Firm and Labor Adjustments to FDI Liberalization[†]

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(Paper Link)

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Motivation

Motivation

- Foreign direct investments (FDI) and multinational productions are crucial components of international trade and global value chains
  - Flows of FDI over global GDP increase from 0.5% in 1970s to over 5% in mid-2000s (The Economist, 2022)
  - 90% of US trade flow through MNEs (Bernard et al., 2009)
- **FDI liberalization** can have a significant impact on domestic manufacturers and their workers
  - Domestic manufacturers: invest and reallocate resource abroad
    $\Rightarrow$ Positive effects from theory
  - Domestic workers: enjoy higher wages due to firm growth or be replaced by foreign workers
    $\Rightarrow$ Unclear effects from theory

Research Question and Preview

How does FDI liberalization affect the investment decisions of firms and the labor market outcomes of associated workers in the home country?

- Object: Electronic manufacturers and their workers in Taiwan (TW)
- Policy: Permission of 122 electronic products to be produced in China (CN) by the TW government in 2001
- Data:
  - Firm level: Matched parent-affiliate production data in TW and CN
  - Individual level: Matched employer-employee taxation data in TW

Research Question and Preview (continue)

How does FDI liberalization affect the investment decisions of firms and the labor market outcomes of associated workers in the home country?

- Findings:
  1. Firm level: For TW electronic manufacturers affected by the policy,
     - Extensive margin: More likely to start outward FDI into CN
     - Intensive margin: More (less) workers in CN (TW), higher (lower) wages per worker in CN (TW), higher sales in TW & CN

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  2. Individual level: For incumbent workers employed by the FDI firms,
     - More likely to change jobs
     - Less likely to stay employed
     - Have less cumulated wages
     - Large heterogeneity: larger effects for low-wage and female workers

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  2. Individual level: For incumbent workers employed by the FDI firms,
     - More likely to change jobs
     - Less likely to stay employed
     - Have less cumulated wages
     - Large heterogeneity: larger effects for low-wage and female workers
- FDI liberalization leads to **resource reallocation** of the TW electronic manufacturers and **income redistribution** for their workers in TW

Background: Taiwanese FDI in China

1980s-2000s

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- Impose a maximum investment cap of 50 million USD on any single investment project

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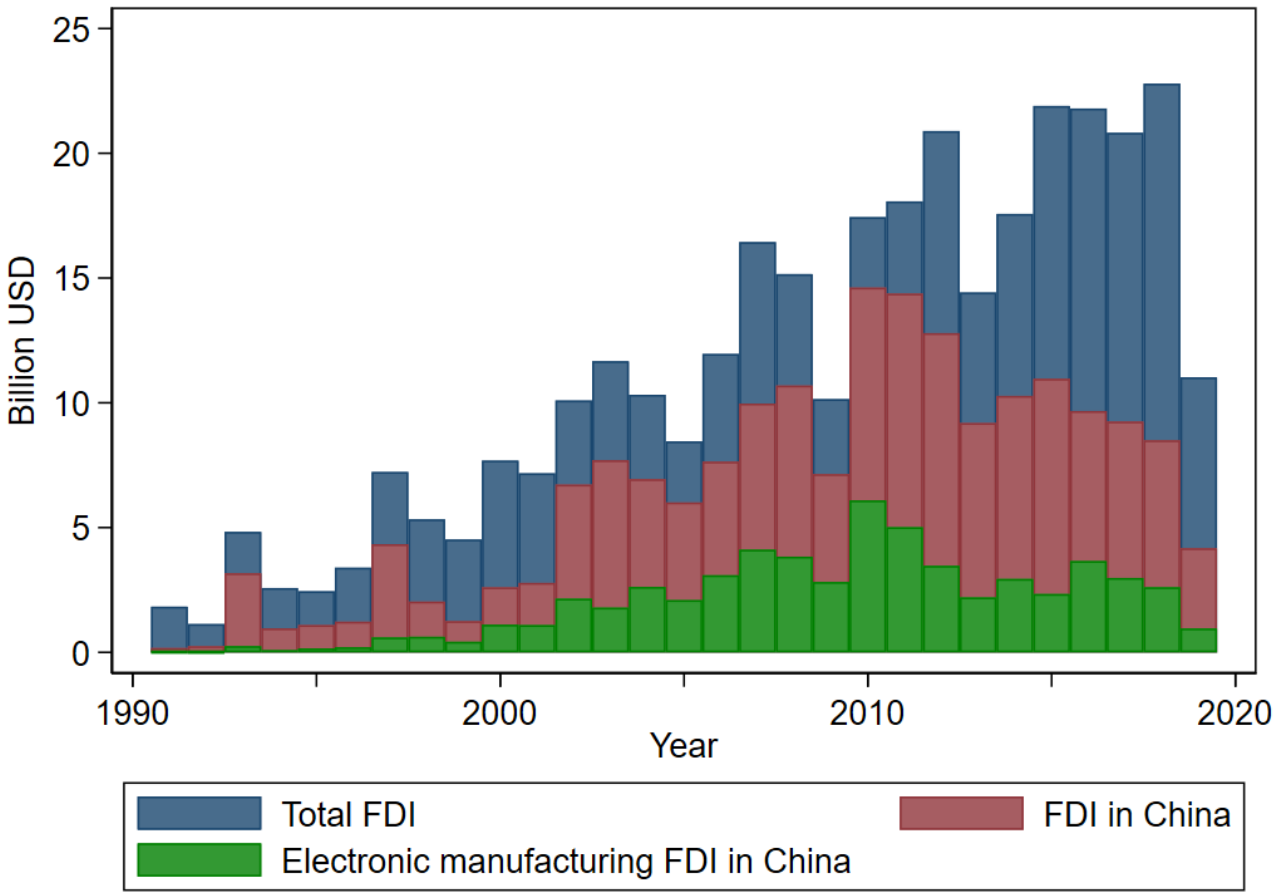
1996-2000 ("no haste, be patient"):

- Prohibit 316 manufacturing products to produce in China
- Impose a maximum investment cap of 50 million USD on any single investment project

2001-2007 ("active opening, effective management"):

- Remove the 50 million USD investment cap
- **Remove 122 high-tech projects from the list of "prohibited categories,"** including laptops, mobile phones, digital optical drives, computer hardware and software, communication products, and consumer electronics

Rising Taiwanese FDI into China Since 1990s



Related Literature

Globalization and firm internal organizations

- Production relocation and employment composition change (Burstein and Vogel, 2017; Hsieh and Woo, 2005; Hur et al., 2019; Bernard and Jensen, 1997; Menezes-Filho and Muendler, 2011; Tsou et al., 2013; Alviarez et al., 2022)
- Technology adoption and innovation (Lileeva and Trefler, 2010; Branstetter et al., 2021)

⇒ **Study a plausibly exogenous policy that affects firm participation in FDI**

Globalization and labor market outcomes

- Regional impact of trade liberalization (Topalova, 2010; Autor et al., 2013; Kovak, 2013; Dix-Carneiro and Kovak, 2017)
- Individual impact of trade liberalization (Autor et al., 2014; Dix-Carneiro, 2014; Dix-Carneiro and Kovak, 2019)

⇒ **Document strong redistributive impact of FDI liberalization**

Data

Data

Annual Survey of Industrial Firms, CN + Taiwan Economic Journal, TW

- Period: 1998-2007
- Sample: Taiwanese electronic manufacturers and their Chinese affiliates
- # employees, total wage bills, fixed assets, total sales, export sales etc.

Admin. Data from Fiscal Information Agency, TW

- Period: 2001-2007
- Matched employer-employee data on different income sources
- Caveat: no info on length of work or skill level of workers; firm id missing from 1998 to 2000

Firm-level Analysis

Empirical Strategy

Matched difference-in-differences exploiting a policy change in Taiwan in 2001.

