Local Corporate Taxes and the Geography of Foreign Multinationals

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November 14-15, 2024
Trade, Value Chains and Financial Linkages in the Global Economy

Motivation

- Many developing countries impose low corporate taxes on foreign multinationals
    - Ambitious goals: fostering regional development, generating positive spillovers, reducing regional inequality
    - Lack of coordination: regional competition and zoning policies make tax gaps vary considerably within the host country
    - The economic implication is not yet clear
- Questions
    - How do corporate tax variations shape the geography of production and welfare?
    - What is the impact of local tax competition, what are the optimal corporate taxes?
- Challenges
    - Need a quantifiable model to answer welfare & CF questions
    - The effective corporate tax rates are endogenous

This Paper

#1 Develops a spatial GE model with multi-site production (MP) and local corporate taxes

#2 Recover the key model parameter, the elasticity of local production w.r.t. variable cost production by exploiting China's 2008 corporate tax reform

- Quantify the welfare implications of the corporate tax changes in three policy scenarios: the 2008 Tax Reform, Nash, Optimal

Preview of Results

- Model-consistent estimation suggests that firm productions *across regions* within China are twice as "footloose" as they are *across countries* (cf. Arkolakis et al. (2018) and Wang (2020))

- China's corporate tax reform in 2008
    - shifted foreign MP towards central and western provinces (consistent with the data)
    - increased Chinese welfare by 0.86% and reduced regional inequality (at RoW cost)

- Regional tax competition within China
    - *beggar-thy-neighbour* policy: low/negative corporate taxes in the Nash equilibrium
    - Chinese welfare reduces by 5.56% (by 2.04% without foreign MP)

- Optimal corporate taxes
    - almost uniformly high corporate taxes on foreign but low taxes on domestic firms
   - Chinese welfare increases by 3.10% (by 0.06% without foreign MP)

Related Literature

- Multinationals and international trade
  - Ramondo (2014), Irarrazabal et al. (2013), Tintelnot (2017), Arkolakis et al. (2018), Garetto et al. (2019), Wang (2020), Setzler & Tintelnot (2021)
  - This paper: first *quantitative* exploration of the implications of foreign multinationals for regional policy competition and coordination *within the host country*.

- Quantitative spatial models
  - Redding (2016), Ramondo et al. (2016), and Caliendo et al. (2018)
  - This paper: incorporate into our framework the Chinese corporate tax structure and allow for multi-site production

- Corporate taxes and the spatial allocation of firms
  - Fajgelbaum et al. (2019), Ossa (2015), Suarez Serrato and Zidar (2016), Henkel et al. (2021) and Mast (2020)
  - This paper: focuses on the implications of MNEs and uses the 2008 tax reform to assist in model identification and validation

China's corporate tax system and the 2008 reform

- Prior to 2007: relatively stable dual-track corporate tax system

    - Statutory tax rates: 33% for domestic-owned enterprises, 15% to 24% to MNEs

    - The effective tax rates of domestic firms were 70% higher on average

    - Regional variations: due to China's Western Development Program, which sets the statutory tax at 15% for all firms, the tax gaps in western provinces are much lower.

