	Difference between left- and right handed individuals

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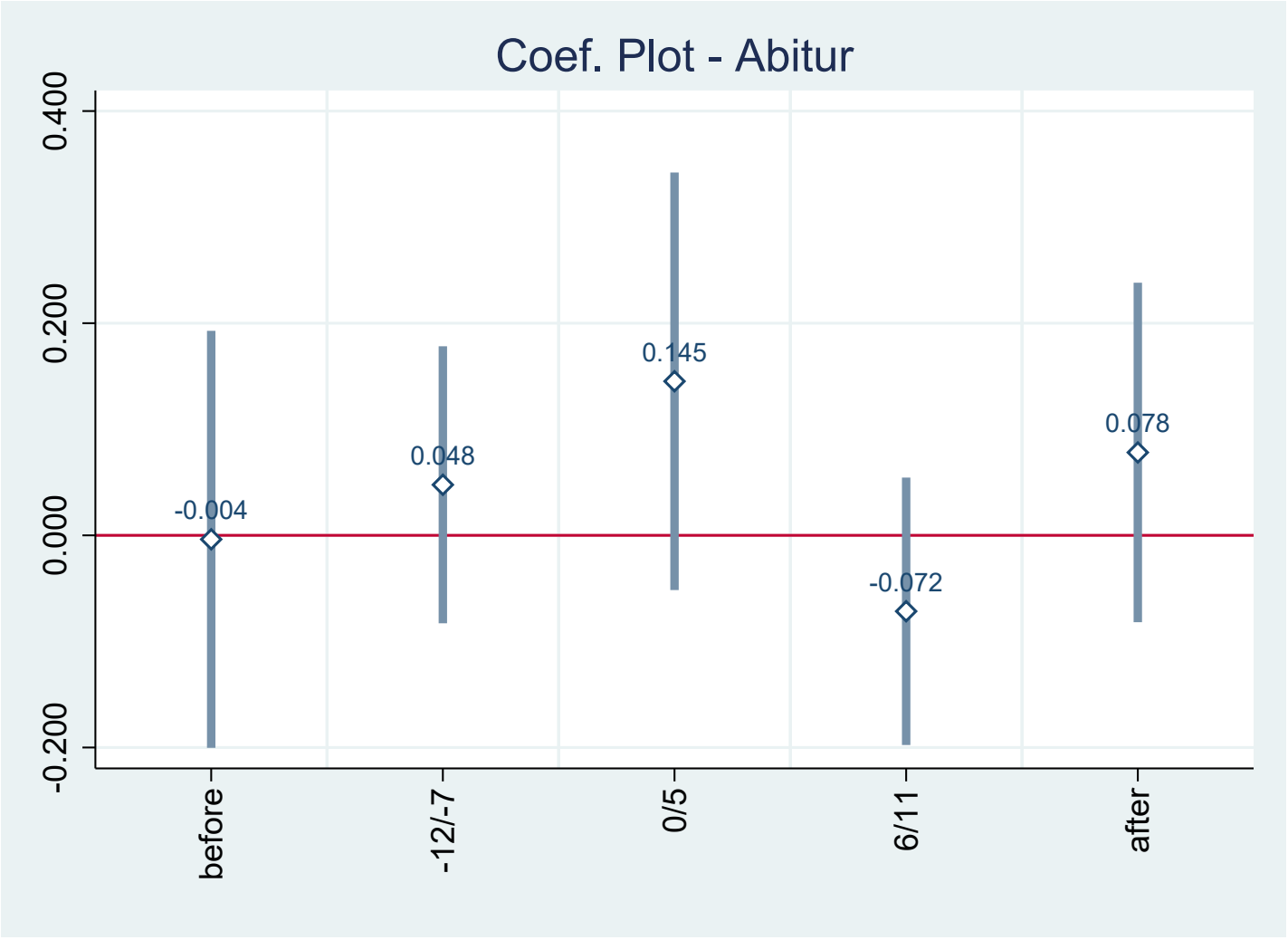
Event Study Plot