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  1. have produced products related to the 122 products over 1998-2000
  2. have invested in China for at most one year over 1998-2000

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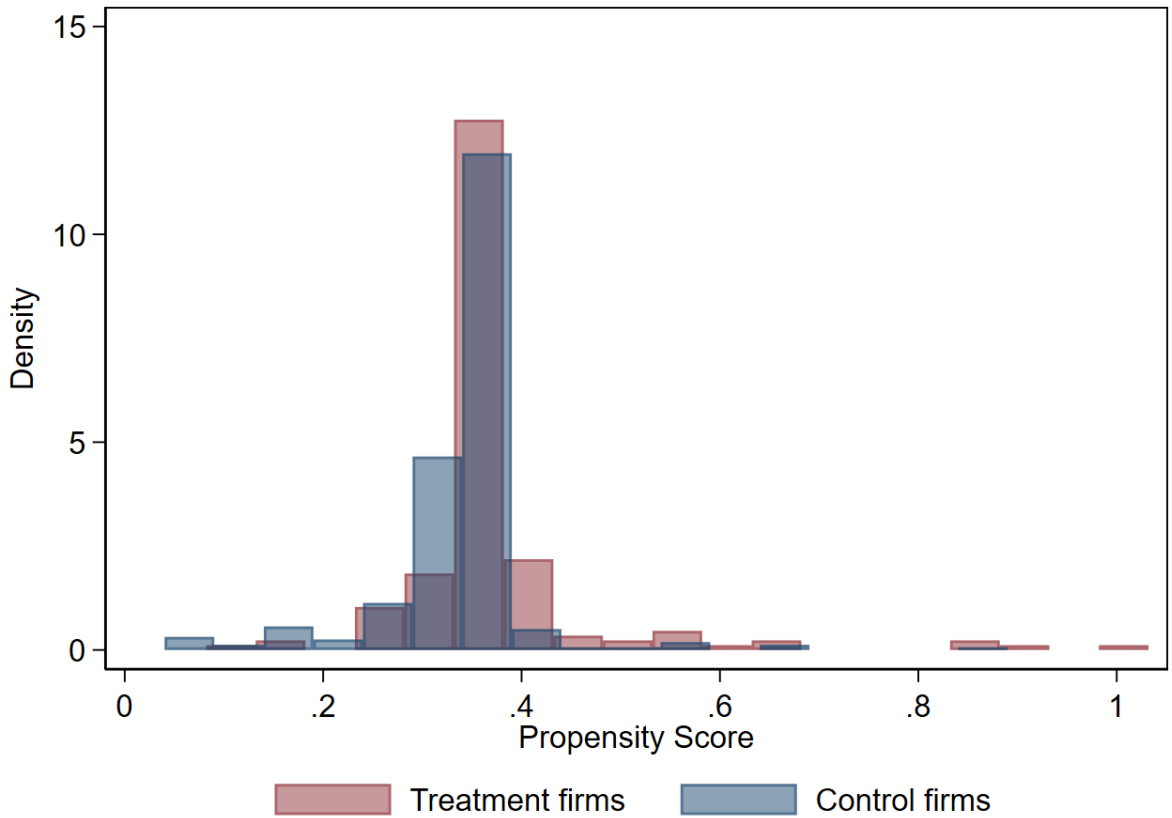
Matched difference-in-differences exploiting a policy change in Taiwan in 2001.

- **Policy**: Permission of 122 electronic products to be produced in CN
- **Treatment firms**: TW electronic manufacturers that
  1. have produced products related to the 122 products over 1998-2000
  2. have invested in China for at most one year over 1998-2000
- **Control firms**: TW electronic manufacturers that
  1. have **never** produced products related to the 122 products over 1998-2000
  2. have invested in China for at most one year over 1998-2000
  3. have similar characteristics to the treatment firms by **one-to-one matching**

Matching Result

- **One-to-one** propensity score matching based on # workers, wage bills, sales, export sales over 1998-2000
- Common support is satisfied



▸ Kernel matching

Summary of Matched Firm Sample

Mean outcomes over 1998-2000

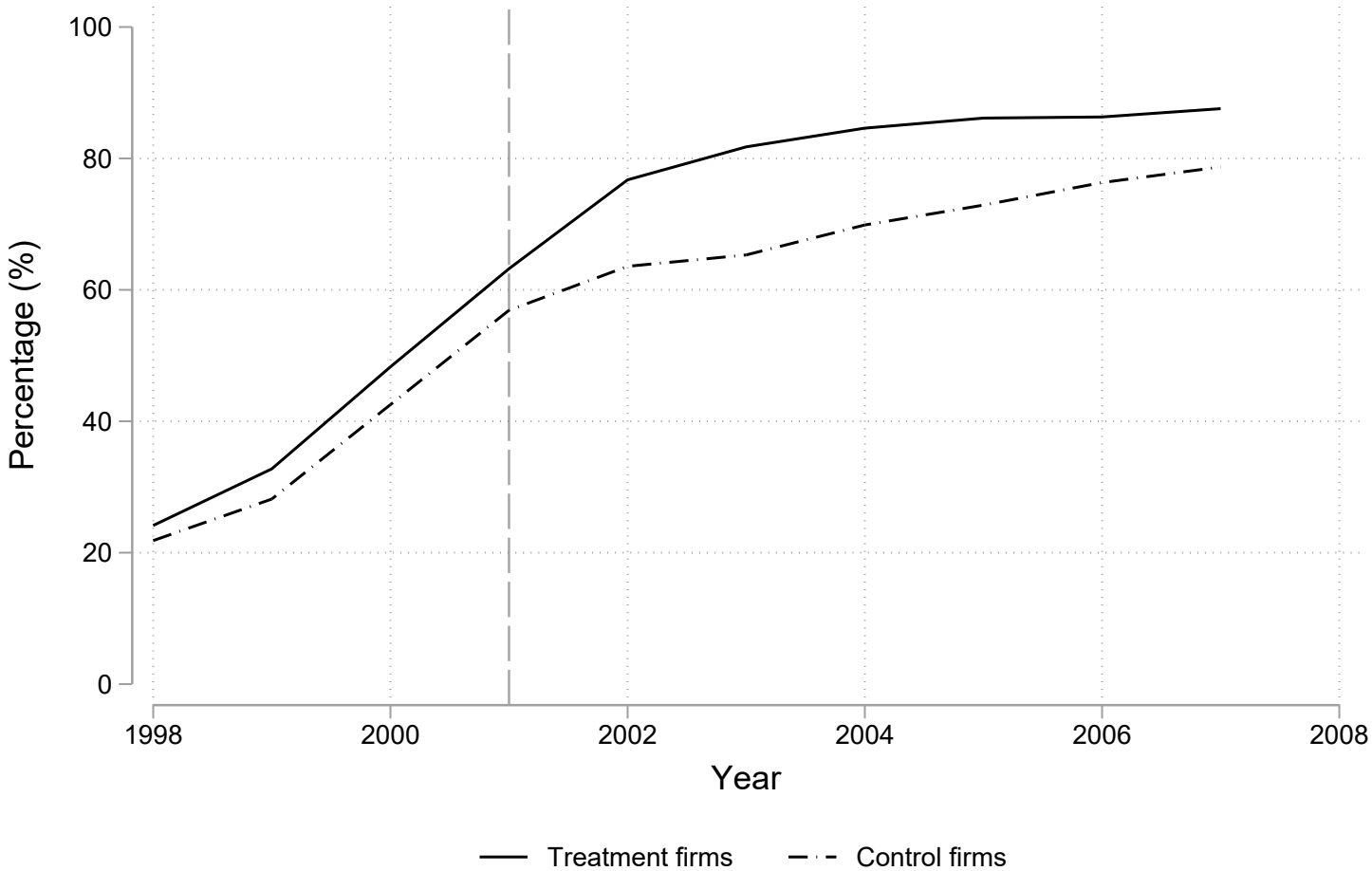
	All	Treatment firm	Control firm	Difference
CN FDI	0.33	0.35	0.31	-0.04
CN FDI SIC3	0.03	0.04	0.02	-0.02
# affiliates	1.22	1.28	1.14	-0.14
Parent # workers	394.73	440.70	348.76	-91.94
Parent average wage bills	4.68	5.19	4.17	-1.02
Parent total sales	51.82	64.14	39.49	-24.65
Parent export sales	39.96	51.51	28.41	-23.10
Affiliate # workers	770.16	764.50	779.16	14.66
Affiliate average wage bills	1.36	1.35	1.38	0.03
Affiliate total sales	51.99	53.08	50.25	-2.83
Affiliate export sales	32.61	28.94	38.44	9.50
Observations	348	174	174	348

The unit of sales and wages is 1000 USD.

