The Dynamics Effects of Industrial Policies Amidst Geoeconomic Tensions

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National Bank of Ukraine (ORS)
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The views expressed here do not necessarily reflect the position of Bank of Lithuania or Eurosystem

Research Question

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- **Question:** What are the dynamic and distributional effects of the industrial policies employed amidst the geoeconomic tensions?

- Why does it matter?
  - Empirical relevance
    - Slowbalization since the financial crisis, rising inequality
  - Ongoing policy debate
    - Brexit, US-China trade war, supply chain resilience during/after Covid-19

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- **Motivating Facts**
- **Model**
- **Calibration**
- **Main Findings**
- **Conclusion**

Motivating Facts

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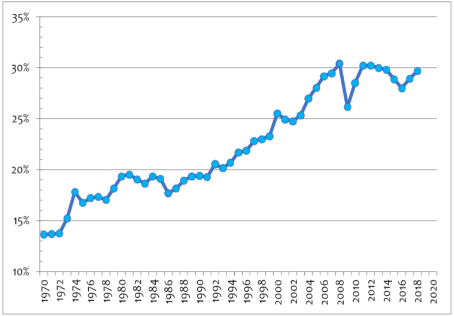
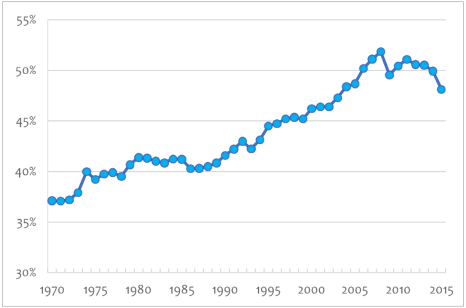
- Slow down of international trade and global value chains (GVC) after the financial crisis

Chart 1. World Trade over World GDP (1970-2018)



Source: World Bank's World Development Indicators (link)

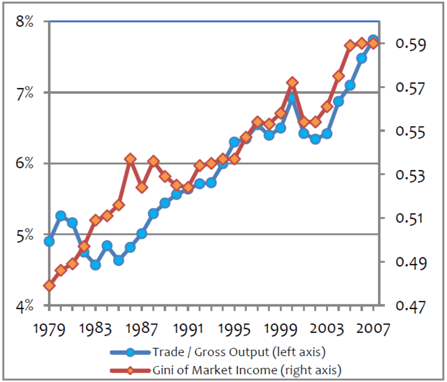
Chart 2. GVC Trade as Percentage of World Trade



Source: Borin and Mancini (2019), as reported in World Development Report (2020)

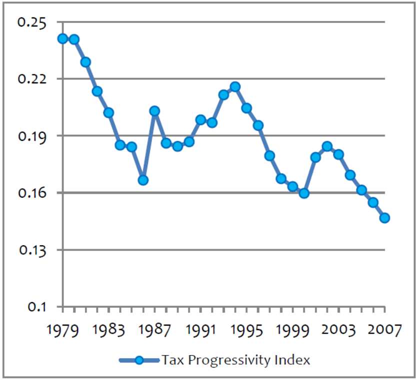
- Inequality-driven political backlash against globalization, such as US-China Trade War, Brexit

Panel A. U.S. Trade Openness and Gini Coefficient



Source: Antràs, de Gortari and Itskhoki (2017).

Panel B. Index of U.S Tax Progressivity



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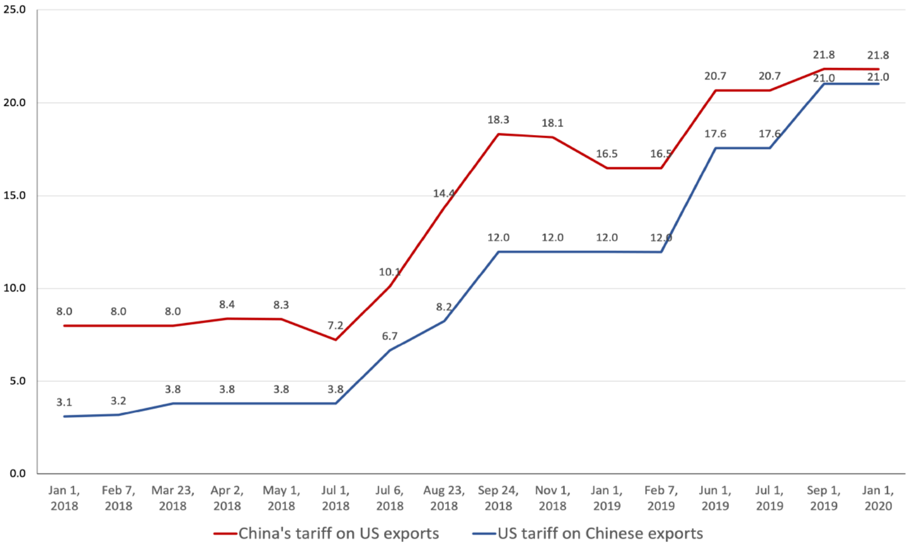
Motivating Facts

Slowbalization/Deglobalization/Decoupling

- US-China Trade War



Motivating Facts

Slowbalization/Deglobalization/Decoupling

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US bars 'advanced tech' firms from building China factories for 10 years

7 September

US Commerce Secretary speaks at White House briefing

- In response to MIC2025, CHIPS Act (Sept 2022)
- Subsidy and export-ban
- "US tech **companies that receive federal funding** will be **barred from building advanced technology facilities in China** for 10 years..."

Motivating Facts

Slowbalization/Deglobalization/Decoupling

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Biden's hugely consequential high-tech export ban on China, explained by an expert

The ban on semiconductor exports to China is one of the most important policy moves of the year — and could set off a geopolitical quake.

By Michael Bluhm | Nov 5, 2022, 8:00am EDT

SHARE

An employee works on the production line of semiconductors at a factory in Huai'an, China, on September 27. | VCG/VCG via

Most Read

1. The deranged Supreme Court case that threatens US democracy, explained
2. What Congress can do with Trump's tax returns
3. There's no such thing as a good cold
4. Take a mental break with the newest Vox crossword
5. World leaders have 2 weeks to agree on a plan to save nature

- Export control-Bureau of Industry and Security (Oct 2022)
- Subsidy and export-ban
- "New export controls **ban the export to China of cutting-edge chips**, as well as **chip design software**, **chip manufacturing equipment**, and **US-built components of manufacturing equipment**..."

Motivating Facts

Slowbalization/Deglobalization/Decoupling

☰ CNN Business Markets Tech Media Calculators Videos

China just stopped exporting two minerals the world's chipmakers need

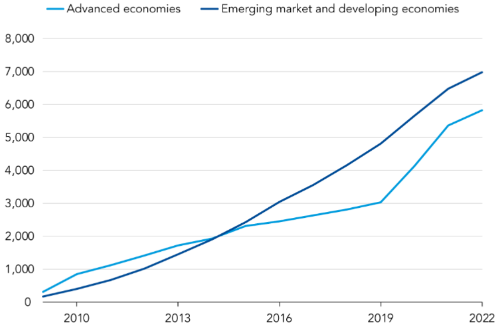
By Laura He, CNN
3 minute read · Updated 5:14 PM EDT, Fri September 22, 2023

- Export control-Chinese Ministry of Commerce (July 2023)
- Export control
- "...the export of **gallium** and **germanium**, two elements used in producing chips, solar panels, and fiber optics, will soon be subject to a **license system** for national security reasons. That means exports of the materials will need to be approved by the government, and **Western companies that rely on them could have a hard time securing a consistent supply from China**."