- China's corporate tax reform in Jan 2008

    - Integrated the statutory tax rate of both domestic and foreign firms to 25%

    - Phased-in reform did away MNEs' tax benefits, 2008-2013

Suggestive Evidence
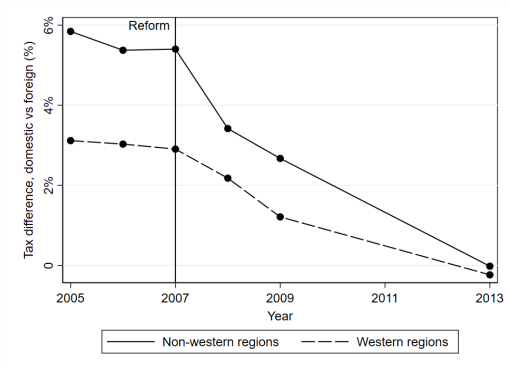
Effective corporate tax rates gaps between domestic and foreign firms
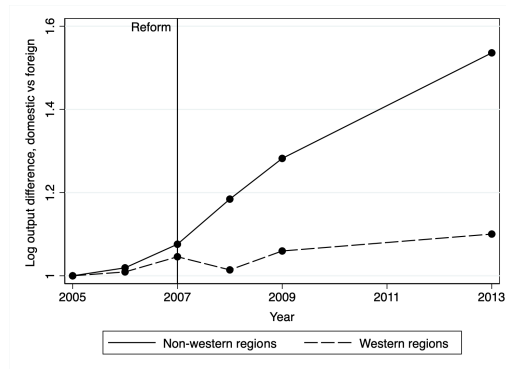
Output differences between domestic and foreign firms

Effective Corporate Tax Rates on Regional Production

- Model-consistent specification:

$$\log X_{j\ell t} = \beta \qquad \log \left(1 - \tilde{\kappa}_{j\ell t}\right) + D_{j\ell} + D_{\ell t} + D_{jt} + \epsilon_{j\ell t}, \qquad (1)$$

  - $X_{j\ell t}$: total revenue of type $j \in \{Foreign, Domestic\}$ firms in region ℓ in year t
  - $\tilde{\kappa}_{j\ell t}$: average effective corporate tax rates of Home/Foreign firms located in the region ℓ in year t

- Instrument net-of-tax rate $\log \left(1 - \tilde{\kappa}_{j\ell t}\right)$ with $Foreign \times West \times Post07$

- Validity of the IV:
  - China's corporate tax reform in 2008 is a universal treatment for all regions
  - The low corporate tax rate in China's western provinces was established by the central government as part of a broad western development strategy in 2001
  - Any confounding factor that biases the IV estimate has to be specific to foreign multinationals in the western provinces of China after 2007

Effective Corporate Tax Rates on Regional Production

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$$\log X_{j\ell t} = \underbrace{\beta^{IV}}_{\text{12.37 (5.43)}} \log\left(1 - \tilde{\kappa}_{j\ell t}\right) + D_{j\ell} + D_{\ell t} + D_{jt} + \epsilon_{j\ell t}, \tag{1}$$

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Empirical Details

A Spatial Model with MP and Local Corporate Taxes

- N home regions indexed by $i = 1, \ldots, N$ and one foreign region indexed by $i = 0$
- Labor is *mobile* across home regions but *immobile* (costly) across countries. Consumer values   Utility fun.

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    - local consumption (CES preference with σ)
    - local amenity levels draw from Fréchet (A_i, η) and migration friction d_{oi}

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- Home and foreign firms with masses $\left\{ M_{j=H/F} \right\}$ engage in monopolistic competition
  - The core productivity $\varphi_j(\omega)$ draws from Pareto (T_j, θ)
  - The vector of production-site-specific productivity $\{z_{j\ell}(\omega)\}_{\ell=0}^{N}$ is drawn independently across firms from a multivariate Fréchet

$$\Pr\left[z_{j0}(\omega) \leq z_0, \ldots, z_{jN}(\omega) \leq z_N\right] = \exp\left\{ -\left(\sum_{\ell=1}^{N} \left[B_\ell z_\ell^{-\epsilon} \right]^{\frac{1}{1-\rho}} \right)^{1-\rho} - B_0 z_0^{-\epsilon} \right\}$$

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local elasticity $= \frac{\epsilon}{1-\rho}$

A Spatial Model with MP and Local Corporate Taxes

- Regions/countries are connected via trade and multi-site production
  - The unit cost for firm ω with type j producing in region ℓ:

$$c_{j\ell}(\omega) = \frac{w_\ell \gamma_{j\ell}}{\varphi_j(\omega) z_{j\ell}(\omega) L_\ell^\alpha}$$

