# Fiscal Policy in the Age of Supply Shocks

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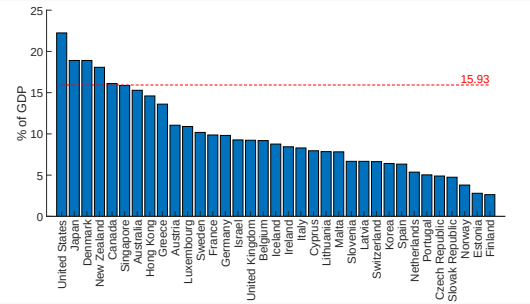
# Fiscal Policy in the Age of COVID

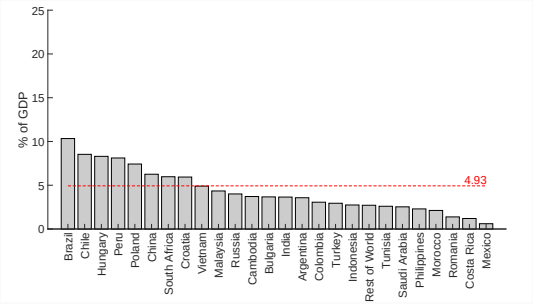
**COVID-19 was an unprecedented shock characterized by:**

- Extreme sectoral heterogeneity.
- Inequality in fiscal space across countries.
  - Fiscal transfers were largest in Advanced Economies (AEs).
  - Early narrative was that US stimulus would spill over to Emerging Economies (EMs).

# Fiscal Spending (% of GDP)




**(a)** Advanced Economies




**(b)** Emerging Markets

Source: IMF Fiscal Policy Tracker

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**This paper tackles two questions:**

- Did fiscal stimulus help support aggregate activity?
- How big are cross-border spillovers?

# I-O Networks and Fiscal Policy

**Recent literature looks at the role of I-O networks in:**

- Complementarities in demand/production may lead to amplification.
  - Closed economy: Baqaee & Farhi 2022a, Guerrieri, Lorenzoni, Straub & Werning 2022
  - Open economy: Baqaee & Farhi 2022b, Benadio, Huo, Levchenko & Pandalai-Nayar 2021, Çakmaklı, Demiralp, Kalemli-Özcan, Yeşiltaş & Yıldırım, 2021, Huo, Levchenko & Pandalai-Nayar 2022
    - All assume Current Accounts are 0

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    - All assume Current Accounts are 0

**We develop and calibrate a global GE production network model where:**

- Each country & sector is subject to a rich set of COVID shocks.
- Intertemporal model – current accounts endogenously react to COVID and fiscal policy.
- Based heavily on Baqaee & Farhi (2022a)

# A Global Intertemporal Production and Trade Model

# Intratemporal Bloc (1)

- **Supply**: firms in country $n$ and sector $j$ produce output $y_{nj}$ with fixed factors $\mathrm{k}_{nj}$, effective labor $A_{nj}L_{nj}$ and intermediate inputs $m_{nj,mk}$.

$$y_{nj} = \left( \alpha_{nj} \mathrm{k}_{nj}^{\frac{\phi-1}{\phi}} + \beta_{nj} \left( A_{nj} L_{nj} \right)^{\frac{\phi-1}{\phi}} + \gamma_{nj} m_{nj}^{\frac{\phi-1}{\phi}} \right)^{\frac{\phi}{\phi-1}} \quad ; \quad m_{nj} = \left( \sum_k \sum_m \vartheta_{nj,mk} m_{nj,mk}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}},$$

- **Labor Market**: rigid wages and labor supply shock $x_{nj} < 1$.

$$L_{nj} \leq x_{nj} \bar{L}_{nj} \; ; \; w_{nj} = \bar{w}_{nj}$$

  - *Supply-constrained sector*: $L_{nj} = x_{nj} \bar{L}_{nj}$
  - *Demand-constrained sector*: $L_{nj} < x_{nj} \bar{L}_{nj}$