Motivating Facts

Global Rise of Industrial Policies

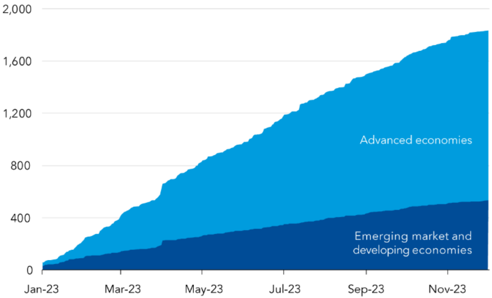
Number of subsidy policies in force



Source: Global Trade Alert; IMF staff calculations.
Note: Cumulative number of subsidy policies starting from January 1, 2009.

IMF

Number of industrial policy measures implemented in 2023



Source: Evenett and others (2024); IMF staff calculations.
Note: Cumulative number of industrial policy measures starting from January 1, 2023. It is possible that the gap between AEs and EMDEs in resort to subsidy interventions will narrow over time as reports from the latter tend to be published with a lag.

IMF

This Paper

- Develop a two-country open economy macro framework with rich micro-foundation
  – Firm heterogeneity, export, and offshoring
- Equipped with various industrial policies (Juhasz et al., 2023)
  – Tariffs, offshoring friction, domestic production subsidy, entry subsidy
- For each industrial policy, we study the
  – Dynamic effects & distributional consequence (wage inequality)
- Explore the welfare implications of unilateral and bilateral policy actions
  – Entire transition path & shorter horizons

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- Myopic policymakers are incentivized to subsidize production
  - Short-term gains but long-term losses
- More forward-looking policymakers prefer to levy import tariffs
  - A ’race to the bottom’ when both countries employ it
- Skill premiums are affected differently by different industrial policies
  - Skill premium ↓ imposing country, but ↑ partner country

Preview of Results

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Related Literature

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- **Macroeconomic impact of geoeconomic fragmentation**
  – (Aiyar et al., 2023; Bolhuis, Chen, and Kett, 2023; Attinasi, Boeckelmann, and Meunier, 2023; Javorcik et al., 2023; Góes and Bekkers, 2022; Cerdeiro et al., 2021)
  ⇒Open economy macro model with trade and offshoring dynamics

  ⋄ US-China trade war
  – (Amiti, Redding, and Weinstein, 2019; Amiti, Redding, and Weinstein, 2020; Tu et al., 2020; Ma and Meng, 2023; Waugh, 2019; Fajgelbaum et al., 2020; Caliendo and Parro, 2022; Chor and Li, 2021)
  ⇒Skill premium in a dynamic setting under various industrial policies

- **New economic of industrial policy**
  – (Juhász, N. J. Lane, and Rodrik, 2023; Aghion et al., 2015; N. Lane, 2022; Liu, 2019; Manelici and Pantea, 2021; Choi and Levchenko, 2021; Juhász, N. Lane, et al., 2022; Lashkaripour and Lugovskyy, 2023; Ju et al., 2024)
  ⇒ The role of producer dynamics in determining the responses to industrial policy shocks

- **International macro with trade**
  – (Ghironi and Melitz, 2005; Auray and Eyquem, 2011; Bergin and Corsetti, 2020; Cacciatore and Ghironi, 2021; Corsetti, Martin, and Pesenti, 2013; Hamano and Zanetti, 2017; Imura and Shukayev, 2019; Jiang, 2023; Kim, 2021; Zlate, 2016)
  ⇒Trade-in-task + two-way offshoring

Model

Key Elements

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- Two countries; North (N) and South (S)
  - Focus on N in the exposition
  - Superscript * pertains to S activities
- Labor is the only factor of production, two types: H and L
  - Both types of labor are supplied inelastically
  - N and S have different H and L endowment
- Cashless economy, all contracts are nominal, flexible prices
  - All variables solved in real terms
- Time is discrete $t = 0, 1, 2, ...$
- Three agents in each economy: household, firms, government
- Trade-in-task (Grossman and Rossi-Hansberg, 2008) + offshoring (Zlate, 2016)
  - Two-way offshoring

Model Overview

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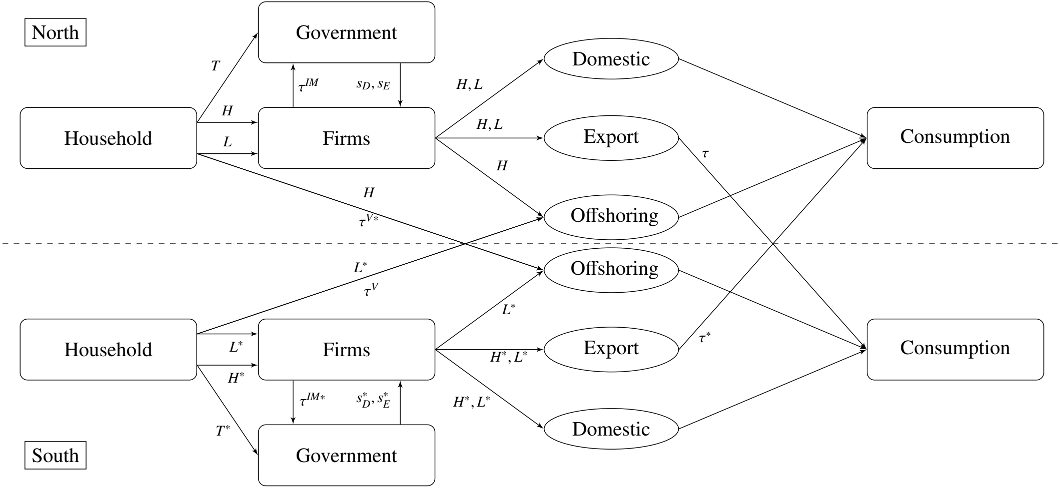

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- Representative household maximize expected lifetime utility

$$\max_{\{C_s, B_{s+1}, x_{s+1}\}_{s=t}^{\infty}} E_t \sum_{s=t}^{\infty} \beta^{s-t} \frac{C_s^{1-\gamma}}{1-\gamma}$$

Subject to:

$$C_t + (N_t + N_{E,t})\,\tilde{v}_t x_{t+1} + B_{N,t+1} = \left(\tilde{v}_t + \tilde{d}_t\right) N_t x_t + (1 + r_t)\, B_{N,t} + w_{h,t} H + w_{l,t} L + T_t$$

- Consumption basket for the Northern household includes:

$$C_t = \left[\underbrace{\int_{z_{\min}}^{z_{V,t}} y_{D,t}(\omega)^{\frac{\theta-1}{\theta}} d\omega}_{\text{Domestic}} + \underbrace{\int_{z_{V,t}}^{\infty} y_{V,t}(\omega)^{\frac{\theta-1}{\theta}} d\omega}_{\text{Offshoring}} + \underbrace{\int_{z_{X,t}^*}^{\infty} y_{X,t}^*(\omega)^{\frac{\theta-1}{\theta}} d\omega}_{\text{Export}^*} \right]^{\frac{\theta}{\theta-1}}$$

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- Entry requires a sunk entry cost:

$$\frac{f_E}{Z_t}\left(\frac{w_{l,t}}{1-\alpha}\right)^{1-\alpha}\left(\frac{w_{h,t}}{\alpha}\right)^{\alpha}$$

After entry, each firm draws its productivity from a Pareto distribution and stays the same afterward