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iceberg MP cost

≥ 0, agglomeration force

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  - The unit cost for firm ω with type j to produce in region ℓ and sell to region n:

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  - Firm with type j producing in region ℓ faces corporate taxes with the rate $\tilde{\kappa}_{j\ell}$

Equiv. to an cost shifter $\kappa_{j\ell} = (1 - \tilde{\kappa}_{j\ell})^{\frac{1}{1-\sigma}}$

A Spatial Model with MP and Local Corporate Taxes

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    - Firm with type j producing in region ℓ faces corporate taxes with the rate $\tilde{\kappa}_{j\ell}$

- Tax and profits distribution
    - Firms' headquarter countries obtain the post-tax profits, which are distributed across Home regions proportional to # firms
    - Tax revenue from each region of China: 40% is distributed equally to local workers and 60% to workers in other parts of the country

Equilibrium and Calibration

- Calibrate the model in relative changes to perform counterfactuals
    - Have guidance on most model parameters, except for ρ ($\frac{\epsilon}{1-\rho}$ informs how sensitive production is across regions within a country when local variable cost changes)
    - The model predicts:

$$\log X_{j\ell} = \frac{\frac{\epsilon}{1-\rho} - (\sigma - 1)}{\sigma - 1} \log(1 - \tilde{\kappa}_{j\ell}) + D_\ell + D_j + u_{j\ell} \qquad (2)$$

    - The IV estimate suggest $\frac{\frac{\epsilon}{1-\rho} - (\sigma-1)}{\sigma-1} = 12.37$. Calibrate $\sigma = 2.94$ (Deng and Wang 2021) we then obtain $\frac{\epsilon}{1-\rho} = 25.82$
    - This elasticity is much larger than that across countries: the estimate is 10.9 in Arkolakis et al. (2018) and 7.69 in Wang (2020)

Counterfactual #1: China's Corporate Tax Reform in 2008

- Counterfactual: starting from the economy in 2007, we change the effective corporate taxes in each province, $(\tilde{\kappa}_{j\ell})_{\ell=1}^{N}$, to their 2013 levels.

Table: Percentage Changes in Aggregate Outcomes of the 2008 Corporate Tax Reform

	GDP			Tax Revenue			Welfare	Theil index
	Total (1)	MNEs (2)	Domestic Firms (3)	Total (4)	MNEs (5)	Domestic Firms (6)	(7)	GDP (8)
National	-0.14	-7.39	3.33	2.83	59.67	-12.68	0.86	-1.05
Coastal & Central	-0.18	-8.15	4.21	4.77	59.90	-11.74	0.83	-1.29
Western	0.17	8.93	-0.91	-13.75	55.35	-19.34	0.93	-0.22

Counterfactual #2: Regional Corporate Tax Competition in China

- Counterfactual: each province maximizes its real income by deciding its local corporate tax rates on domestic and foreign firms, given other provinces' tax rates.
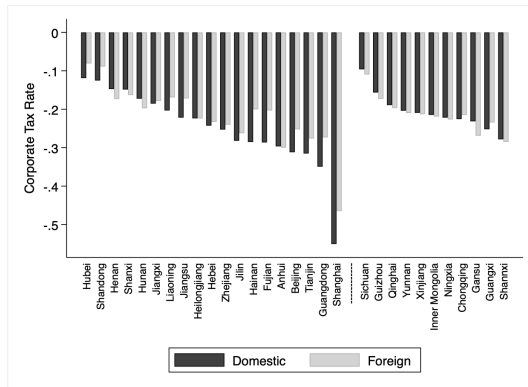

Figure: Nash Equilibrium of Regional Tax Competition in China

Counterfactual #2: Regional Corporate Tax Competition in China

Table: Percentage Changes in Aggregate Outcomes of Regional Tax Competition

	GDP			Tax Revenue			Welfare	Theil index
	Total (1)	MNEs (2)	Domestic Firms (3)	Total (4)	MNEs (5)	Domestic Firms (6)	(7)	GDP (8)
National	7.85	6.51	8.49	-392.09	-531.62	-354.01	-5.56	23.91
Coastal & Central	10.02	5.39	12.58	-392.75	-518.93	-354.94	-4.03	26.97
Western	-6.62	30.68	-11.20	-362.46	-665.30	-337.94	-9.29	-4.69