▸ Kernel matching ▸ Full sample

Treatment Firms More Likely to Invest in China

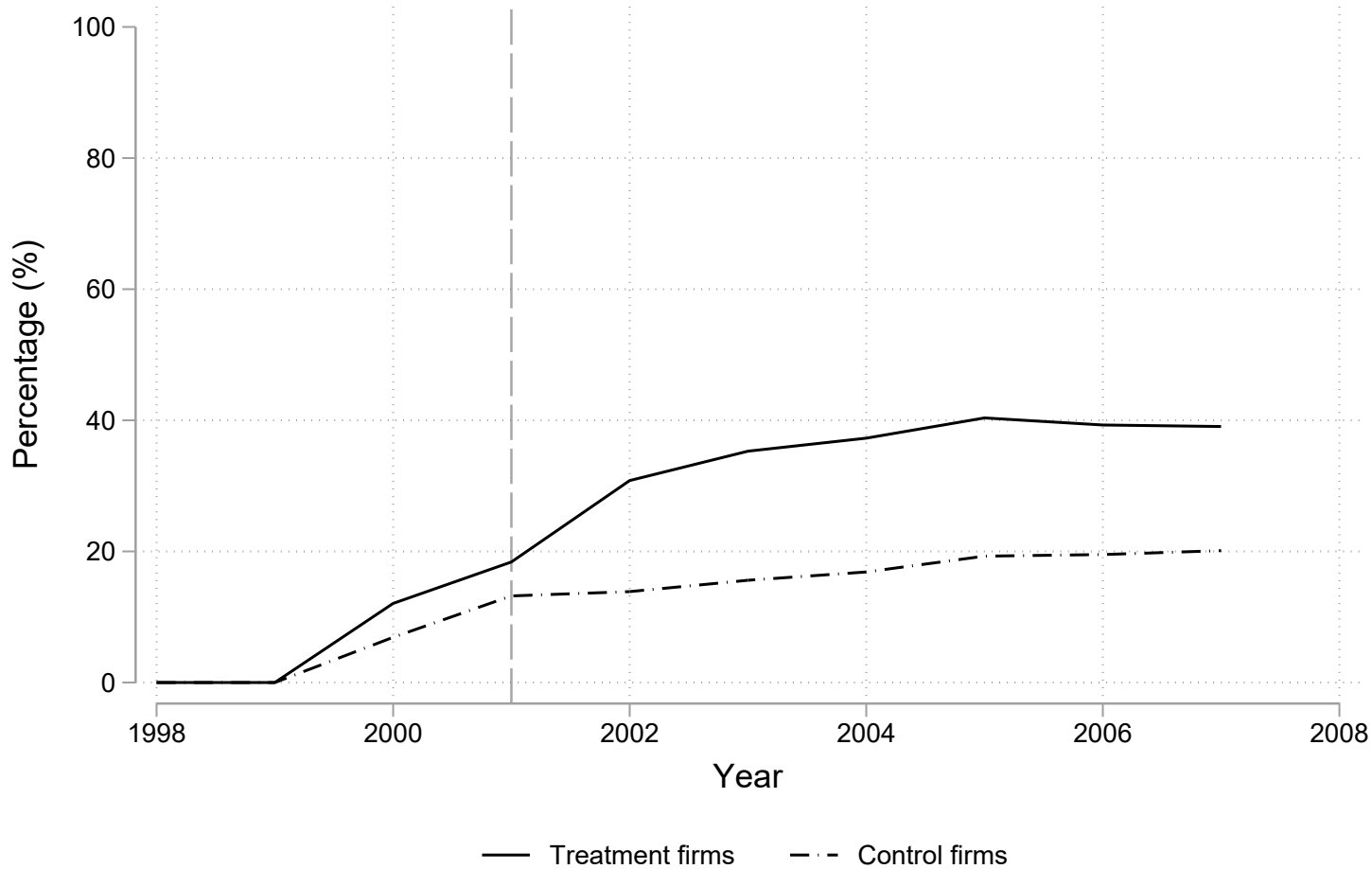
Outcome: Have CN Affiliates



▸ Kernel matching ▸ Full sample

Treatment Firms More Likely to Invest in China

Outcome: Have CN Affiliates in the Same 3-digit Industry



▸ Kernel matching ▸ Full sample

Empirical Specification

DID and Event Study of the 2001 Policy Treatment

For firm j in industry k and year t:

$$Y_{jkt} = \alpha_0 + \alpha_1 \, Treatment_j \times Post_t + Year_t + Firm_j + \varepsilon_{jkt}$$

$$Y_{jkt} = \alpha_0 + \sum_{t'=1998}^{2007} \alpha_{t'} \, Treatment_j \times Year_{t'} + Year_t + Firm_j + \varepsilon_{jkt}$$

Y_{jkt} includes:

- Extensive margins: $\mathbb{1}$(Exit the market), $\mathbb{1}$(FDI in CN), $\mathbb{1}$(FDI in the same 3-digit industry in CN)
- Intensive margins: affiliate/parent # employees, affiliate/parent wage bill, affiliate/parent total sales, affiliate/parent export sales.

DID: Extensive Margins

	(1) Exit	(2) CN FDI	(3) CN FDI SIC3
Treatment*Post	0.002	0.082**	0.163**
	(0.004)	(0.037)	(0.070)
Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Pre-policy control mean	0	0.308	0.023
Observations	3480	3480	3480

Standard errors are clustered at the 3-digit industry level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

▸ Kernel matching ▸ Full sample

Event Study: Extensive Margins

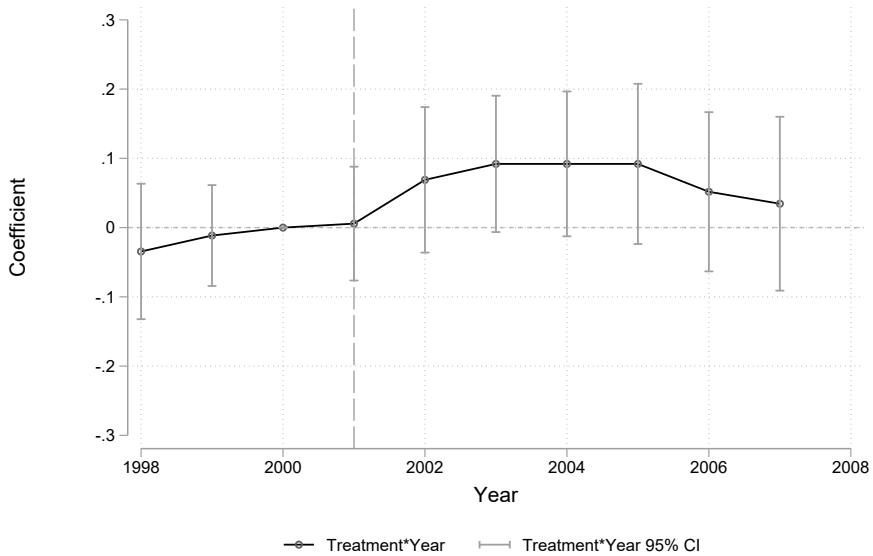


Figure: CN FDI

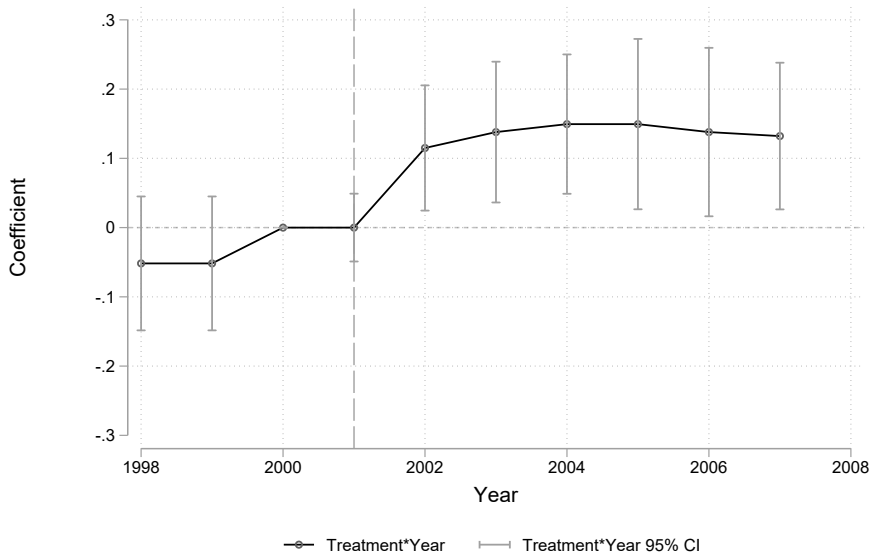


Figure: CNFDI SIC3

▸ Relaxing parallel trends assumption

DID: Intensive Margins

Outcomes in Log

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	TW	CN	TW	CN	TW	CN	TW	CN
Outcome	# Workers		Wage Bills Per Worker		Total Sales		Export Sales	
Treatment*Post	-0.313*	0.511	-0.228	0.507*	0.380	0.481	-0.025	0.770**
	(0.172)	(0.287)	(0.164)	(0.244)	(0.201)	(0.288)	(0.475)	(0.284)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	300	280	250	300	150	290	150	230

