

# Firm and Labor Adjustments to FDI Liberalization

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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)
  - ▶ Foreign affiliates account for 12% of global output (Cadestin et al., 2018)
- **FDI liberalization** can have a significant impact on domestic manufacturers and their workers
  - ▶ Domestic manufacturers: invest and reallocate resource abroad  
⇒ Positive effects from theory
  - ▶ Domestic workers: enjoy higher wages due to firm growth or be replaced by foreign workers  
⇒ 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: Taiwan (TW) public electronic firms and their incumbent workers
- 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 firms affected by the policy,
  - ▶ Extensive margin: More likely to start outward FDI into CN
  - ▶ Intensive margin: TW employment  $\sim$ , wages per worker  $\downarrow$ , sales and exports  $\uparrow$ ;  
CN employment  $\uparrow$ , wages per worker  $\sim$ , sales and exports  $\uparrow$
- 2 Individual level: For incumbent workers employed by the FDI firms,
  - ▶ More likely to change jobs
  - ▶ Less likely to stay employed (insignificant)
  - ▶ Heterogeneity: Larger negative effects for low-wage and female workers

FDI liberalization leads to **production relocation** of the TW electronic firms 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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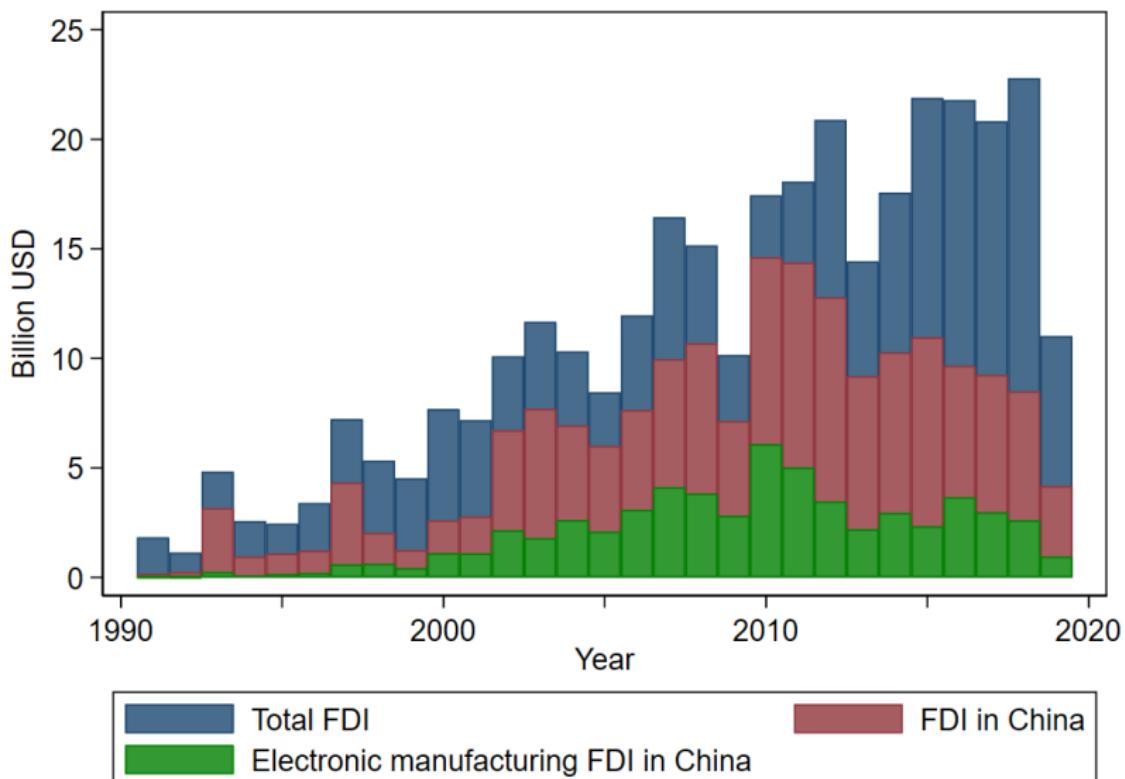
1996-2000 (“no haste, be patient”):

- ▶ 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 firms 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-level Analysis

# Empirical Strategy

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

- **Policy:** Permission of 122 electronic products to be produced in CN

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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 firms 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

