# The Ripple Effects of Global Tax Reform on the U.S. Economy
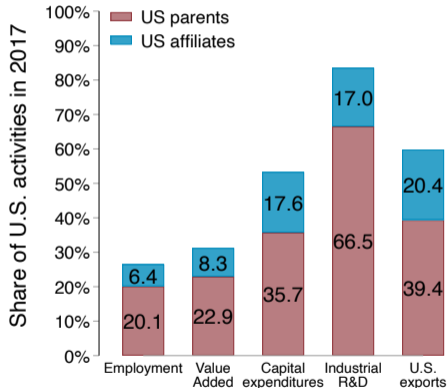
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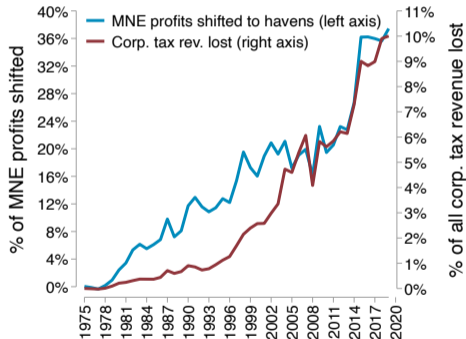
# Importance of MNEs and profit shifting in the United States

*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.

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

2. Conduct a series of experiments:

   $\rightarrow$ All but US introduce GMT: with and without spillovers
   $\rightarrow$ Only US introduces GMT: with and without spillovers
   $\rightarrow$ All including US introduce GMT: with and without spillovers
   $\rightarrow$ 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**:

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

2. Contrast with GILTI provision of TCJA

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

# The Model

# Environment overview

- Standard multi-country GE model:

  $\rightarrow$ Five regions: US, Europe, Rest of the World, Low Tax (LT), Tax Haven (TH)

  $\rightarrow$ Representative consumers with standard preferences choosing consumption, labor and tangible investment.

  $\rightarrow$ Aggregator: nontradable final goods

  $\rightarrow$ Tradable, country-specific intermediate goods produced with labor, tangible and intangible capital.

  $\rightarrow$ Governments collect corporate tax revenues and rebate it back to the consumers.

- Add multinational enterprises:

  $\rightarrow$ Intangible capital as in (**McGrattan and Prescott (2009**; **2010)**) with spillover externality

  $\rightarrow$ Theory of transfer pricing and profit shifting as in (**Dyrda et al. (2022)**)

  $\rightarrow$ Detailed representation of the MNE-related provisions of TCJA

# Intangible Capital: nonrivalry and spillover

- The intangible capital $z$ is **nonrival** within MNE.
- It 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 $i$
  $\rightarrow$ $\nu$: spillover elasticity

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

# Locations, intangible capital and profit shifting.

MNE maximizes dividends:

$$d_i(a) = \max_{\substack{z, J_X, J_F, \\ \boldsymbol{\lambda} \in \Gamma}} \left\{ (1 - \tau_i)\pi_{ii} + \sum_{j \in J_F \setminus \{LT\}} (1 - \tau_j)\pi_{ij} + (1 - \tau_{LT})\pi_{i,LT} 1_{\{LT \in J_F\}} \right.$$

$$\left. + (1 - \tau_{TH})\pi_{i,TH} 1_{\{\lambda_{TH} > 0\}} - T_i^{GILTI} 1_{\{i = US\}} - \sum_{j \in J_F \cup \{i\}} r_j k_j \right\}$$

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
- $\pi_{ii}$: taxable profits of the parent division
- $\pi_{ij}$: 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

$$
\pi_{ii} = \overbrace{\pi_i^D(a, z; J_X)}^{\text{Operating pre-tax profits}} - W_i \overbrace{\left( l_i^z + \sum_{j \in J_X} \kappa_{ij}^X + \sum_{j \in J_F} \kappa_{ij}^F + \kappa_{iTH} 1_{\{\lambda_{TH} > 0\}} \right)}^{\text{Costs of intangible capital production and fixed costs}}
$$

$$
+ \overbrace{(\varphi_{iLT} \lambda_{LT} + \varphi_{iTH} \lambda_{TH}) \nu_i(z) z}^{\text{Proceeds from selling } z} + \overbrace{\sum_{j \in J_F} (1 - \lambda_{LT} - \lambda_{TH}) \vartheta_{ij}(z) z}^{\text{Licensing fee receipts}} - \overbrace{(\lambda_{LT} + \lambda_{TH}) \vartheta_{ii}(z) z}^{\text{Licensing fee payments}}
$$

$$
- \overbrace{W_i \mathcal{C}_i(\lambda_{LT}, \lambda_{TH}) \nu_i(z) z}^{\text{Cost of transferring } z}.
$$

where:

