The Impact of Climate Policy on Manufacturing Employment: Establishment-Level Evidence from Germany

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Introduction

- Understanding how climate policy affects firms is important
  - Economic consequences
  - Political durability

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- Growing empirical literature examining the economic effects of climate policy on firms
  - Many papers focused on carbon pricing (e.g. EU ETS) (Martin, Muûls and Wagner, 2016; Jaraite-Kaukauske and Maria, 2016; Borghesi, Franco and Marin, 2016; Koch and Basse Mama, 2019; Naegele and Zaklan, 2019; Colmer et al., 2020; Hintermann et al., 2020)
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  - Other policies (e.g. EEG levy exemption) less well explored (Gerster, 2017; Gerster and Lamp, 2022)

- This paper:
  - New detailed administrative data on establishments in Germany
  - Contains wealth of information on employees
  - Examine two key policies: EU ETS and EEG levy exemption
  - Look at: employment, wages and entry/exit

Outline

1. Data
2. Empirical Strategy
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Data

- IAB Establishment History Panel (BHP)
  - Establishment-level dataset
  - Limit to 2000-2019
  - Limit to manufacturing sector (10+ employees)
- Climate Policies
  - EU ETS Transaction Log
  - EEG Levy Exemption Register
- Other Information
  - Firm identifiers from Bureau Van Djik and Creditreform
  - AKM measures of wage premia

Summary Statistics

Table: *Summary Statistics*

Variable	**N**	**Mean (Std. Dev)**
Total No of Employees	1,338,223	94 (484)
Shr Employees (Full-Time)	1,306,078	0.74 (0.22)
Shr Employees (Female)	1,306,078	0.33 (0.24)
Shr Employees (Low-Skilled)	1,306,078	0.14 (0.13)
Shr Employees (Medium-Skilled)	1,306,078	0.75 (0.16)
Shr Employees (High-Skilled)	1,306,078	0.09 (0.13)
Shr Employees (Engineer/Scientist)	1,306,078	0.02 (0.06)
Shr Employees (Apprentice/Trainee)	1,306,078	0.04 (0.06)
Shr Employees (German)	1,306,078	0.92 (0.12)
Average Age of Employees	1,338,223	42.2 (5.2)
Shr Employees (Age 15-34)	1,306,078	0.30 (0.16)
Shr Employees (Age 35-54)	1,306,078	0.52 (0.15)
Shr Employees (Age 55+)	1,306,078	0.18 (0.13)
Median Wage of Employees	1,319,434	36,210 (13,979)
25th Percentile Wage of Employees	1,319,434	30,995 (11,386)
75th Percentile Wage of Employees	1,319,434	44,010 (18,818)

Summary Statistics

Table: *Treatment Crosstab*

	Treated EEG		
	No	Yes	Total
Treated ETS			
No	98,063 (97%)	1,853 (1.8%)	99,916 (99%)
Yes	487 (0.5%)	415 (0.4%)	902 (0.9%)
Total	98,550 (98%)	2,268 (2.2%)	100,818 (100%)

Summary Statistics

Table: *Summary Statistics by Treatment Status*

			Treated EEG		
Variable	**N**	**Overall**, N = 100,818	**No**, N = 98,550	**Yes**, N = 2,268	**p-value**
Total No of Employees	100,818	84 (403)	81 (401)	192 (449)	<0.001
Average Age of Employees	100,818	42.1 (4.5)	42.1 (4.5)	42.8 (3.3)	<0.001
Average Wage of Employees	100,621	36,409 (13,821)	36,367 (13,888)	38,216 (10,395)	<0.001
Establishment Entered	100,818	0.25 (0.43)	0.25 (0.43)	0.25 (0.43)	>0.99
Establishment Exited	100,818	0.32 (0.47)	0.32 (0.47)	0.10 (0.31)	<0.001
Energy Intense Industry	100,818	0.44 (0.49)	0.44 (0.49)	0.66 (0.47)	<0.001
Balance (2000-2019)	100,818	0.78 (0.32)	0.78 (0.32)	0.85 (0.24)	<0.001

(a) *EEG*

			Treated ETS		
Variable	**N**	**Overall**, N = 100,818	**No**, N = 99,916	**Yes**, N = 902	**p-value**
Total No of Employees	100,818	84 (403)	78 (335)	736 (2,288)	<0.001
Average Age of Employees	100,818	42.1 (4.5)	42.1 (4.5)	43.4 (3.0)	<0.001
Average Wage of Employees	100,621	36,409 (13,821)	36,320 (13,811)	46,206 (11,158)	<0.001
Establishment Entered	100,818	0.25 (0.43)	0.25 (0.43)	0.13 (0.34)	<0.001
Establishment Exited	100,818	0.32 (0.47)	0.32 (0.47)	0.11 (0.31)	<0.001
Energy Intense Industry	100,818	0.44 (0.49)	0.44 (0.49)	0.81 (0.39)	<0.001
Balance (2000-2019)	100,818	0.78 (0.32)	0.78 (0.32)	0.89 (0.22)	<0.001

