

# Consequences of Banning Handedness Conversion

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# Motivation

## Definition handedness conversion:

- ▶ Pressuring left-handed individuals to use their right hand for writing or other manual activities

## Background:

- ▶ Cultural shift since the beginning of the 20<sup>th</sup> century in the west
  - ▶ Change in educational attitudes
  - ▶ Increasing knowledge of potentially harmful effects
  - ▶ Banned or discouraged between 1960s and 1990s in Germany
- ▶ Little evidence on psychological, social and economic costs
- ▶ Still common practice in many Asian, Arabic and African countries (Kushner, 2013; Sato et al., 2008; Singh et al., 2001; Zverev, 2006).



# Research Question

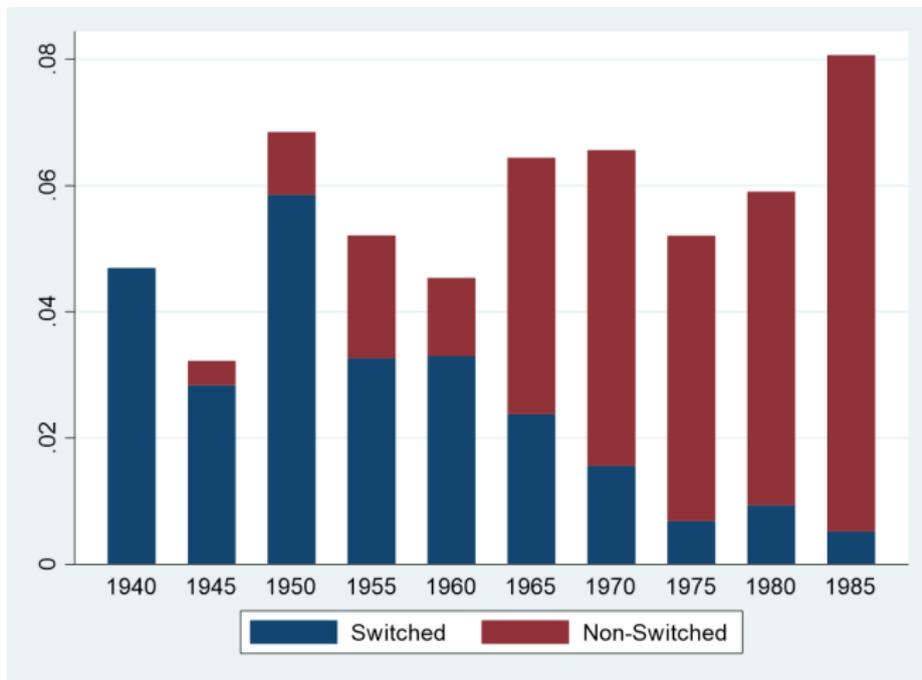
## Research question:

- ▶ What are the consequences of banning handedness conversion for education and labor market outcomes?



# Handedness by Birth Cohort

Share of “switched” left-handers decreases over time



# Left Handedness and Later Life Outcomes

## Mixed evidence on associations between outcomes and left-handedness:

- ▶ US/UK:  
Lower educational attainment, lower cognitive skills and lower earnings (Goodman, 2014, JEP)
- ▶ UK:  
Wage benefit for men, wage penalty for women (Denny and O'Sullivan, 2007, JHR)
- ▶ DE:  
Lower educational attainment, lower employment and lower earnings (Guber, 2019, LE)



# 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, LE)

## Contribution:

Little is known about causal effects of conversion on later life outcomes.



# Change in Educational Policy

- ▶ Staggered implementation of policy that discourages switching in schools between 1962 and 1993 in most German states
- ▶ "Soft" ban (mention) and later "hard" ban in most states:

## **Mention - Bavaria, 1981:**

„[...] leichte LH [...] zum Gebrauch der rechten Hand anregen. Ausgeprägte LH dürfen nicht gezwungen werden, die Schreibhand zu wechseln“

## **Ban - Bavaria, 2000:**

„Die angeborene Händigkeit darf nicht umgeschult werden.“

▶▶ Chart



# German Socio-Economic Panel Study (SOEP) - 1984-2019

**Handedness:** self-reported as part of grip strength test

## 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:

- 1 Natural right-handers
- 2 Natural left-handers
- 3 “switched” 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

## Further restrictions:

- ▶ Main working age: 25-65 years
- ▶ Birth cohorts: 1944-1989

**Sample size:** 9,059 men and women in final sample



# Summary Statistics

- ▶ Cohort differences in switched vs. non-switched group
- ▶ Mean year of birth: 1960 (Switched) vs. 1975 (Non-Switched)
- ▶ Left-handed sample: Only 490 or 6% left-handed individuals in sample

▶ Summary Table



# Identification Strategy - Static DiD:

**Treatment:** "Soft" ban on handedness conversion.

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

**Empirical Specification:**

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

$Y_{it}$ : Outcomes of individual  $i$  entering elementary school at time  $t$

$Left_i$ : Left handed individual  $i$

$Post_t$ : School enrollment after the reform is implemented

$\beta$ : Change in difference between left- and right handed individuals after the reform



# "Soft"-Reform Effect on Education

	(1)	(2)	(3)	(4)	(5)	(6)
	Education Years	Education Years	High School	High School	> Lower Sec.	> Lower Sec.
Left_Post	0.552*** (0.000)	0.294** (0.014)	0.051** (0.045)	0.015 (0.606)	0.097*** (0.002)	0.076*** (0.000)
Post	0.412*** (0.005)	0.122 (0.318)	0.126*** (0.000)	0.007 (0.639)	0.061 (0.105)	0.007 (0.713)
Left	-0.132 (0.344)	-0.160 (0.162)	-0.014 (0.580)	-0.022 (0.290)	-0.049** (0.048)	-0.042** (0.017)
Controls	-	+	-	+	-	+
Observations	9059	9059	9059	9059	9059	9059
R-squared	0.006	0.180	0.016	0.171	0.005	0.113