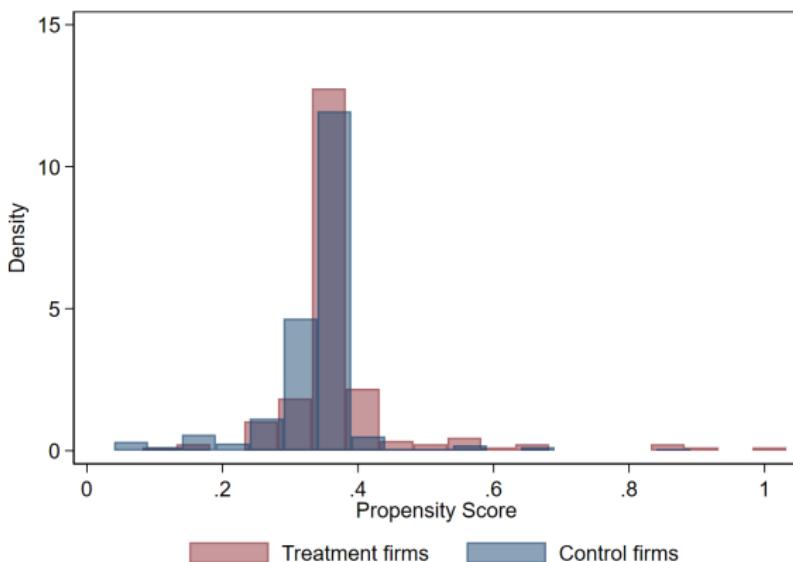
# Empirical Strategy

**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 firms 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 firms 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**
  - 4 have never produced products on the prohibited list

# Matching Result

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



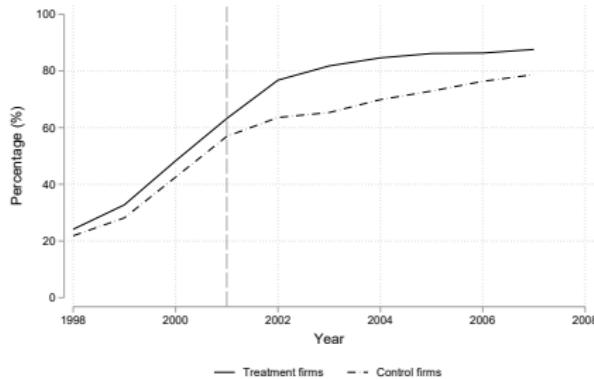
# Summary of Matched Firm Sample

## Mean outcomes over 1998-2000

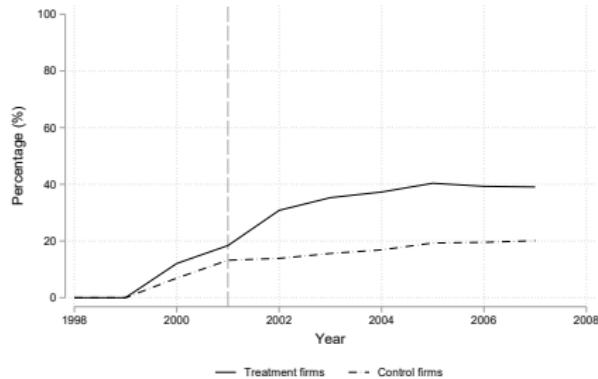
Group	Before matching		After matching	
	Treatment	Control	Treatment	Control
CN FDI	0.39	0.41	0.36	0.43
CN FDI SIC3	0.09	0.06	0.05	0.03
Number of affiliates	1.28	1.25	1.28	1.12
Parent employment	474.15	377.84	440.70	348.80
Parent total wage bill	5.61	4.35	5.22	4.25
Parent total sales	71.89	41.73	64.34	41.51
Parent export sales	58.44	30.27	51.67	31.88
Affiliate employment	866.23	797.28	765.86	618.99
Affiliate total wage bill	1.53	1.20	1.35	0.98
Affiliate total sales	67.94	19.42	53.12	20.68
Affiliate export sales	43.65	17.25	28.97	18.41
Observations	190	194	174	104

The unit for sales and wages is million USD.