- Production starts next period; death shock with a probability of δ

$$N_{t+1} = (1-\delta)(N_t + N_{E,t})$$

- In equilibrium, free entry ensures the following condition:

$$\tilde{v}_t = (1 - s_E)\frac{f_E}{Z_t}\left(\frac{w_{l,t}}{1-\alpha}\right)^{1-\alpha}\left(\frac{w_{h,t}}{\alpha}\right)^{\alpha}$$

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- Production of final good requires two tasks:

$$y_t(z) = [y_{h,t}(z)]^{\alpha} [y_{l,t}(z)]^{1-\alpha}$$

- If both tasks are produced domestically:

$$\begin{aligned} y_{h,t}(z) &= zZ_t h_t(z) \\ y_{l,t}(z) &= zZ_t l_t(z) \end{aligned}$$

- If a firm decides to offshore low-skilled tasks to the South:

$$\begin{aligned} y_{h,t}(z) &= zZ_t h_t(z) \\ y_{l,t}(z) &= zZ_t^* l_t^*(z) \end{aligned}$$

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- For each production location, domestic(D), offshoring(V), export(X):

$$\max_{\rho_{D,t}(z)} d_{D,t}(z) = \rho_{D,t}(z) y_{D,t}(z) - \underbrace{\frac{1 - s_D}{Z_t z} \left(\frac{w_{l,t}}{1-\alpha}\right)^{1-\alpha} \left(\frac{w_{h,t}}{\alpha}\right)^{\alpha}}_{\equiv mc_{D,t}(z)} y_{D,t}(z)$$

$$\max_{\rho_{V,t}(z)} d_{V,t}(z) = \rho_{V,t}(z) y_{V,t}(z) - \underbrace{\frac{1}{z} \left(\frac{(1+\tau^{IM})\tau^{V} Q_t w^*_{l,t}}{Z^*_t (1-\alpha)}\right)^{1-\alpha} \left(\frac{w_{h,t}}{Z_t \alpha}\right)^{\alpha}}_{\equiv mc_{V,t}(z)} y_{V,t}(z) - \underbrace{f_V \frac{Q_t}{Z^*_t} \left(\frac{w^*_{l,t}}{1-\alpha}\right)^{1-\alpha} \left(\frac{w^*_{h,t}}{\alpha}\right)^{\alpha}}_{\text{Fixed cost of offshoring}}$$

$$\max_{\rho_{X,t}(z)} d_{X,t}(z) = Q_t \rho_{X,t}(z) y_{X,t}(z) - \underbrace{\frac{\tau Q_t^{-1}}{z Z_t} \left(\frac{w_{l,t}}{1-\alpha}\right)^{1-\alpha} \left(\frac{w_{h,t}}{\alpha}\right)^{\alpha}}_{\equiv mc_{X,t}(z)} y_{X,t}(z) - \underbrace{\frac{f_X}{Z_t} \left(\frac{w_{l,t}}{1-\alpha}\right)^{1-\alpha} \left(\frac{w_{h,t}}{\alpha}\right)^{\alpha}}_{\text{Fixed cost of export}}$$

- To ensure the North offshore low-skilled tasks to the South:

$$\tau^{V}(1+\tau^{IM})(1-s_D)^{\frac{1}{\alpha-1}}\,TOL_l < 1$$

where $TOL_l = \frac{Q_t w^*_{l,t}/Z^*_t}{w_{l,t}/Z_t}$ stands for the ratio between the cost of effective low-skill labor

- To ensure the South offshore high-skilled tasks to the North:

$$(\tau^{V*})^{-1}(1+\tau^{IM*})^{-1}(1-s^*_D)^{\frac{1}{\alpha}}\,TOL_h > 1$$

where $TOL_h = \frac{Q_t w^*_{h,t}/Z^*_t}{w_{h,t}/Z_t}$ stands for the ratio between the cost of effective high-skill labor

- We set the high-skilled and low-skilled endowment of labor such that both conditions hold

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- We set the high-skilled and low-skilled endowment of labor such that both conditions hold

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- All agents are optimizing
- Labor market clearing for both H and L
- Aggregate accounting ▸ Aggregate accounting
- Governments balance their budgets ▸ Gov budget
- Balance of payments ▸ BOP
- All together, a system of 57 equations in 57 endogenous variables: C_t, r_t, $\tilde{v}_t$, $\tilde{d}_t$, $w_{l,t}$, $w_{h,t}$, N_t, $N_{E,t}$, $N_{D,t}$, $N_{V,t}$, $N_{X,t}$, $\tilde{\rho}_{D,t}$, $\tilde{\rho}_{V,t}$, $\tilde{\rho}_{X,t}$, T_t, $\tilde{d}_{D,t}$, $\tilde{d}_{V,t}$, $\tilde{d}_{X,t}$, $\tilde{z}_{D,t}$, $z_{V,t}$, $\tilde{z}_{V,t}$, $\tilde{z}_{X,t}$, $\tilde{h}_{D,t}$, $\tilde{h}_{V,t}$, $\tilde{h}_{X,t}$, $\tilde{l}_{D,t}$, $\tilde{l}_{V,t}$, $\tilde{l}_{X,t}$, their Southern counterparts and the real exchange rate Q_t.

Calibration

Calibration

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Parameter	Meaning	Value	Source/target
β	discount factor	0.9900	(Ghironi and Melitz, 2005)
γ	(inverse) intertemporal elasticity	2.0000	(Ghironi and Melitz, 2005)
θ	elasticity of substitution between varieties	3.8000	(Ghironi and Melitz, 2005)
k	shape parameter of productivity distribution	3.4000	(Ghironi and Melitz, 2005)
τ	melting-iceberg trade cost	1.3000	(Ghironi and Melitz, 2005)
z_{min}	lower bound of productivity	1.0000	normalization
δ	exogenous firm exit shock	0.0250	(Ghironi and Melitz, 2005)
α	skill intensity in production	0.4000	wage share of high-skilled
Z	steady state aggregate productivity	1.0000	normalization
ζ_Z	persistence of TFP process	0.9000	(Ghironi and Melitz, 2005)
ζ	persistence of policy process	0.5600	(Barattieri, Cacciatore, and Ghironi, 2021)
H	endowment of high-skilled labor in North	0.2220	(Lechthaler and Mileva, 2021)
L	endowment of low-skilled labor in North	0.7780	(Lechthaler and Mileva, 2021)
H^*	endowment of high-skilled labor in South	0.0955	(Lechthaler and Mileva, 2021)
L^*	endowment of low-skilled labor in South	0.9045	(Lechthaler and Mileva, 2021)
f_V	fixed cost of offshoring in North	0.1910	fraction of offshoring firms N (SMM)
f_X	fixed cost of exporting in North	0.2500	fraction of exporting firms N (SMM)
f_V^*	fixed cost of offshoring in South	0.0400	fraction of offshoring firms S (SMM)
f_X^*	fixed cost of exporting in South	0.2500	fraction of exporting firms S (SMM)
f_E	sunk entry cost	15.289	normalization of high-skilled wage N
τ^{IM}	import tariff	0.0000	no steady state intervention
τ^V	iceberg friction on offshoring	1.0000	no steady state intervention
s_E	entry subsidy	0.0000	no steady state intervention
s_D	domestic production subsidy	0.0000	no steady state intervention

Main Findings

Exercises

- Dynamics
  – Impulse responses to 1% individual industrial policy shocks
- Welfare
  – Unilateral policies
  – Policy wars
  – Different time horizons: 1 year/ 4 year/ entire transition path