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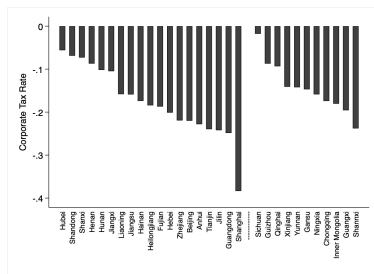
Without Foreign Multinationals

Figure: Nash Equilibrium of Regional Tax Competition

Table: Percent Changes in Aggregate Outcomes

	GDP	Tax Revenue	Welfare	Theil Index
	(1)	(2)	(3)	(4)
National	5.06	-273.10	-2.04	17.71
Coastal & Central	6.58	-272.28	-1.06	20.01
Western	-4.43	-267.98	-4.42	-2.86

Counterfactual #3: The Optimal Corporate Taxes in China

- Counterfactual: China's central government chooses $(\tilde{\kappa}_{j\ell})_{\ell=1}^{N}$ to maximize the population-weighted aggregate welfare changes.
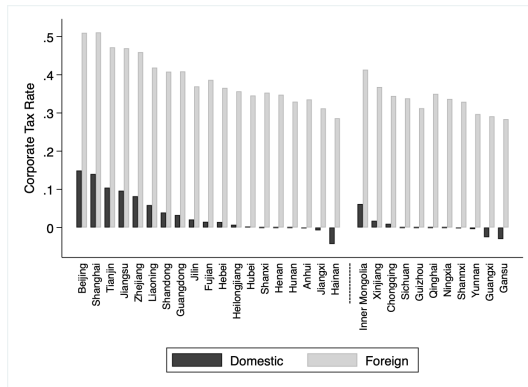

Figure: Optimal Corporate Taxes in China: Fixed Revenue

Counterfactual #3: The Optimal Corporate Taxes in China

Table: Percentage Changes in Aggregate Outcomes of Optimal Taxes: Fixed Revenue

| | GDP | | | Tax Revenue | | | Welfare | Theil index |
| | Total | MNEs | Domestic Firms | Total | MNEs | Domestic Firms | | GDP |
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
National	-2.77	-53.22	21.33	0.00	170.73	-46.60	3.10	-6.54
Coastal & Central	-3.23	-55.39	25.54	6.97	162.90	-39.75	2.78	-7.35
Western	0.27	-6.46	1.10	-56.35	402.19	-93.49	3.88	0.71

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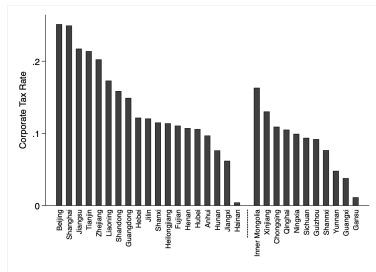
Without Foreign Multinationals


Figure: Optimal Corporate Taxes: Fixed Tax Revenue

Table: Percent Changes in Aggregate Outcomes

	GDP	Tax Revenue	Welfare	Theil index of GDP
	(1)	(2)	(3)	(4)
National	-0.54	0.00	0.06	-3.05
Coastal & Central	-0.71	4.04	0.03	-3.45
Western	0.49	-36.89	0.14	0.02

Conclusion

- We develop a spatial model with multinational presence (MP) and local corporate taxes for policy evaluations.

    1. China's 2008 corporate tax reform shifted MNE production to western provinces and improved aggregate welfare.
    2. Regional corporate tax competition significantly reduces aggregate welfare and magnifies regional inequality.
    3. Optimal corporate tax structure: uniformly high corporate taxes on foreign firms and low taxes on domestic firms; welfare improvement is substantial, as is regional equality.