# Treatment Firms More Likely to Invest in China

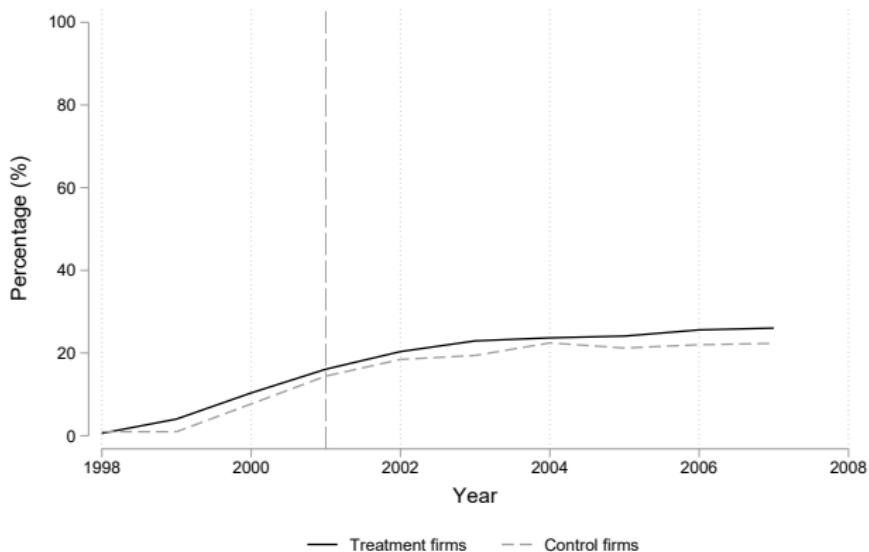


**Figure:** CN FDI



**Figure:** CN FDI SIC3

# No Significant Difference in Other Outward Investments



**Figure:** Non-CN FDI

# Empirical Specification

## DID and Event Study of the 2001 Policy

For firm j in industry k and year t:

$$Y_{jkt} = \alpha_1 Post_t \times Treatment_j + \beta_1 Post_t \times NNTR_k + \beta_2 \tau_{kt}^{US} + \beta_3 \tau_{kt}^{CN} + X_{jkt} + \varepsilon_{jkt},$$

$$Y_{jkt} = \sum_{t'=1998}^{2007} \alpha_{t'} Year_{t'} \times Treatment_j + \beta_1 Post_t \times NNTR_k + \beta_2 \tau_{kt}^{US} + \beta_3 \tau_{kt}^{CN} + X_{jkt} + \varepsilon_{jkt}.$$

$Y_{jkt}$  includes:

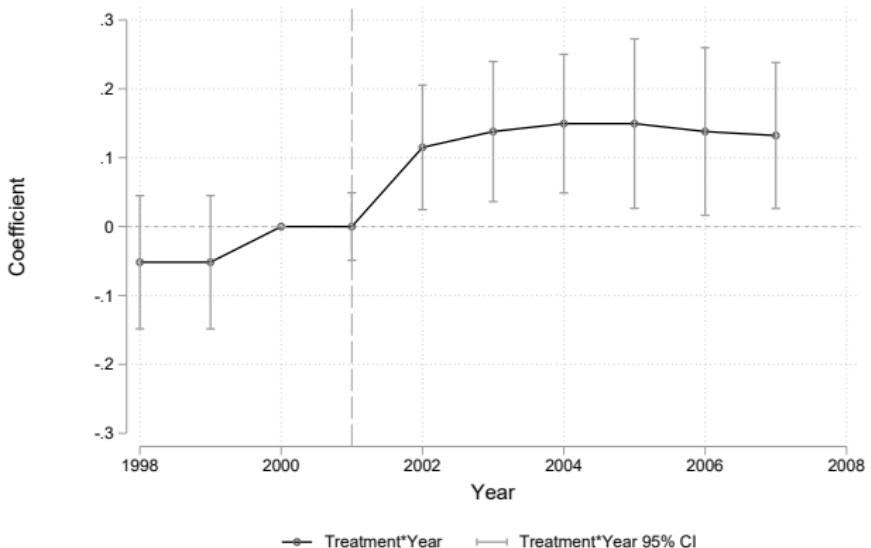
- Extensive margins:  $\mathbb{1}(\text{Exit the market})$ ,  $\mathbb{1}(\text{FDI in CN})$ ,  $\mathbb{1}(\text{FDI in the same 3-digit industry in CN})$
- Intensive margins: affiliate/parent # employees, wage bill per worker, total sales, export sales.

# DID: Extensive Margins

	Exit	CNFDI	CNFDI SIC3	CNFDI NOT SIC3
Treatment*Post	-0.002 (0.005)	0.084* (0.042)	0.101** (0.045)	-0.017 (0.056)
US NNTR Gap*Post	-0.000 (0.000)	-0.003 (0.003)	0.001 (0.002)	-0.005 (0.003)
US Import Tariffs	-0.004 (0.024)	0.003 (0.040)	-0.069 (0.062)	0.073 (0.084)
CN Import Tariffs	-0.001 (0.001)	-0.012 (0.008)	-0.019** (0.007)	0.008 (0.006)
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Size*Post FE	Yes	Yes	Yes	Yes
Pre-policy control mean	0.000	0.413	0.032	0.381
Observations	2780	2780	2780	2780