(b) *ETS*

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Estimation Approach

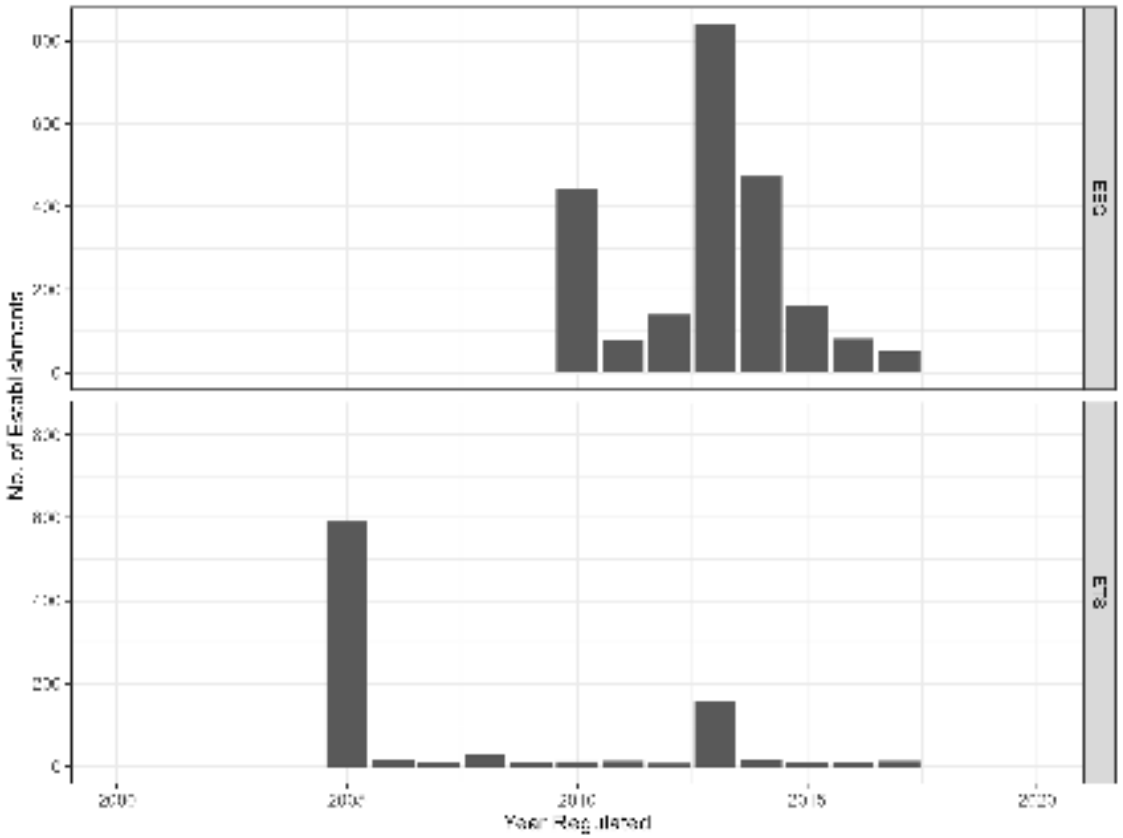
- Dependent variable:
  - Total employment and composition of employment
  - Wages
  - Entry and exit (to-do)
- Treatment is determined by:
  - *treat* = whether establishment ever subject to ETS/EEG policy
  - *post* = after year when became subject to ETS/EEG
- Difference-in-difference specification is of the form:

$$L_{it} = \beta D_{it} + \gamma X_{it} + \theta_i + \lambda_{st} + \delta_{rt} + \epsilon_{it} \quad (1)$$

Where employment, L, of establishment, i, in sector, s, in region, r, in year, t is regressed on treatment, D, a vector of controls, X, and a set of fixed effects.

Estimation Approach: Staggered treatment

Figure: *Time of treatment*



- Treatment also varies over time:
  - ETS phases 1, 2, 3
  - EEG exemption amended in 2012
- We follow Callaway and Sant'Anna (2021) to allow for staggered treatment

Estimation Approach: Matching

- Matching to resolve imbalance:
  - Clearly treatment not randomly assigned
  - Don't observe emissions, thermal capacity, energy consumption etc.
  - Many observables on employment and wages
  - Prefer exact matching over propensity scores
  - Match on size and sector
  - Prefer matching on 2 digit sectors over 3 digit
- Rich set of fixed effects
  - Establishment or firm fixed effects
  - Sector-by-year
  - Region-by-year

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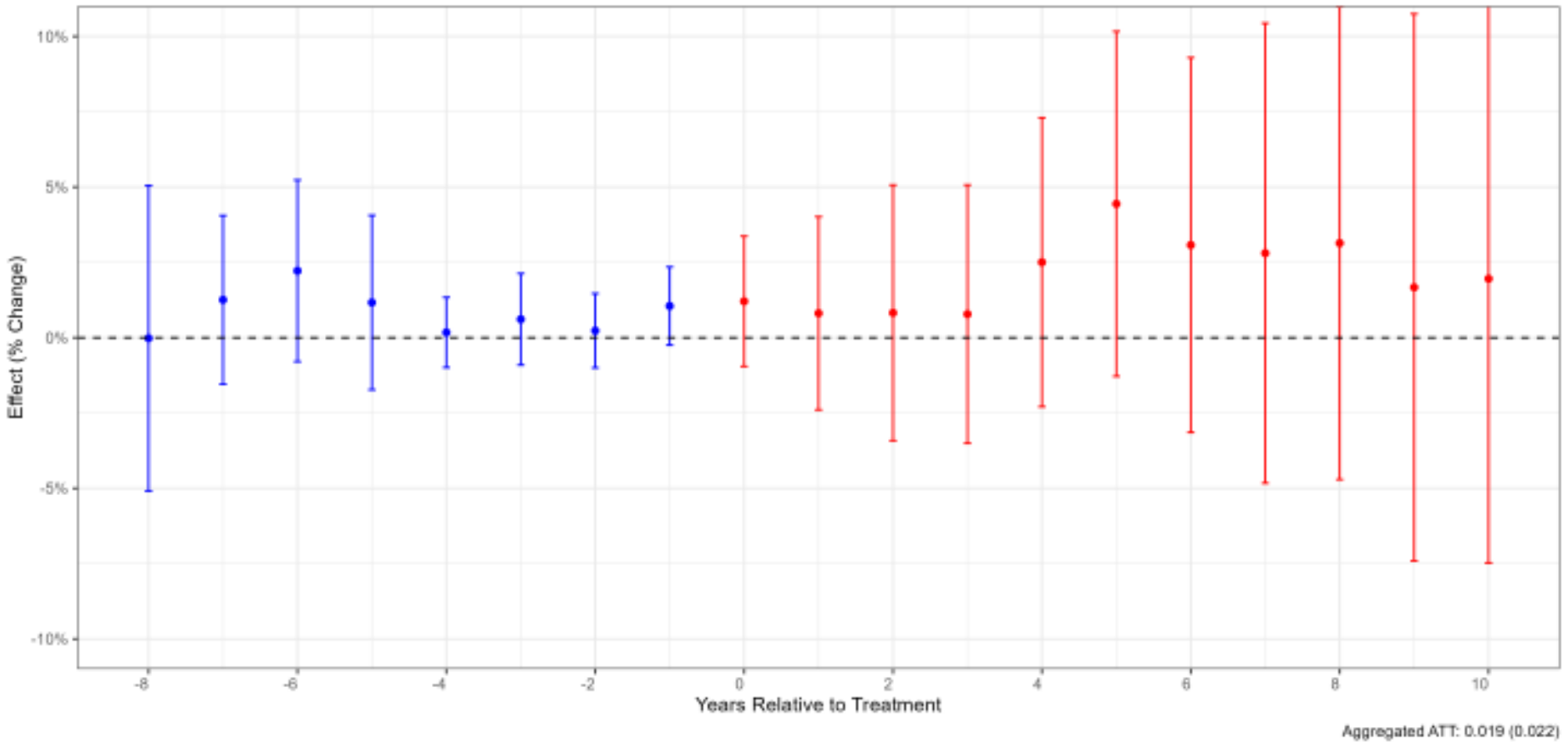
Results (ETS and Employment)