Standard errors are clustered at the 3-digit industry level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Outcomes in level

Worker-level Analysis

Summary of Incumbent Workers

2001 vs. 2007

	Treated worker	Untreated worker
Male (%)	54.2	52.7
Age in 2001	32.7	32.0
Wage in 2001 (1000 USD)	17.7	17.6
Wage in 2007 (1000 USD)	18.9	20.3
Left initial firm by 2007 (%)	67.7	53.7
Number of workers	61,468	49,958

- Treated workers: Workers employed by the treatment firms in 2001
- Untreated workers: Workers employed by the control firms in 2001

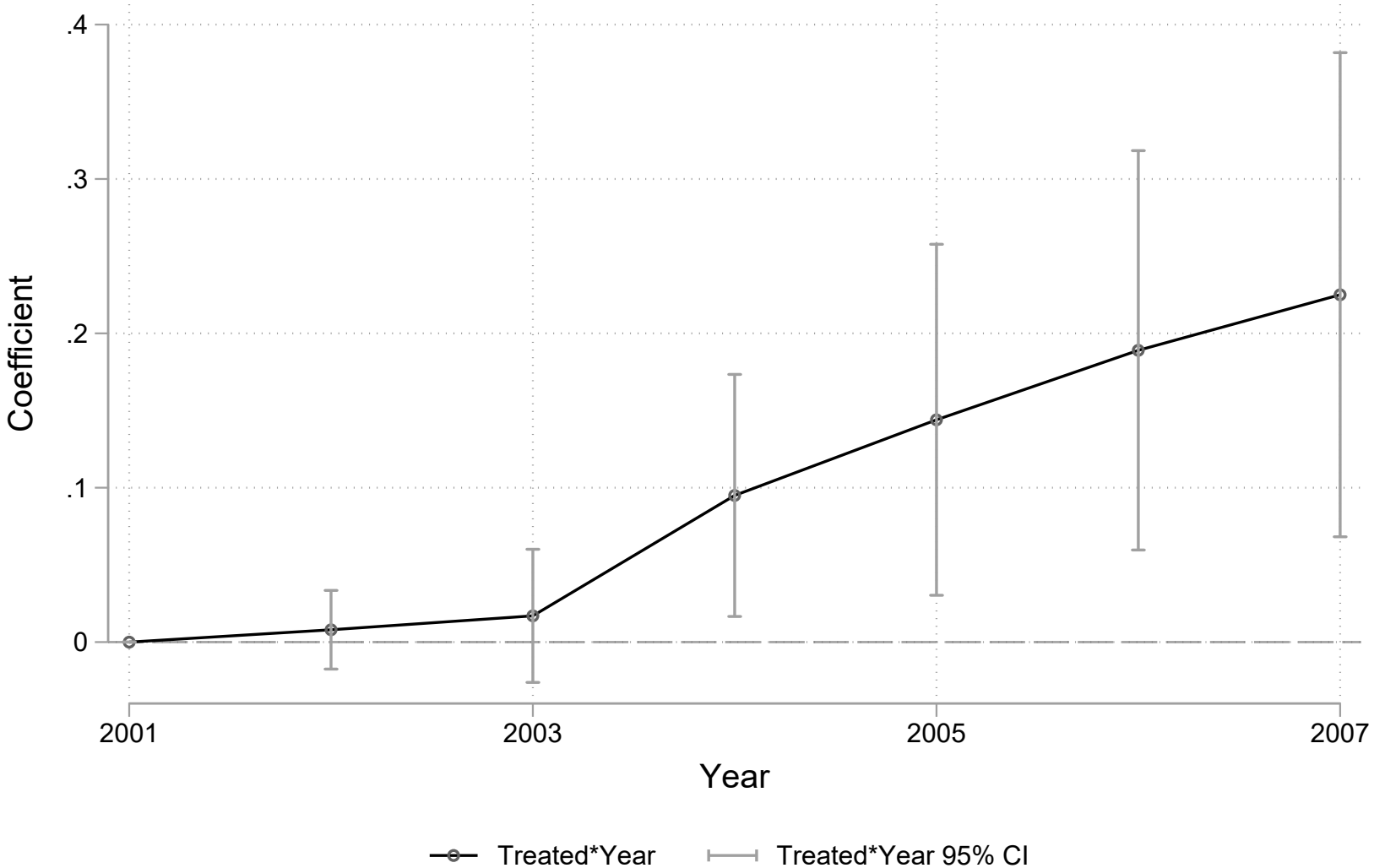
Empirical specification

Incumbent worker i employed by firm j, industry k in 2001:

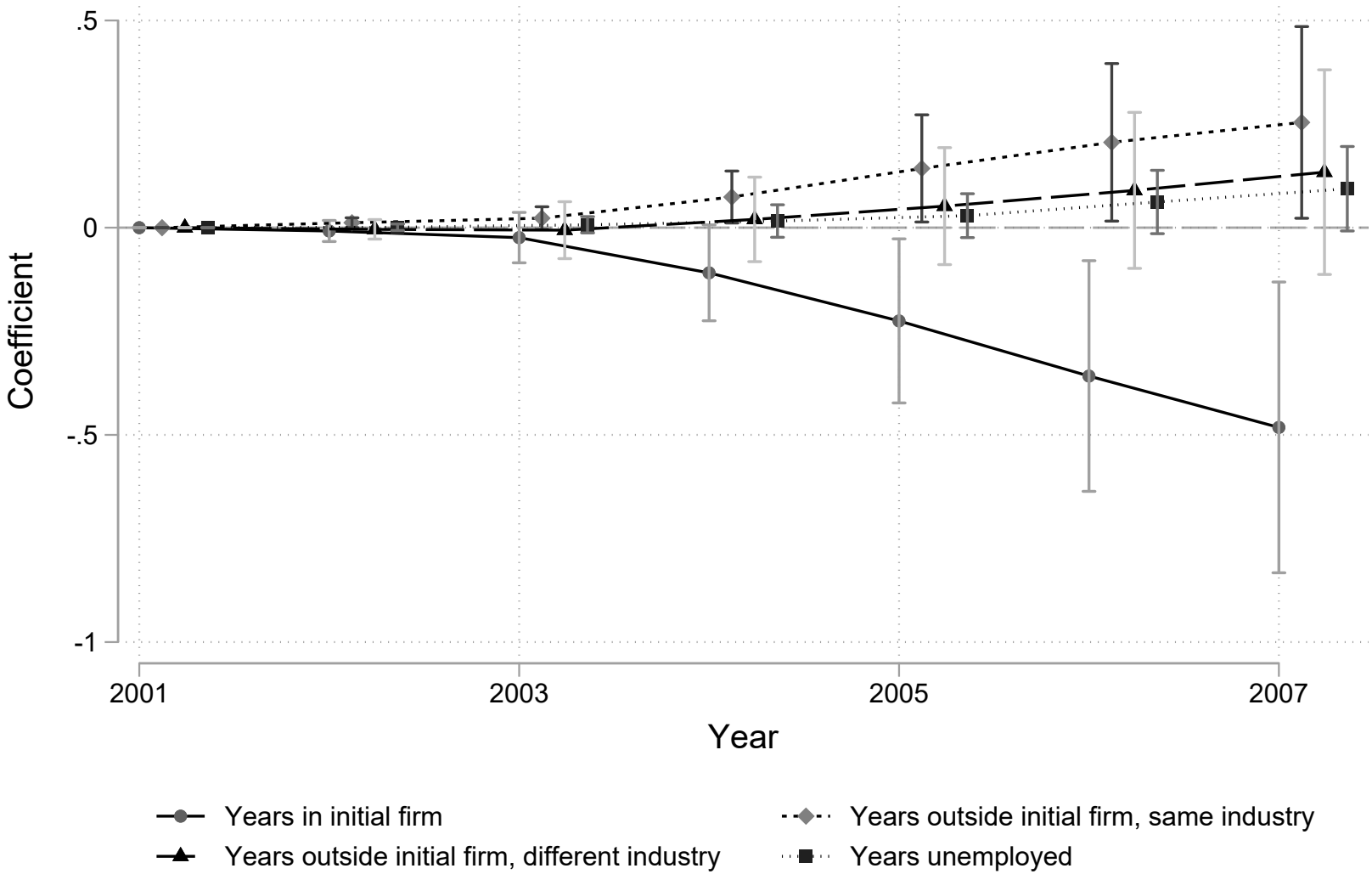
$$Y_{ijkt} = \alpha_t \; Treated_j + Industry_k + X_{ijk2001} + \zeta_{ijkt}$$