# Intratemporal Bloc (2)

- **Demand**: firms within sectors sell differentiated varieties (nested CES demand)

$$D_n = \left[\sum_j \xi_{nj} D_{nj}^{(\eta-1)/\eta}\right]^{\eta/(\eta-1)}, \quad D_{nj} = \left(\sum_m \zeta_{n,mj} d_{n,mj}^{(\rho-1)/\rho}\right)^{\rho/(\rho-1)},$$

  $\xi_{nj}$ : sectoral demand shocks – redistributes demand between sectors

- **Sectoral Demand Curve**

$$p_{nj} y_{nj} = \sum_m \omega_{m,nj} P_m D_m + \sum_m \sum_k \Omega^m_{mk,nj} p_{mk} y_{mk}$$

- **Value Added:** $V_n = \sum_j (1 - \gamma_{nj})\, p y_{nj}$

  *Implies (In matrix form):*

$$\mathbf{PD} = \mathcal{M}(\xi, \mathbf{p})\mathbf{V}, \qquad \mathbf{TB} = \mathbf{V} - \mathbf{PD} = (I - \mathcal{M}(\xi, \mathbf{p}))\mathbf{V}$$

  - Other work: Find $\mathbf{p}$ s.t. $\mathbf{TB} = \mathbf{0}$
  - This paper: Inter-temporal block gives $\mathbf{TB} = f(\mathbf{V}, \dots)$

# Intertemporal Bloc

- **Simplified set-up:**
  - Two periods: present (COVID, fixed wages) and future ($*$, flexible wages).
  - Each country is small and takes the global nominal interest rate $i$ as given.
  - Global equilibrium ensures that $\sum_n TB_n = \sum_n TB_{n*} = 0$.
- **Heterogenous Households**: share $0 < \mu_n < 1$ are *hand-to-mouth*; remaining share $(1 - \mu_n)$ are *Ricardian* with log-preferences and discount factor $\delta_n$.
  - Precautionary shock ($\uparrow \delta_n$) needed to match increased private savings.
- **Fiscal Transfers**: Transfer $T_n$
  - Financed by debt with per-capita future tax $t_{n*} = T_n(1 + i)/\bar{L}_n$.

# Aggregate Demand Determination

$$P_n D_n = \mu_n \left(V_n + T_n\right) + (1-\mu_n)(1-\delta_n)\left(V_n + \frac{V_{n*}}{1+i}\right) \tag{1}$$

$$TB_n = (1-\mu_n)\left(\delta_n V_n - (1-\delta_n)\frac{V_{n*}}{1+i}\right) - \mu_n T_n. \tag{2}$$

(1) determines aggregate nominal expenditures. (2) is the country's trade balance.

- HtM households needed for fiscal policy $T_n$ to matter. MPC of 1.
- Unemployment lowers income $V_n$, reducing aggregate demand (Keynesian cross).
- Precautionary shock and higher interest rate reduce aggregate demand of Ricardian HHs.
- Trade balance: twin deficits and role of precautionary shocks

# Details on Solving the Model

- Intertemporal + Demand System are *Nominal*.
  - Need two nominal anchors to solve model.
  - Equivalent to specifying monetary policy

- We pick a reference country that targets nominal GDP.
  - Specifically, a country that is advanced, 'isolated,' and less likely to be affected by COVID: *New Zealand*.

- All other countries fix their exchange rate relative to the reference country.
  - Saves us specifying country-by-country monetary policy
  - The results should be interpreted as *upper bounds of the effect of fiscal policy*.

# From the Model to the Data

# Calibration

**Elasticities**: $(\eta, \rho, \phi, \sigma) = (1, 2, 0.6, 0.2)$

- As in, Baqaee & Farhi (2022b) and di Giovanni, Kalemli-Özcan, Silva & Yıldırım (2022).