Exercises

- Dynamics
  - Impulse responses to 1% individual industrial policy shocks
- Welfare
  - Unilateral policies
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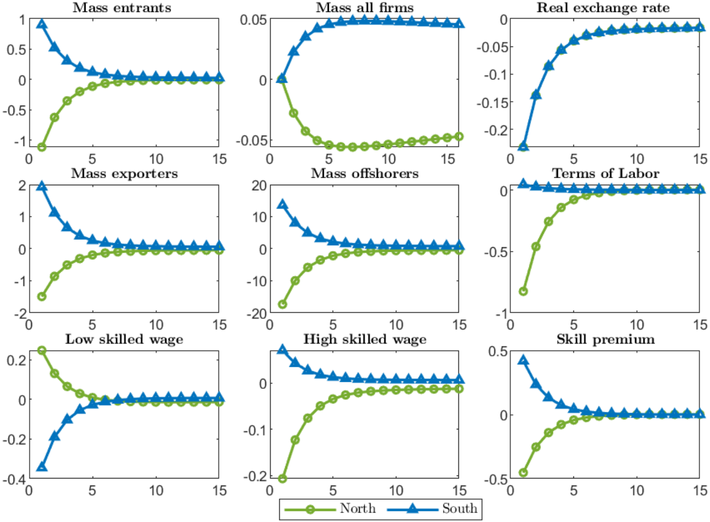
Dynamics

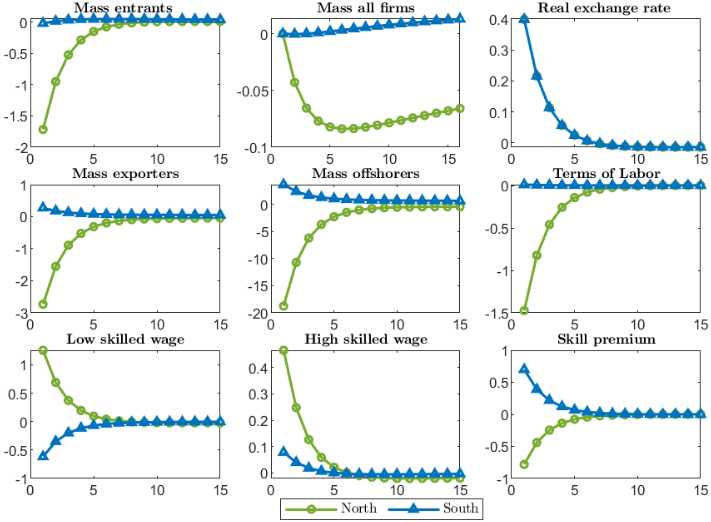
IRF of 1% Offshoring Friction Shock from North



All shocks

Dynamics

IRF of 1% Production Subsidy Shock from North



All shocks

Welfare

LIETUVOS BANKAS
EUROSISTEMA

- The economy is shocked in period $t = 1$, where it then takes X periods to return to its initial steady state.
- When considering the whole transition, the lifetime utility measures with and without geoeconomic tension are given by

$$\mathbb{W}_0^{\text{GT}}(T \to \infty) = \sum_{t=0}^{X} \beta^t \frac{C_t^{1-\gamma}}{1-\gamma} + \frac{\beta^{X+1}}{1-\beta} \times \frac{C_{X+1}^{1-\gamma}}{1-\gamma}$$

$$\mathbb{W}_0^{\text{No GT}}(T \to \infty) = \frac{1}{1-\beta} \times \frac{C_0^{1-\gamma}}{1-\gamma}$$

- For shorter horizons $T < X$,

$$\mathbb{W}_0^{\text{GT}}(T) = \sum_{t=0}^{T} \beta^t \frac{C_t^{1-\gamma}}{1-\gamma}$$

$$\mathbb{W}_0^{\text{No GT}}(T) = \frac{1-\beta^T}{1-\beta} \times \frac{C_0^{1-\gamma}}{1-\gamma}$$

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EUROSISTEMA

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$$\mathbb{W}_0^{\text{GT}}(T \to \infty) = \sum_{t=0}^{X} \beta^t \frac{C_t^{1-\gamma}}{1-\gamma} + \frac{\beta^{X+1}}{1-\beta} \times \frac{C_{X+1}^{1-\gamma}}{1-\gamma}$$

$$\mathbb{W}_0^{\text{No GT}}(T \to \infty) = \frac{1}{1-\beta} \times \frac{C_0^{1-\gamma}}{1-\gamma}$$

- For shorter horizons $T < X$,

$$\mathbb{W}_0^{\text{GT}}(T) = \sum_{t=0}^{T} \beta^t \frac{C_t^{1-\gamma}}{1-\gamma}$$

$$\mathbb{W}_0^{\text{No GT}}(T) = \frac{1-\beta^T}{1-\beta} \times \frac{C_0^{1-\gamma}}{1-\gamma}$$

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$$\mathbb{W}_0^{\mathrm{GT}}(T \to \infty) = \sum_{t=0}^{X} \beta^t \frac{C_t^{1-\gamma}}{1-\gamma} + \frac{\beta^{X+1}}{1-\beta} \times \frac{C_{X+1}^{1-\gamma}}{1-\gamma}$$

$$\mathbb{W}_0^{\mathrm{No\ GT}}(T \to \infty) = \frac{1}{1-\beta} \times \frac{C_0^{1-\gamma}}{1-\gamma}$$

- For shorter horizons $T < X$,

$$\mathbb{W}_0^{\mathrm{GT}}(T) = \sum_{t=0}^{T} \beta^t \frac{C_t^{1-\gamma}}{1-\gamma}$$

$$\mathbb{W}_0^{\mathrm{No\ GT}}(T) = \frac{1-\beta^T}{1-\beta} \times \frac{C_0^{1-\gamma}}{1-\gamma}$$

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EUROSISTEMA

	Time horizon (T)		
	$T = 4$	$T = 16$	$T \to \infty$
τ^{IM}	(-0.0138, -0.0824)	(0.0045, -0.0369)	(0.0043, -0.0104)
τ^{V}	(-0.0005, -0.0443)	(-0.0176, -0.0021)	(-0.0086, 0.0052)
s_D	(0.2230, -0.1083)	(0.0381, -0.0343)	(-0.0017, -0.0024)
s_E	(-0.2298, -0.0011)	(-0.0374, -0.0015)	(0.0029, -0.0044)

Welfare of Unilateral Policies: Offshoring Friction

LIETUVOS BANKAS
EUROSISTEMA

	Time horizon (T)		
	$T = 4$	$T = 16$	$T \to \infty$
τ^{IM}	(-0.0138, -0.0824)	(0.0045, -0.0369)	(0.0043, -0.0104)
τ^{V}	(-0.0005, -0.0443)	(-0.0176, -0.0021)	(-0.0086, 0.0052)
s_D	(0.2230, -0.1083)	(0.0381, -0.0343)	(-0.0017, -0.0024)
s_E	(-0.2298, -0.0011)	(-0.0374, -0.0015)	(0.0029, -0.0044)

Welfare of Unilateral Policies: Production Subsidy

	Time horizon (T)		
	$T = 4$	$T = 16$	$T \to \infty$
τ^{IM}	(-0.0138, -0.0824)	(0.0045, -0.0369)	(0.0043, -0.0104)
τ^{V}	(-0.0005, -0.0443)	(-0.0176, -0.0021)	(-0.0086, 0.0052)
s_D	(0.2230, -0.1083)	(0.0381, -0.0343)	(-0.0017, -0.0024)
s_E	(-0.2298, -0.0011)	(-0.0374, -0.0015)	(0.0029, -0.0044)