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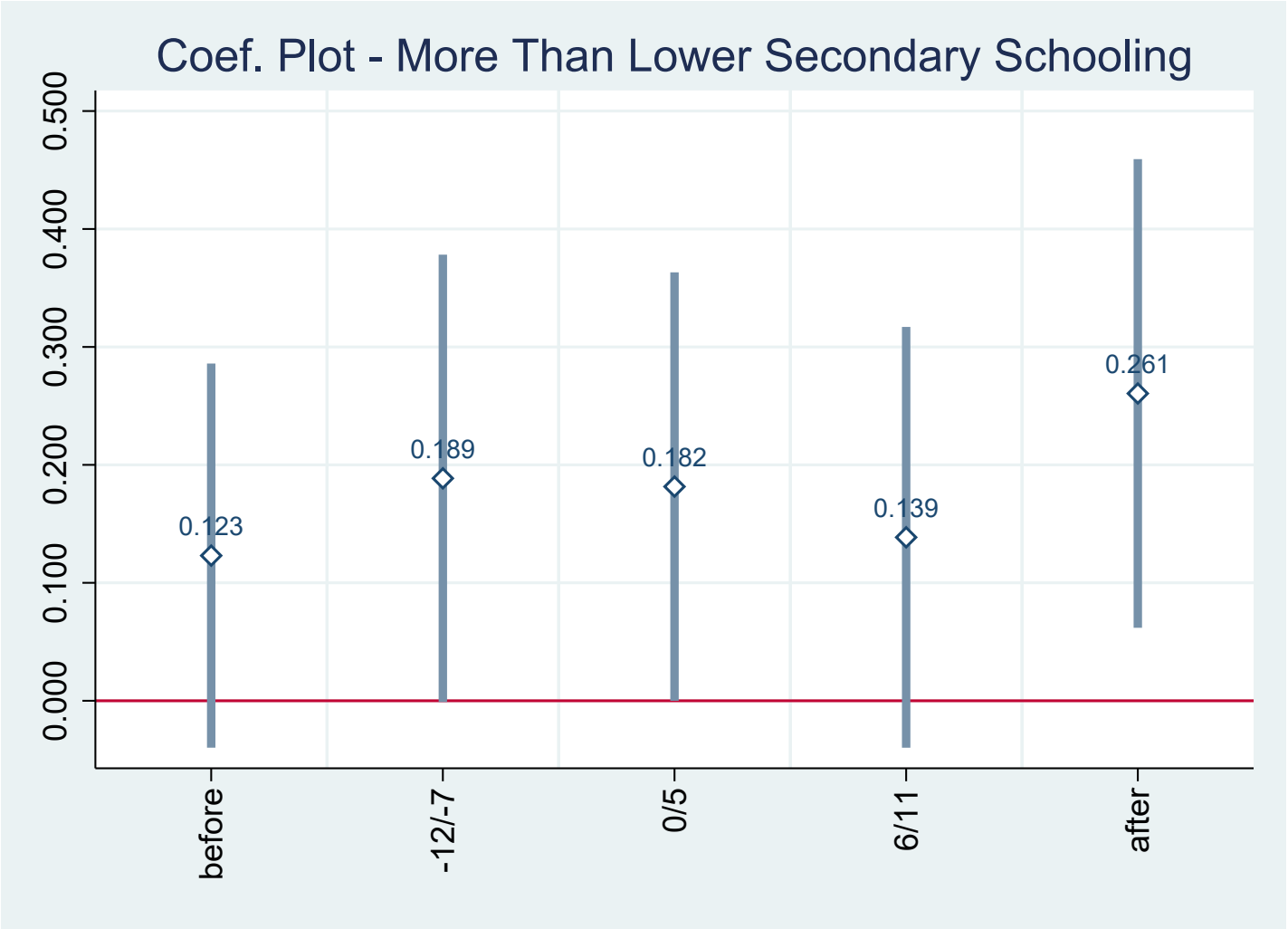
Event Study Plot



