The Ripple Effects of Global Tax Reform on the U.S. Economy

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Motivation

Introduction

Multinational Enterprises (MNEs) shift large portions of their profits to tax havens, reducing tax revenues in their home countries by hundreds of billions of dollars per year

- Tørsløv et al. (2022): 36% of global MNE profits shifted to tax havens
- OECD: $240 bn. (10%) of global corporate tax revenues lost annually

In October 2021, 136 countries representing 90% of global GDP signed onto historic policy framework designed by OECD/G20 to address profit shifting

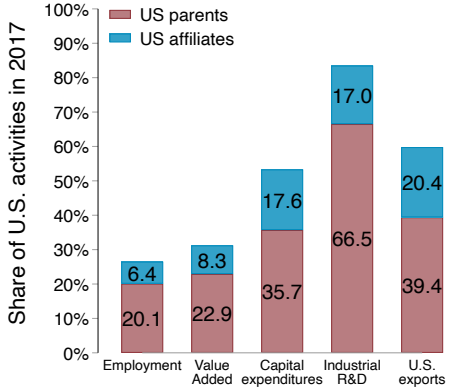
- Pillar 1: Sales-based allocation of profit taxation rights
- Pillar 2: Global minimum corporate income tax (GMT)

Since then:

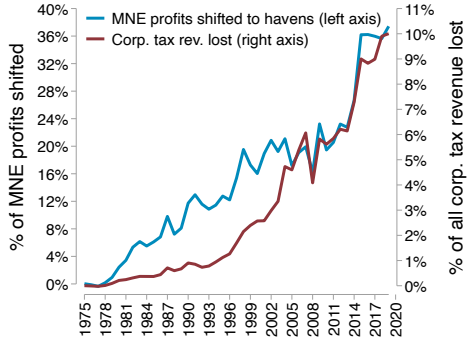
- EU has implemented GMT starting from January 1, 2024
- Many countries followed, e.g. Australia, South Korea, Japan
- No progress on either pillar in the US; home to the largest share of MNEs globally

Importance of MNEs and profit shifting in the United States

Introduction



(a) Importance of MNEs



(b) Rise of profit shifting

What we do

Introduction

1. Develop a quantitative framework to study the effects of the GMT on the US economy.

   → Incorporate profit shifting through transfer of the property rights to intangible capital
   → Incorporate MNEs related provisions introduced by the Tax Cuts and Jobs Act (TCJA) and their interactions with the profit shifting
   → Incorporate spillovers associated with intangible capital production technology

2. Conduct a series of experiments:

   → All but US introduce GMT: with and without spillovers
   → Only US introduces GMT: with and without spillovers
   → All including US introduce GMT: with and without spillovers
   → The macro effects of TCJA's provisions applying to MNEs

Key takeaways

Introduction

1. Local corporate income tax reforms can have global, **ripple macroeconomic effects**:

   → The channel is through nonrival intangible capital and spillovers
   → Other countries introduce GMT: negative effect for the US
   → US introducing GMT: negative effect for the US and everyone else

2. Contrast with GILTI provision of TCJA

   → Similar effects on profit shifting as GMT, but smaller ripple effect
   → Negative effects on intangible investment offset by positive effects on tangible investment in foreign subsidiaries; consistent with **Chodorow-Reich et.al. (2024)**
   → Net effect is small gain in global output. Amplified by spillovers.

The Model

Environment overview

- Standard multi-country GE model:
  - → Five regions: US, Europe, Rest of the World, Low Tax (LT), Tax Haven (TH)
  - → Representative consumers with standard preferences choosing consumption, labor and tangible investment.
  - → Aggregator: nontradable final goods
  - → Tradable, country-specific intermediate goods
  - → Governments collect corporate tax revenues and rebate it back to the consumers.

- Add multinational enterprises:
  - → Intangible capital as in (**McGrattan and Prescott (2009**; **2010)**) with spillover externality
  - → Theory of transfer pricing and profit shifting as in (**Dyrda et al. (2022)**)
  - → Detailed representation of the MNE-related provisions of TCJA

Intermediate Goods Producers: Technology

- Each productive region i has a unit measure Ω_i of firms that compete monopolistically.
- A firm from region i produces in any productive region j according to:

$$y_{ij} = \sigma_{ij} A_j a \left(N_j z\right)^{\phi} k_j^{\alpha} \ell_j^{\gamma}.$$

where z is nonrival, within MNE, intangible capital, $\sigma_{ij} \in [0,1]$ are FDI barriers (McGrattan and Prescott, 2010) and a is idiosyncratic productivity.