▶ Kernel matching

# Event Study: Conducting FDI in the Same Industry in China



# DID: Intensive Margins

## Parent firms in Taiwan

	Employment	Wage bill per worker	Total sales	Export sales
Treatment*Post	87.2 (334.7)	-1.3* (0.6)	908.6*** (207.1)	882.6*** (209.1)
US NNTR Gap*Post	7.4* (3.7)	0.2*** (0.0)	6.5 (8.0)	6.5 (7.7)
US Import Tariffs	-60.0 (130.7)	2.8*** (0.7)	-215.6* (101.3)	-205.6* (101.6)
CN Import Tariffs	12.2 (7.5)	0.2* (0.1)	-1.1 (11.8)	-0.1 (11.7)
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Size*Post FE	Yes	Yes	Yes	Yes
Pre-policy control mean	907.4	12.7	96.4	76.0
Observations	269	269	269	269

▶ Kernel matching

# DID: Intensive Margins

## Affiliate firms in China

	Employment	Wage bill per worker	Total sales	Export sales
Treatment*Post	2529.9** (688.9)	-0.4 (0.6)	625.0** (241.1)	605.7* (249.3)
US NNTR Gap*Post	116.9** (37.7)	-0.1*** (0.0)	5.0 (4.2)	3.4 (4.4)
US Import Tariffs	1762.6 (1162.2)	-0.3 (0.4)	-10.5 (69.2)	-20.8 (64.0)
CN Import Tariffs	133.4 (138.7)	0.0 (0.0)	20.6* (10.3)	17.6 (9.9)
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Size*Post FE	Yes	Yes	Yes	Yes
Pre-policy control mean	699.0	1.8	23.9	22.0
Observations	269	269	269	269

▶ Kernel matching

## Worker-level Analysis

# Summary of Incumbent Workers

2001 vs. 2007

	Treated worker	Untreated worker
Male (%)	54.2	52.7
Age in 2001	32.7	32.8
Wage in 2001	15.6	13.5
Wage in 2007	20.4	17.3
Left initial firm by 2007 (%)	67.7	58.0
Number of workers	61,468	28,898