Figure: *Event Study*



▸ Effects by treatment group

Results (EEG and Employment)

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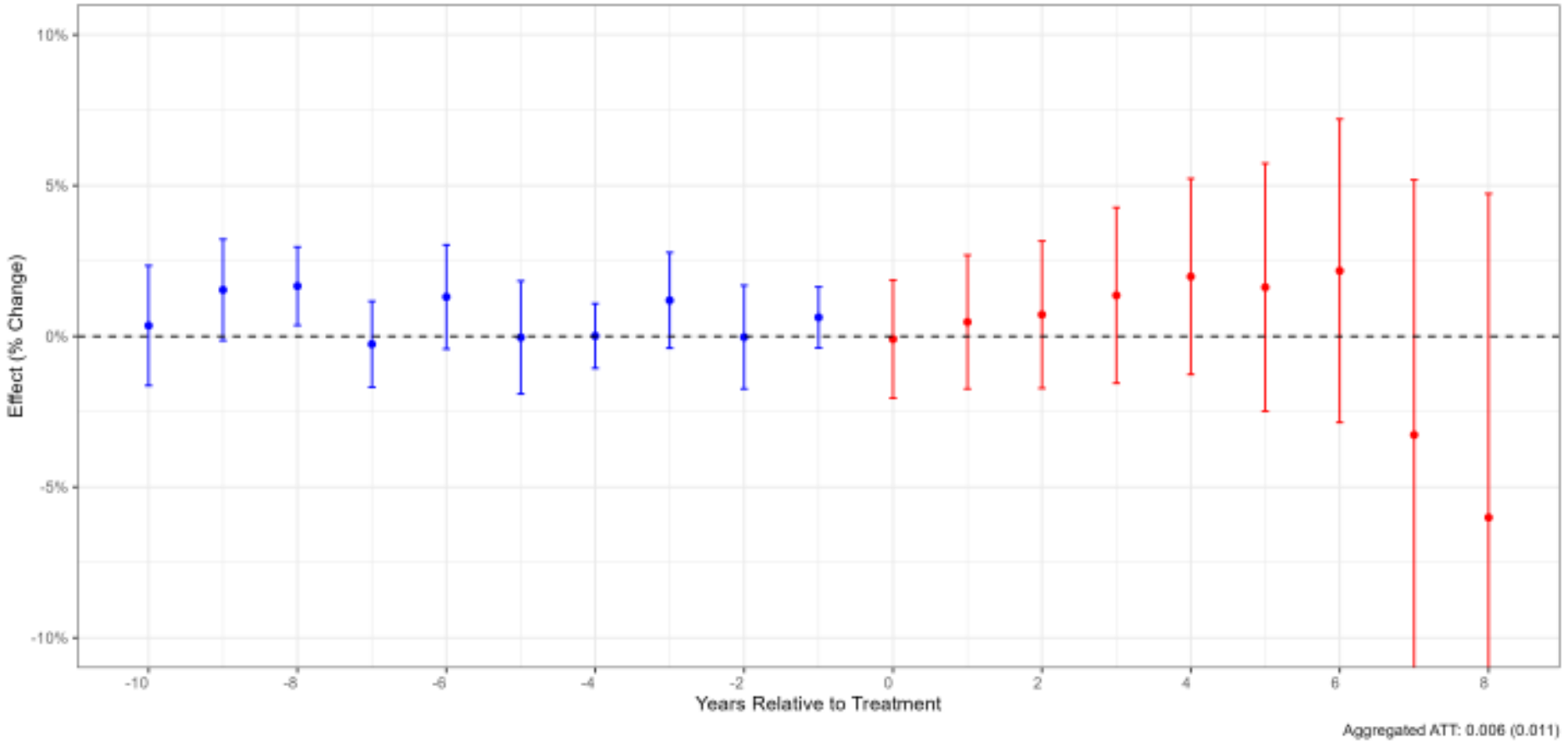