- The presence of foreign MNEs exacerbates welfare losses from corporate tax competition and increases the gains from optimal taxation.

- (Hopefully) a useful baseline for future work: incentives for subsidizing foreign multinationals, *e.g.*, technology spillovers, input-output linkages, quality advantages, and labor market outcomes.

Thank you!
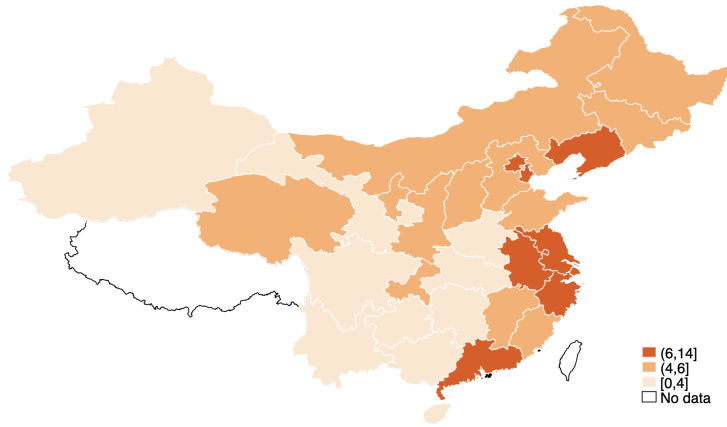
Figure: Corporate Tax Gaps between Domestic and Foreign Firms in China

(Notes: Corporate tax gap is equal to the effective corporate tax rate on domestic firms (in %) minus that on foreign firms. The data is for the year 2007. Data source: Annual Survey of Industrial Firms in China. Back)

FDI and FDI Policies in Developing countries

- FDI inflows to developing countries were about $12.5 billion (25% of the world's total FDI inflows) in 1980 and $837 billion (53%) in 2021.

- The share of FDI in GDP of developing countries increases from about 4.5% in 1980 to 20.4% in 2021.

- In 2021, 87% of measures that were favorable to MNE investment were undertaken in developing countries. In contrast, the majority of the measures (76%) adopted by developed countries introduced or reinforced investment restrictions.

Empirical Results

## Table: Baseline Results

| Dependent var	OLS	Baseline IV			Robustness		
log($X_{j\ell t}$)		Reduced Form	First Stage	Second Stage	Drop SOEs	Diff Sampling	Unbalanced Panel
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Province-level regressions							
log($X_{j\ell t}$)	11.76**			12.37**	13.77*	12.08**	13.19**
	(4.49)			(5.43)	(7.32)	(5.82)	(6.22)
Foreign × West × Post07		0.22***	0.02***				
		(0.07)	(0.01)				
Anderson-Rubin CI				(5.52, 28.36)	(4.54, 37.55)	(4.73, 29.65)	(5.82, 34.83)
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First-stage F stat.				10.19	8.37	9.94	7.89
Kleibergen-Paap stat.				10.22	8.39	9.97	7.92
Observations	360	360	360	360	360	360	370
R-squared	0.97	0.96	0.94	0.97	0.96	0.96	0.97

Notes: Columns (1) shows the OLS results, controlling for province-year, ownership-year, and ownership-western region fixed effects. Columns (2) - (4) report the reduced form and IV estimation results. Columns (5)-(7) report the IV estimation results with the regional output being computed excluding SOEs, using the same sample firms as Brandt et al. (2014), and with an unbalanced panel of data, respectively. When conducting instrumental variable regression, we report the first-stage F-statistic, Kleibergen-Paap statistic, and Anderson-Rubin 90 percent confidence intervals. Robust standard errors are clustered at the province level. *** p<0.01, ** p<0.05, * p<0.1.