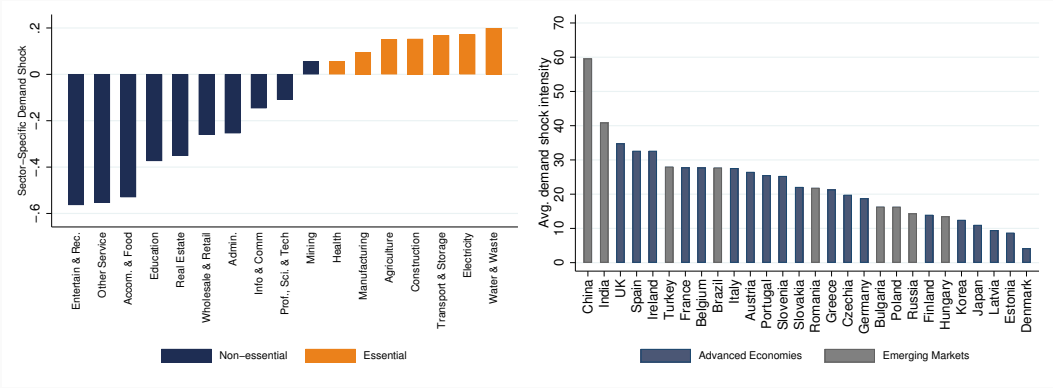
**COVID shocks:** vary by country and sector (36 ICIO sectors)

- **Labor utilization constraint** ($\hat{L}_{nj} \leq \hat{x}_{nj}$):
  - Feasibility of remote work (Dingel & Neimam, 2020) $\times$ lockdown intensity (OGRT).
- **Productivity shock** ($\hat{A}_{nj} \leq 1$): Assume remote workers are 20% less productive.
  - Change in the number of remote workers (ACS, O*NET) $\times$ lockdown intensity (OGRT).
- **Sectoral demand shock** ($\hat{\xi}_{nj}$):
  - Reliance on face-to-face interaction (O*NET) $\times$ mobility intensity Google Mobility Index.

**Fiscal policy & other parameters**

- $T_n$ from IMF's COVID fiscal tracker (above the line spending).
- HtM estimates $\mu_n$ for European countries (Almagren, Gallegos, Kramer & Lima, forthcoming).

# Sector-Specific Demand Shocks




**(a)** Sector-Specific Demand (O*NET)

**(b)** Demand Shock Intensity (Google Mobility)

Supply Shocks

# Results

# Fiscal Multiplier and Activity Reallocation

| | Δ Real GDP % | Δ % Demand Constrained (pp) | Δ Keynesian Unemp. (pp) | Δ Prices % |
|---|---|---|---|---|
| COVID w/o stimulus | -8.90 | 39.22 | 2.36 | -0.77 |
| COVID w/ stimulus | -8.44 | 32.04 | 1.53 | 2.50 |
| Effect of Stimulus (Δ) | 0.50 | -7.18 | -0.83 | 3.27 |

# Fiscal Multiplier and Activity Reallocation: Low Multiplier

| | Δ Real GDP % | Δ Share Demand Constrained (pp) | Δ Keynesian Unemp (pp) | Δ Prices % |
|---|---|---|---|---|
| COVID w/o stimulus | -8.90 | 39.22 | 2.36 | -0.77 |
| COVID w/ stimulus | -8.44 | 32.04 | 1.53 | 2.50 |
| Effect of Stimulus (Δ) | **0.50** | -7.18 | -0.83 | 3.27 |

- **Fiscal Multiplier = 0.04:** Impulse of 11.3% of GDP raises output by 0.50%.

| *Channels:* | *Multiplier:* |
|---|---|
| Transfers work through MPC *(avg. = 0.29)* | 0.40 |
| + Bottlenecks in 2/3 of sectors *(w/o I-O)* | 0.11 |
| + I-O structure matters | 0.06 |
| + Global Policy Rate Rises | 0.04 |