- Y_{ijkt}: Cumulative outcomes from 2001 up to year $t \in [2002, 2007]$
  - Job transitions
  - Years w/ positive wages by worker destination
  - Normalized wage (w.r.t wage in 2001) by worker destination
- $Treated_j$: whether main employer in 2001 is a treatment firm
- $X_{ijk2001}$: age, age^2, gender, & marital status in 2001

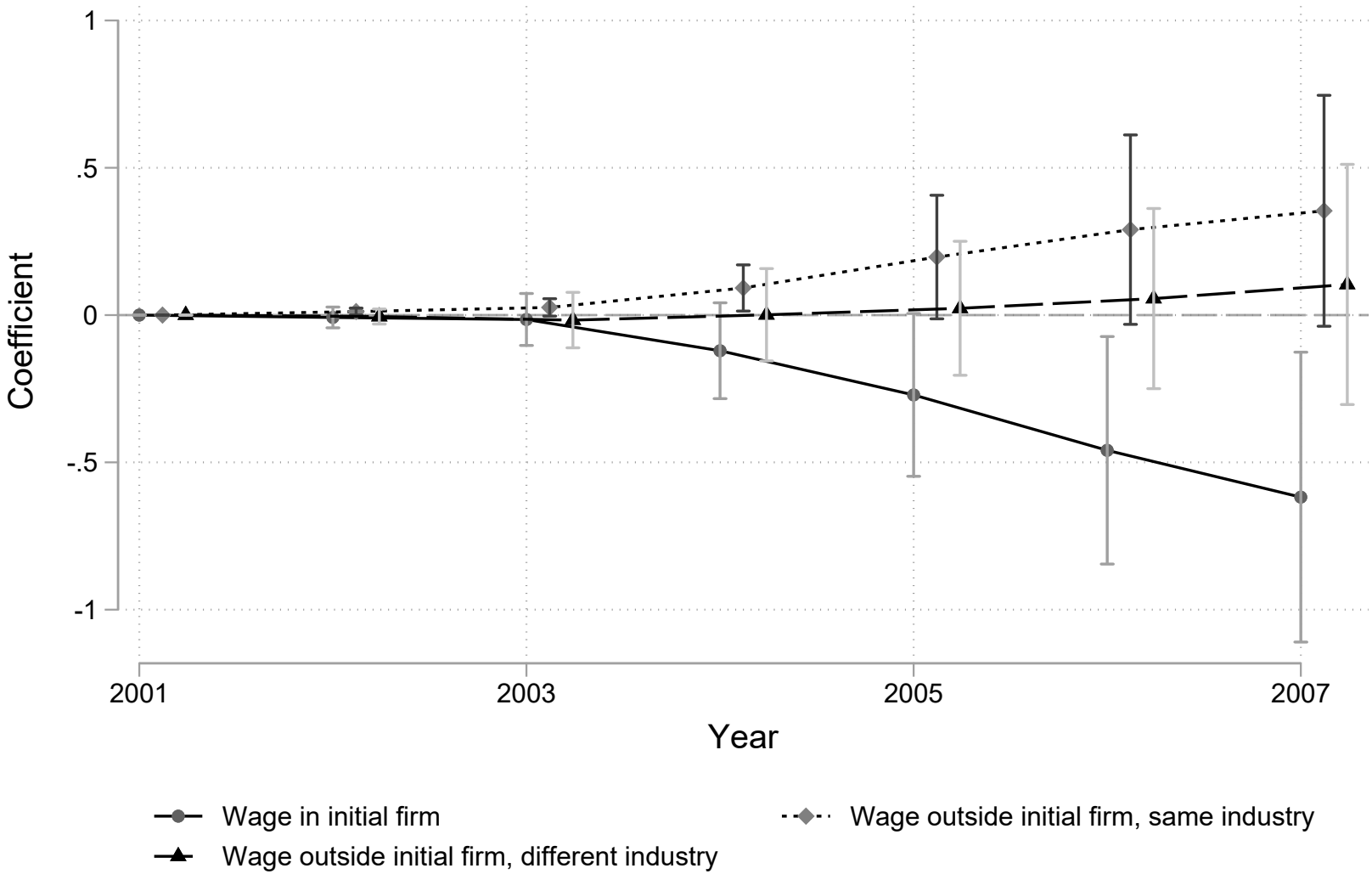
Cumulative Job transitions



Employment Years By Destination



Cumulative Wage By Destination



Heterogeneity by Initial Wages

	Job transition	Years employed				Years unemployed
		Overall	Initial firm	Initial industry	Other industries	
Treated*<p25	0.251**	-0.098	-0.687**	0.182*	0.408*	0.098
	(0.079)	(0.059)	(0.224)	(0.072)	(0.182)	(0.059)
Treated*p25-p50	0.305***	-0.226***	-0.802***	0.198*	0.379*	0.226***
	(0.073)	(0.061)	(0.172)	(0.091)	(0.144)	(0.061)
Treated*p50-p75	0.229***	-0.250***	-0.544***	0.053	0.241**	0.250***
	(0.053)	(0.070)	(0.125)	(0.062)	(0.082)	(0.070)
Treated*p75-p90	0.000	-0.069	0.046	-0.106	-0.010	0.069
	(0.074)	(0.043)	(0.151)	(0.071)	(0.100)	(0.043)
Treated	0.051	0.019	-0.040	0.154*	-0.096	-0.019
	(0.072)	(0.046)	(0.182)	(0.062)	(0.193)	(0.046)
Control mean in 2007	0.950	6.385	4.755	0.474	1.157	0.615
Observations	111,426	111,426	111,426	111,426	111,426	111,426

Heterogeneity by Initial Wages

	Wages earned			
	Overall	Initial firm	Initial industry	Other industries
Treated*<p25	-0.692*	-1.317***	0.106	0.519**
	(0.276)	(0.260)	(0.165)	(0.188)
Treated*p25-p50	-0.974***	-1.463***	0.148	0.341*
	(0.240)	(0.273)	(0.145)	(0.141)
Treated*p50-p75	-1.138***	-1.248***	-0.054	0.164
	(0.235)	(0.253)	(0.101)	(0.098)
Treated*p75-p90	-0.986***	-0.656*	-0.226	-0.104
	(0.213)	(0.255)	(0.141)	(0.108)
Treated	0.707*	0.455	0.341**	-0.089
	(0.314)	(0.250)	(0.107)	(0.280)
Control mean in 2007	7.136	5.304	0.583	1.249
Observations	111,426	111,426	111,426	111,426

Heterogeneity by Worker Gender

	Job transitions	Years employed				Years unemployed
		Overall	Initial firm	Initial industry	Other industries	
Treated*Male	-0.186***	0.182***	0.547***	-0.190*	-0.175*	-0.182***
	(0.037)	(0.045)	(0.091)	(0.081)	(0.076)	(0.045)
Treated	0.320***	-0.187	-0.763***	0.352**	0.224*	0.187*
	(0.084)	(0.072)	(0.197)	(0.129)	(0.110)	(0.072)
Control mean in 2007	0.950	6.385	4.755	0.474	1.157	0.615
Observations	111,426	111,426	111,426	111,426	111,426	111,426

Heterogeneity by Worker Gender

	Wage earned			
	Overall	Initial firm	Initial industry	Other industries
Treated*Male	0.259*	0.523***	-0.205	-0.058
	(0.120)	(0.138)	(0.110)	(0.103)
Treated	-0.294	-0.887**	0.459*	0.134
	(0.247)	(0.255)	(0.210)	(0.168)
Control mean in 2007	7.136	5.304	0.583	1.249
Observations	111,426	111,426	111,426	111,426

Conclusion

- The effect of FDI liberalization is potentially substantial but less studied
- The liberalization policy in Taiwan provides a great natural experiment to study the effect
- Treatment firms increased FDI in China at extensive and intensive margins
- Incumbent workers of the treatment firms were more likely to change jobs, became unemployed, and accumulated less wages
- Larger negative effects for low-wage and female workers
- Rising FDI into China could have substantial aggregate effects

Thank you!

Please share comments and suggestions.