Event Study
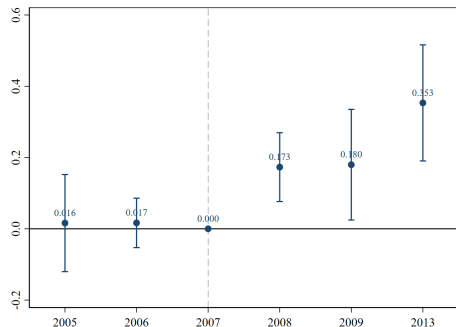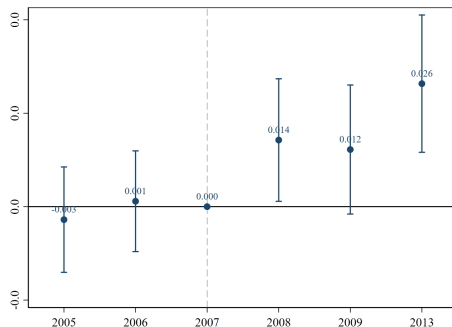
(a) Reduced Form   (b) First Stage

Notes: The points indicate estimated changes in regional output in response to tax changes (panel a) and tax reforms (panel b) in the event study design. The estimates are normalized to be compared with one period before the tax reform, which is displayed as an effect of 0 to aid the visual analysis. The bounds are given from the 90% confidence intervals, where standard errors are clustered at the province level. Note that there are serious quality issues with the ASIF data for 2010-2012; therefore, these years are excluded from all our analyses.

Back

City-level Evidence

Table: City-level Evidence

Dependent var	OLS	Baseline IV			Robustness		
$\log(X_{j\ell t})$		Reduced Form	First Stage	Second Stage	Drop SOEs	Diff Sampling	Unbalanced Panel
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
City-level regressions							
$\log(1 - \tilde{\kappa}_{j\ell t})$	2.78**			10.93**	11.59**	10.89**	15.82**
	(1.08)			(4.82)	(5.43)	(5.17)	(6.81)
Foreign × West × Post07		0.21***	0.02***				
		(0.07)	(0.01)				
Anderson-Rubin CI				(4.65, 22.92)	(4.52, 26.38)	(4.17, 24.55)	(7.49, 36.50)
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First-stage F stat.				13.65	11.15	11.78	9.67
Kleibergen-Paap stat.				13.65	11.16	11.79	9.67
Observations	3,432	3,432	3,432	3,432	3,420	3,420	3,720
R-squared	0.91	0.91	0.83	0.90	0.89	0.90	0.90

Notes: Columns (1) shows the OLS results, controlling for city-year, ownership-year, and ownership-western city fixed effects. Columns (2) - (4) report the reduced form and IV estimation results. Columns (5)-(7) report the IV estimation results with the regional output being computed excluding SOEs, using the same sample firms as Brandt et al. (2014), and with an unbalanced panel of data, respectively. When conducting instrumental variable regression, we report the first-stage F-statistic, Kleibergen-Paap statistic, and Anderson-Rubin 90 percent confidence intervals. Robust standard errors are clustered at the city level. *** p<0.01, ** p<0.05, * p<0.1.

Additional Robustness

Table: Additional Robustness

Dependent var	Province-level Estimates					
$\log(X_{j\ell t})$	Financial Crisis (1)	Infrastructure (2)	Fiscal Stimulus (3)	Δ FDI Policy (4)	Anticipation (5)	Survey Threshold (6)
$\log(1-\tilde{\kappa}_{j\ell t})$	27.17***	27.31***	11.72**	11.69*	12.45**	12.05*
	(9.61)	(9.44)	(5.19)	(5.82)	(5.33)	(6.07)
Finance× Foreign × Post07	27.11***					
	(8.84)					
Construction× Foreign × Post07		13.23***				
		(4.09)				
$Credit$ × Foreign × Post09			0.28			
			(0.30)			
FDI^+ × Foreign × Post07				-2.22		
				(3.86)		
FDI^- × Foreign × Post07				-10.43*		
				(5.70)		
Anderson-Rubin CI	(15.07, 51.74)	(15.42, 51.44)	(4.79, 26.18)	(3.48, 28.32)	(6.15, 30.14)	(4.86, 33.16)
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes
First-stage F stat.	10.29	10.13	8.94	4.34	9.15	8.05
Kleibergen-Paap stat.	14.18	13.35	10.99	8.63	9.21	8.07
Observations	360	360	360	360	180	360
R-squared	0.96	0.96	0.97	0.97	0.96	0.96