- $\kappa_i^X$: a fixed cost to export domestically produced goods
- $\kappa_i^F$: 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 $j$:

$$\pi_{i,j} = \underbrace{\pi_{ij}^F(a,z)}_{\text{Operating pre-tax profits}} - \underbrace{\vartheta_{ij}(z)z}_{\text{Licensing fee}}.$$

- Low Tax (LT) region:

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

- 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 $\lambda_{LT}$

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

- Without GILTI:

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

  $\rightarrow \lambda_{LT} \searrow$ in LT tax rate $\tau_{LT}$
  $\rightarrow \lambda_{LT} \searrow$ in mispricing the intangible capital $\varphi_{LT}$

- With GILTI:

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

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

# 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 |

# 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 |

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

# 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 |

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

# 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 |

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*

| 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 |

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*

| 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 |

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

# 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 |

Without spillovers almost no impact on the US.

# 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*

| 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 |

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*

| 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 |

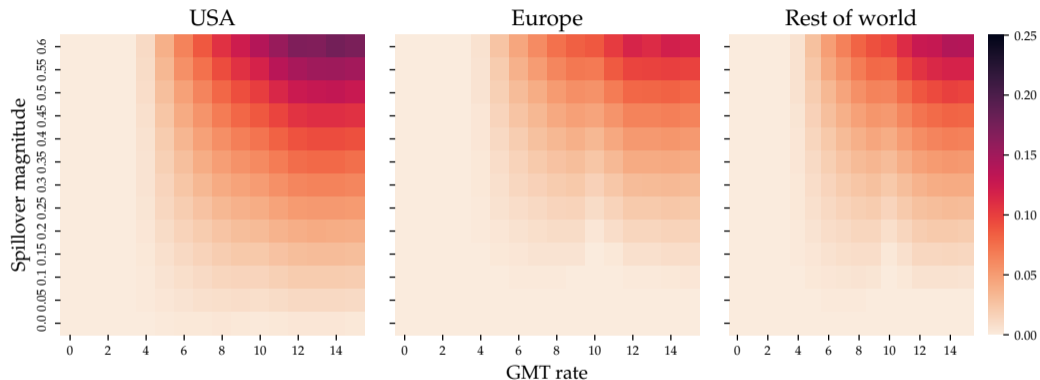Though it curbs profit shifting significantly and brings back revenues to high tax jurisdictions.