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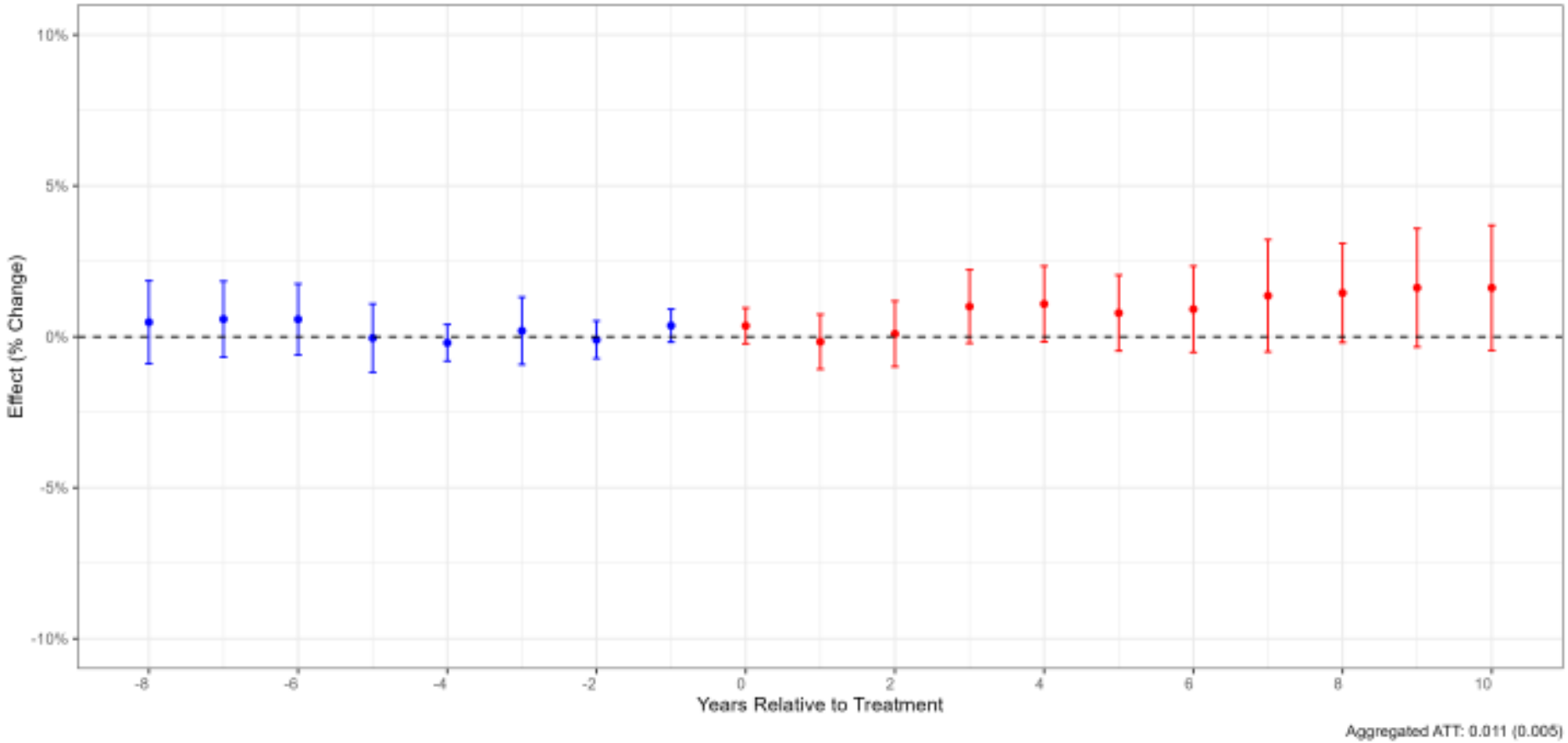

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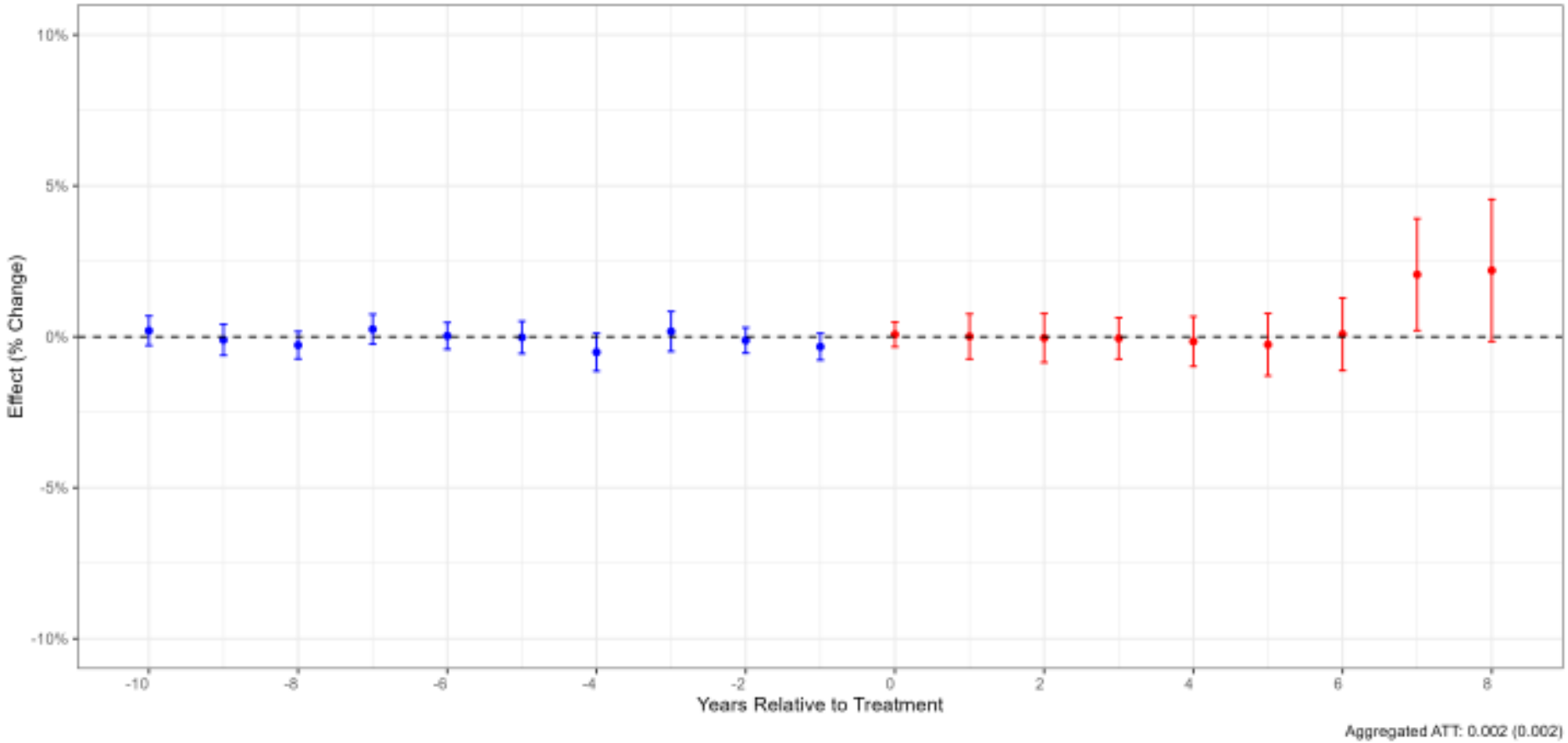