Extensive vs. Intensive Margin Adjustments

Figure: Extensive vs. Intensive Margin Adjustments

(a) Extensive Margin   (b) Intensive Margin
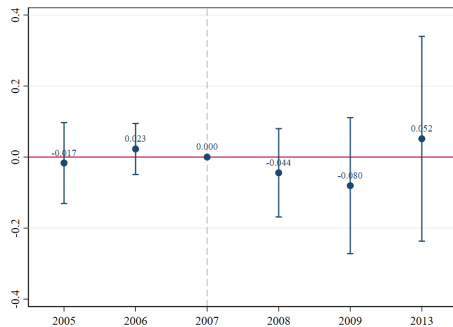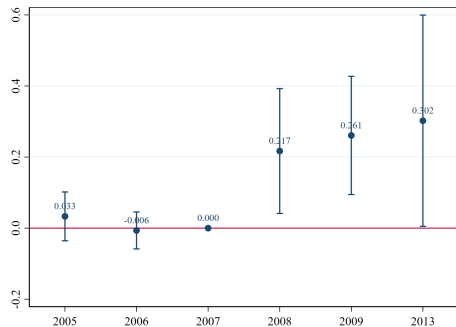
Data for Empirical Estimation

- Annual Survey of Industrial Enterprises (ASIF)
    - contains detailed firm-level information, including location, ownership, and accounting information, such as sales, employment, capital stock, material inputs, payroll, and exports

    - allows us to measure the total firm output and the effective corporate tax rate

    - We use this data for the years 2005–2013, with years 2010-2012 being excluded for a well-known quality issues

- Effective corporate tax rate at the firm level

$$\text{effective corporate tax rate} = \frac{\text{income tax payable}}{\text{profit before tax}}$$

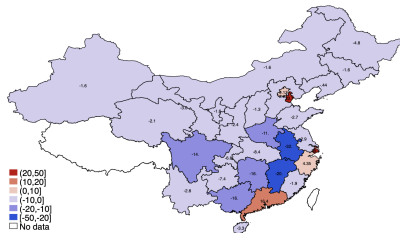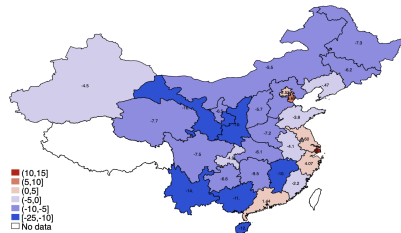Then take simple average to get $\tilde{\kappa}_{j\ell t}$
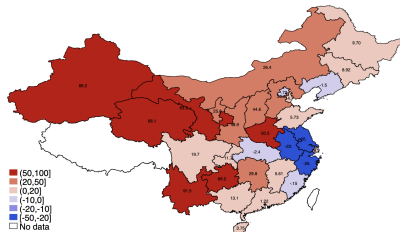
(c) MNEs Production
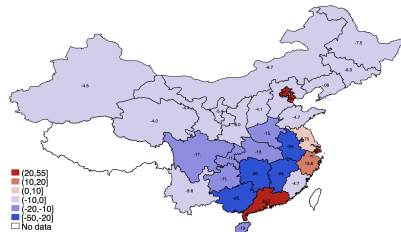
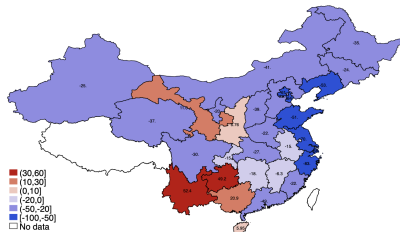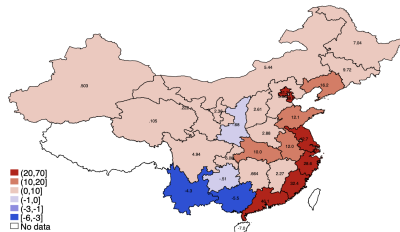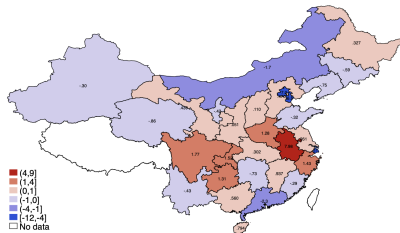(d) Domestic-firm Production