- The firm's resource constraints:

$$y_{ii} = q_{ii} + \sum_{j \in J_X} \xi_{ij} q_{ij}^X,$$

$$y_{ij} = q_{ij},\ j \in J_F,$$

where

→ ξ_{ij}: iceberg transportation cost for each unit of goods shipped abroad.
→ q_{ij}^X: exported goods
→ q_{ii}: goods that are produced and consumed in the same location
→ $J_X \subseteq I \setminus \{i\}$: set of export destinations, $J_F \subseteq I \setminus \{i\}$: set of regions with foreign affiliates

Production of Intangible Capital

- The intangible capital z is produced according to:

$$z_i = aA_i l_i^z \cdot \left(\sum_{j \neq i} \int_{\Omega_{ji}} z_j(\omega)\, d\omega \right)^{\nu}$$

  where
  - $\rightarrow$ l_i^z: the measure of R&D workers
  - $\rightarrow$ $\sum_{j \neq i} \int_{\Omega_{ji}} z_j(\omega)\, d\omega$: the total amount of foreign intangible capital used in country i
  - $\rightarrow$ ν: spillover elasticity

- Empirical evidence on significant backward spillovers to upstream industries: **Javorcik (2004)**, forward spillovers to downstream industries: **Liu (2008)**

Stage 2: Operating pre-tax profits

- The domestic parent corporation's profits are

$$\pi_i^D(a,z;J_X) = \max_{q_{ii},\{q_{ij}^X\}_{j\in J_X},\ell_i,k_i} \left\{ p_{ii}(q_{ii})q_{ii} + \sum_{j\in J_X} p_{ij}(q_{ij}^X)q_{ij}^X - W_i\ell_i - \delta P_i k_i \right\}$$
$$\text{s.t} \quad q_{ii} + \sum_{j\in J_X} \xi_{ij} q_{ij} = y_{ii}$$

- Foreign subsidiaries' profits are

$$\pi_{ij}^F(a,z) = \max_{q_{ij},\ell_j,k_j} \; p_{ij}(q_{ij})q_{ij} - W_j\ell_j - \delta P_j k_j, \; j \in J_F.$$

Stage 1: Locations, intangible capital and profit shifting.

MNE maximizes dividends:

$$d_i(a) = \max_{\substack{z, J_X, J_F, \\ \boldsymbol{\lambda} \in \Gamma}} \Big\{ (1-\tau_i)\pi_{ii} + \sum_{j \in J_F \setminus \{LT\}} (1-\tau_j)\pi_{ij} + (1-\tau_{LT})\pi_{i,LT} 1_{\{LT \in J_F\}} + (1-\tau_{TH})\pi_{i,TH} 1_{\{\lambda_{TH}>0\}} - T_i^{GILTI} 1_{\{i=US\}} - \sum_{j \in J_F \cup \{i\}} r_j k_j \Big\}$$

subject to

$$\Gamma = \left\{ \boldsymbol{\lambda} \in [0,1]^2 : \lambda_{LT} + \lambda_{TH} \leq 1 \right\}.$$

where:

- $\boldsymbol{\lambda} = (\lambda_{LT}, \lambda_{TH})$: shares of rights to intangible capital sold to LT and TH
- π_{ii}: taxable profits of the parent division
- π_{ij}: taxable profits of affiliates in other high-tax regions
- $\pi_{i,LT}$: taxable profits of the low-tax affiliate
- $\pi_{i,TH}$: taxable profits of the tax-haven affiliate
- T_i^{GILTI}: Global Intangible Low-Taxed Income tax liability for the U.S. MNEs

Taxable profits: parent division

$$\pi_{ii} = \pi_i^D(a,z;J_X) - W_i \overbrace{\left(l_i^z + \sum_{j\in J_X} \kappa_{ij}^X + \sum_{j\in J_F} \kappa_{ij}^F + \kappa_{iTH} 1_{\{\lambda_{TH}>0\}} \right)}^{\text{Costs of intangible capital production and fixed costs}}$$
$$+ \overbrace{\left(\varphi_{iLT}\lambda_{LT} + \varphi_{iTH}\lambda_{TH}\right)\nu_i(z)z}^{\text{Proceeds from selling } z} + \overbrace{\sum_{j\in J_F}(1-\lambda_{LT}-\lambda_{TH})\vartheta_{ij}(z)z}^{\text{Licensing fee receipts}} - \overbrace{(\lambda_{LT}+\lambda_{TH})\vartheta_{ii}(z)z}^{\text{Licensing fee payments}}$$
$$- \overbrace{W_i \mathcal{C}_i(\lambda_{LT},\lambda_{TH})\nu_i(z)z}^{\text{Cost of transferring } z}.$$

where:

- κ_i^X: a fixed cost to export domestically produced goods
- κ_i^F: a fixed cost to open a foreign affiliate and produce locally
- $\vartheta_{ij}(z)z \equiv \phi p_{ij} y_{ij}/z$: licensing fee of a subsidiary in region j
- $\nu_i(z)z \equiv \sum_{j\in J_F\cup\{i\}} \vartheta_{ij}(z)z$: total amount of licensing fees across the conglomerate
- $\varphi_{iLT}, \varphi_{iTH}$: markdowns (mispricing) on selling rights to intangible capital