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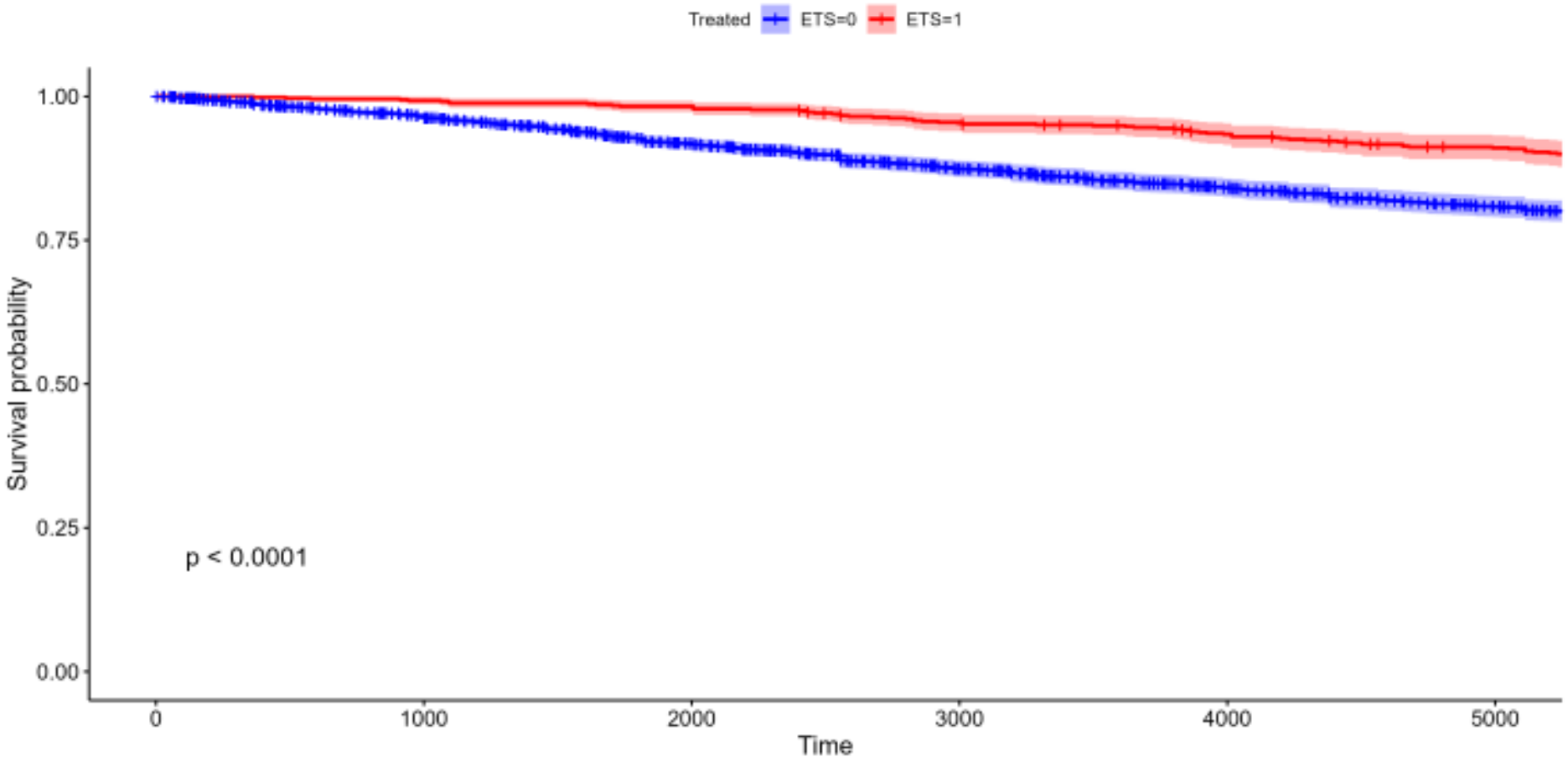
Results (ETS and Exit)

Figure: *Survival Curve*



Results (EEG and Exit)