# Real GDP Change: All but US introduce GMT
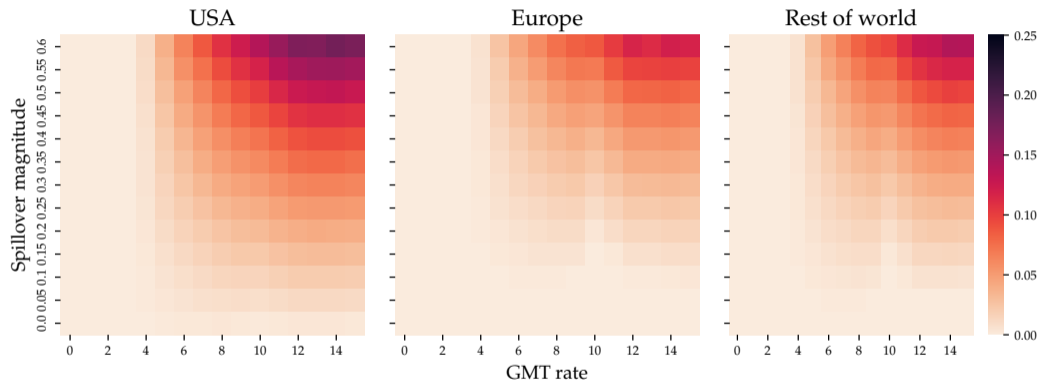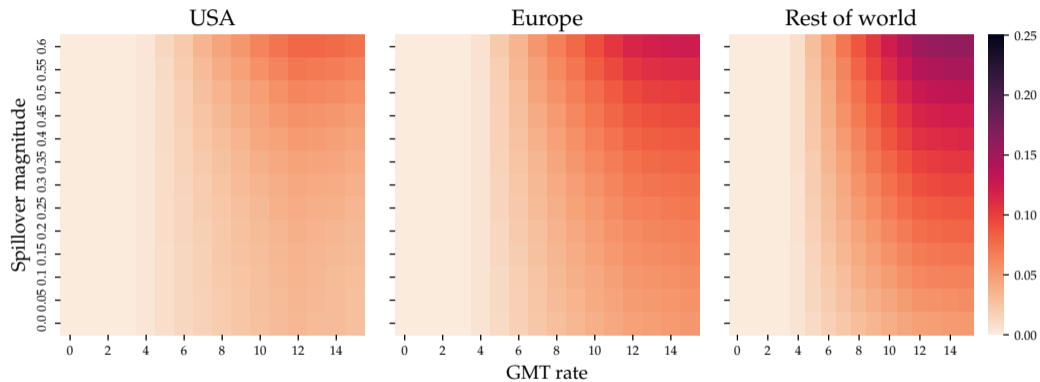
*Experiments*

# Real GDP Change: All but US introduce GMT

*Experiments*



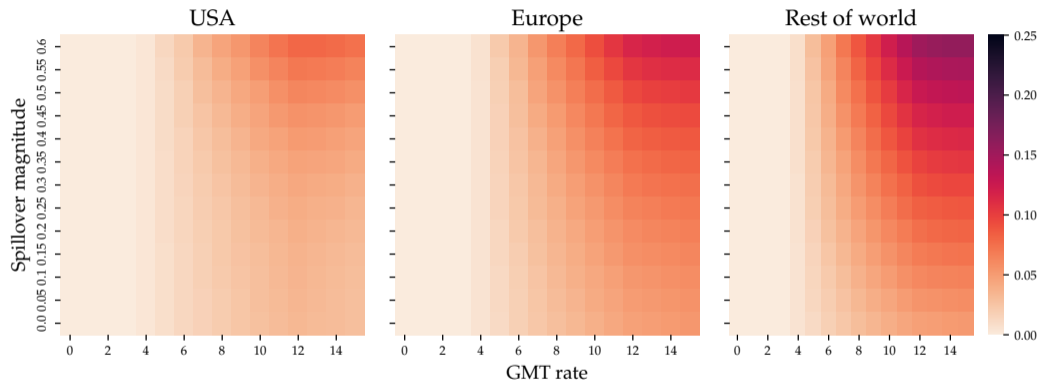The larger the spillovers the more the negative effect ripples through to the US economy.

# Real GDP Change: US only introduces GMT

*Experiments*
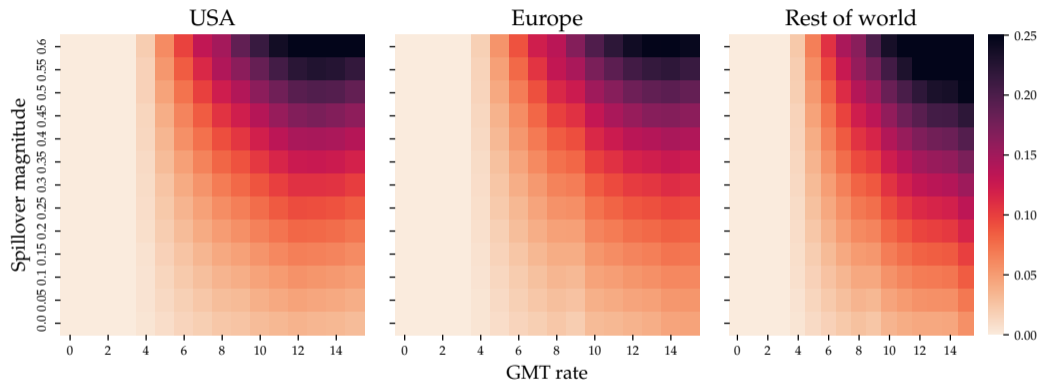
# Real GDP Change: US only introduces GMT