*p*-values in parentheses

Clustered at state level

Controls: state, age, year of birth, male, not German, father high school, mother high school, grew-up in village, parents are catholic

> Lower Sec.: more than lower secondary education

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



## Potential Channels: Personality Traits

	(1)	(2)	(3)	(4)	(5)
	Openness	Conscientiousness	Extraversion	Agreeableness	Neuroticism
Left_Post	0.132 (0.152)	-0.043 (0.708)	0.043 (0.780)	0.047 (0.699)	-0.046 (0.527)
Post	0.026 (0.258)	-0.059* (0.092)	0.025 (0.369)	-0.025 (0.322)	0.033 (0.262)
Left	-0.012 (0.734)	-0.160** (0.013)	-0.122** (0.021)	-0.112** (0.044)	0.108*** (0.009)
Observations	9059	9059	9059	9059	9059
R-squared	0.001	0.003	0.001	0.001	0.001

*p*-values in parentheses

Clustered at state level

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



## Potential Channels: Ability and Health (Subsamples)

	(1)	(2)	(3)	(4)	(5)	(6)
	SCT	WFT	German	Math	MCS	PCS
Left_Post	0.230** (0.018)	0.440 (0.143)	-0.207*** (0.003)	-0.170 (0.246)	0.029 (0.683)	0.067 (0.136)
Post	0.011 (0.823)	-0.238*** (0.000)	0.133** (0.032)	0.150*** (0.001)	0.032* (0.058)	-0.023 (0.484)
Left	-0.038 (0.566)	0.034 (0.839)	0.133*** (0.007)	0.127** (0.031)	-0.069** (0.014)	-0.002 (0.951)
Observations	4355	1333	6379	6404	9059	9059
R-squared	0.001	0.012	0.006	0.004	0.001	0.000

*p*-values in parentheses

Clustered at state level

SCT: Symbol Correspondence Test (fluid mechanics); WFT: Word Fluency Test (crystallized pragmatics)

German: Last grade in German (lower is better); Math: Last grade in Math (lower is better)

MCS: Summary Scale Mental (NBS); PCS: Summary Scale Physical (NBS)

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



# No Reform Effect on Labor Market Outcomes (Males)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Employed	Employed	Employed	Employed	ln wage	ln wage	ln wage	ln wage
Left_Post	0.002 (0.953)	0.009 (0.814)	-0.005 (0.894)	0.013 (0.709)	0.041 (0.594)	0.066 (0.359)	0.089 (0.198)	0.093 (0.204)
Year of Birth	-	-	+	+	-	-	+	+
Age/Age2	-	-	+	-	-	-	+	-
Exp/Exp2	-	-	-	+	-	-	-	+
State	-	+	+	+	-	+	+	+
Observations	50510	50510	50510	50450	41999	41999	41999	41952
R-squared	0.011	0.018	0.124	0.099	0.002	0.098	0.245	0.184

*p*-values in parentheses

Clustered at individual level

Coefficients for Post and Left not shown. Additional controls: East German

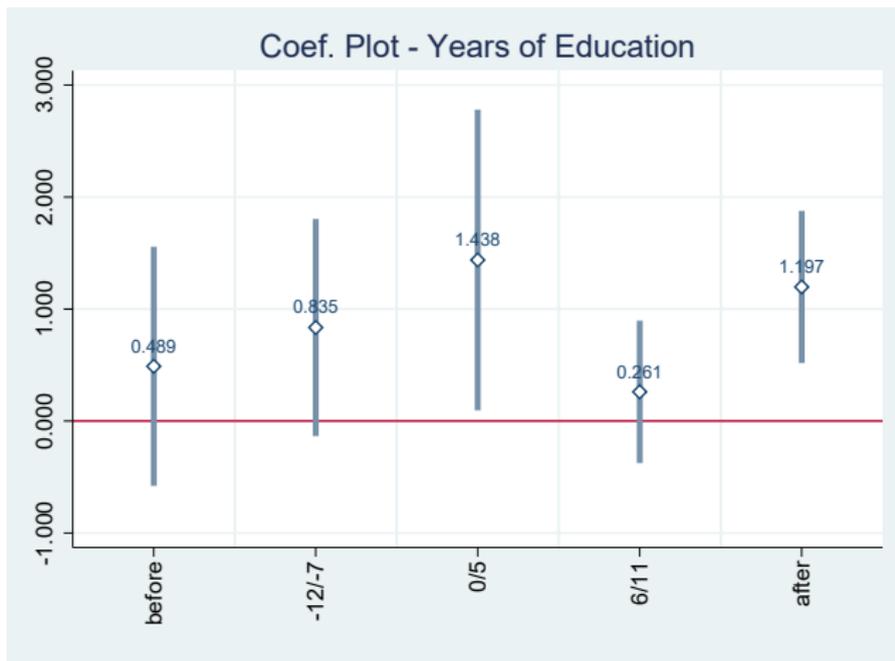
\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

» All

» Female



# Time Event Study - Coefficient Plot



▶▶ Model

▶▶ &gt; lower sec.