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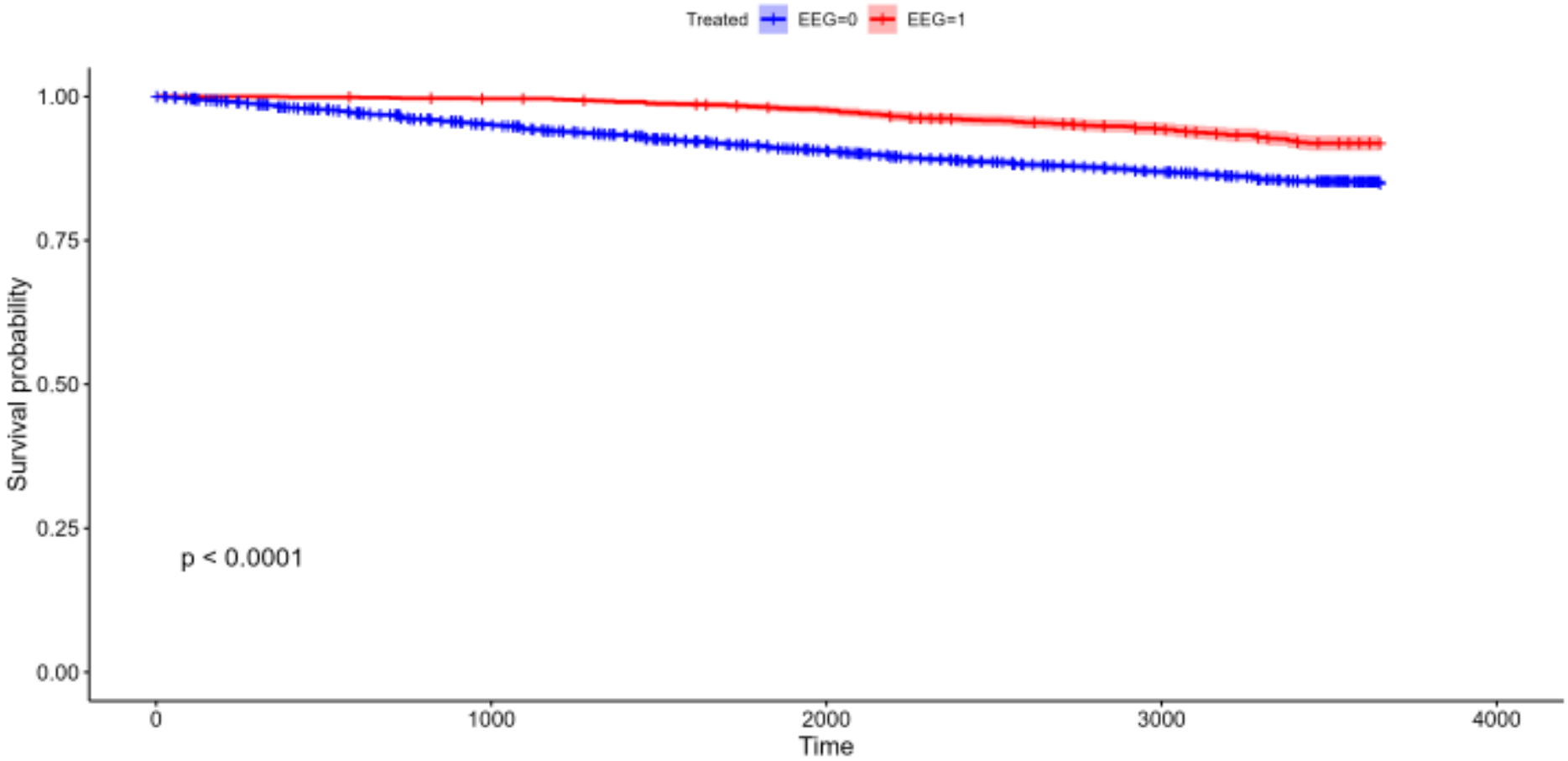

Results (Exit)

Table: *Survival Results*

	Model 1	Model 2
EEG	-0.82^{***}	-0.73^{***}
	(0.09)	(0.09)
Age	-0.00^{***}	-0.00^{***}
	(0.00)	(0.00)
Matching	No	Yes
AIC	208196.63	106464.96
R^2	0.01	0.00
Max. R^2	0.97	0.84
Num. events	9610	9610
Num. obs.	57412	57412
Missings	11749	11749
PH test	0.00	0.00

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

(a) *EEG*

	Model 1	Model 2
ETS	-1.04^{***}	-0.77^{***}
	(0.12)	(0.13)
Age	-0.00^{***}	-0.00^{***}
	(0.00)	(0.00)
Matching	No	Yes
AIC	368004.76	47038.40
R^2	0.01	0.00
Max. R^2	1.00	0.51
Num. events	16869	16869
Num. obs.	66297	66297
Missings	3684	3684
PH test	0.00	0.00

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

(b) *ETS*

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Discussion

- Neither ETS nor EEG have negative impacts on establishment employment
  - Also no significant impact on composition in terms of skills
- Wages increase in ETS-regulated establishments, but not in EEG-exempt estalishments
  - Not due to composition effects
  - Windfall gains from free allocation and bargaining within firm?
- Exit is lower in ETS-regulated and EEG-exempt establishments
  - Policy effect or shortcomings of matching?

Next Steps

- Improving identification
  - Firm level analyses
  - Interaction effects of EEG and ETS
- Expanding scope of analysis
  - Explore wage dynamics further
  - Expand sectors / time period?