Taxable profits: foreign subsidiaries, LT and TH

- Foreign subsidiary j:

$$\pi_{i,j} = \pi^F_{ij}(a,z) - \underbrace{\vartheta_{ij}(z)z}_{\text{Licensing fee}}.$$

- Low Tax (LT) region:

$$\pi_{i,LT} = \pi^F_{i,LT}(a,z) - \underbrace{\varphi_{iLT}\lambda_{LT}\nu_i(z)z}_{\text{Cost of buying } z} + \overbrace{\sum_{j\in J_F\cup\{i\}\setminus\{LT\}} \lambda_{LT}\vartheta_{ij}(z)z}^{\text{Licensing fee receipts}} - \underbrace{(1-\lambda_{LT})\vartheta_{iLT}(z)z}_{\text{Licensing fee payment}}$$

- Tax Haven (TH) :

$$\pi_{i,TH} = \underbrace{\sum_{j\in J_F\cup\{i\}} \lambda_{TH}\vartheta_{ij}(z)z}_{\text{Licensing fee receipts}} - \underbrace{\varphi_{iTH}\lambda_{TH}\nu_i(z)z}_{\text{Cost of buying } z}.$$

Global intangible low-taxed income (GILTI)

- The GILTI tax base

$$\pi_{US}^{GILTI} \equiv \underbrace{\theta^{GILTI}}_{\substack{\text{tax base adjustment} \\ \theta^{GILTI} = 50\%:}} \times \sum_j \left(\pi_{USj} - \underbrace{\theta^{QBAI} \times P_j k_j}_{\substack{\text{tax exemption for} \\ \text{tangible assets base} \\ \text{with } \theta^{QBAI} = 10\%}} \right)$$

- GILTI tax liability paid by the U.S. shareholders:

$$T_{US}^{GILTI} \equiv \underbrace{\tau_{US} \times \pi_{US}^{GILTI}}_{\substack{\text{U.S. tax rate} \\ \text{applied to GILTI base}}} - \min \left\{ \underbrace{\theta^{DPFT} \times \sum_j (\tau_j \times \pi_{USj})}_{\substack{\text{Deemed paid foreign taxes (DPFT)} \\ \text{where } \theta^{DPFT} = 80\%}}, \underbrace{\tau_{US} \times \left(\pi_{US}^{GILTI} - \sum_j x_{USj} \right)}_{\substack{\text{Foreign tax credit limitation} \\ x_{USj}\text{: U.S. expenses allocated} \\ \text{to the subsidiary in j}}} \right\}$$

GILTI and share of shifted property rights λ_{LT}

Impose the cost function $\mathcal{C}(\lambda) = \lambda + (1-\lambda)\log(1-\lambda)$ per unit value of z transferred. Then:

- Without GILTI:

$$\lambda_{LT} = 1 - \exp\left(\frac{(\tau_{US} - \tau_{LT})(1-\varphi_{LT})}{(1-\tau_{US})W_{US}}\right)$$

  → $\lambda_{LT} \searrow$ in LT tax rate τ_{LT}
  → $\lambda_{LT} \searrow$ in mispricing the intangible capital φ_{LT}

- With GILTI:

$$\lambda_{LT} = 1 - \exp\left(\frac{\left(\left(1-\theta^{GILTI}\right)\tau_{US} - \left(1-\theta^{DPFT}\right)\tau_{LT}\right)(1-\varphi_{LT})}{(1-\tau_{US})W_{US}}\right)$$

  → $\lambda_{LT} \searrow$ in the GILTI tax base adjustment θ^{GILTI}
  → $\lambda_{LT} \nearrow$ in how much GILTI rules allow for deducting foreign tax payments θ^{DPFT}

Global Minimum Corporate Income Tax (GMT) in the Model

- If firm from i reports profits in j with $\tau_j < \tau_{GMT} = 15\%$, then i taxes these profits at rate $\tau_{GMT} - \tau_j$
- Does not require tax havens to change their tax rates or affect their tax revenues (unless firms react by shifting fewer profits). Parent corporate in i just pays larger tax bill.
- Share of shifted property rights:

$$\lambda_i = 1 - \exp\left(\frac{(\tau_i - \max(\tau_{GMT}, \tau_{LT}))(1 - \varphi_{LT})}{(1 - \tau_i) W_i}\right)$$

- Additional revenue for i is

$$\tilde{R}_i = \sum_{j=1}^{N} \int_{\Omega_i} \max\left[(\tau_{GMT} - \tau_j), 0\right] \pi_j(\omega)\, d\omega$$

Experiments

GMT: All regions except US (with spillovers)

Experiments

Region	Lost profits (benchmark = 1)	Corp. tax rev. (% chg.)	Value added (% chg.)				Intangible capital (% chg.)		
			Total	Non MNEs	Domestic MNEs	Foreign MNEs	Total	Non MNEs	Domestic MNEs
USA	1.00	-0.03	-0.09	-0.08	-0.08	-0.16	-0.05	-0.09	-0.05
Europe	0.29	2.92	-0.05	0.02	-0.13	-0.03	-0.39	0.01	-0.43
Rest of world	0.24	1.30	-0.06	-0.03	-0.08	-0.09	-0.20	-0.03	-0.21
Low tax	0.56	-6.68	0.00	0.31	0.04	-0.51	0.14	0.36	0.11

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Domestic MNEs in Europe and Rest of the World reduce their intangible capital.