▶▶ High School

▶▶ German

▶▶ Wage

▶▶ Empl



# Robustness Checks

- Pseudo reform t-5 ▶▶ 1
- Drop never treated state (Hesse) ▶▶ 2
- Absolute ban rather than mention ▶▶ 3
- Control for state specific cohort trends and compulsory schooling / drop East Germany ▶▶ 4
- Drop school cohorts before year 1960 ▶▶ 5
- Drop non-natives and individuals with migration background ▶▶ 6



# Preliminary Conclusion

- ▶ **Positive effect on education outcomes**
- ▶ No operation through personality traits, mental health or physical health
- ▶ Positive effect on cognitive ability measures
- ▶ No positive labor market effects



*Thank you!*



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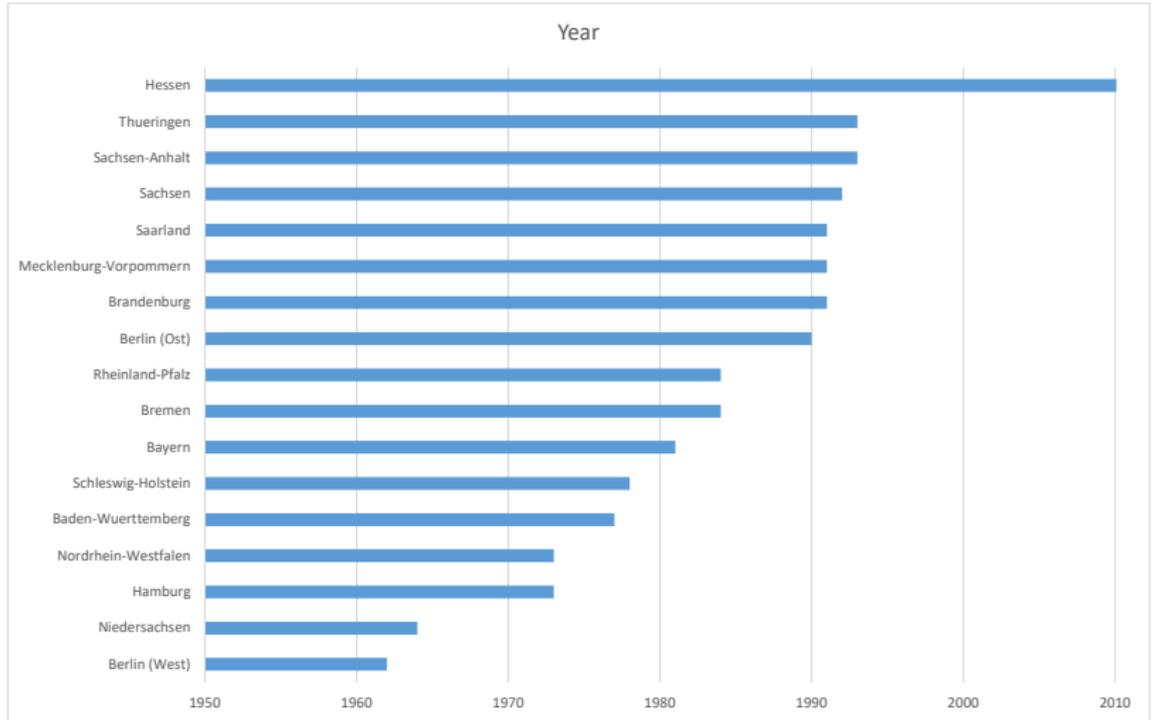
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# Handedness Conversion as Practiced across Federal States















## Pseudo Reform - Include t-3 in Post Treatment Period

	(1)	(2)	(3)	(4)
	Education Years	> Lower Sec.	High School	German
Post_Treat	0.244 (0.300)	0.041 (0.243)	0.051 (0.143)	-0.196** (0.018)
Post	0.437*** (0.001)	0.062 (0.125)	0.130*** (0.000)	0.143** (0.024)
Left	-0.048 (0.722)	-0.032 (0.203)	-0.021 (0.290)	0.142*** (0.001)
Observations	9059	9059	9059	6379
R-squared	0.006	0.005	0.019	0.007

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*p*-values in parentheses

Clustered at state level

Pseudo reform includes t-3 in post treatment group.

> Lower Sec.: more than lower secondary education

German: Last grade in German (lower is better)

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



# Drop Never Treated States

	(1)	(2)	(3)	(4)
	Education Years	> Lower Sec.	High School	German
Left_Post	0.531*** (0.001)	0.100*** (0.004)	0.041 (0.118)	-0.208*** (0.005)
Post	0.437*** (0.003)	0.068* (0.093)	0.136*** (0.000)	0.145** (0.033)
Left	-0.111 (0.484)	-0.051* (0.070)	-0.004 (0.878)	0.135** (0.015)
Observations	8379	8379	8379	5880
R-squared	0.007	0.006	0.019	0.007

*p*-values in parentheses  
 Clustered at state level  
 > Lower Sec.: more than lower secondary education  
 German: Last grade in German (lower is better)  
 \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

▶▶ Back





# Drop School Cohorts Below Year 1960

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Education Years	High School	> Lower Sec.	German	Math	MCS	PCS	SCT	WFT
Left_Post	0.465*** (0.002)	0.037 (0.200)	0.092*** (0.007)	-0.215*** (0.007)	-0.161 (0.285)	0.057 (0.483)	0.095* (0.051)	0.239** (0.042)	0.393 (0.231)
Post	0.286** (0.042)	0.103*** (0.001)	0.014 (0.698)	0.128* (0.056)	0.133*** (0.004)	0.023 (0.157)	-0.025 (0.465)	0.013 (0.783)	-0.254*** (0.003)
Left	-0.045 (0.793)	-0.001 (0.984)	-0.044* (0.076)	0.140** (0.035)	0.154* (0.059)	-0.096** (0.011)	-0.030 (0.382)	-0.048 (0.506)	0.081 (0.719)
Observations	7448	7448	7448	5305	5305	7448	7448	3630	967
R-squared	0.004	0.011	0.001	0.005	0.004	0.001	0.000	0.001	0.017