Welfare of Unilateral Policies: Entry Subsidy

	Time horizon (T)		
	$T = 4$	$T = 16$	$T \to \infty$
τ^{IM}	(-0.0138, -0.0824)	(0.0045, -0.0369)	(0.0043, -0.0104)
τ^{V}	(-0.0005, -0.0443)	(-0.0176, -0.0021)	(-0.0086, 0.0052)
s_D	(0.2230, -0.1083)	(0.0381, -0.0343)	(-0.0017, -0.0024)
s_E	(-0.2298, -0.0011)	(-0.0374, -0.0015)	(0.0029, -0.0044)

Welfare of Bilateral Policies: Myopic Policymaker

LIETUVOS BANKAS
EUROSISTEMA

One year horizon ($T = 4$)

North \ South	—	τ^{IM*}	τ^{V*}	s_D^*	s_E^*
—	(0.0000, 0.0000)	(-0.0494, -0.0372)	(-0.0106, 0.0159)	(-0.0592, 0.2236)	(-0.0038, -0.2279)
τ^{IM}	(-0.0138, -0.0824)	(-0.0631, -0.1197)	(-0.0243, -0.0665)	(-0.0729, 0.1412)	(-0.0176, -0.3104)
τ^{V}	(-0.0005, -0.0443)	(-0.0499, -0.0816)	(-0.0111, -0.0284)	(-0.0596, 0.1794)	(-0.0044, -0.2723)
s_D	(0.2230, -0.1083)	(0.1737, -0.1456)	(0.2125, -0.0924)	(0.1640, 0.1154)	(0.2192, -0.3364)
s_E	(-0.2298, -0.0011)	(-0.2792, -0.0384)	(-0.2404, 0.0148)	(-0.2890, 0.2224)	(-0.2336, -0.2290)

Four year horizon ($T = 16$)

North \ South	—	τ^{IM*}	τ^{V*}	s_D^*	s_E^*
—	(0.0000, 0.0000)	(-0.0279, 0.0048)	(0.0045, -0.0116)	(-0.0155, 0.0323)	(-0.0044, -0.0344)
τ^{IM}	(0.0045, -0.0369)	(-0.0234, -0.0322)	(0.0090, -0.0485)	(-0.0110, -0.0045)	(0.0001, -0.0715)
τ^{V}	(-0.0176, -0.0021)	(-0.0455, 0.0026)	(-0.0131, -0.0137)	(-0.0331, 0.0303)	(-0.0220, -0.0366)
s_D	(0.0381, -0.0343)	(0.0102, -0.0296)	(0.0425, -0.0459)	(0.0227, -0.0019)	(0.0337, -0.0689)
s_E	(-0.0374, -0.0015)	(-0.0654, 0.0032)	(-0.0330, -0.0131)	(-0.0530, 0.0307)	(-0.0418, -0.0360)

Infinite horizon ($T \to \infty$)

North \ South	—	τ^{IM*}	τ^{V*}	s_D^*	s_E^*
—	(0.0000, 0.0000)	(-0.0094, 0.0071)	(0.0044, -0.0076)	(0.0015, -0.0054)	(-0.0048, 0.0051)
τ^{IM}	(0.0043, -0.0104)	(-0.0051, -0.0033)	(0.0087, -0.0180)	(0.0058, -0.0158)	(-0.0004, -0.0053)
τ^{V}	(-0.0086, 0.0052)	(-0.0180, 0.0123)	(-0.0042, -0.0024)	(-0.0071, -0.0003)	(-0.0133, 0.0103)
s_D	(-0.0017, -0.0024)	(-0.0111, 0.0047)	(0.0027, -0.0100)	(-0.0002, -0.0079)	(-0.0064, 0.0026)
s_E	(0.0029, -0.0044)	(-0.0065, 0.0028)	(0.0073, -0.0120)	(0.0044, -0.0098)	(-0.0018, 0.0007)

Welfare of Bilateral Policies: Myopic Policymaker

LIETUVOS BANKAS
EUROSISTEMA

One year horizon ($T = 4$)

North \ South	—	τ^{IM*}	τ^{V*}	s_D^*	s_E^*
—	(0.0000, 0.0000)	(-0.0494, -0.0372)	(-0.0106, 0.0159)	(-0.0592, 0.2236)	(-0.0038, -0.2279)
τ^{IM}	(-0.0138, -0.0824)	(-0.0631, -0.1197)	(-0.0243, -0.0665)	(-0.0729, 0.1412)	(-0.0176, -0.3104)
τ^{V}	(-0.0005, -0.0443)	(-0.0499, -0.0816)	(-0.0111, -0.0284)	(-0.0596, 0.1794)	(-0.0044, -0.2723)
s_D	(0.2230, -0.1083)	(0.1737, -0.1456)	(0.2125, -0.0924)	(0.1640, 0.1154)	(0.2192, -0.3364)
s_E	(-0.2298, -0.0011)	(-0.2792, -0.0384)	(-0.2404, 0.0148)	(-0.2890, 0.2224)	(-0.2336, -0.2290)

Four year horizon ($T = 16$)

North \ South	—	τ^{IM*}	τ^{V*}	s_D^*	s_E^*
—	(0.0000, 0.0000)	(-0.0279, 0.0048)	(0.0045, -0.0116)	(-0.0155, 0.0323)	(-0.0044, -0.0344)
τ^{IM}	(0.0045, -0.0369)	(-0.0234, -0.0322)	(0.0090, -0.0485)	(-0.0110, -0.0045)	(0.0001, -0.0715)
τ^{V}	(-0.0176, -0.0021)	(-0.0455, 0.0026)	(-0.0131, -0.0137)	(-0.0331, 0.0303)	(-0.0220, -0.0366)
s_D	(0.0381, -0.0343)	(0.0102, -0.0296)	(0.0425, -0.0459)	(0.0227, -0.0019)	(0.0337, -0.0689)
s_E	(-0.0374, -0.0015)	(-0.0654, 0.0032)	(-0.0330, -0.0131)	(-0.0530, 0.0307)	(-0.0418, -0.0360)

Infinite horizon ($T \to \infty$)

North \ South	—	τ^{IM*}	τ^{V*}	s_D^*	s_E^*
—	(0.0000, 0.0000)	(-0.0094, 0.0071)	(0.0044, -0.0076)	(0.0015, -0.0054)	(-0.0048, 0.0051)
τ^{IM}	(0.0043, -0.0104)	(-0.0051, -0.0033)	(0.0087, -0.0180)	(0.0058, -0.0158)	(-0.0004, -0.0053)
τ^{V}	(-0.0086, 0.0052)	(-0.0180, 0.0123)	(-0.0042, -0.0024)	(-0.0071, -0.0003)	(-0.0133, 0.0103)
s_D	(-0.0017, -0.0024)	(-0.0111, 0.0047)	(0.0027, -0.0100)	(-0.0002, -0.0079)	(-0.0064, 0.0026)
s_E	(0.0029, -0.0044)	(-0.0065, 0.0028)	(0.0073, -0.0120)	(0.0044, -0.0098)	(-0.0018, 0.0007)

Welfare of Bilateral Policies: Entire Transition Path

One year horizon ($T = 4$)