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Summary of firm outcomes, 1998-2000

Full sample

	All	Treatment firm	Control firm	Difference
CN FDI	0.33	0.39	0.29	-0.10**
CN FDI SIC3	0.06	0.09	0.04	-0.06***
# affiliates	1.25	1.28	1.23	-0.05
Parent # workers	472.64	474.15	471.78	-2.37
Parent average wage bills	5.22	5.61	5.01	-0.59
Parent total sales	53.67	71.89	43.30	-28.58*
Parent export sales	39.47	58.44	28.68	-29.76*
Affiliate # workers	851.17	866.23	837.98	-28.25
Affiliate average wage bills	1.43	1.53	1.35	-0.17
Affiliate total sales	49.29	67.94	32.97	-34.97
Affiliate export sales	34.41	43.65	26.32	-17.33
Observations	533	190	343	533

The unit of sales and wages is 1000 USD.

Back

Summary of Firm Outcomes, 1998-2000

Kernel matching sample

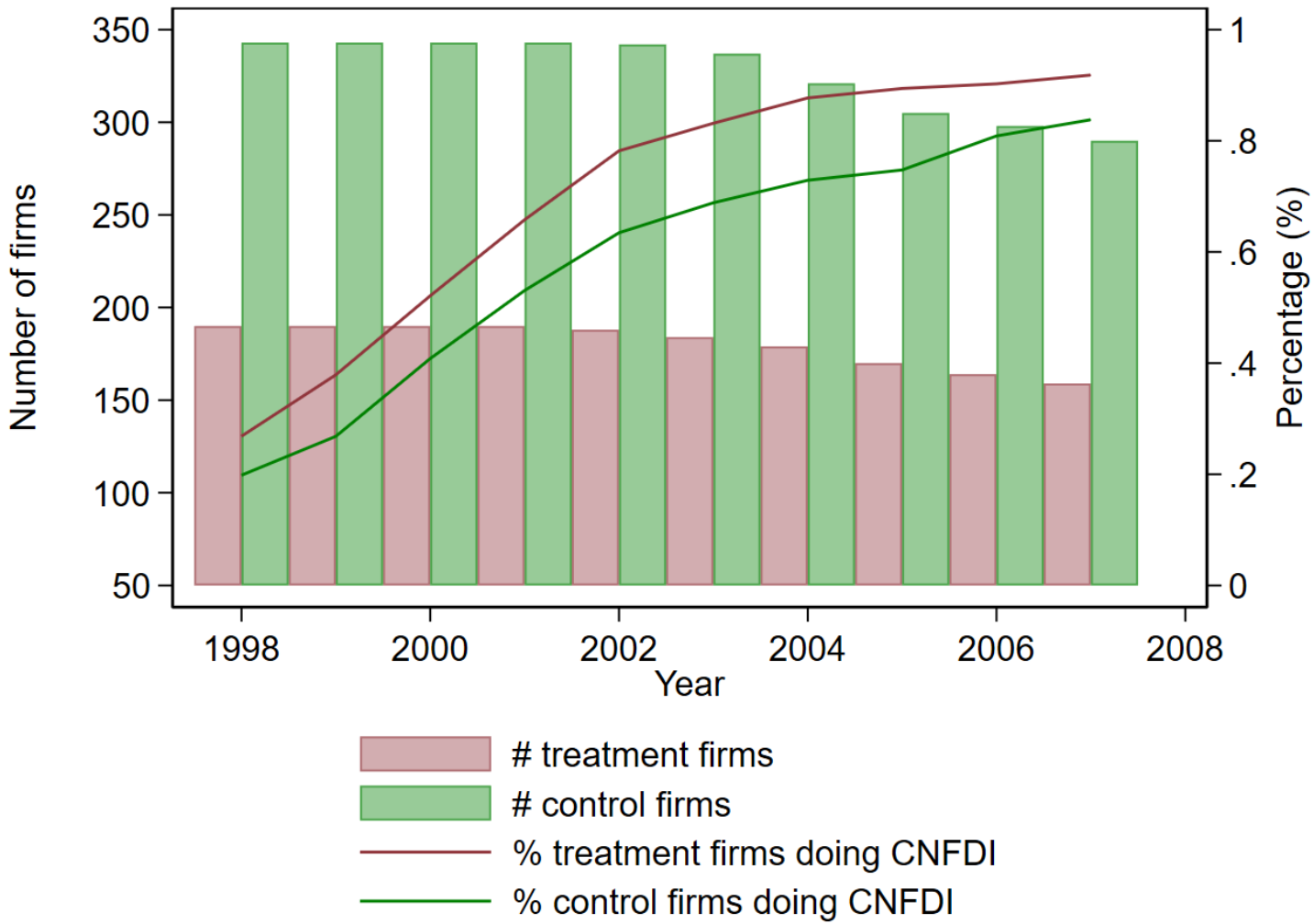
	All	Treatment firm	Control firm	Difference
CN FDI	0.30	0.35	0.28	-0.07
CN FDI SIC3	0.03	0.04	0.02	-0.02
# affiliates	1.22	1.28	1.19	-0.09
Parent # workers	462.38	440.70	474.10	33.40
Parent average wage bills	5.04	5.17	4.97	-0.20
Parent total sales	47.31	63.89	38.43	-25.46*
Parent export sales	33.68	51.26	24.27	-26.99*
Affiliate # workers	698.66	764.50	647.46	-117.04
Affiliate average wage bills	1.23	1.35	1.13	-0.21
Affiliate total sales	40.88	53.08	31.38	-21.70
Affiliate export sales	26.34	28.94	24.31	-4.64
Observations	511	175	336	511

The unit of sales and wages is 1000 USD.