*p*-values in parentheses  
 Clustered at state level  
 > Lower Sec.: more than lower secondary education  
 German: Last grade in German (lower is better)  
 \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

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# Drop School Cohorts Below Year 1960 and Above 1979

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Education Years	High School	> Lower Sec.	German	Math	SCT	WFT	MCS	PCS
Left_Post	0.276 (0.427)	0.030 (0.595)	0.029 (0.317)	-0.111 (0.381)	0.088 (0.715)	0.182 (0.125)	0.405 (0.185)	0.053 (0.538)	-0.011 (0.879)
Post	0.081 (0.608)	0.058 (0.106)	0.001 (0.974)	0.155** (0.034)	0.187*** (0.000)	-0.012 (0.874)	-0.277*** (0.003)	0.015 (0.448)	-0.015 (0.722)
Left	0.150 (0.440)	0.016 (0.635)	-0.014 (0.488)	0.106 (0.143)	0.074 (0.342)	-0.004 (0.955)	0.099 (0.667)	-0.112*** (0.010)	-0.001 (0.988)
Observations	4739	4739	4739	3250	3250	2283	784	4739	4739
R-squared	0.001	0.003	0.000	0.006	0.006	0.000	0.018	0.001	0.000

p-values in parentheses  
 Clustered at state level  
 > Lower Sec.: more than lower secondary education  
 German: Last grade in German (lower is better)  
 \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

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# Drop Non-Natives

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Education Years	High School	> Lower Sec.	German	Math	MCS	PCS	SCT	WFT
Left_Post	0.454*** (0.002)	0.038 (0.124)	0.072** (0.021)	-0.206*** (0.005)	-0.128 (0.381)	0.030 (0.686)	0.077 (0.116)	0.184* (0.072)	0.379 (0.164)
Post	0.452*** (0.005)	0.134*** (0.000)	0.076* (0.063)	0.132** (0.033)	0.131*** (0.006)	0.025 (0.132)	-0.023 (0.492)	0.023 (0.613)	-0.202*** (0.001)
Left	-0.151 (0.248)	-0.017 (0.513)	-0.039* (0.089)	0.132*** (0.007)	0.117* (0.060)	-0.064** (0.024)	-0.011 (0.745)	-0.036 (0.611)	0.029 (0.861)
Observations	8654	8654	8654	6237	6237	8654	8654	4193	1257
R-squared	0.007	0.018	0.007	0.006	0.004	0.001	0.000	0.001	0.009

*p*-values in parentheses  
 Clustered at state level  
 > Lower Sec.: more than lower secondary education  
 German: Last grade in German (lower is better)  
 \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

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# Drop Non-Natives And Individuals With Migration Background

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Education Years	High School	> Lower Sec.	German	Math	MCS	PCS	SCT	WFT
Left_Post	0.348** (0.015)	0.019 (0.436)	0.063* (0.054)	-0.221*** (0.000)	-0.105 (0.520)	0.015 (0.858)	0.115** (0.042)	0.210* (0.075)	0.346 (0.224)
Post	0.545*** (0.003)	0.144*** (0.000)	0.083** (0.050)	0.127* (0.051)	0.152*** (0.001)	0.032* (0.086)	-0.038 (0.282)	0.061 (0.202)	-0.137** (0.039)
Left	-0.153 (0.218)	-0.019 (0.454)	-0.040* (0.084)	0.141*** (0.004)	0.117** (0.050)	-0.083*** (0.008)	-0.010 (0.787)	-0.069 (0.268)	0.018 (0.914)
Observations	7959	7959	7959	5800	5800	7959	7959	3848	1194
R-squared	0.009	0.019	0.008	0.005	0.005	0.001	0.001	0.002	0.004

*p*-values in parentheses

Clustered at state level

> Lower Sec.: more than lower secondary education

German: Last grade in German (lower is better)

\* *p* < 0.1, \*\* *p* < 0.05, \*\*\* *p* < 0.01

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# Rich Controls and State Specific Cohort Trends

	(1)	(2)	(3)	(4)
	Education Years	High School	> Lower Sec.	German
Left_Post	0.236* (0.083)	0.019 (0.566)	0.071*** (0.004)	-0.166** (0.030)
Observations	6930	6930	6930	4999
R-squared	0.193	0.165	0.107	0.090

*p*-values in parentheses

Clustered at state level

Sociodemographic Controls: age, year of birth, male, not German, father high school, mother high school, grew-up in village, parents are catholic

Additional Controls: State specific cohort trends, expansion of compulsory schooling

East German states are dropped. Coefficients for Left and Post not shown.