North \ South	—	τ^{IM*}	τ^{V*}	s_D^*	s_E^*
—	(0.0000, 0.0000)	(-0.0494, -0.0372)	(-0.0106, 0.0159)	(-0.0592, 0.2236)	(-0.0038, -0.2279)
τ^{IM}	(-0.0138, -0.0824)	(-0.0631, -0.1197)	(-0.0243, -0.0665)	(-0.0729, 0.1412)	(-0.0176, -0.3104)
τ^{V}	(-0.0005, -0.0443)	(-0.0499, -0.0816)	(-0.0111, -0.0284)	(-0.0596, 0.1794)	(-0.0044, -0.2723)
s_D	(0.2230, -0.1083)	(0.1737, -0.1456)	(0.2125, -0.0924)	(0.1640, 0.1154)	(0.2192, -0.3364)
s_E	(-0.2298, -0.0011)	(-0.2792, -0.0384)	(-0.2404, 0.0148)	(-0.2890, 0.2224)	(-0.2336, -0.2290)

Four year horizon ($T = 16$)

North \ South	—	τ^{IM*}	τ^{V*}	s_D^*	s_E^*
—	(0.0000, 0.0000)	(-0.0279, 0.0048)	(0.0045, -0.0116)	(-0.0155, 0.0323)	(-0.0044, -0.0344)
τ^{IM}	(0.0045, -0.0369)	(-0.0234, -0.0322)	(0.0090, -0.0485)	(-0.0110, -0.0045)	(0.0001, -0.0715)
τ^{V}	(-0.0176, -0.0021)	(-0.0455, 0.0026)	(-0.0131, -0.0137)	(-0.0331, 0.0303)	(-0.0220, -0.0366)
s_D	(0.0381, -0.0343)	(0.0102, -0.0296)	(0.0425, -0.0459)	(0.0227, -0.0019)	(0.0337, -0.0689)
s_E	(-0.0374, -0.0015)	(-0.0654, 0.0032)	(-0.0330, -0.0131)	(-0.0530, 0.0307)	(-0.0418, -0.0360)

Infinite horizon ($T \to \infty$)

North \ South	—	τ^{IM*}	τ^{V*}	s_D^*	s_E^*
—	(0.0000, 0.0000)	(-0.0094, 0.0071)	(0.0044, -0.0076)	(0.0015, -0.0054)	(-0.0048, 0.0051)
τ^{IM}	(0.0043, -0.0104)	(-0.0051, -0.0033)	(0.0087, -0.0180)	(0.0058, -0.0158)	(-0.0004, -0.0053)
τ^{V}	(-0.0086, 0.0052)	(-0.0180, 0.0123)	(-0.0042, -0.0024)	(-0.0071, -0.0003)	(-0.0133, 0.0103)
s_D	(-0.0017, -0.0024)	(-0.0111, 0.0047)	(0.0027, -0.0100)	(-0.0002, -0.0079)	(-0.0064, 0.0026)
s_E	(0.0029, -0.0044)	(-0.0065, 0.0028)	(0.0073, -0.0120)	(0.0044, -0.0098)	(-0.0018, 0.0007)

Welfare of Bilateral Policies: Tariff War

LIETUVOS BANKAS
EUROSISTEMA

One year horizon ($T = 4$)

North \ South	—	τ^{IM*}	τ^{V*}	s_D^*	s_E^*
—	(0.0000, 0.0000)	(-0.0494, -0.0372)	(-0.0106, 0.0159)	(-0.0592, 0.2236)	(-0.0038, -0.2279)
τ^{IM}	(-0.0138, -0.0824)	(-0.0631, -0.1197)	(-0.0243, -0.0665)	(-0.0729, 0.1412)	(-0.0176, -0.3104)
τ^{V}	(-0.0005, -0.0443)	(-0.0499, -0.0816)	(-0.0111, -0.0284)	(-0.0596, 0.1794)	(-0.0044, -0.2723)
s_D	(0.2230, -0.1083)	(0.1737, -0.1456)	(0.2125, -0.0924)	(0.1640, 0.1154)	(0.2192, -0.3364)
s_E	(-0.2298, -0.0011)	(-0.2792, -0.0384)	(-0.2404, 0.0148)	(-0.2890, 0.2224)	(-0.2336, -0.2290)

Four year horizon ($T = 16$)

North \ South	—	τ^{IM*}	τ^{V*}	s_D^*	s_E^*
—	(0.0000, 0.0000)	(-0.0279, 0.0048)	(0.0045, -0.0116)	(-0.0155, 0.0323)	(-0.0044, -0.0344)
τ^{IM}	(0.0045, -0.0369)	(-0.0234, -0.0322)	(0.0090, -0.0485)	(-0.0110, -0.0045)	(0.0001, -0.0715)
τ^{V}	(-0.0176, -0.0021)	(-0.0455, 0.0026)	(-0.0131, -0.0137)	(-0.0331, 0.0303)	(-0.0220, -0.0366)
s_D	(0.0381, -0.0343)	(0.0102, -0.0296)	(0.0425, -0.0459)	(0.0227, -0.0019)	(0.0337, -0.0689)
s_E	(-0.0374, -0.0015)	(-0.0654, 0.0032)	(-0.0330, -0.0131)	(-0.0530, 0.0307)	(-0.0418, -0.0360)

Infinite horizon ($T \to \infty$)

North \ South	—	τ^{IM*}	τ^{V*}	s_D^*	s_E^*
—	(0.0000, 0.0000)	(-0.0094, 0.0071)	(0.0044, -0.0076)	(0.0015, -0.0054)	(-0.0048, 0.0051)
τ^{IM}	(0.0043, -0.0104)	(-0.0051, -0.0033)	(0.0087, -0.0180)	(0.0058, -0.0158)	(-0.0004, -0.0053)
τ^{V}	(-0.0086, 0.0052)	(-0.0180, 0.0123)	(-0.0042, -0.0024)	(-0.0071, -0.0003)	(-0.0133, 0.0103)
s_D	(-0.0017, -0.0024)	(-0.0111, 0.0047)	(0.0027, -0.0100)	(-0.0002, -0.0079)	(-0.0064, 0.0026)
s_E	(0.0029, -0.0044)	(-0.0065, 0.0028)	(0.0073, -0.0120)	(0.0044, -0.0098)	(-0.0018, 0.0007)

Welfare of Bilateral Policies: Decoupling from GVC

One year horizon ($T = 4$)

North \ South	—	τ^{IM*}	τ^{V*}	s_D^*	s_E^*
—	(0.0000, 0.0000)	(-0.0494, -0.0372)	(-0.0106, 0.0159)	(-0.0592, 0.2236)	(-0.0038, -0.2279)
τ^{IM}	(-0.0138, -0.0824)	(-0.0631, -0.1197)	(-0.0243, -0.0665)	(-0.0729, 0.1412)	(-0.0176, -0.3104)
τ^{V}	(-0.0005, -0.0443)	(-0.0499, -0.0816)	(-0.0111, -0.0284)	(-0.0596, 0.1794)	(-0.0044, -0.2723)
s_D	(0.2230, -0.1083)	(0.1737, -0.1456)	(0.2125, -0.0924)	(0.1640, 0.1154)	(0.2192, -0.3364)
s_E	(-0.2298, -0.0011)	(-0.2792, -0.0384)	(-0.2404, 0.0148)	(-0.2890, 0.2224)	(-0.2336, -0.2290)

Four year horizon ($T = 16$)