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The opposite is true for the LT region. MNEs there benefit from cheaper inputs.

GMT: All regions except US (with spillovers)

Experiments

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Europe	0.29	2.92	-0.05	0.02	-0.13	-0.03	-0.39	0.01	-0.43
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Low tax	0.56	-6.68	0.00	0.31	0.04	-0.51	0.14	0.36	0.11

Profits flow back to Europe and RoW. Corporate tax revenues rise in EU and RoW, fall in LT.

GMT: All regions except US (with spillovers)

Experiments

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Europe	0.29	2.92	-0.05	0.02	-0.13	-0.03	-0.39	0.01	-0.43
Rest of world	0.24	1.30	-0.06	-0.03	-0.08	-0.09	-0.20	-0.03	-0.21
Low tax	0.56	-6.68	0.00	0.31	0.04	-0.51	0.14	0.36	0.11

The negative effects ripple to the US economy through the FDI spillovers.

GMT: All regions except US (without spillovers)

Experiments

Region	Lost profits (benchmark = 1)	Corp. tax rev. (% chg.)	Value added (% chg.)				Intangible capital (% chg.)		
			Total	Non MNEs	Domestic MNEs	Foreign MNEs	Total	Non MNEs	Domestic MNEs
USA	1.00	-0.01	-0.00	0.00	0.01	-0.07	0.02	0.00	0.02
Europe	0.29	2.97	0.01	0.07	-0.08	0.05	-0.34	0.07	-0.38
Rest of world	0.24	1.32	0.01	0.04	-0.02	0.01	-0.13	0.05	-0.15
Low tax	0.56	-6.64	0.10	0.42	0.16	-0.45	0.26	0.49	0.23

GMT: All regions except US (without spillovers)

Experiments

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USA	1.00	-0.01	-0.00	0.00	0.01	-0.07	0.02	0.00	0.02
Europe	0.29	2.97	0.01	0.07	-0.08	0.05	-0.34	0.07	-0.38
Rest of world	0.24	1.32	0.01	0.04	-0.02	0.01	-0.13	0.05	-0.15
Low tax	0.56	-6.64	0.10	0.42	0.16	-0.45	0.26	0.49	0.23

Similar impact in Europe, RoW and LT on intangible capital, lost profits and tax revenues.

GMT: All regions except US (without spillovers)

Experiments

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USA	1.00	-0.01	-0.00	0.00	0.01	-0.07	0.02	0.00	0.02
Europe	0.29	2.97	0.01	0.07	-0.08	0.05	-0.34	0.07	-0.38
Rest of world	0.24	1.32	0.01	0.04	-0.02	0.01	-0.13	0.05	-0.15
Low tax	0.56	-6.64	0.10	0.42	0.16	-0.45	0.26	0.49	0.23

Without spillovers almost no impact on the US.

The macro effect (?) of GILTI.

Experiments

Region	Lost profits (benchmark = 1)	Corp. tax rev. (% chg.)	Value added (% chg.)				Intangible capital (% chg.)		
			Total	Non MNEs	Domestic MNEs	Foreign MNEs	Total	Non MNEs	Domestic MNEs
USA	0.84	1.01	0.02	0.03	0.01	0.03	0.03	0.02	0.03
Europe	1.00	0.00	0.02	0.02	0.02	0.01	-0.00	0.00	-0.00
Rest of world	1.00	0.00	0.02	0.02	0.02	0.01	0.00	0.00	0.00
Low tax	1.00	-0.02	0.07	0.11	-0.02	0.09	-0.02	0.05	-0.03

The macro effect (?) of GILTI.

Experiments

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Europe	1.00	0.00	0.02	0.02	0.02	0.01	-0.00	0.00	-0.00
Rest of world	1.00	0.00	0.02	0.02	0.02	0.01	0.00	0.00	0.00
Low tax	1.00	-0.02	0.07	0.11	-0.02	0.09	-0.02	0.05	-0.03

The macro effects of GILTI per se are limited. Two counteracting forces.

The macro effect (?) of GILTI.

Experiments

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Rest of world	1.00	0.00	0.02	0.02	0.02	0.01	0.00	0.00	0.00
Low tax	1.00	-0.02	0.07	0.11	-0.02	0.09	-0.02	0.05	-0.03

GILTI dampens the after-tax rate of return on intangible investment ...

The macro effect (?) of GILTI.

Experiments

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Rest of world	1.00	0.00	0.02	0.02	0.02	0.01	0.00	0.00	0.00
Low tax	1.00	-0.02	0.07	0.11	-0.02	0.09	-0.02	0.05	-0.03

... but incentivizes tangible investment abroad. The second channel together with spillovers dominates.