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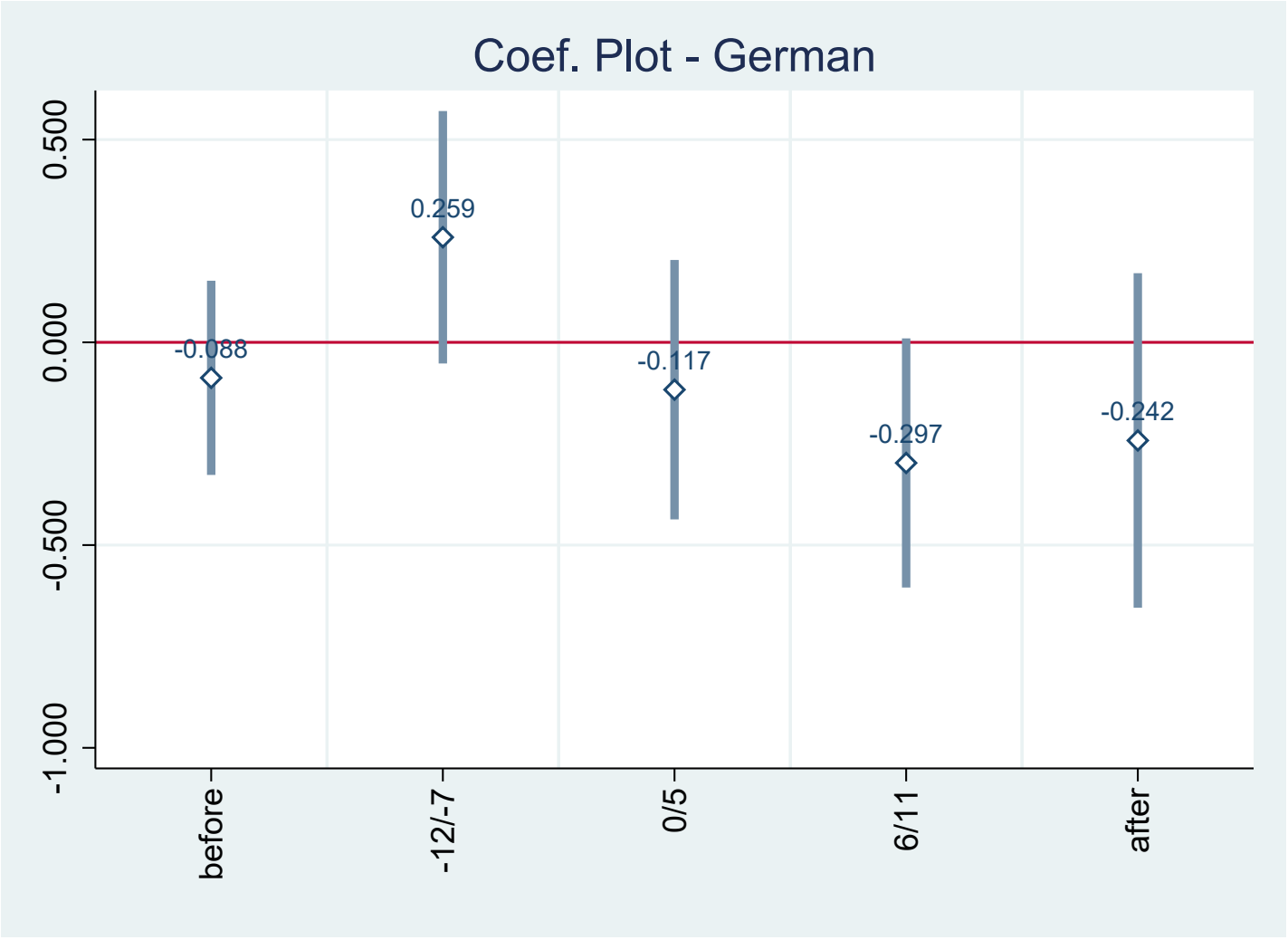
Event Study Plot