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

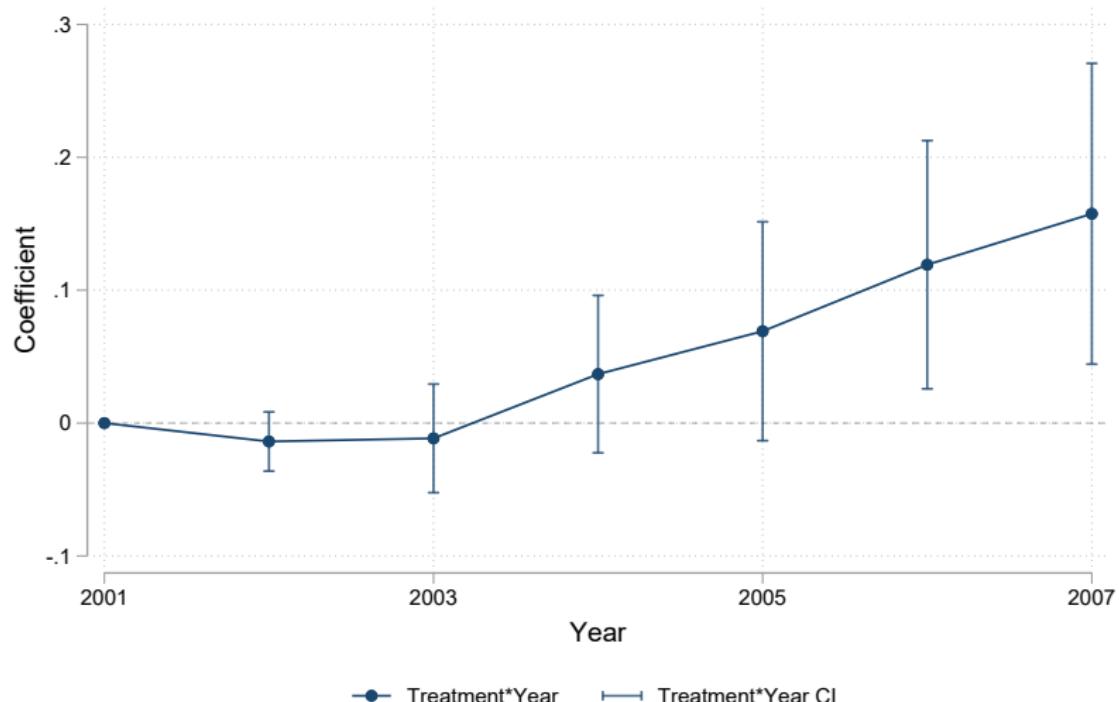
## Empirical specification

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

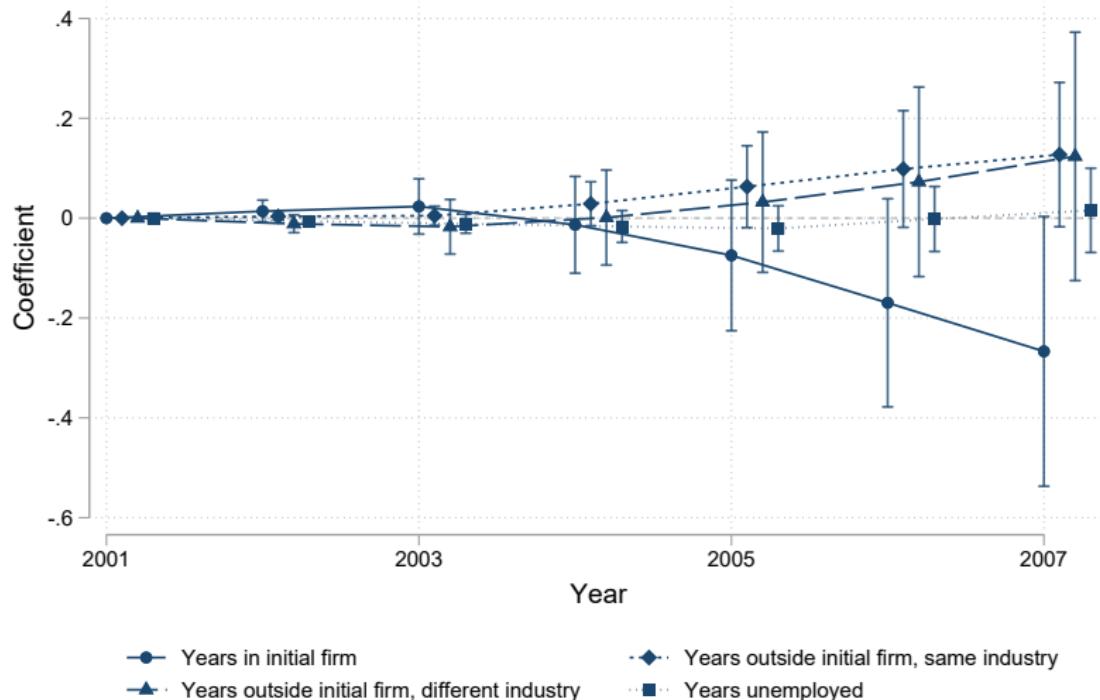
$$Y_{ijkt} = \alpha_t \text{ Treated}_j + \delta_{1t} \text{ NNTR}_k + \delta_{2t} \Delta\tau_k^{US} + \delta_{3t} \Delta\tau_k^{CN} + X_{ijk2001} + \zeta_{ijkt}.$$

- $Y_{ijkt}$ : 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
- $\text{Treated}_j$ : whether main employer in 2001 is a treatment firm
- $X_{ijk2001}$ : age, age<sup>2</sup>, gender, & marital status in 2001