GMT: All regions including US (with spillovers)

Experiments

Region	Lost profits (benchmark = 1)	Corp. tax rev. (% chg.)	Value added (% chg.)				Intangible capital (% chg.)		
			Total	Non MNEs	Domestic MNEs	Foreign MNEs	Total	Non MNEs	Domestic MNEs
USA	0.47	1.09	-0.15	-0.10	-0.17	-0.23	-0.30	-0.04	-0.33
Europe	0.29	2.89	-0.14	-0.07	-0.21	-0.15	-0.41	-0.02	-0.45
Rest of world	0.24	1.28	-0.19	-0.17	-0.20	-0.19	-0.24	-0.10	-0.25
Low tax	0.50	-7.65	-0.10	0.26	-0.02	-0.71	0.16	0.38	0.13

GMT: All regions including US (with spillovers)

Experiments

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Rest of world	0.24	1.28	-0.19	-0.17	-0.20	-0.19	-0.24	-0.10	-0.25
Low tax	0.50	-7.65	-0.10	0.26	-0.02	-0.71	0.16	0.38	0.13

With the US on board GMT and spillovers reduce global output across the world, through reduction of intangible capital.

GMT: All regions including US (with spillovers)

Experiments

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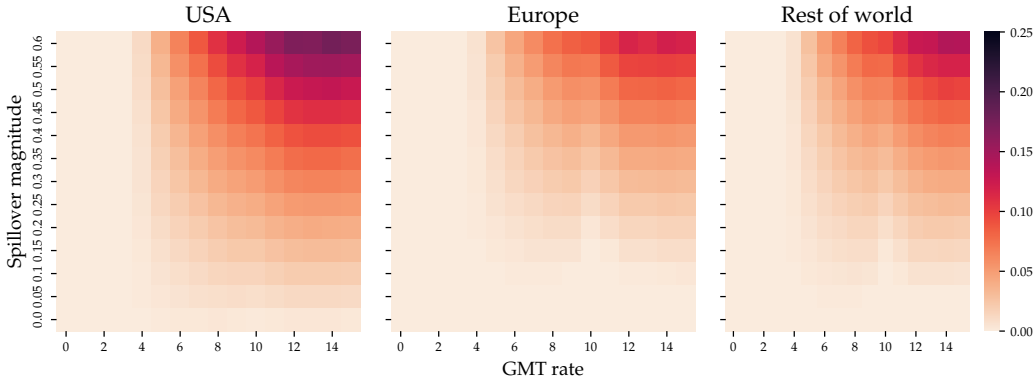
Rest of world	0.24	1.28	-0.19	-0.17	-0.20	-0.19	-0.24	-0.10	-0.25
Low tax	0.50	-7.65	-0.10	0.26	-0.02	-0.71	0.16	0.38	0.13

Though it curbs profit shifting significantly and brings back revenues to high tax jurisdictions.

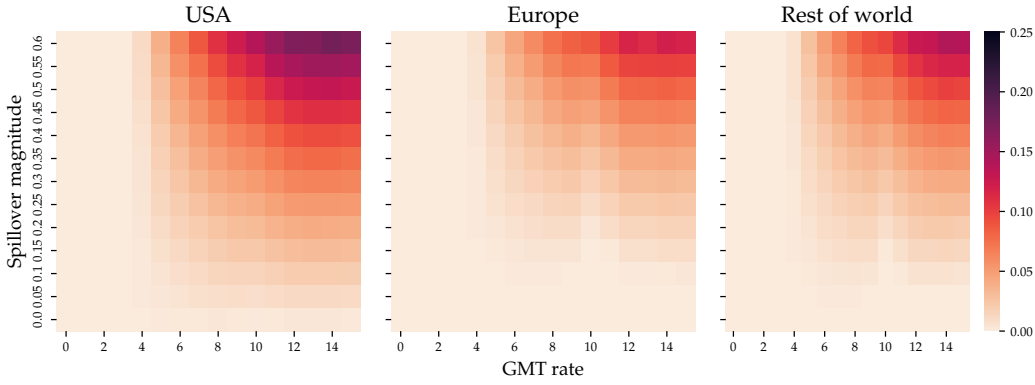
Real GDP Change: All but US introduce GMT

Experiments



Real GDP Change: All but US introduce GMT

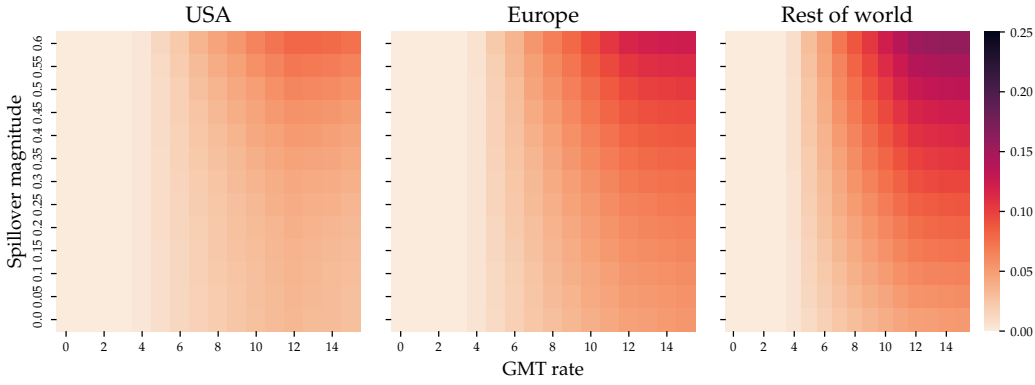
Experiments



The larger the spillovers the more the negative effect ripples through to the US economy.