(e) GDP

(f) Welfare

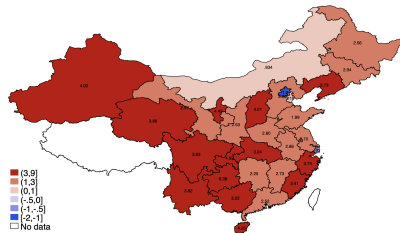# Counterfactual #3: The Optimal Corporate Taxes in China: Fixed Tax Revenue

(a) MNEs Production

(b) Domestic-firm Production

(c) GDP

(d) Welfare

Counterfactual #1: China's Corporate Tax Reform

Table: Model Fit of Variation Across Provinces

Actual changes	Regional Shares			MNEs Regional Shares			MNEs Local Contribution		
	Output (1)	Tax Revenue (2)	Export (3)	Output (4)	Tax Revenue (5)	Export (6)	Output (7)	Tax Revenue (8)	Export (9)
Model prediction	2.73*	0.78***	1.24**	1.50***	0.20	0.20	0.77**	0.48**	0.70**
	(1.51)	(0.28)	(0.49)	(0.24)	(0.34)	(0.16)	(0.30)	(0.23)	(0.29)
Observations	30	30	30	30	30	30	30	30	30
R-squared	0.10	0.21	0.18	0.57	0.01	0.05	0.19	0.13	0.17

Notes: This table regresses observed changes in the data for the period 2007 - 2013 on the model's predicted changes after the tax reform. The first three columns examine respectively the changes in provincial shares of national output, tax revenues, and exports. Columns (4)-(6) examine respectively the changes in provincial shares of national output, tax revenues, and exports generated by MNEs. Columns (7)-(9) examine the changes in the share of multinational firms in regional output, tax revenue, and exports, respectively. All regressions are weighted by the initial-period outcome variables. Standard errors are in parentheses.

Counterfactual #1: China's Corporate Tax Reform

- Counterfactual: starting from the economy in 2007, we change the effective corporate taxes in each province, $(\tilde{\kappa}_{j\ell})_{\ell=1}^{N}$, to their 2013 levels.

Table: The Effects of the Tax Reform: Illustrative Examples

	Shanghai Domestic (1)	Shanghai Foreign (2)	Chongqing Domestic (3)	Chongqing Foreign (4)
Tax rate before reform	14.19	7.29	10.01	6.75
Tax rate after reform	13.72	13.24	8.35	8.36
Changes %	-0.47	5.95	-1.66	1.61
Local output of foreign firms	-1.19	-18.38	-10.38	-10.47
Local output of domestic firms	1.51	13.71	3.19	2.72
Local tax revenue from foreign firms	-1.48	49.01	-10.58	10.87
Local tax revenue from domestic firms	-2.15	14.33	-14.11	2.76
Local Welfare	0.13	-0.10	0.12	-0.02
National output of foreign firms	-0.08	-1.91	-0.01	-0.02
National output of domestic firms	0.09	0.72	0.01	0.01
National tax revenue from foreign firms	-0.14	17.17	-0.01	0.12
National tax revenue from domestic firms	-0.54	0.76	-0.17	0.00
National Welfare	0.00	0.22	0.00	0.00