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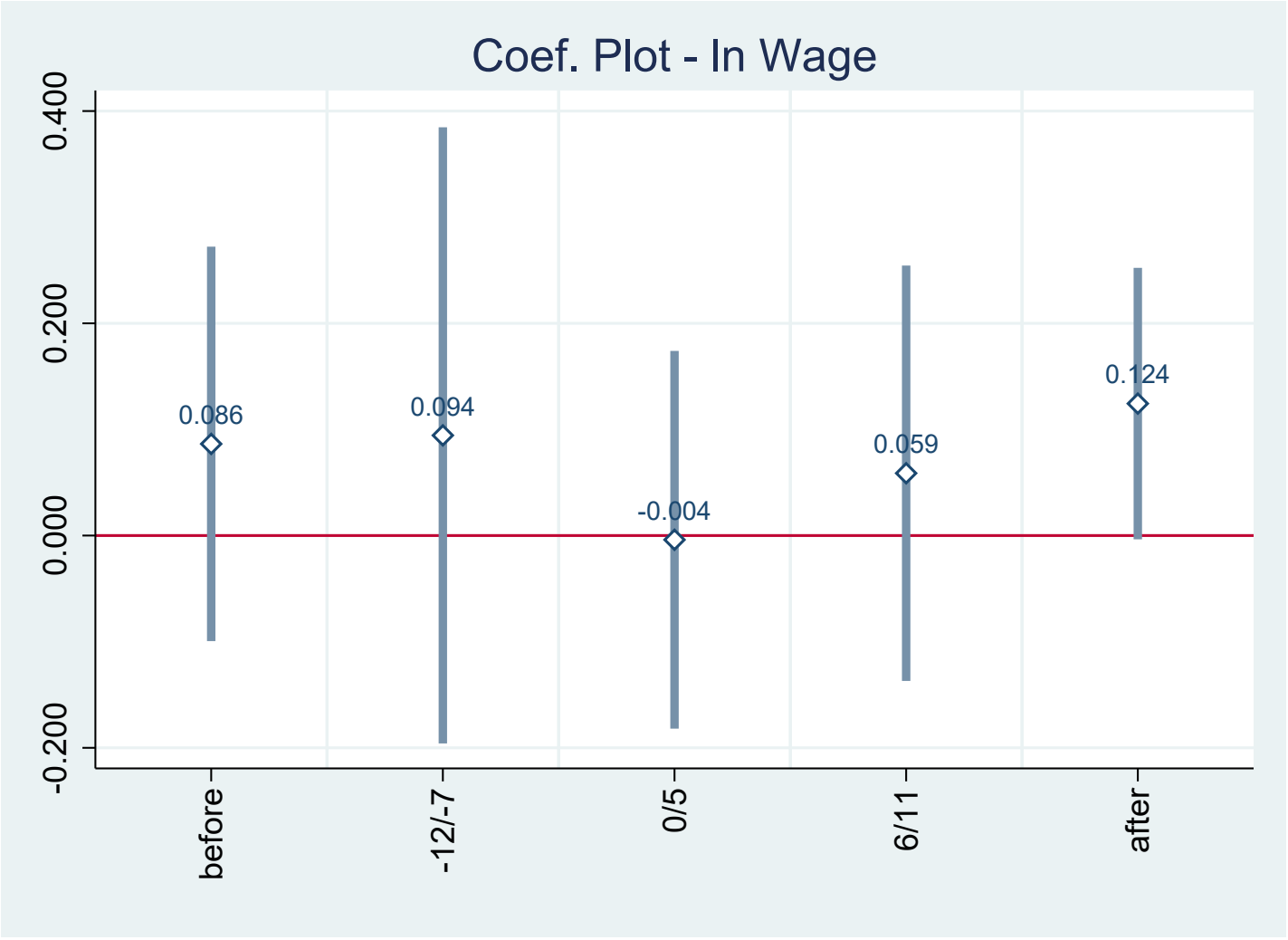
Event Study Plot



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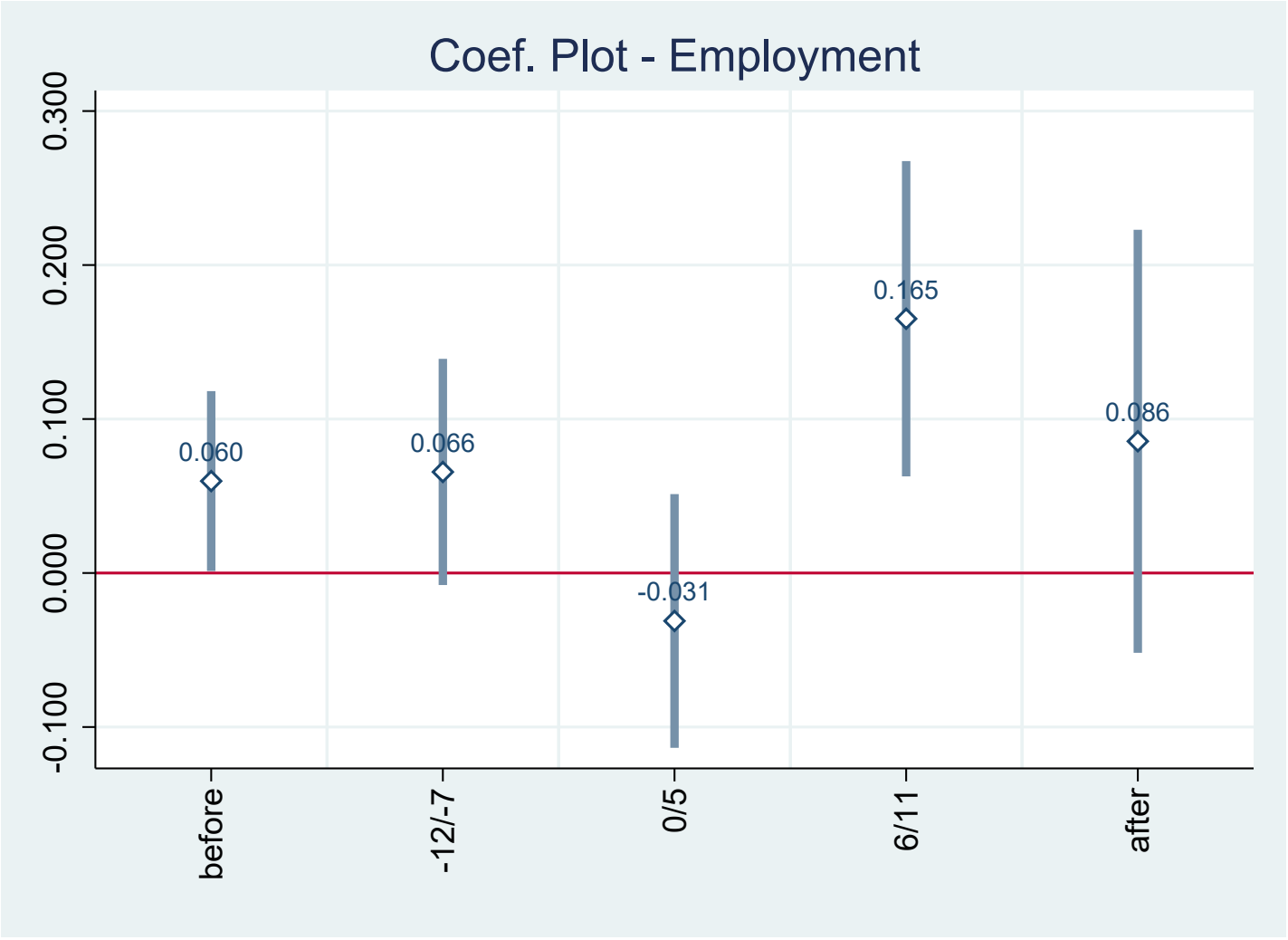
Event Study Plot