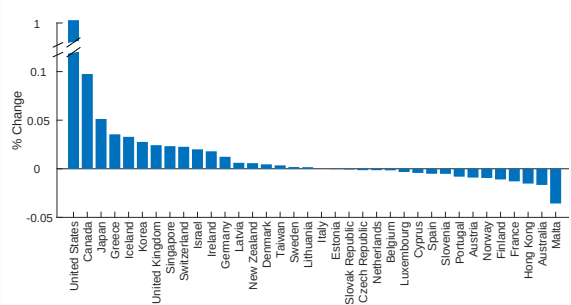
# Fiscal Multiplier and Activity Reallocation: Employment

| | Δ Real GDP % | Δ Share Demand Constrained (pp) | Δ Keynesian Unemp. (pp) | Δ Prices % |
|---|---|---|---|---|
| COVID w/o stimulus | -8.90 | 39.22 | 2.36 | -0.77 |
| COVID w/ stimulus | -8.44 | 32.04 | 1.53 | 2.50 |
| Difference (Δ) | 0.50 | **-7.18** | **-0.83** | 3.27 |

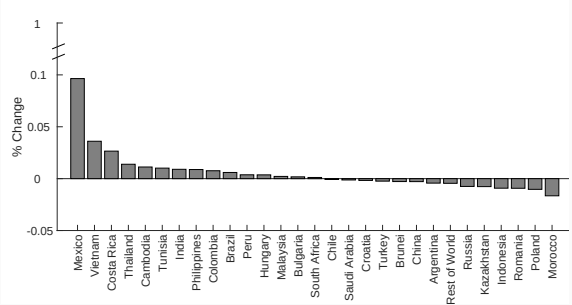
– Fiscal Policy dissipated through higher prices—**but, stimulus supported employment:**

- Policy increased activity in demand-constrained sectors.
- 7% of GDP no longer demand constrained.
- 'Keynesian Unemployment' decreases from 2.36% to 1.53% of labor force.

# Cross-border Spillovers: US-only Fiscal policy Scenario



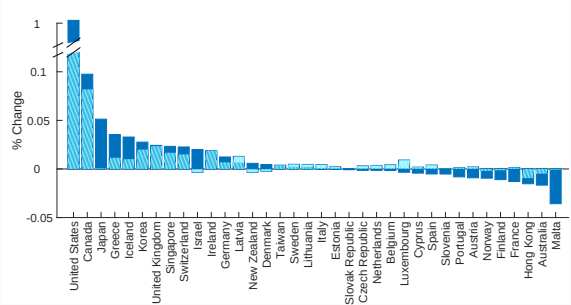

**(a)** RGDP – Advanced Economies




**(b)** RGDP – Emerging Economies

- **Spillovers are small!**
  - 20 % of US NGDP stimulus $\rightarrow$ 1% rise in US RGDP $\rightarrow$ 0.1% of GDP rise in Canada!
  - Supply shocks matter. If the whole world were demand constrained:
    *20 % of US NGDP stimulus $\rightarrow$ 2.7% rise in US RGDP $\rightarrow$ 0.4% of GDP rise in Canada!* No Supply Shocks
  - Home bias also important in explaining low fiscal spillovers.

# Cross-border Spillovers: Role of International I-O

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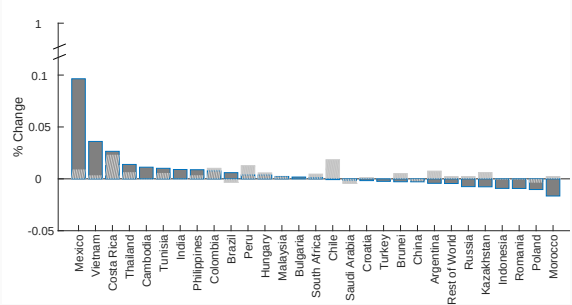
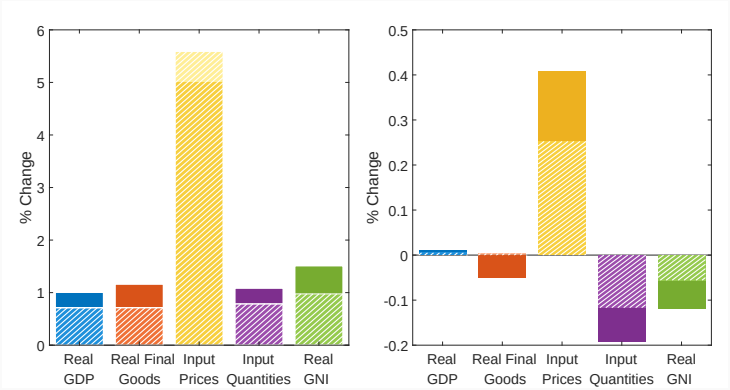