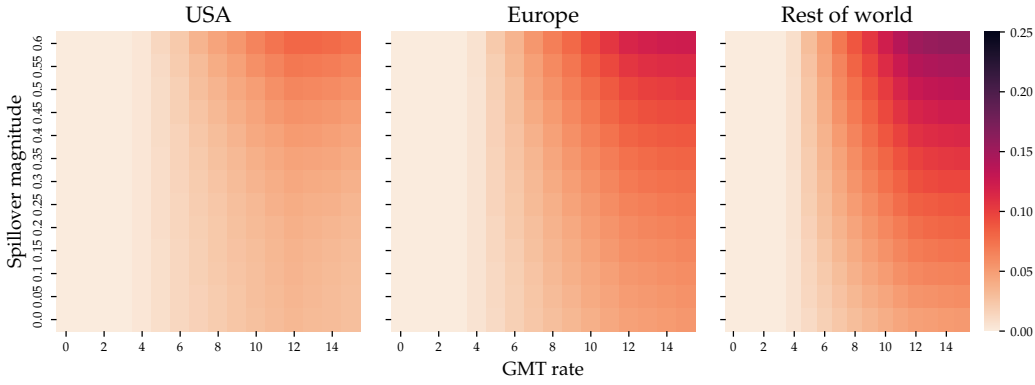
Real GDP Change: US only introduces GMT

Experiments



Real GDP Change: US only introduces GMT

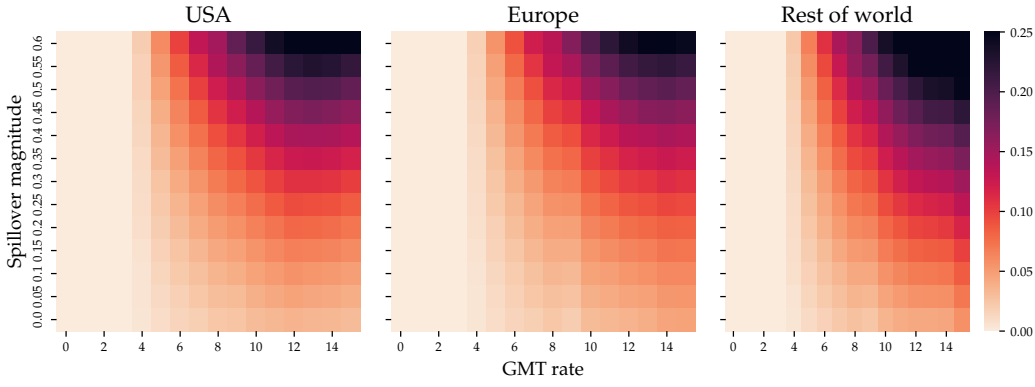
Experiments



The effect is actually stronger than if US would unilaterally introduce GMT.

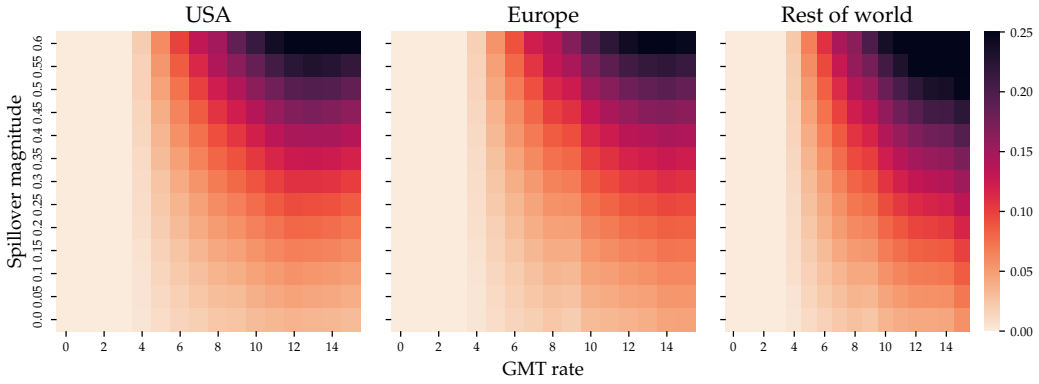
Real GDP Change: All regions including US introduce GMT

Experiments



Real GDP Change: All regions including US introduce GMT

Experiments



Spillovers amplify the effects of the GMT across the world.