Back

Treatment and Control Firms by Year

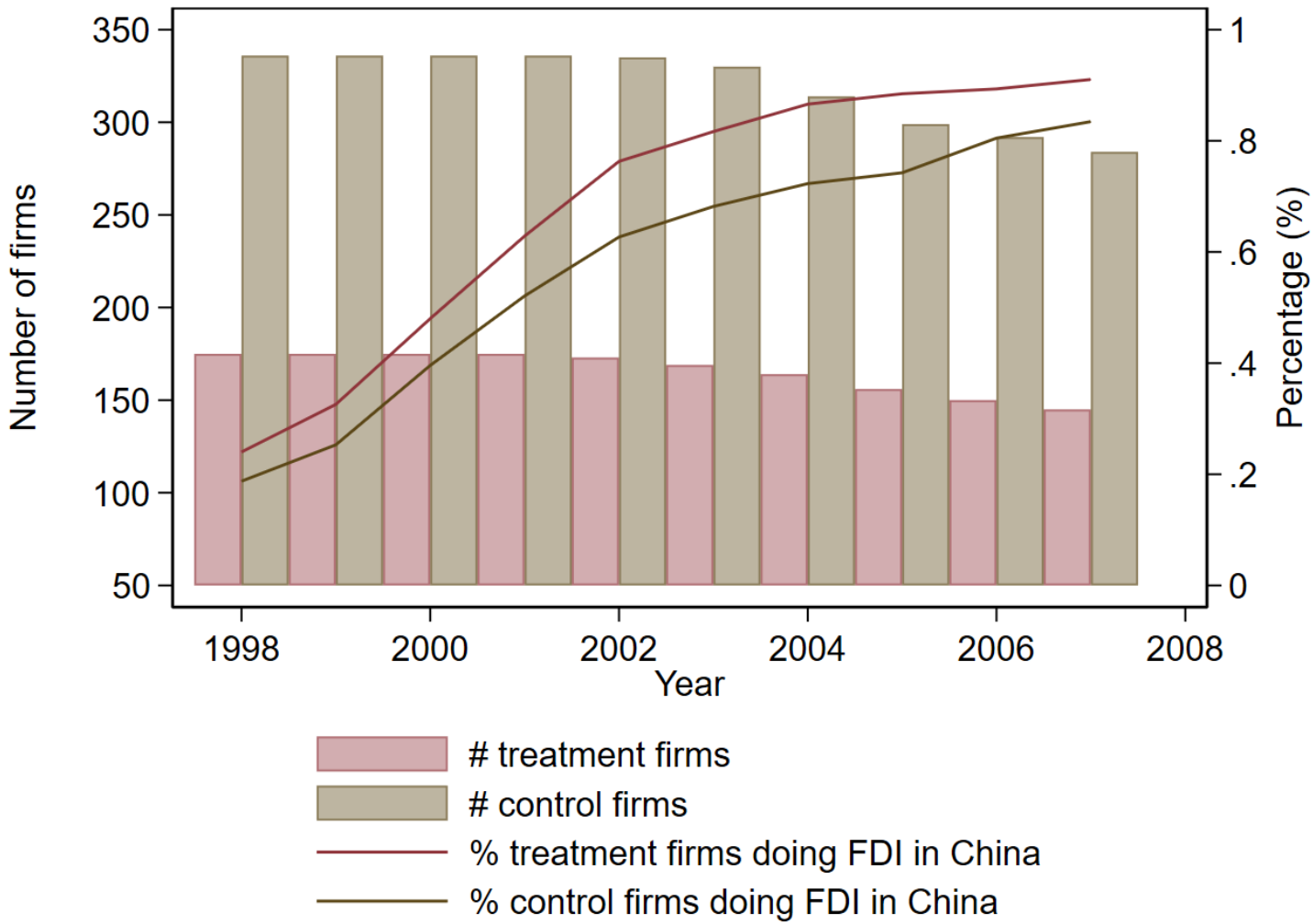
Doing FDI in China for full sample



Back

Treatment and Control Firms by Year

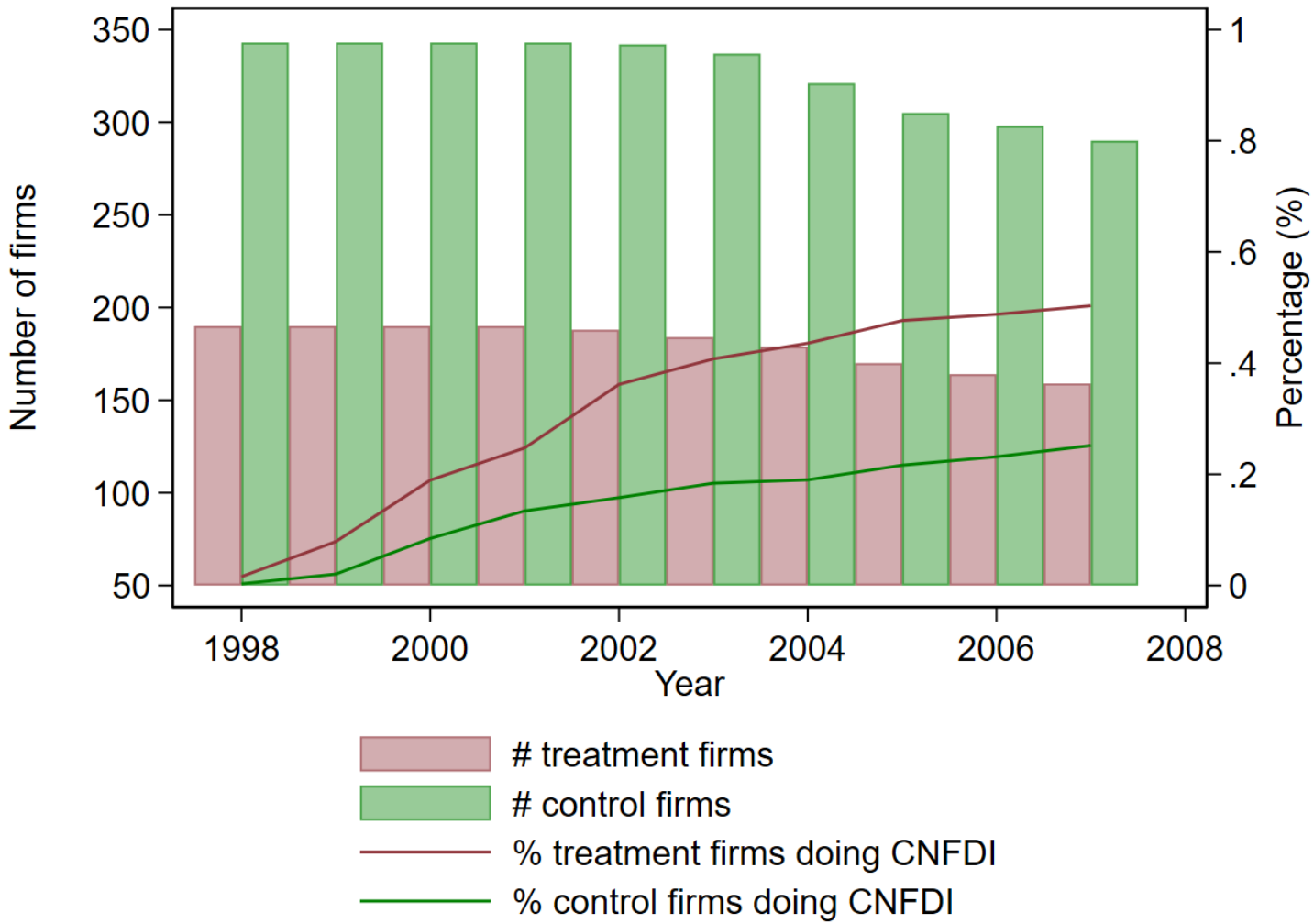
Doing FDI in China for kernel matching sample



Back

Treatment and Control Firms by Year

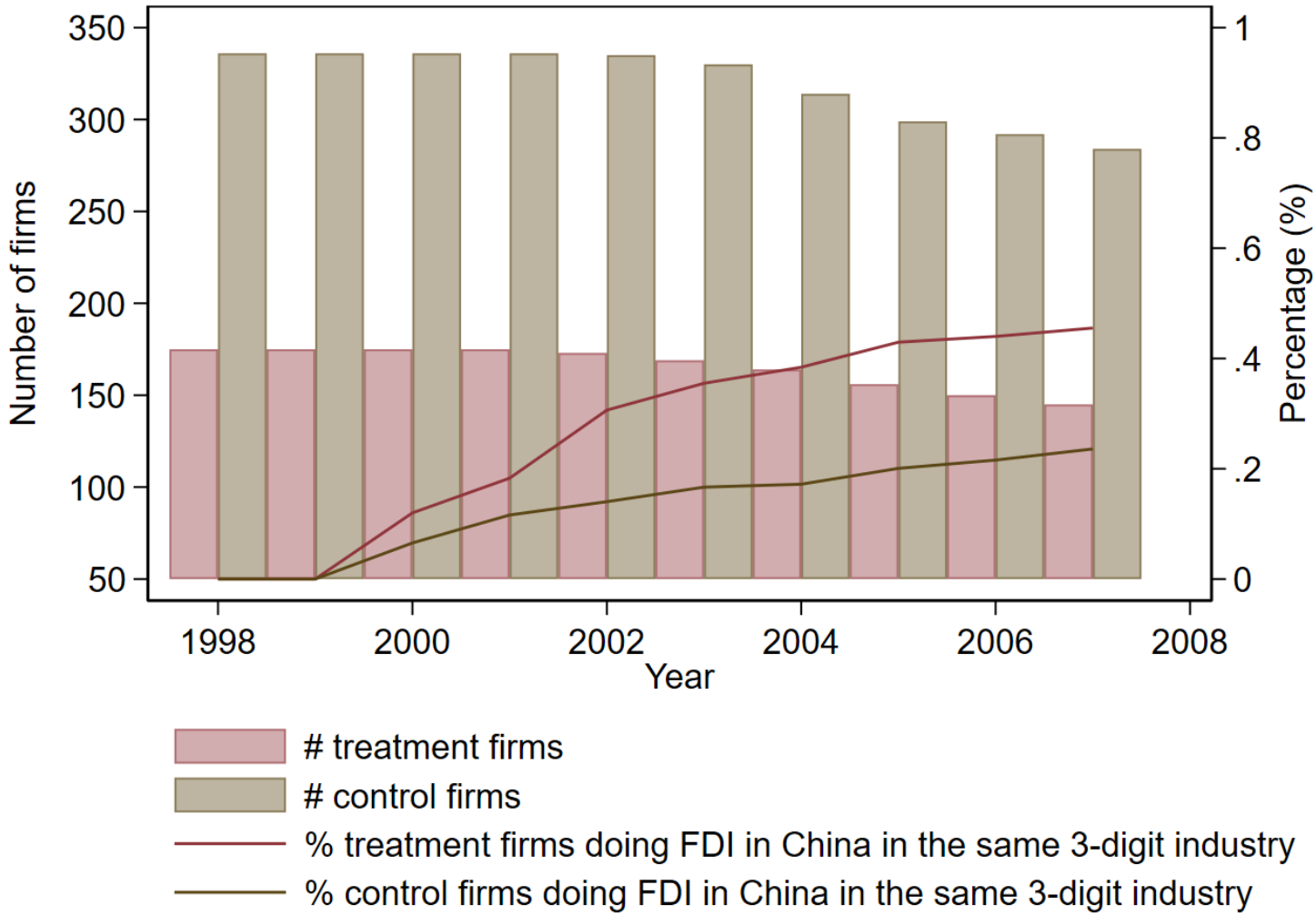
Doing FDI in China in the same 3-digit industry for full sample