North \ South	—	τ^{IM*}	τ^{V*}	s_D^*	s_E^*
—	(0.0000, 0.0000)	(-0.0279, 0.0048)	(0.0045, -0.0116)	(-0.0155, 0.0323)	(-0.0044, -0.0344)
τ^{IM}	(0.0045, -0.0369)	(-0.0234, -0.0322)	(0.0090, -0.0485)	(-0.0110, -0.0045)	(0.0001, -0.0715)
τ^{V}	(-0.0176, -0.0021)	(-0.0455, 0.0026)	(-0.0131, -0.0137)	(-0.0331, 0.0303)	(-0.0220, -0.0366)
s_D	(0.0381, -0.0343)	(0.0102, -0.0296)	(0.0425, -0.0459)	(0.0227, -0.0019)	(0.0337, -0.0689)
s_E	(-0.0374, -0.0015)	(-0.0654, 0.0032)	(-0.0330, -0.0131)	(-0.0530, 0.0307)	(-0.0418, -0.0360)

Infinite horizon ($T \to \infty$)

North \ South	—	τ^{IM*}	τ^{V*}	s_D^*	s_E^*
—	(0.0000, 0.0000)	(-0.0094, 0.0071)	(0.0044, -0.0076)	(0.0015, -0.0054)	(-0.0048, 0.0051)
τ^{IM}	(0.0043, -0.0104)	(-0.0051, -0.0033)	(0.0087, -0.0180)	(0.0058, -0.0158)	(-0.0004, -0.0053)
τ^{V}	(-0.0086, 0.0052)	(-0.0180, 0.0123)	(-0.0042, -0.0024)	(-0.0071, -0.0003)	(-0.0133, 0.0103)
s_D	(-0.0017, -0.0024)	(-0.0111, 0.0047)	(0.0027, -0.0100)	(-0.0002, -0.0079)	(-0.0064, 0.0026)
s_E	(0.0029, -0.0044)	(-0.0065, 0.0028)	(0.0073, -0.0120)	(0.0044, -0.0098)	(-0.0018, 0.0007)

Welfare of Bilateral Policies: Production Subsidy War

LIETUVOS BANKAS
EUROSISTEMA

One year horizon ($T = 4$)

North \ South	—	τ^{IM*}	τ^{V*}	s_D^*	s_E^*
—	(0.0000, 0.0000)	(-0.0494, -0.0372)	(-0.0106, 0.0159)	(-0.0592, 0.2236)	(-0.0038, -0.2279)
τ^{IM}	(-0.0138, -0.0824)	(-0.0631, -0.1197)	(-0.0243, -0.0665)	(-0.0729, 0.1412)	(-0.0176, -0.3104)
τ^{V}	(-0.0005, -0.0443)	(-0.0499, -0.0816)	(-0.0111, -0.0284)	(-0.0596, 0.1794)	(-0.0044, -0.2723)
s_D	(0.2230, -0.1083)	(0.1737, -0.1456)	(0.2125, -0.0924)	(0.1640, 0.1154)	(0.2192, -0.3364)
s_E	(-0.2298, -0.0011)	(-0.2792, -0.0384)	(-0.2404, 0.0148)	(-0.2890, 0.2224)	(-0.2336, -0.2290)

Four year horizon ($T = 16$)

North \ South	—	τ^{IM*}	τ^{V*}	s_D^*	s_E^*
—	(0.0000, 0.0000)	(-0.0279, 0.0048)	(0.0045, -0.0116)	(-0.0155, 0.0323)	(-0.0044, -0.0344)
τ^{IM}	(0.0045, -0.0369)	(-0.0234, -0.0322)	(0.0090, -0.0485)	(-0.0110, -0.0045)	(0.0001, -0.0715)
τ^{V}	(-0.0176, -0.0021)	(-0.0455, 0.0026)	(-0.0131, -0.0137)	(-0.0331, 0.0303)	(-0.0220, -0.0366)
s_D	(0.0381, -0.0343)	(0.0102, -0.0296)	(0.0425, -0.0459)	(0.0227, -0.0019)	(0.0337, -0.0689)
s_E	(-0.0374, -0.0015)	(-0.0654, 0.0032)	(-0.0330, -0.0131)	(-0.0530, 0.0307)	(-0.0418, -0.0360)

Infinite horizon ($T \to \infty$)

North \ South	—	τ^{IM*}	τ^{V*}	s_D^*	s_E^*
—	(0.0000, 0.0000)	(-0.0094, 0.0071)	(0.0044, -0.0076)	(0.0015, -0.0054)	(-0.0048, 0.0051)
τ^{IM}	(0.0043, -0.0104)	(-0.0051, -0.0033)	(0.0087, -0.0180)	(0.0058, -0.0158)	(-0.0004, -0.0053)
τ^{V}	(-0.0086, 0.0052)	(-0.0180, 0.0123)	(-0.0042, -0.0024)	(-0.0071, -0.0003)	(-0.0133, 0.0103)
s_D	(-0.0017, -0.0024)	(-0.0111, 0.0047)	(0.0027, -0.0100)	(-0.0002, -0.0079)	(-0.0064, 0.0026)
s_E	(0.0029, -0.0044)	(-0.0065, 0.0028)	(0.0073, -0.0120)	(0.0044, -0.0098)	(-0.0018, 0.0007)

Welfare of Bilateral Policies: Entry Subsidy War

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One year horizon ($T = 4$)

North \ South	—	τ^{IM*}	τ^{V*}	s_D^*	s_E^*
—	(0.0000, 0.0000)	(-0.0494, -0.0372)	(-0.0106, 0.0159)	(-0.0592, 0.2236)	(-0.0038, -0.2279)
τ^{IM}	(-0.0138, -0.0824)	(-0.0631, -0.1197)	(-0.0243, -0.0665)	(-0.0729, 0.1412)	(-0.0176, -0.3104)
τ^{V}	(-0.0005, -0.0443)	(-0.0499, -0.0816)	(-0.0111, -0.0284)	(-0.0596, 0.1794)	(-0.0044, -0.2723)
s_D	(0.2230, -0.1083)	(0.1737, -0.1456)	(0.2125, -0.0924)	(0.1640, 0.1154)	(0.2192, -0.3364)
s_E	(-0.2298, -0.0011)	(-0.2792, -0.0384)	(-0.2404, 0.0148)	(-0.2890, 0.2224)	(-0.2336, -0.2290)

Four year horizon ($T = 16$)

North \ South	—	τ^{IM*}	τ^{V*}	s_D^*	s_E^*
—	(0.0000, 0.0000)	(-0.0279, 0.0048)	(0.0045, -0.0116)	(-0.0155, 0.0323)	(-0.0044, -0.0344)
τ^{IM}	(0.0045, -0.0369)	(-0.0234, -0.0322)	(0.0090, -0.0485)	(-0.0110, -0.0045)	(0.0001, -0.0715)
τ^{V}	(-0.0176, -0.0021)	(-0.0455, 0.0026)	(-0.0131, -0.0137)	(-0.0331, 0.0303)	(-0.0220, -0.0366)
s_D	(0.0381, -0.0343)	(0.0102, -0.0296)	(0.0425, -0.0459)	(0.0227, -0.0019)	(0.0337, -0.0689)
s_E	(-0.0374, -0.0015)	(-0.0654, 0.0032)	(-0.0330, -0.0131)	(-0.0530, 0.0307)	(-0.0418, -0.0360)

Infinite horizon ($T \to \infty$)