*Experiments*



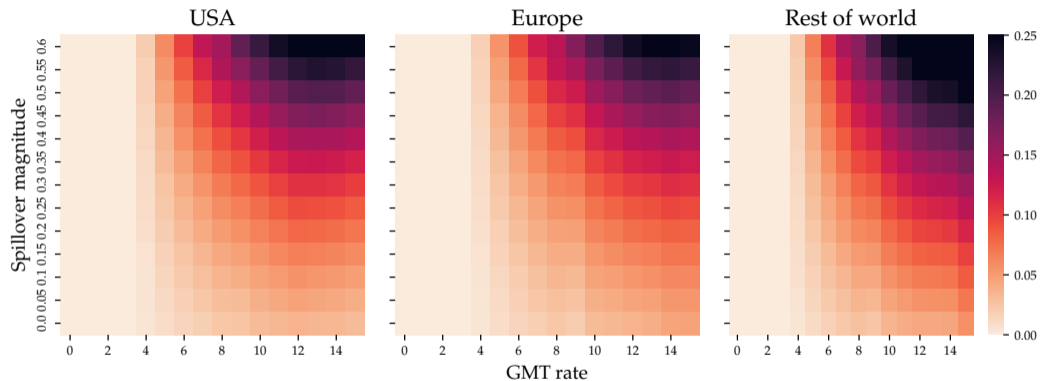The effect is actually stronger than if US would unilaterally introduce GMT.

# 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

# Intermediate Goods Producers: Technology

- Each productive region $i$ has a unit measure $\Omega_i$ 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
  - $\rightarrow \xi_{ij}$: iceberg transportation cost for each unit of goods shipped abroad.
  - $\rightarrow q_{ij}^X$: exported goods
  - $\rightarrow q_{ii}$: goods that are produced and consumed in the same location
  - $\rightarrow J_X \subseteq I \setminus \{i\}$: set of export destinations, $J_F \subseteq I \setminus \{i\}$: set of regions with foreign affiliates

# 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

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

# 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 $\omega$ from region $j$, $\Omega_{jit}$ 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:

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

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

- The low-tax region's services:

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

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

$$\sum_{j \neq i} \int_{\Omega_j} \varphi_j \lambda_{LT}(\omega)\nu_j(\omega)z(\omega) \, d\omega.$$

# 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:

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

# 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 ($\sigma_a$): GDP and firm size dist.
- Intangible share ($\phi$): Foreign MNEs' intangible share
- Trade costs ($\kappa^X, \xi$): Num. exporters, trade flows
- FDI costs ($\kappa^F, \sigma$): Num. MNEs, foreign MNEs' VA shares
- Corporate tax rates ($\tau$): taken from Tørsløv et al. (2022)
- Markdowns ($\varphi_i$): 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 | – | – |
| *(b) Calibrated parameter values* | | | | | |
| TFP $(A_i)$ | 1.00 | 0.76 | 1.19 | 0.24 | – |
| Prod. dispersion $(\eta_i)$ | 4.74 | 4.75 | 5.23 | 4.59 | – |
| Utility weight on leisure $(\psi_i)$ | 1.41 | 1.43 | 1.43 | 1.42 | – |
| Fixed export cost $(\kappa_i^X)$ | 3.8e-3 | 7.5e-3 | 2.0e-3 | 3.1e-2 | – |
| Variable FDI cost $(\sigma_i)$ | 0.44 | 0.54 | 0.51 | 0.54 | – |
| Fixed FDI cost $(\kappa_i^F)$ | 2.33 | 3.02 | 0.91 | 16.0 | – |

# Measuring profit shifting in the model

*Taking the Model to the Data*

- The profits shifted out of region $j$ by firm $\omega$ 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.
- $\beta_\tau$: 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

# 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*

| 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 effects of GILTI per se are limited. Two counteracting forces.

# 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 |

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

# 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 |

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