**(b)** RGDP – Emerging Economies

▨ Only Domestic I-O Connections (*Lighter bars*) ☐ Full International I-O (*darker bars*)

- **International I-O shapes the distribution of spillovers**:
  - On top of previous graph: $\Delta$ RGDP if I-O connections are *domestic only*
  - International I-O connections matter for the distribution of spillovers No Supply Shocks

# Cross-border Spillovers: Explaining GNI Decline in ROW




**(a)** USA **(b)** Avg. ROW

▨ Only Domestic I-O Connections *(lighter bars)*

□ Full International I-O *(darker bars)*

- **Standard: Final Demand ToT (1/2)**
  - US goods prices rise
  - ROW pays more for US goods
- **New: Intermediates ToT (1/2)**
  - US GDP and final goods ↑
  - US intermediate demand ↑
  - $P_m$ ↑, ROW intermediates ↓
  - ROW Final Goods Production ↓
- RGDP vs. RGNI ↔ $P_{GDP}$ vs. $P_{CPI}$

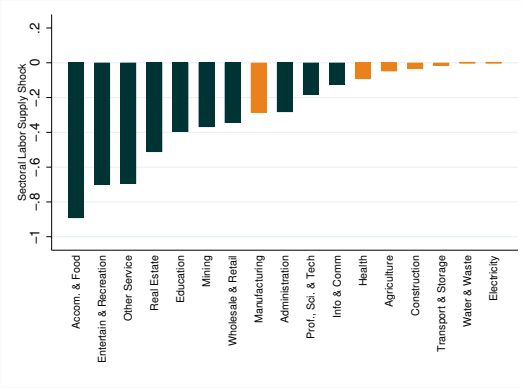
Final Output | RGNI

# Fiscal Policy and COVID

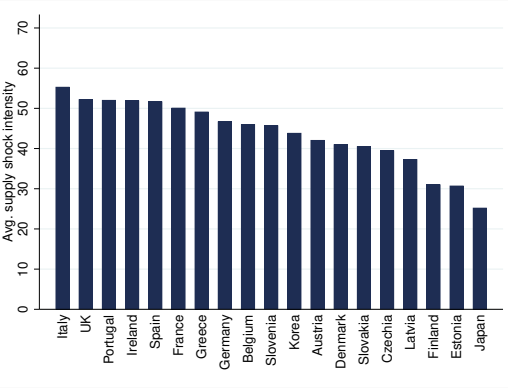
- The multiplier from fiscal transfers is very small.
  - *This is to be expected: transfers + bottlenecks + I-O linkages.*
- Nonetheless, fiscal policy increase demand to sectors with slack
  - *Fiscal policy in COVID reduced 'Keynesian' unemployment by 1/3*
- Cross border spillovers are small & RGNI falls for two reasons:
  - *Standard terms of trade mechanisms (1/2) & competition for constrained intermediates (1/2)*