North \ South	—	τ^{IM*}	τ^{V*}	s_D^*	s_E^*
—	(0.0000, 0.0000)	(-0.0094, 0.0071)	(0.0044, -0.0076)	(0.0015, -0.0054)	(-0.0048, 0.0051)
τ^{IM}	(0.0043, -0.0104)	(-0.0051, -0.0033)	(0.0087, -0.0180)	(0.0058, -0.0158)	(-0.0004, -0.0053)
τ^{V}	(-0.0086, 0.0052)	(-0.0180, 0.0123)	(-0.0042, -0.0024)	(-0.0071, -0.0003)	(-0.0133, 0.0103)
s_D	(-0.0017, -0.0024)	(-0.0111, 0.0047)	(0.0027, -0.0100)	(-0.0002, -0.0079)	(-0.0064, 0.0026)
s_E	(0.0029, -0.0044)	(-0.0065, 0.0028)	(0.0073, -0.0120)	(0.0044, -0.0098)	(-0.0018, 0.0007)

Summary

- What are the dynamic (and distributional) effects of the industrial policies employed amidst the geoeconomic tensions?
- Developed an open economy macro framework with trade and offshoring dynamics
- We found considerable variation across combinations of policies and time horizons, highlighting the need to use dynamic analysis when studying the implications of industrial policies.
- Next: proper welfare analysis across different skill classes

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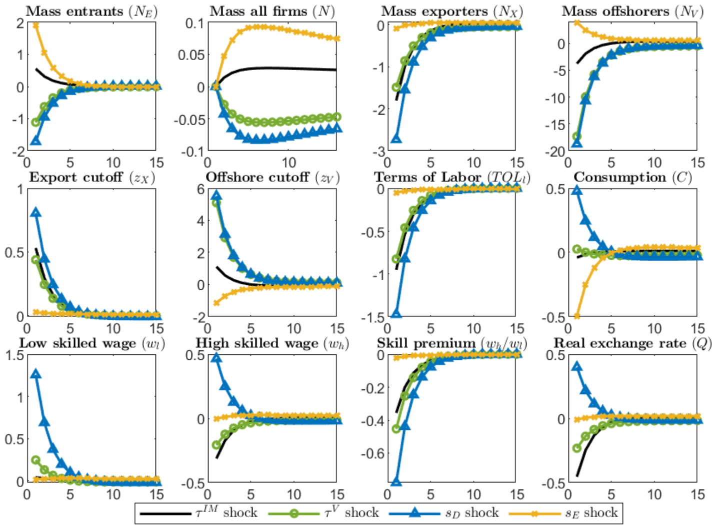
Aggregate accounting

- Aggregate accounting

$$C_t + N_{E,t}\tilde{v}_t = w_{l,t}L + w_{h,t}H + N_t\tilde{d}_t + T_t$$

▸ Equilibrium

All Shocks to North



dynamics offshoring

All Shocks to South

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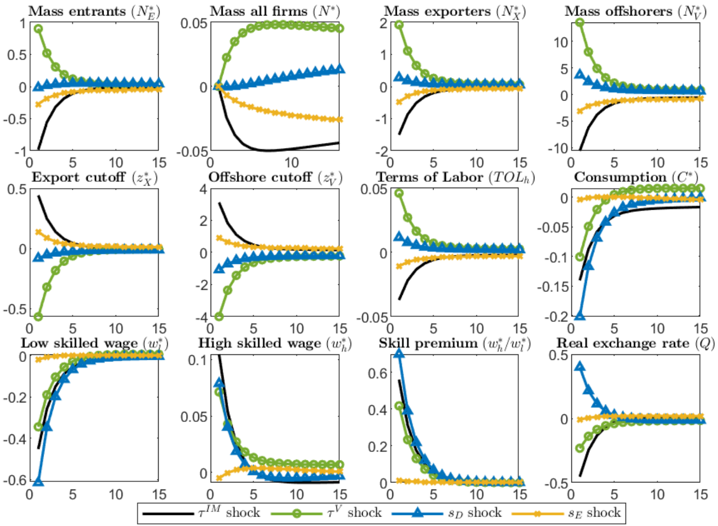

dynamics offshoring

Government Budget

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- Government budget constraint for the North

$$\tau^V \tau^{IM} N_{V,t} w^*_{l,t} \tilde{l}_{V,t} Q_t + \tau^{IM} N^*_{X,t} \tilde{\rho}^*_{X,t} [(1+\tau^{IM})\tilde{\rho}^*_{X,t}]^{-\theta} C_t$$
$$= s_E N_{E,t} \frac{f_E}{Z_t} \left(\frac{w_{l,t}}{1-\alpha}\right)^{1-\alpha} \left(\frac{w_{h,t}}{\alpha}\right)^{\alpha} + s_D N_{D,t} \tilde{\rho}^{-\theta}_{D,t} C_t \frac{1}{Z_t \tilde{z}_D} \left(\frac{w_{l,t}}{1-\alpha}\right)^{1-\alpha} \left(\frac{w_{h,t}}{\alpha}\right)^{\alpha} + T_t,$$

- Similarly, the balanced budget for the Southern government is given by:

$$\tau^{V*} \tau^{IM*} N^*_{V,t} w_{h,t} \tilde{h}^*_{V,t} Q^{-1}_t + \tau^{IM*} N_{X,t} \tilde{\rho}_{X,t} [(1+\tau^{IM*})\tilde{\rho}_{X,t}]^{-\theta} C^*_t$$
$$= s^*_E N^*_{E,t} \frac{f^*_E}{Z^*_t} \left(\frac{w^*_{l,t}}{1-\alpha}\right)^{1-\alpha} \left(\frac{w^*_{h,t}}{\alpha}\right)^{\alpha} + s^*_D N^*_{D,t} \tilde{\rho}^{*-\theta}_{D,t} C^*_t \frac{1}{Z^*_t \tilde{z}^*_D} \left(\frac{w^*_{l,t}}{1-\alpha}\right)^{1-\alpha} \left(\frac{w^*_{h,t}}{\alpha}\right)^{\alpha} + T^*_t.$$

▸ Equilibrium

Balance of Payments

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The balance of international payments (expressed in units of the Northern consumption basket) requires that the trade balance equals the net aggregate fixed offshoring cost:

$$TB_t = N_{V,t} f_V \frac{Q_t}{Z_t^*} \left(\frac{w_{l,t}^*}{1-\alpha} \right)^{1-\alpha} \left(\frac{w_{h,t}^*}{\alpha} \right)^{\alpha} - N_{V,t}^* f_V^* \frac{1}{Z_t} \left(\frac{w_{l,t}}{1-\alpha} \right)^{1-\alpha} \left(\frac{w_{h,t}}{\alpha} \right)^{\alpha} .$$

The trade balance, TB_t, is given by the value of regular exports and the value offshoring exports of high-skilled tasks minus the value of offshoring imports of low-skilled tasks and the value of regular imports:

$$TB_t \equiv \underbrace{N_{X,t} \tilde{\rho}_{X,t} \left((1+\tau^{IM*}) \tilde{\rho}_{X,t} \right)^{-\theta} C_t^* Q_t}_{\text{Regular exports}} + \underbrace{\tau^{V*} N_{V,t}^* w_{h,t} \tilde{h}_{V,t}^*}_{\text{Offshoring exports}}$$

$$- \underbrace{\tau^{V} N_{V,t} w_{l,t}^* \tilde{l}_{V,t} Q_t}_{\text{Offshoring imports}} - \underbrace{N_{X,t}^* \tilde{\rho}_{X,t}^* \left((1+\tau^{IM}) \tilde{\rho}_{X,t}^* \right)^{-\theta} C_t}_{\text{Regular imports}} .$$

▸ Equilibrium