Thank you

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Thank you for your attention

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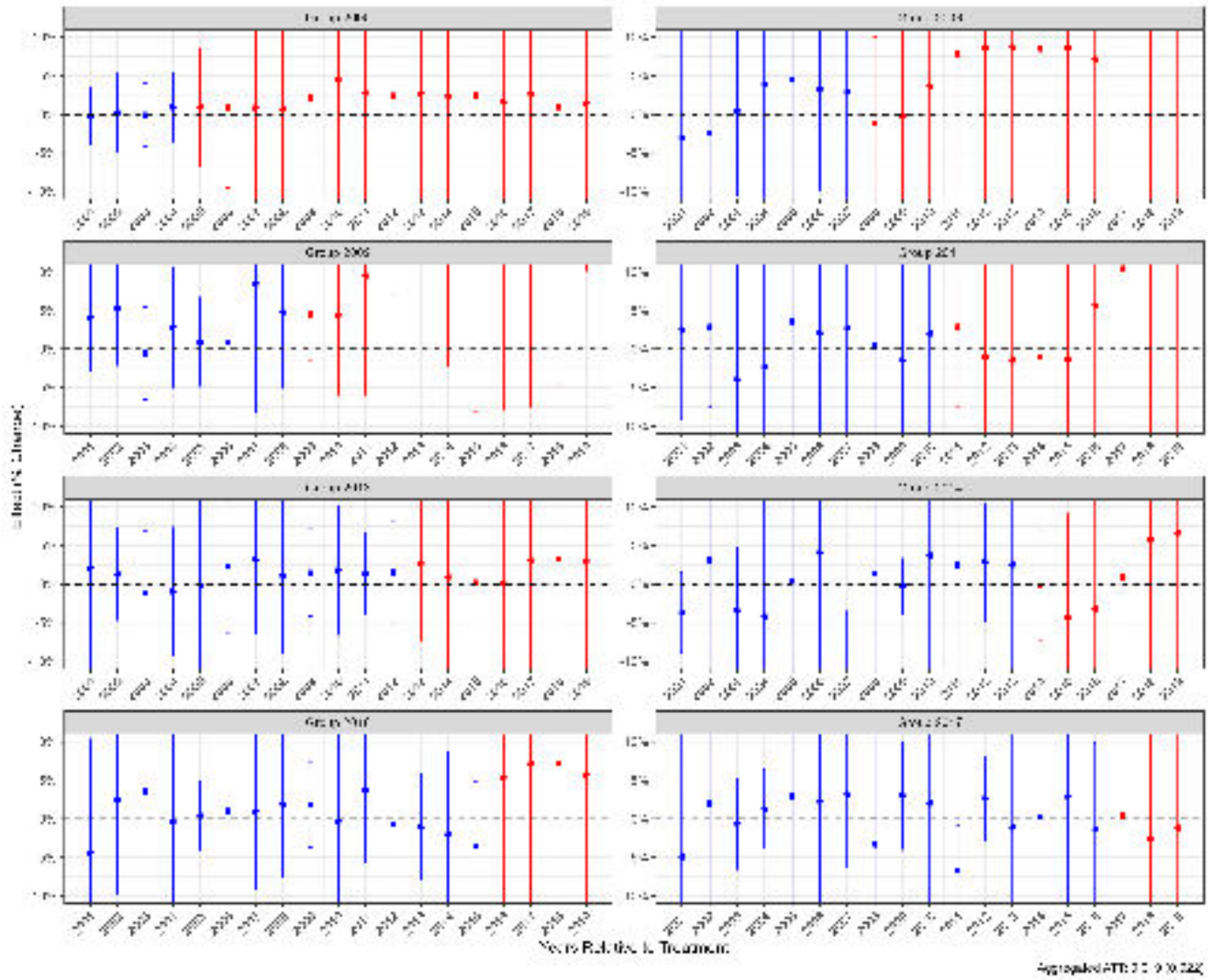
Appendix

- Extra slides...

Additional Results (ETS and Employment)

Figure: *Event Study by Group-Time*



Additional Results (EEG and Employment)

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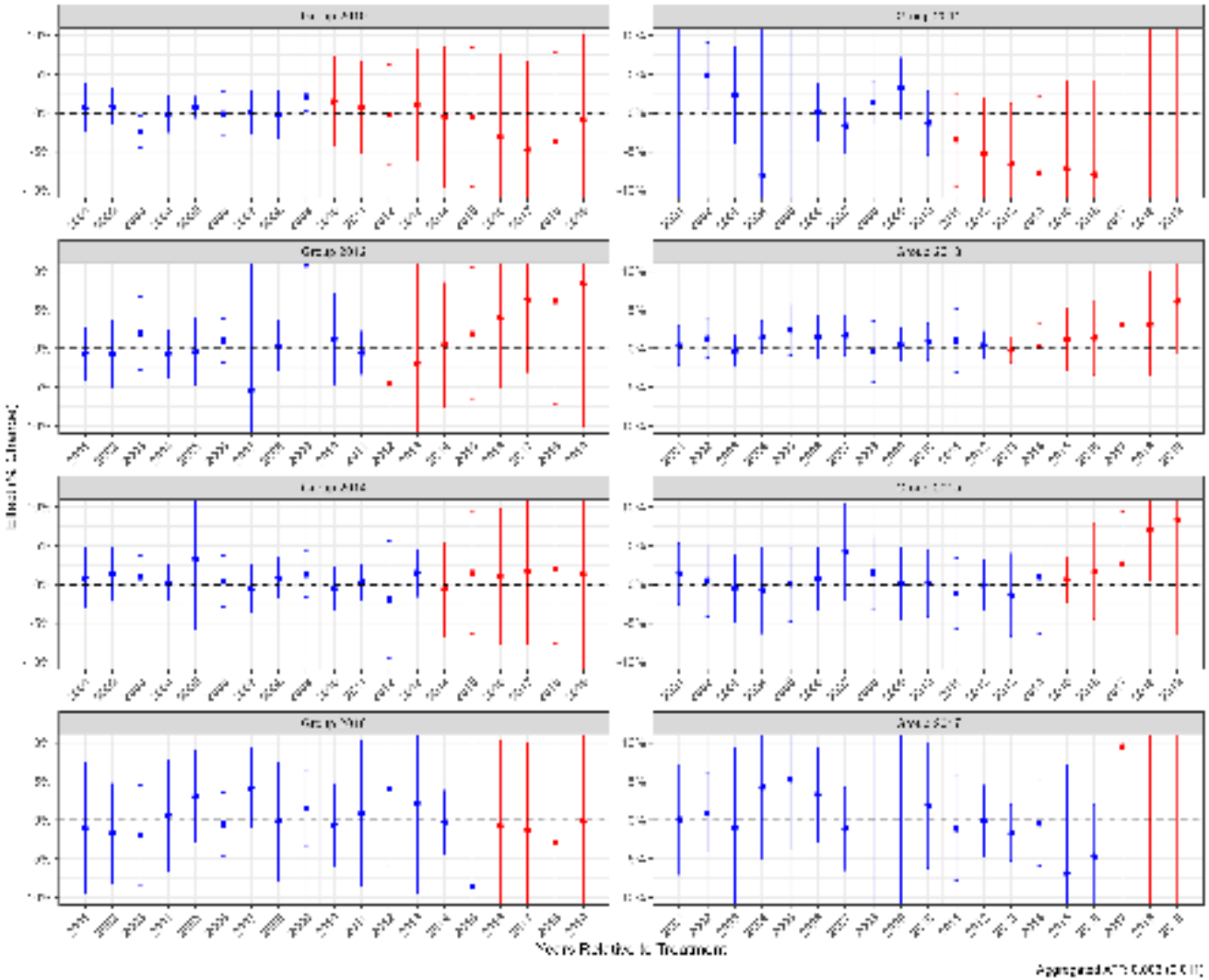