> Lower Sec.: more than lower secondary education

German: Last grade in German (lower is better)

\* *p* < 0.1, \*\* *p* < 0.05, \*\*\* *p* < 0.01

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# Female: No Measurable Effect of Reform on Labor Market Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Employed	Employed	Employed	Employed	In wage	In wage	In wage	In wage
Left_Post	0.001 (0.989)	-0.002 (0.968)	-0.013 (0.810)	0.013 (0.790)	-0.097 (0.211)	-0.073 (0.351)	-0.076 (0.328)	-0.047 (0.558)
Year of Birth	-	-	+	+	-	-	+	+
Age/Age2	-	-	+	-	-	-	+	-
Exp/Exp2	-	-	-	+	-	-	-	+
State	-	+	+	+	-	+	+	+
Observations	57877	57877	57877	57818	40318	40318	40318	40285
R-squared	0.002	0.008	0.067	0.162	0.004	0.038	0.145	0.151

*p*-values in parentheses  
 Clustered at individual level  
 Coefficients for Post and Left not shown. Additional controls: East German  
 \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

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# Male and Female: No Measurable Effect of Reform on Labor Market Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Employed	Employed	Employed	Employed	ln wage	ln wage	ln wage	ln wage
Left_Post	0.004 (0.909)	0.006 (0.855)	-0.005 (0.868)	0.015 (0.612)	-0.025 (0.654)	0.005 (0.922)	0.014 (0.788)	0.031 (0.570)
Year of Birth	-	-	+	+	-	-	+	+
Age/Age2	-	-	+	-	-	-	+	-
Exp/Exp2	-	-	-	+	-	-	-	+
State	-	+	+	+	-	+	+	+
Observations	108387	108387	108387	108268	82317	82317	82317	82237
R-squared	0.045	0.049	0.119	0.169	0.042	0.100	0.221	0.198

*p*-values in parentheses

Clustered at individual level

Coefficients for Post and Left not shown. Additional controls: male, East German

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

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# Event Study Plot - Test of Parallel Trends

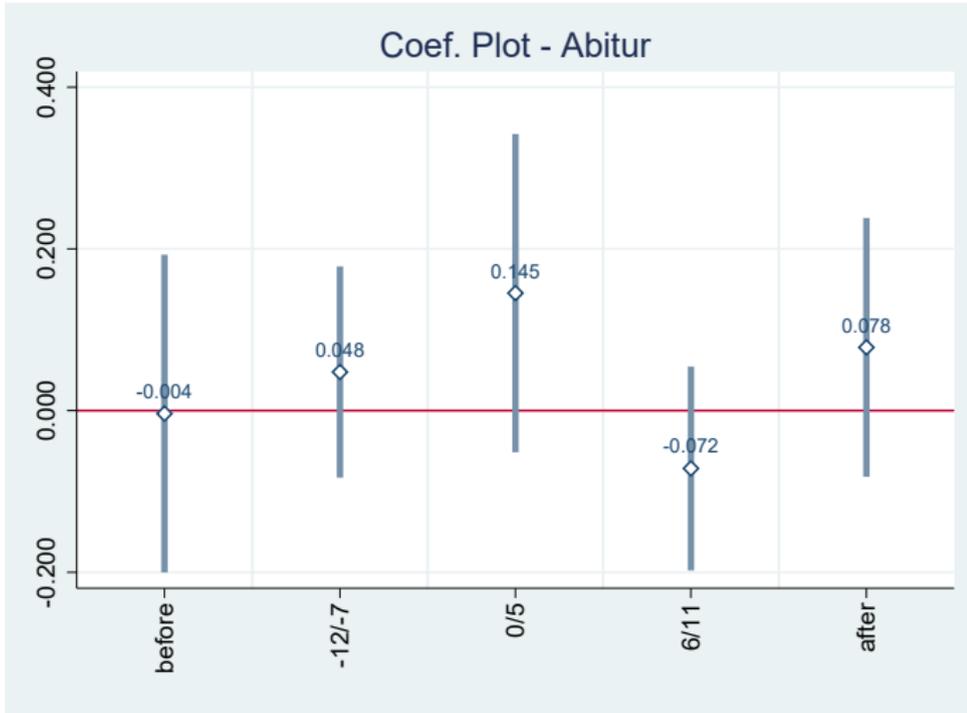
$$Y_{it} = \alpha + \gamma Left_i + \lambda TimeTil_t + \beta(Left_i \cdot TimeTil_t) + \epsilon_{it}$$

- $Y_{it}$ : 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)
- $\beta$ : Difference between left- and right handed individuals