Conclusions

1. Corporate tax reforms have ripple macro effects in modern economy due to importance of nonrival intangible capital, profit shifting and spillovers.

2. Even if the US abstains from GMT implementation it will still experience its negative impact without curbing profit shifting and increasing tax revenues.

3. GILTI had limited macroeconomic impact due to counteracting investment incentives.

Additional Slides

Households: preferences and budgets

- In each region i representative household solves:

$$\max_{\{C_{it},L_{it},X_{it},B_{it+1}\}_{t=0}^{\infty}} \sum_{t=0}^{\infty} \beta^t \left[\log\left(\frac{C_{it}}{N_i}\right) + \psi_i \log\left(1 - \frac{L_{it}}{N_i}\right) \right].$$

  where C_{it} is consumption, L_{it} is labor supply.

- Budget constraint:

$$P_{it}[C_{it} + X_{it}] + P_{bt}B_{it+1} = W_{it}L_{it} + R_{it}K_{it} + B_{it} + D_{it} + T_{it},$$

  where X_{it} is tangible investment and B_{it+1} are internationally-traded bonds, D_{it} dividends of MNEs headquartered in i, and T_{it} are lump sum transfers.

  The law of motion for tangible capital:

$$K_{it+1} = (1 - \delta)K_{it} + X_{it},$$

Final Goods Producers

In each region i representative final-good producer that combines domestic and foreign products into a nontradable aggregate:

$$Q_{it} = \left[\sum_{j=1}^{J} \int_{\Omega_{jit}} q_{jit}(\omega)^{\frac{\varrho-1}{\varrho}} d\omega \right]^{\frac{\varrho}{\varrho-1}},$$

where $q_{jit}(\omega)$ is the quantity of variety ω from region j, Ω_{jit} is the set of goods from j available in i (determined by firms' exporting and FDI decisions specified later).

The aggregate price index is:

$$P_{it} = \left[\sum_{j=1}^{J} \int_{\Omega_{jit}} p_{jit}(\omega)^{1-\varrho} d\omega \right]^{\frac{1}{1-\varrho}}$$

Aggregation and accounting measures: GDP and Goods trade

- Gross domestic product:

$$GDP_i = \sum_{j=1}^{I} \int_{\omega \in \Omega_j, i \in J_F(\omega)} p_{ji}(\omega) y_{ji}(\omega)\, d\omega.$$

- Goods trade:

$$EX_i^G = \sum_{j \neq i} \int_{\Omega_i} p_{ij}^X(\omega)\,(1+\xi_{ij})\, q_{ij}^X(\omega)\, d\omega,$$

$$IM_i^G = \sum_{j \neq i} \int_{\Omega_j} p_{ji}^X(\omega)\,(1+\xi_{ji})\, q_{ji}^X(\omega)\, d\omega.$$

Aggregation and accounting measures: Services trade

- High-tax regions' services:

$$EX_i^S = \sum_{j \neq i} \int_{\Omega_i} \left[1 - \lambda_{LT}(\omega) - \lambda_{TH}(\omega))\right] \vartheta_{ij}(\omega) z(\omega)\, d\omega + \int_{\Omega_i} \varphi_i(\lambda_{LT}(\omega) + \lambda_{TH}(\omega)) \nu_i(\omega) z(\omega)\, d\omega$$

$$IM_i^S = \sum_{j \neq i} \int_{\Omega_i} \left[\lambda_{LT}(\omega) + \lambda_{TH}(\omega)\right] \vartheta_{ij}(\omega) z(\omega)\, d\omega + \sum_{j \neq i} \int_{\Omega_j} \vartheta_{ji}(\omega) z(\omega)\, d\omega.$$

- The low-tax region's services:

$$EX_{LT}^S = \sum_{j \neq i} \int_{\Omega_i} \left[1 - \lambda_{TH}(\omega)\right] \vartheta_{ij}(\omega) z(\omega)\, d\omega + \sum_{j \neq i} \int_{\Omega_j} \lambda_{LT} \vartheta_{ji}(\omega) z(\omega)\, d\omega,$$

$$IM_{LT}^S = \sum_{j \neq i} \int_{\Omega_i} \lambda_{TH}(\omega) \vartheta_{ij}(\omega) z(\omega)\, d\omega + \sum_{j \neq i} \int_{\Omega_j} \left[1 - \lambda_{LT}(\omega)\right] \vartheta_{ji}(\omega) z(\omega)\, d\omega +$$
$$\sum_{j \neq i} \int_{\Omega_j} \varphi_j \lambda_{LT}(\omega) \nu_j(\omega) z(\omega)\, d\omega.$$