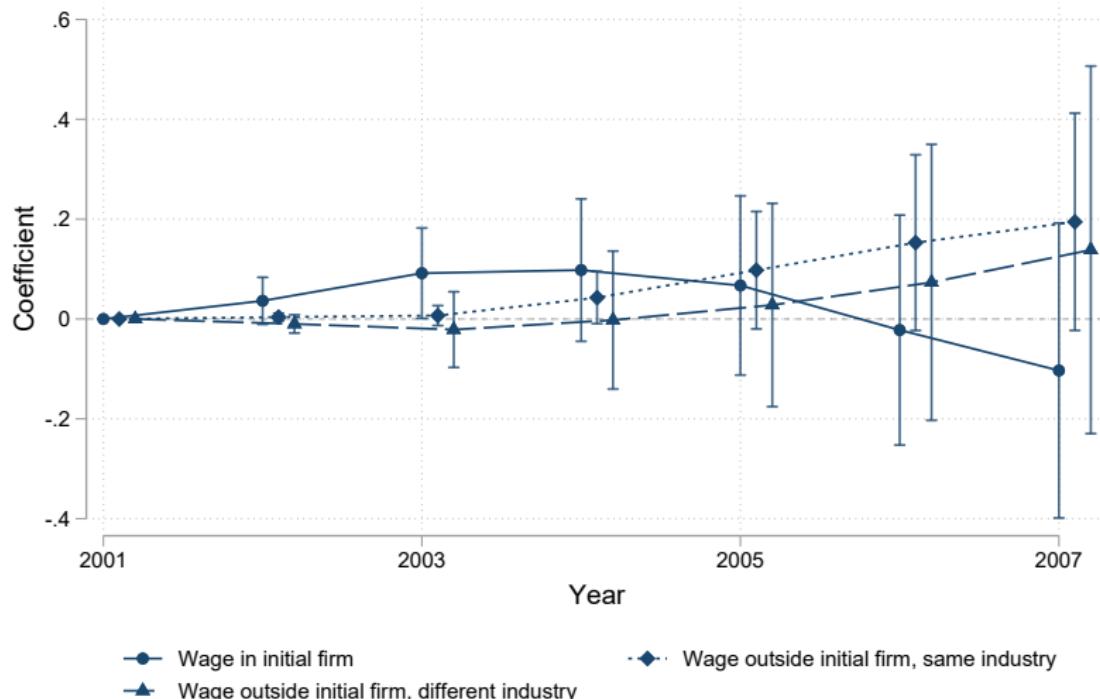
# Cumulative Job transitions



# Employment Years By Destination



# Cumulative Wage By Destination



# Heterogeneity by Initial Wages

	Job transitions	Years employed				Years unemployed
		Overall	Initial firm	Initial industry	Other industries	
Treated*< p25	0.195*	0.086	-0.486	0.129	0.443	-0.086
	(0.097)	(0.106)	(0.274)	(0.067)	(0.224)	(0.106)
Treated*p25-p50	0.267*	-0.083	-0.646*	0.103	0.460*	0.083
	(0.108)	(0.090)	(0.268)	(0.090)	(0.229)	(0.090)
Treated*p50-p75	0.177*	-0.128	-0.386	0.007	0.251	0.129
	(0.085)	(0.080)	(0.214)	(0.066)	(0.168)	(0.080)
Treated*p75-p90	-0.079	0.016	0.237	-0.114*	-0.107	-0.016
	(0.086)	(0.033)	(0.184)	(0.056)	(0.139)	(0.033)
Treated	0.028	-0.043	0.023	0.074	-0.140	0.043
	(0.086)	(0.046)	(0.233)	(0.061)	(0.230)	(0.046)
Size FE	Yes	Yes	Yes	Yes	Yes	Yes
Control mean in 2007	1.039	6.279	4.516	0.377	1.386	0.721
Observations	90,366	90,366	90,366	90,366	90,366	90,366

# Heterogeneity by Initial Wages (continue)

	Wages earned			
	Overall	Initial firm	Initial industry	Other industries
Treated*<p25	0.174 (0.241)	-0.626 (0.333)	0.177 (0.110)	0.623* (0.258)
Treated*p25-p50	-0.168 (0.261)	-0.801** (0.291)	0.128 (0.128)	0.504 (0.267)
Treated*p50-p75	-0.377 (0.230)	-0.592* (0.231)	-0.015 (0.087)	0.230 (0.206)
Treated*p75-p90	-0.366* (0.169)	-0.048 (0.206)	-0.145 (0.083)	-0.173 (0.162)
Treated	0.351 (0.259)	0.360 (0.287)	0.137* (0.054)	-0.147 (0.308)
Size FE	Yes	Yes	Yes	Yes
Control mean in 2007	6.797	4.857	0.440	1.500
Observations	90,366	90,366	90,366	90,366

# Heterogeneity by Worker Gender

	Job transitions		Years employed			Years unemployed
		Overall	Initial firm	Initial industry	Other industries	
Treated*Male	-0.194*** (0.042)	0.192*** (0.053)	0.547*** (0.117)	-0.105* (0.045)	-0.250*** (0.070)	-0.192*** (0.053)
Treated	0.261*** (0.060)	-0.117 (0.0656)	-0.557*** (0.144)	0.183* (0.0786)	0.256* (0.109)	0.117 (0.066)
Size FE	Yes	Yes	Yes	Yes	Yes	Yes
Control mean in 2007	1.039	6.279	4.516	0.377	1.386	0.721
Observations	90,366	90,366	90,366	90,366	90,366	90,366