▶ Back



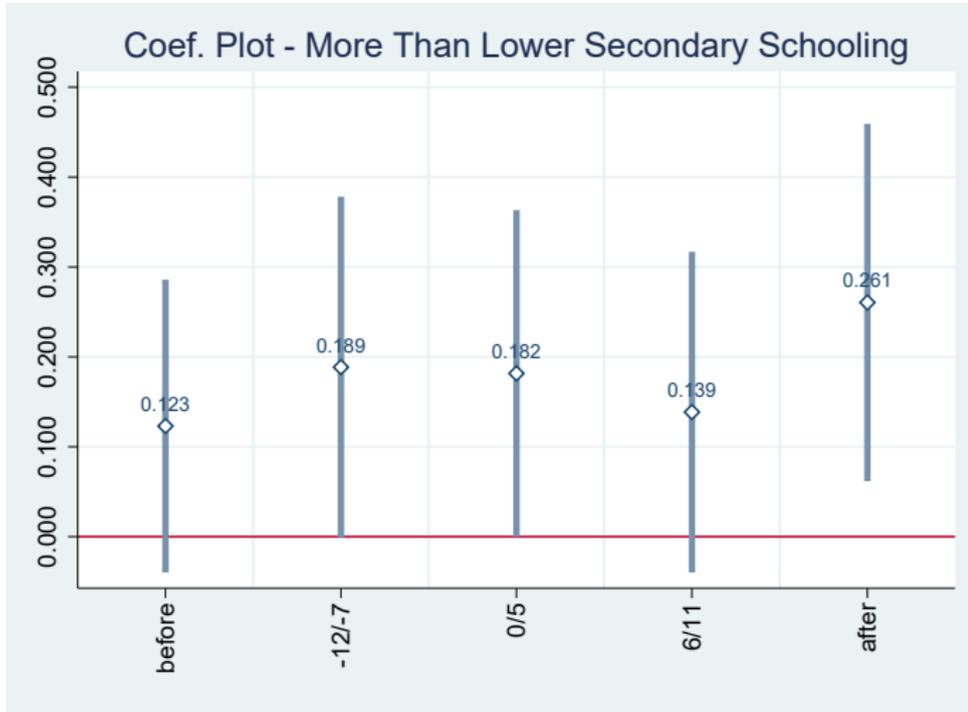
# Event Study Plot



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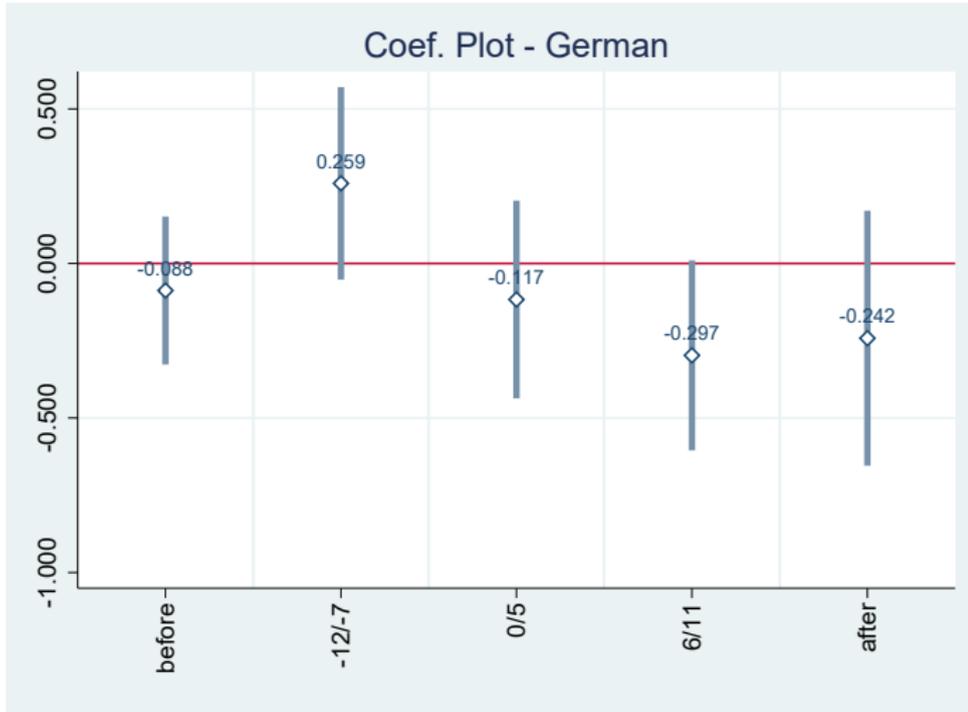
# Event Study Plot



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# Event Study Plot



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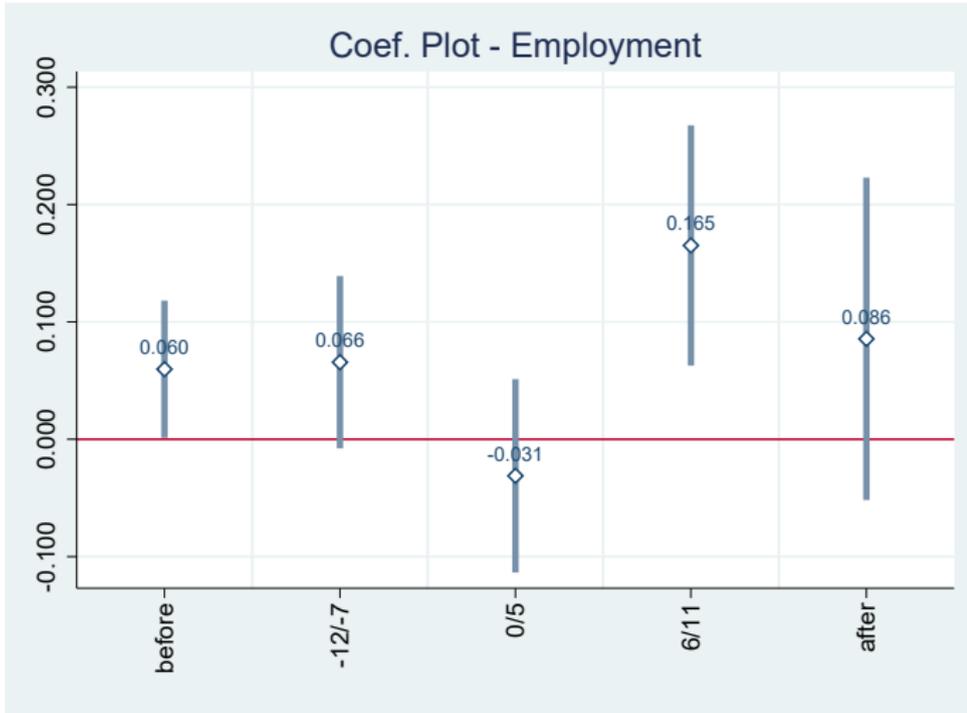
# Event Study Plot