Market clearings

- Labor market:

$$L_i = \overbrace{\sum_{j=1}^{I} \int_{\Omega_j} \ell_{ji}(\omega)\, d\omega}^{\text{goods production}} + \overbrace{\int_{\Omega_i} l_i^z\, d\omega}^{z \text{ production}} + \overbrace{\int_{\Omega_i} \left(\sum_{j \in J_X(\omega)} \kappa_i^X + \sum_{j \in J_F(\omega)} \kappa_i^F + 1_{\{\lambda_{TH}(\omega) > 0\}} \kappa_i^{TH} \right) d\omega}^{\text{fixed costs}}$$
$$+ \underbrace{\int_{\Omega_i} \mathcal{C}_i(\lambda_{LT}, \lambda_{TH}) \nu(\omega) z(\omega)\, d\omega}_{\text{costs of shifting } z}.$$

- Capital market:

$$K_i = \sum_{j=1}^{I} \int_{\Omega_j} k_{ji}(\omega)\, d\omega$$

- Government budget constraint:

$$T_i = \tau_i \sum_{j=1}^{I} \int_{\Omega_j} \pi_{ji}(\omega)\, d\omega.$$

Market clearings

- Balance of payments:

$$EX_i^G + EX_i^S - IM_i^G - IM_i^S + NFR_i - NFP_i = 0.$$

where:

$$NFR_i = \sum_{j \neq i} \int_{\Omega_i} (1 - \tau_j) \pi_{ij}(\omega) \, d\omega,$$

$$NFP_i = \sum_{j \neq i} \int_{\Omega_j} (1 - \tau_i) \pi_{ji}(\omega) \, d\omega.$$

are net factor receipts from (payments to) foreigners.

Taking the Model to the Data

Calibration

Taking the Model to the Data

Aggregate countries into 5 regions:

- High-tax regions: United States (US), Europe (EU), Rest of the World (RW)
- Profit-shifting destinations identified by Tørsløv et al. (2022) split into
  - Low tax (LT): Belgium, Switzerland, Netherlands, Ireland etc.
  - Tax haven (TH): Antigua, Aruba, the Bahamas, Barbados etc.
  - US, EU, and RW firms can shift profits to LT and/or TH (after paying fixed FDI costs)

Discipline for key parameters:

- TFP (A_i) and prod. dispersion (σ_a): GDP and firm size dist.
- Intangible share (ϕ): Foreign MNEs' intangible share
- Trade costs (κ^X, ξ): Num. exporters, trade flows
- FDI costs (κ^F, σ): Num. MNEs, foreign MNEs' VA shares
- Corporate tax rates (τ): taken from Tørsløv et al. (2022)
- Markdowns (φ_i): Lost profit estimates from Tørsløv et al. (2022)
  - Lost profits/GDP: 0.6% for US, 1.4% for EU, 0.7% for RoW.

Calibration: Region-specific target moments

Taking the Model to the Data

Statistic or parameter value	US	Europe	Low-tax	RoW	Tax haven
(a) Assigned parameters and target moments					
Population (NA = 100)	100	137	17	2,041	–
Real GDP (NA = 100)	100	98	18	383	–
Corporate tax rate (%)	21.0	17.3	11.4	17.4	3.3
Foreign MNEs' VA share (%)	11.12	19.82	28.73	9.55	–
Total lost profits ($B)	143	216	–	257	–
Lost profits to TH (%)	66.4	44.5	–	71.1	–
Imports from… (% GDP)					
North America	–	1.54	0.33	8.92	–
Europe	1.01	–	2.99	8.24	–
Low tax	1.49	12.43	–	7.89	–
Row	2.36	3.70	0.59	–	–

Measuring profit shifting in the model

Taking the Model to the Data

- The profits shifted out of region j by firm ω is

$$ps_{ij}(\omega) = \tilde{\pi}_{ij}(\omega) - \pi_{ij}(\omega).$$

  where $\tilde{\pi}_{ij}$ are the profits a firm would have reported in region j if it did not shift profits.

- Aggregating firm-level shifted profits yields the total profits shifted out of region j:

$$PS_{jt} = \sum_{i=1}^{I} \int_{\Omega_i} ps_{ijt}(\omega)\, d\omega.$$

- $\tilde{\pi}_{ijt}(\omega)$ can be computed in PE (calibration) or in GE (experiments).

Validation

Taking the Model to the Data

Simulate at the model generated data the following

$$\log \pi_i^k(\omega) = \beta_0 + \beta_\ell \log \ell_i^k(\omega) + \beta_z \log z^k(\omega) - \beta_\tau \hat{\tau}_i^k + \epsilon_i^k(\omega)$$

- $\hat{\tau}_i^k$: tax differential between an MNE's home region and LT or TH.
- β_τ: percentage change in reported profit in response to a one-percentage-point change in the tax differential between the home country and a tax haven
- k: the index of the counterfactual economy

Additional Validation

Taking the Model to the Data

1. Share of corporate income taxes paid by foreign MNEs

Source	NA	EU	LT	RW
Data	16.65	41.58	72.40	16.32
Model	24.40	40.56	73.30	18.54

2. Global MNE spending on profit-shifting employees
   - → Tørsløv et al. (2020): $25 billion
   - → Model: $75 billion