# Heterogeneity by Worker Gender (continue)

Wage earned				
	Overall	Initial firm	Initial industry	Other industries
Treated*Male	0.523*** (0.142)	0.728*** (0.153)	-0.044 (0.060)	-0.161 (0.105)
Treated	-0.048 (0.206)	-0.489** (0.150)	0.218* (0.106)	0.224 (0.153)
Size FE	Yes	Yes	Yes	Yes
Control mean in 2007	6.797	4.857	0.440	1.500
Observations	90,366	90,366	90,366	90,366

## 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
- 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

## Kernel matching sample

Group	Before matching		After matching	
	Treatment	Control	Treatment	Control
CN FDI	0.39	0.41	0.36	0.41
CN FDI SIC3	0.09	0.06	0.05	0.04
No. of affiliates	1.28	1.25	1.28	1.19
Parent employment	474.15	377.84	440.70	378.45
Parent total wage bill	5.61	4.35	5.22	4.39
Parent total sales	71.89	41.73	64.34	33.97
Parent export sales	58.44	30.27	51.67	23.03
Affiliate employment	866.23	797.28	765.86	539.80
Affiliate total wage bill	1.53	1.20	1.35	0.89
Affiliate total sales	67.94	19.42	53.12	16.11
Affiliate export sales	43.65	17.25	28.97	13.75
Observations	190	194	174	184

The unit for sales and wages is million USD.

▶ Back

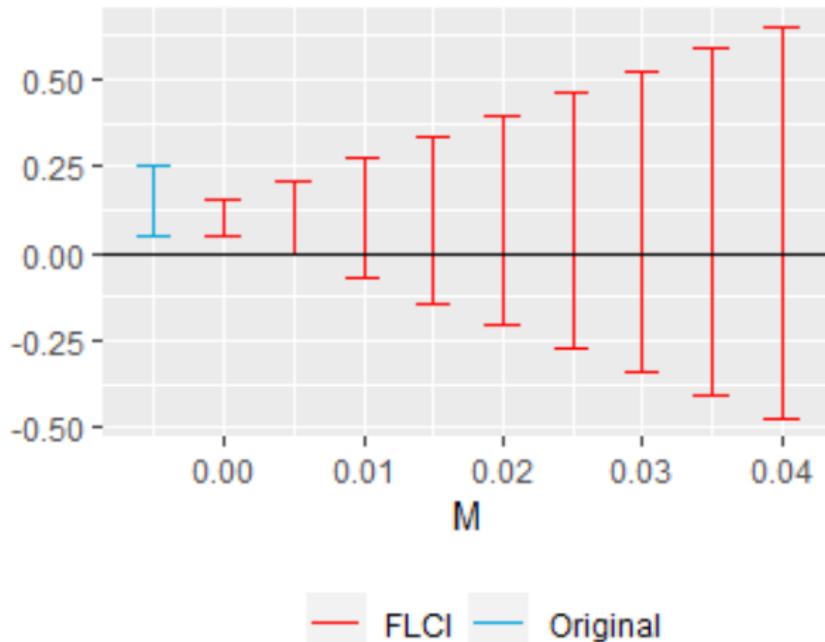
# DID: Extensive Margins

## Kernel matching sample

	Exit	CNFDI	CNFDI SIC3	CNFDI NOT SIC3
Treatment*Post	0.000 (0.004)	0.050 (0.041)	0.100** (0.044)	-0.050 (0.052)
US NNTR Gap*Post	-0.000 (0.000)	-0.002 (0.003)	0.002 (0.002)	-0.004 (0.003)
US Import Tariffs	-0.000 (0.021)	0.006 (0.048)	-0.062 (0.060)	0.068 (0.089)
CN Import Tariffs	-0.001 (0.001)	-0.006 (0.008)	-0.014** (0.007)	0.008 (0.006)
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Size*Post FE	Yes	Yes	Yes	Yes
Pre-policy control mean	0.000	0.390	0.035	0.355
Observations	3580	3580	3580	3580

## Results Robust to Linear Time Trend

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



# DID: Intensive Margins

## Kernel matching sample

	Employment	Wage bill per worker	Total sales	Export sales
Treatment*Post	-189.5 (314.4)	-1.0 (0.8)	736.3** (205.8)	731.5** (206.6)
US NNTR Gap*Post	6.2 (4.6)	0.2*** (0.1)	17.2* (8.0)	17.2* (7.7)
US Import Tariffs	2.1 (80.5)	2.2** (0.8)	3.5 (106.1)	6.1 (105.5)
CN Import Tariffs	15.6 (9.7)	0.2 (0.1)	-4.7 (14.6)	-3.7 (13.7)
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Size*Post FE	Yes	Yes	Yes	Yes
Observations	367	367	367	367
Adjusted R <sup>2</sup>	0.9	0.4	0.6	0.6