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# Event Study Plot

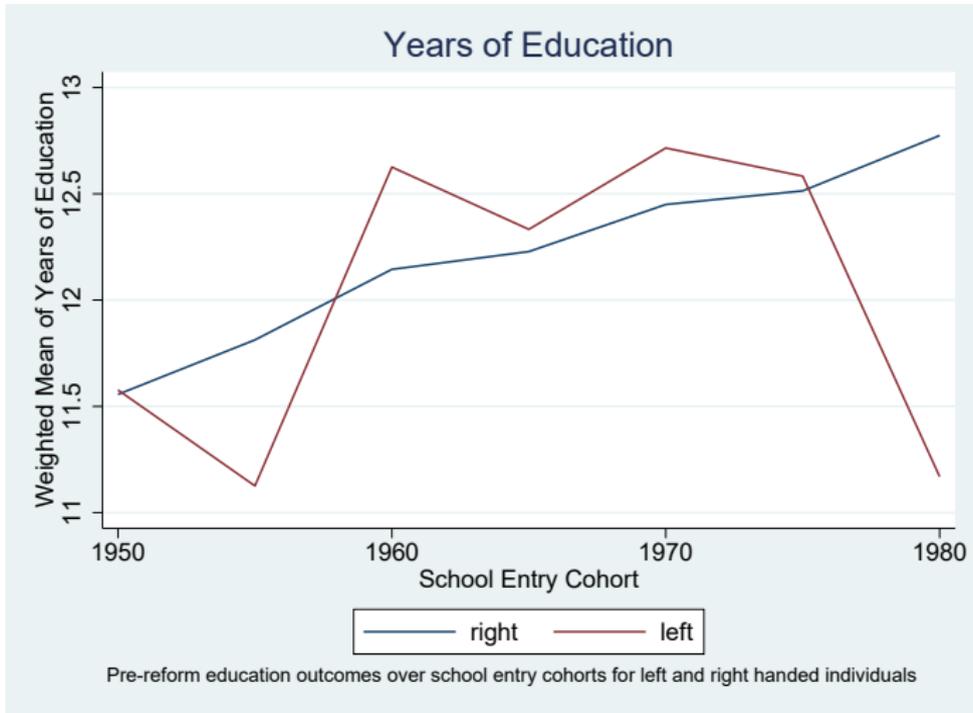


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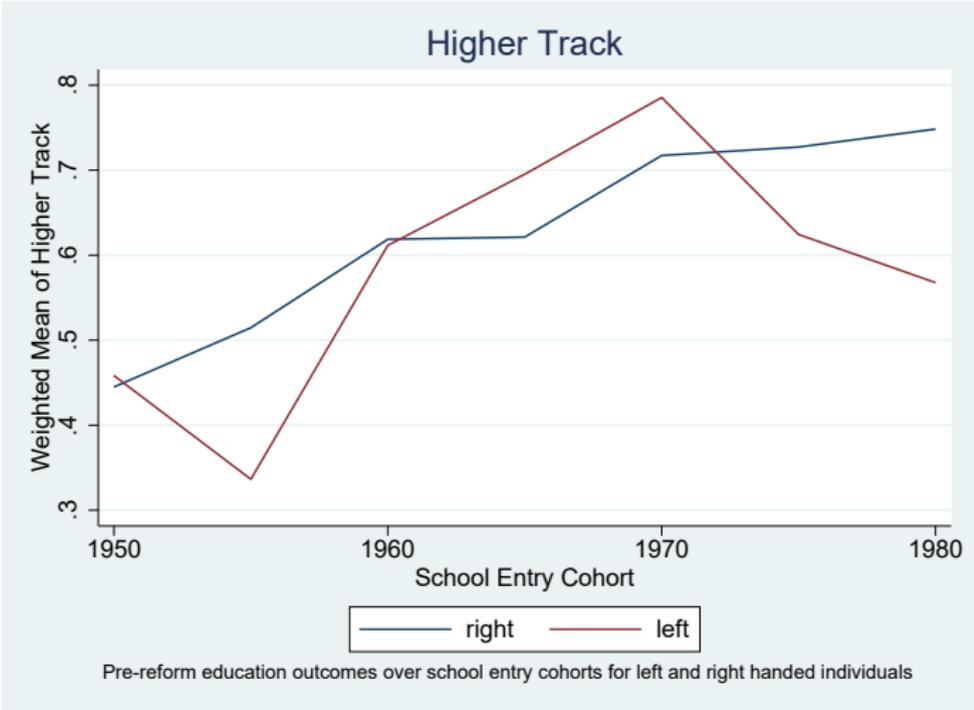
# Parallel Trends - Non-Treated Individuals



- » Abitur
- » German
- » Wage
- » Empl



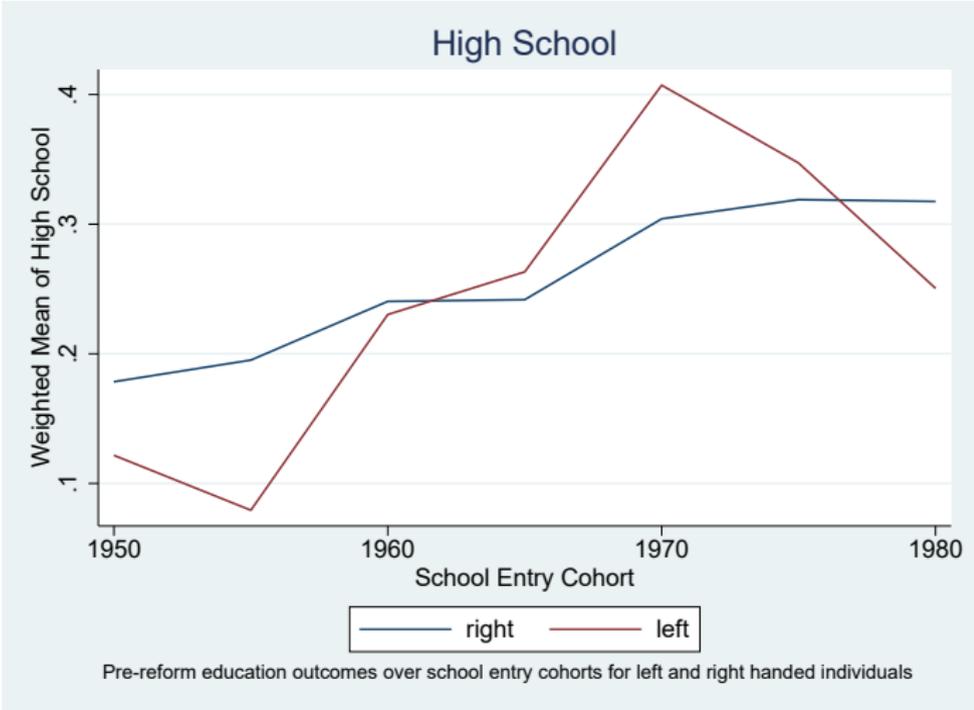
# Parallel Trends - Non-treated Individuals