# Thank You

# Intensity of Sectoral Supply & Demand Shocks



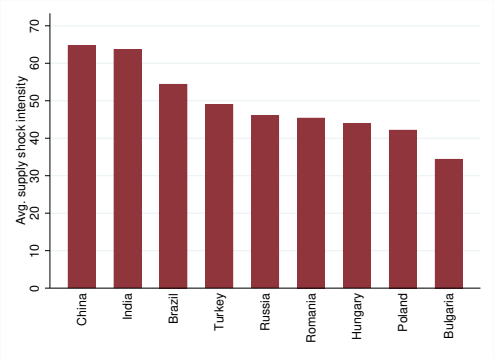

**(a)** Sectoral Labor Restrictions



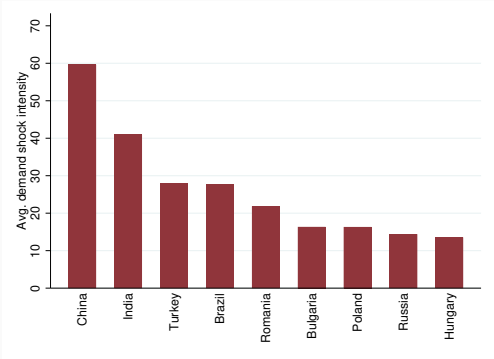

**(b)** Supply Shock Intensity: Advanced

Back

# Intensity of Sectoral Supply & Demand Shocks




**(a)** Supply Shock Intensity: Emerging

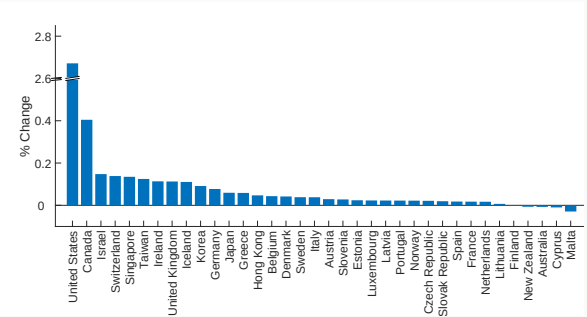



**(b)** Demand Shock Intensity: Emerging

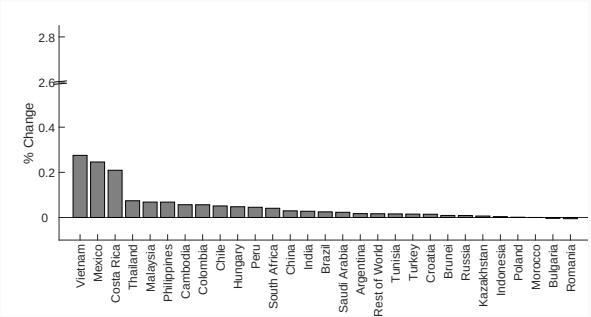
Back

# Cross-border Spillovers – No Supply Shocks

Counterfactual: US fiscal policy only (relative to no fiscal policy)




**(a)** Advanced




**(b)** Emerging

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# Cross-border Spillovers

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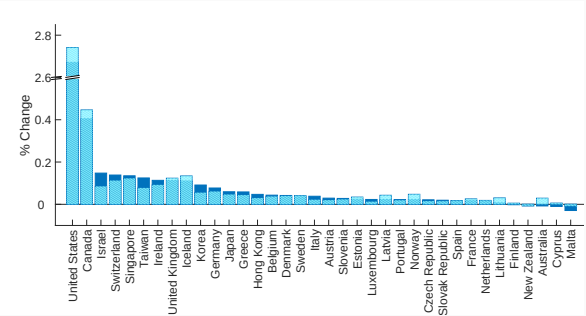