## DID: Intensive Margins (continue)

	Employment	Wage bill per worker	Total sales	Export sales
Treatment*Post	2970.6*** (630.6)	-1.0 (0.5)	674.2* (291.7)	652.9* (303.4)
US NNTR Gap*Post	155.1 *** (40.6)	-0.1 *** (0.0)	15.6* (6.6)	13.5* (6.7)
US Import Tariffs	1910.0 (1086.7)	-0.5 (0.4)	91.3* (42.8)	80.2** (31.3)
CN Import Tariffs	128.8 (89.7)	0.0 (0.0)	12.8** (4.4)	10.0** (3.7)
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Size*Post FE	Yes	Yes	Yes	Yes
Observations	367	367	367	367
Adjusted $R^2$	0.7	0.3	0.6	0.5

# Heterogeneity by Initial Wages

## Kernel matching sample

	Job transitions	Years employed			Years unemployed	
		Overall	Initial firm	Initial industry	Other industries	
Treated*<p25	0.172** (0.060)	-0.141 (0.080)	-0.490*** (0.129)	0.129 (0.065)	0.220 (0.121)	0.141 (0.080)
Treated*p25-p50	0.242** (0.088)	-0.324*** (0.080)	-0.624** (0.189)	0.134 (0.073)	0.165 (0.139)	0.324*** (0.080)
Treated*p50-p75	0.183** (0.053)	-0.310*** (0.076)	-0.448*** (0.122)	0.049 (0.040)	0.089 (0.088)	0.310*** (0.076)
Treated*p75-p90	0.019 (0.068)	-0.123*** (0.032)	-0.004 (0.141)	-0.083 (0.043)	-0.036 (0.104)	0.123*** (0.032)
Treated	0.094 (0.050)	0.131* (0.054)	-0.076 (0.115)	0.007 (0.056)	0.200 (0.146)	-0.131* (0.054)
Size FE	Yes	Yes	Yes	Yes	Yes	Yes
Control mean in 2007	0.922	6.365	4.777	0.489	1.099	0.635
Observations	174,242	174,242	174,242	174,242	174,242	174,242

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# Heterogeneity by Initial Wages (continue)

## Kernel matching sample

	Wages earned			
	Overall	Initial firm	Initial industry	Other industries
Treated*<p25	-0.449 (0.384)	-0.846** (0.252)	0.052 (0.163)	0.345* (0.135)
Treated*p25-p50	-0.849** (0.279)	-1.066*** (0.264)	0.081 (0.114)	0.136 (0.139)
Treated*p50-p75	-1.005*** (0.226)	-0.964*** (0.220)	-0.046 (0.070)	0.005 (0.097)
Treated*p75-p90	-0.833*** (0.122)	-0.530** (0.178)	-0.184* (0.075)	-0.118 (0.122)
Treated	0.629* (0.247)	0.335 (0.226)	0.103 (0.083)	0.191 (0.172)
Size FE	Yes	Yes	Yes	Yes
Control mean in 2007	7.179	5.333	0.616	1.230
Observations	174,242	174,242	174,242	174,242

# Heterogeneity by Gender

## Kernel matching sample

	Job transitions		Years employed			Years unemployed
		Overall	Initial firm	Initial industry	Other industries	
Treated*Male	-0.226*** (0.032)	0.164*** (0.041)	0.619*** (0.079)	-0.188* (0.080)	-0.267*** (0.073)	-0.164*** (0.041)
Treated	0.356*** (0.048)	-0.154* (0.064)	-0.767*** (0.118)	0.172* (0.084)	0.441*** (0.105)	0.154* (0.064)
Size FE	Yes	Yes	Yes	Yes	Yes	Yes
Control mean in 2007	0.922	6.365	4.777	0.489	1.099	0.635
Observations	174,242	174,242	174,242	174,242	174,242	174,242

# Heterogeneity by Gender (continue)

## Kernel matching sample

		Wages earned			
		Overall	Initial firm	Initial industry	Other industries
Treated*Male		0.134 (0.179)	0.588*** (0.137)	-0.234 (0.141)	-0.220* (0.094)
Treated		-0.150 (0.176)	-0.754*** (0.140)	0.215 (0.117)	0.389** (0.135)
Size FE		Yes	Yes	Yes	Yes
Control mean in 2007		7.179	5.333	0.616	1.230
Observations		174,242	174,242	174,242	174,242