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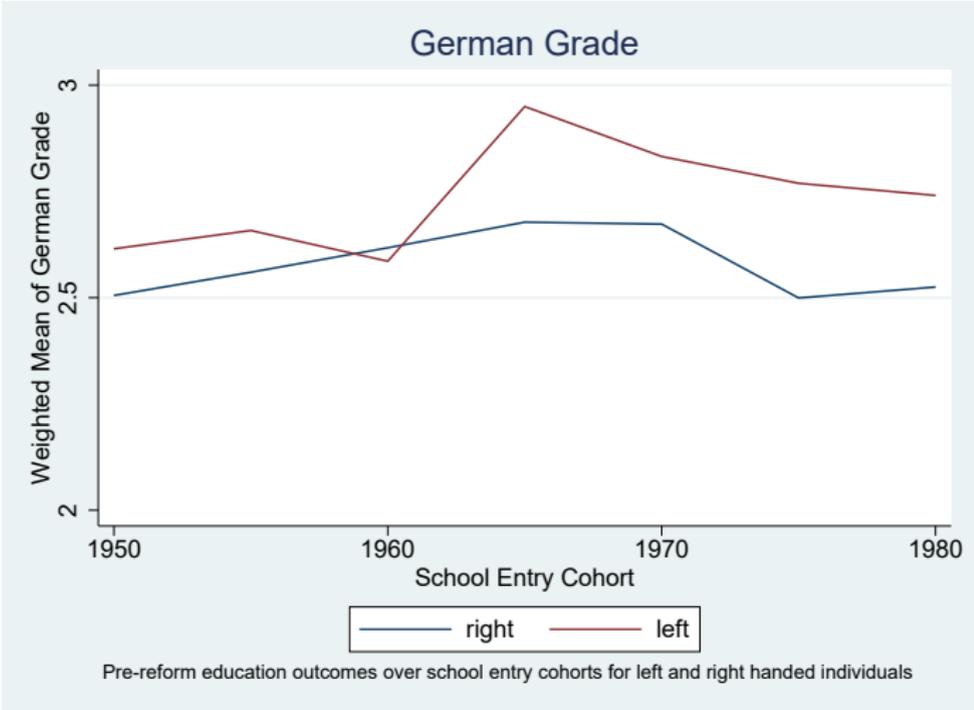
# Parallel Trends - Non-treated Individuals



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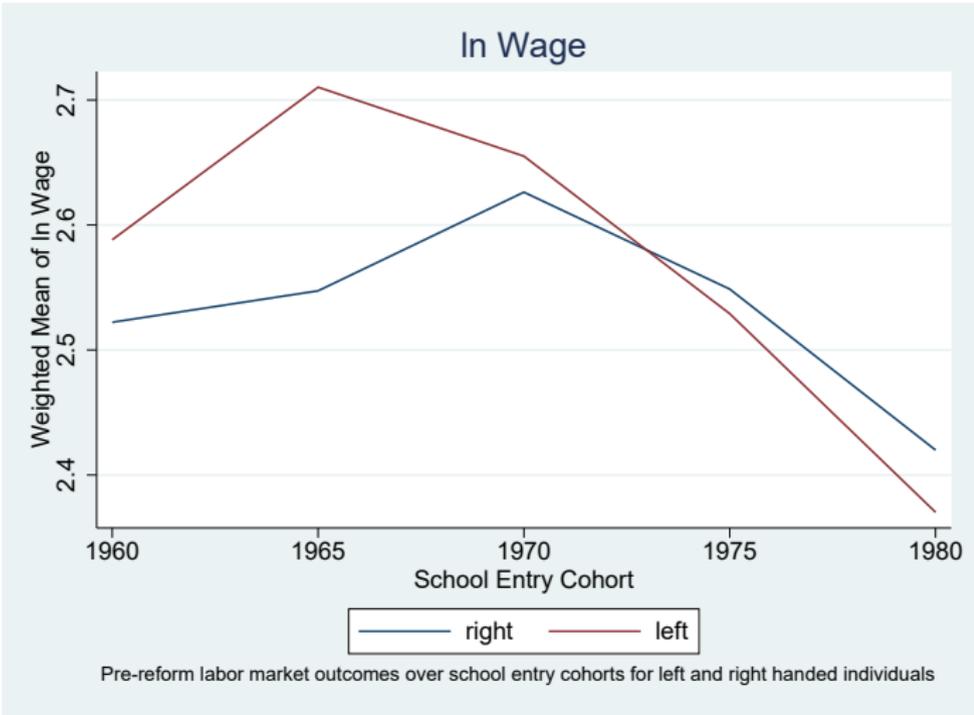
# Parallel Trends - Non-treated Individuals



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# Parallel Trends - Non-treated Individuals



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