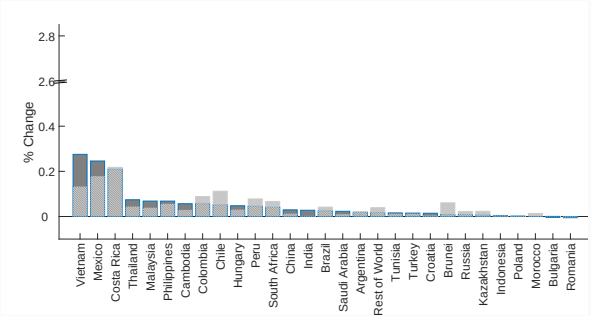


**(a)** Advanced **(b)** Emerging

▨ Only Domestic I-O Connections ☐ Full International I-O

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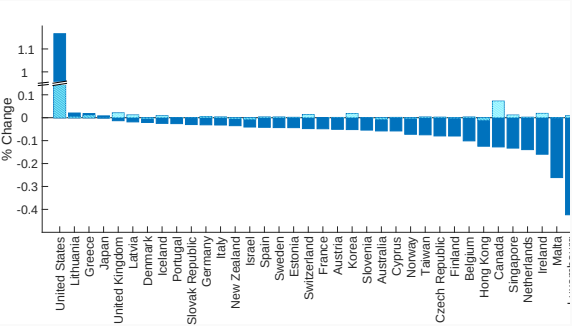
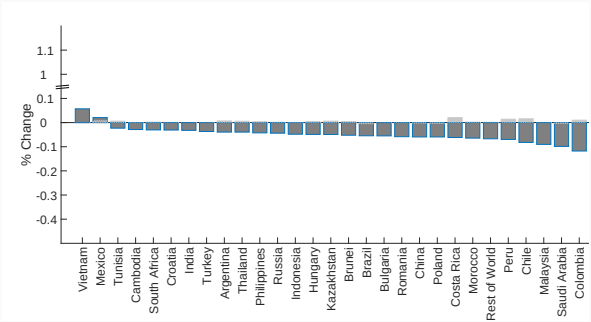
# Cross-border Spillovers – Final Output Decomposition




**(a)** Final Output – Advanced Economies

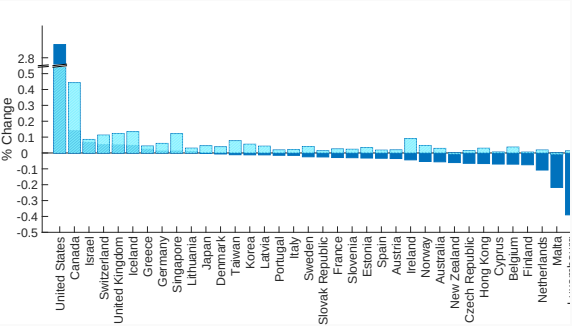



**(b)** Final Output – Emerging Economies

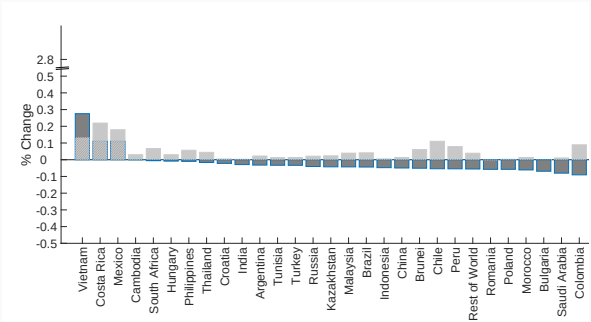
Only Domestic I-O Connections ☐ Full International I-O

- Need supply shocks *and* international I-O for non-US final output to fall
- (Competition for global intermediates needs both) Back

# Cross-border Spillovers – Final Output w.o. supply shocks Decomposition




**(a)** Final Output – Advanced Economies




**(b)** Final Output – Emerging Economies

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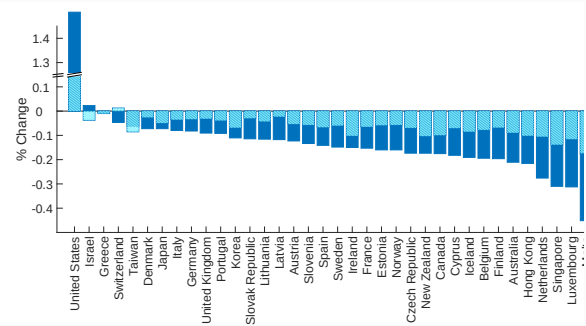
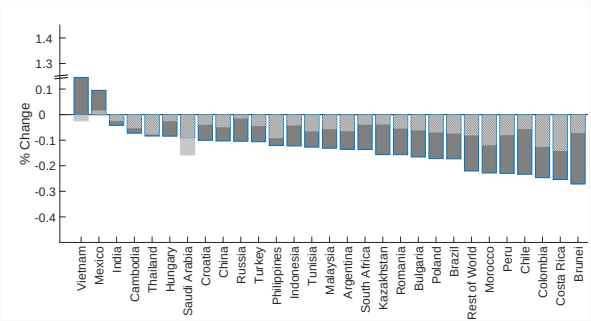
# Cross-border Spillovers – RGNI Decomposition




**(a)** Final Output – Advanced Economies




**(b)** Final Output – Emerging Economies

▨ Only Domestic I-O Connections ☐ Full International I-O

- Back