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Handedness by Birth Cohort

Share of left-handers increases over time

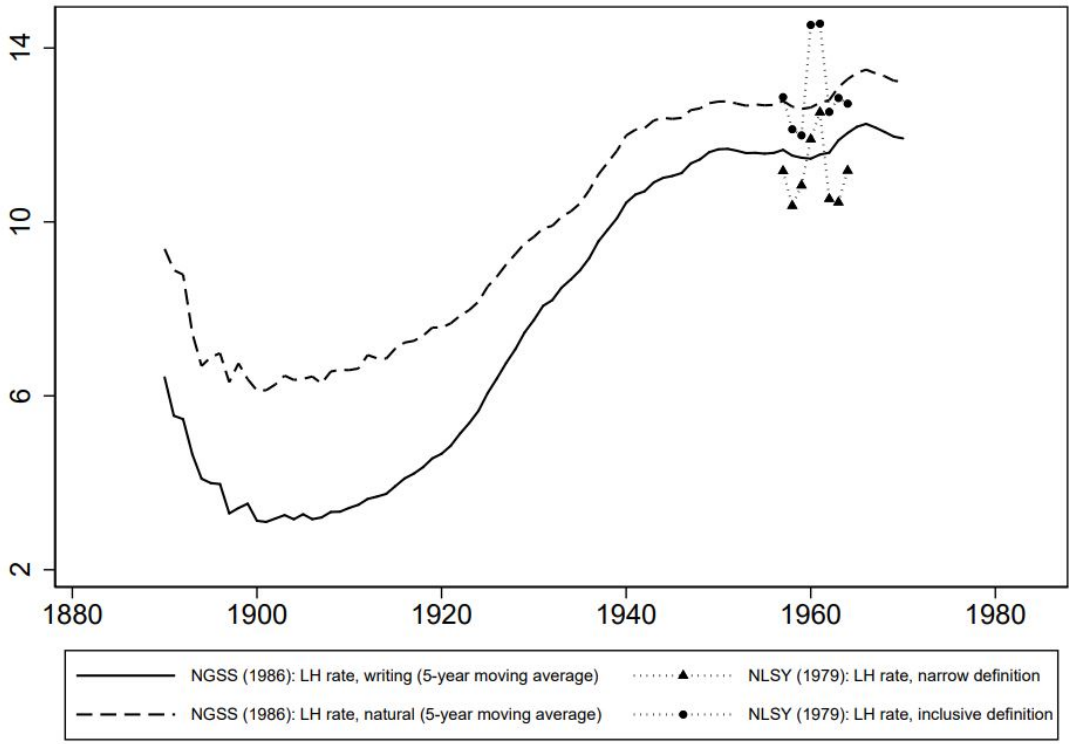

Figure 1: Left-handedness in the United States: 1887-1976.

Mariani et al. (2021) for upward trend in handedness.

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