Additional Results (ETS and Wages)

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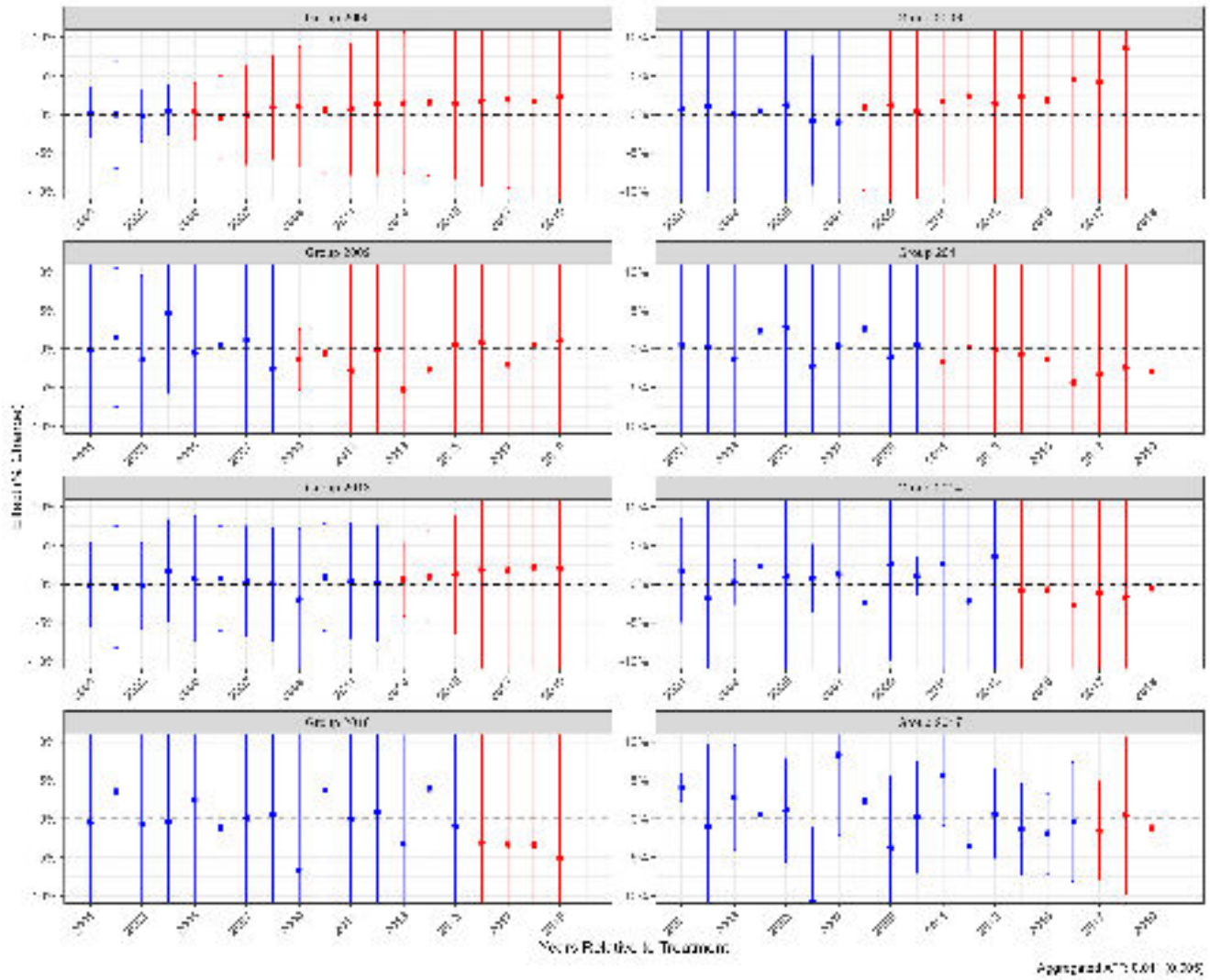

Additional Results (EEG and Wages)

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