Back

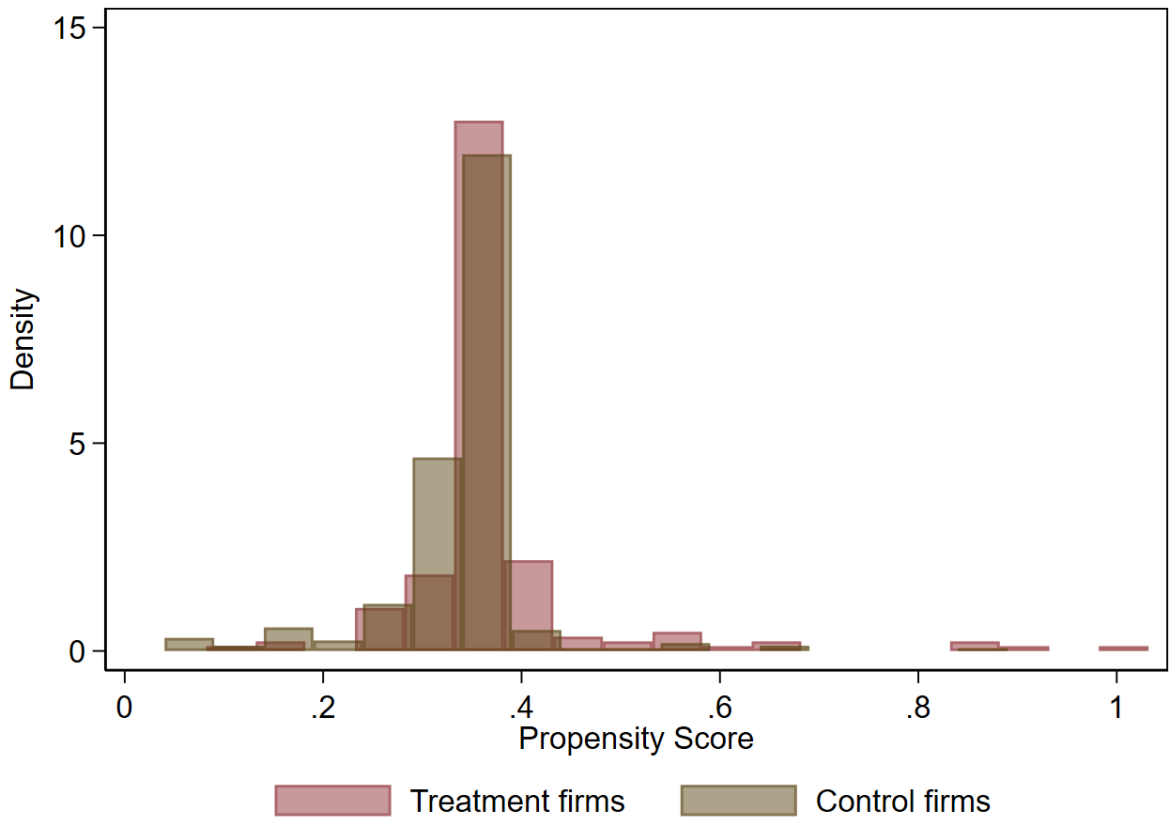
Treatment and Control Firms by Year

Doing FDI in China in the same 3-digit industry for kernel matching sample



Back

Estimated Propensity Scores for Kernel Matching



Back

DID: Extensive Margins

Kernel Matching Sample

	(1) Exit	(2) CN FDI	(3) CN FDI SIC3
Treatment*Post	0.002	0.047	0.155*
	(0.004)	(0.031)	(0.076)
Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Pre-policy control mean	0	0.279	0.022
Observations	5110	5110	5110

Standard errors are clustered at the 3-digit industry level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Back

DID: Extensive Margins

Full Sample

	(1) Exit	(2) CN FDI	(3) CN FDI SIC3
Treatment*Post	0.000	0.028	0.146*
	(0.005)	(0.027)	(0.071)
Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Pre-policy control mean	0	0.291	0.036
Observations	5330	5330	5330

Standard errors are clustered at the 3-digit industry level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Back

DID: Intensive Margins

Outcomes in Level

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	TW	CN	TW	CN	TW	CN	TW	CN
Outcome	# workers		Wage bills per worker		Total sales		Export sales	
Treatment	-607.342	1856.475*	-7.126*	5.073	361.903	397.685*	415.767	376.429*
*Post	(411.408)	(894.928)	(3.633)	(4.050)	(298.915)	(182.646)	(279.423)	(182.974)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	298	298	298	298	298	298	298	298

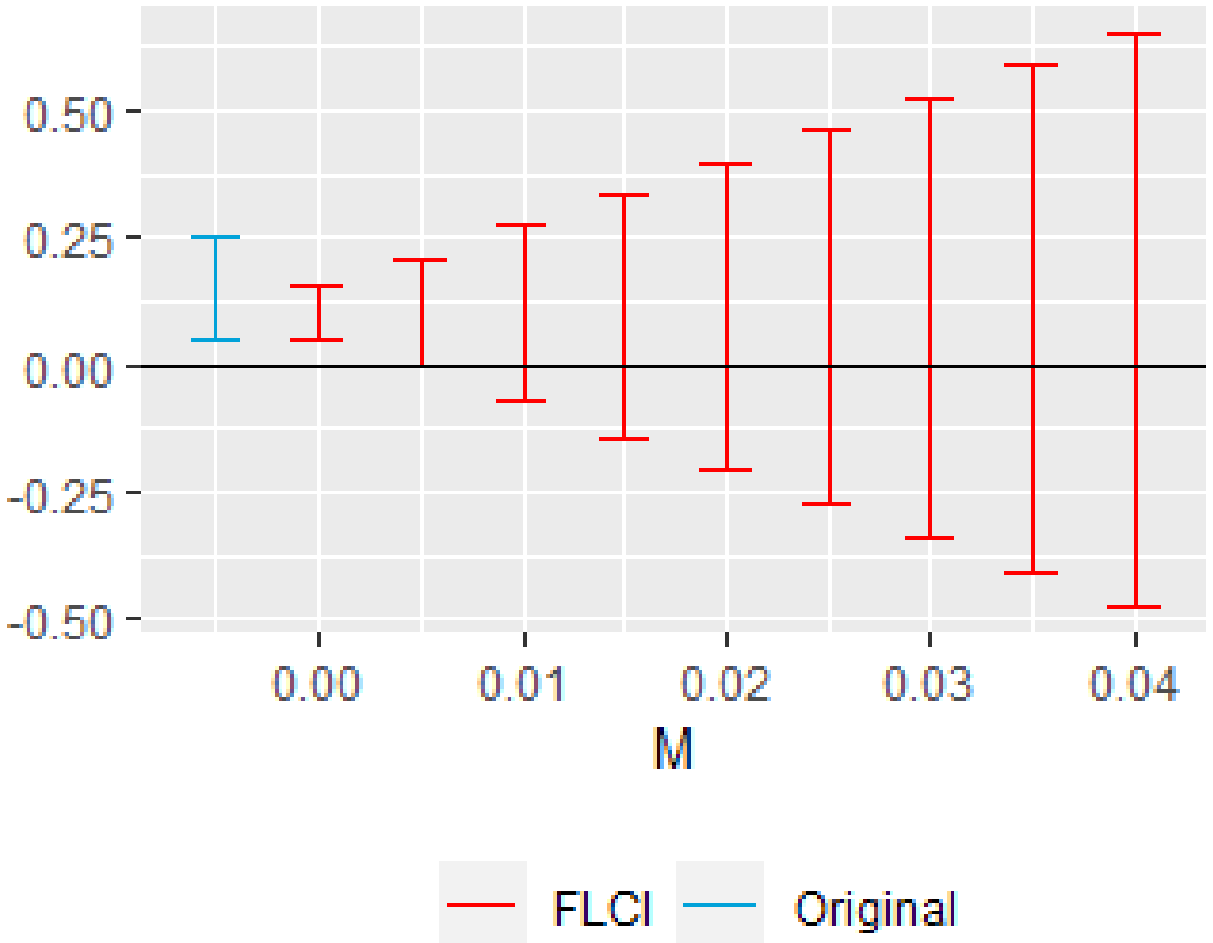
Standard errors are clustered at the 3-digit industry level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Back

Results Are Robust Allowing For Linear Time Trend

- Sensitivity check following Rambachan and Roth (2023)
  E.g. the event study estimate for CN FDI SIC 3 in 2004



Back