Trade Fragmentation, Inflationary Pressures and Monetary Policy

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Globalisation has stalled...

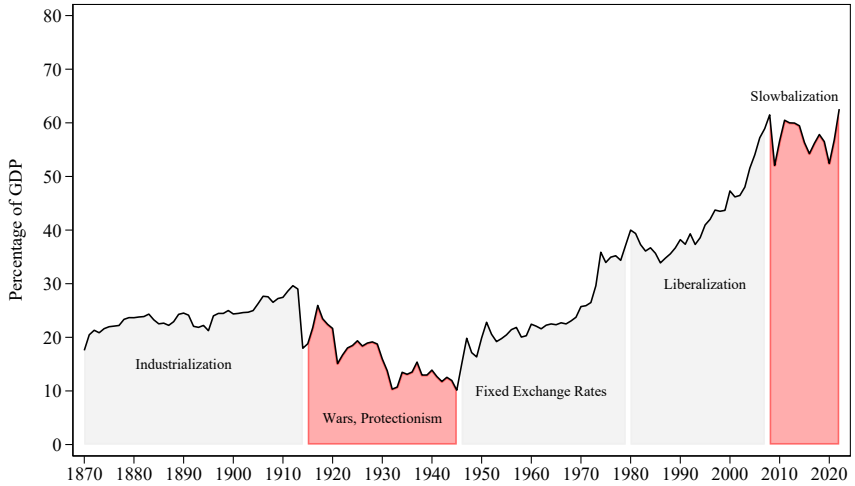


Figure: Sum of exports and imports,% of GDP

... and Trade is Increasingly Influenced by Geopolitics

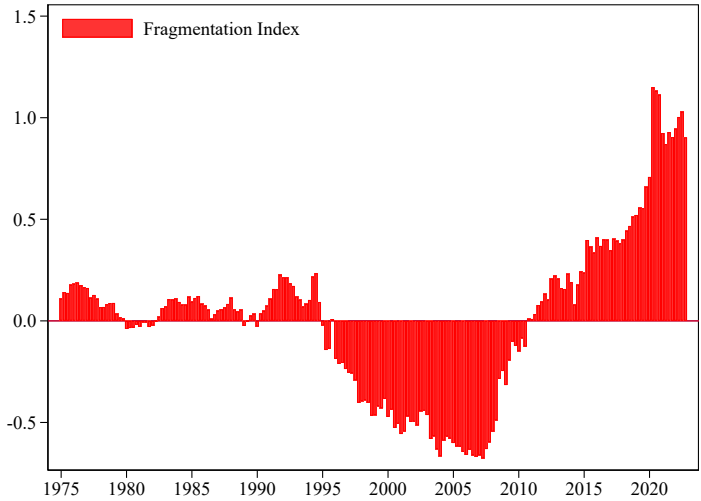


Figure: Fragmentation Index - Fernández-Villaverde, Mineyama, and Song (2024)

Background and two questions

- Trade fragmentation driven by geopolitics will in all likelihood lead to:
  - Higher imported goods prices
  - Lower real incomes

1. Will fragmentation lead to a high-inflation environment?
2. What would be the monetary policy response needed to keep inflation at target?

Preview of answers

1. Will fragmentation lead to a high-inflation environment?
   - Fragmentation does not imply central banks should change their remits
   - Rephrase: will it lead to higher inflationary pressures? It depends
     - **Front-loaded** fragmentation might create a short-term **inflationary** pressure
     - **Gradual** fragmentation might lead to **stagnation**, with lower demand and domestic **disinflationary** pressures
2. What is the monetary policy response needed to keep inflation at target? (How will the equilibrium r* respond?) It depends
   - On how demand responds to (permanently) lower real incomes
     - Fragmentation might increase or lower r*

Literature Review

- **Monetary policy & small open economies**: Benigno and Benigno (2003), Gali and Monacelli (2005), Santacreu et al. (2005), De Paoli (2009), Schmitt-Grohe and Uribe (2003), etc.

- **External shocks on macroeconomic outcomes using structural models**: Romero et al. (2008), Catao and Chang (2013), Hevia and Nicolini (2013) Bergholt (2014), Ferrero and Seneca (2019), Wills (2013), Drechsel, McLeay, and Tenreyro (2019), Auclert, Rognlie, Souchier, and Straub (2021), Siena (2021), Broadbent, Di Pace, Drechsel, Harrison, and Tenreyro (2023), Auclert, Monnery, Rognlie, and Straub (2023), Chan, Diz, and Kanngiesser (2024), Guerrieri, Marcussen, Reichlin, and Tenreyro (2024), etc.

- **Globalisation & Macroeconomy**: Rogoff et al. (2003), Rogoff et al. (2006), Roberts (2006), Sbordone (2008), Chen, Imbs, and Scott (2009), Attinasi and Balatti (2021)), Carluccio, Gautier, Guilloux-Nefussi (2023)), etc.

- **Macroeconomic impact of tariffs**: Meng, Russ, and Singh, (2023) Bergin and Corsetti (2023); Bianchi and Coulibaly (2024); Auclert, Rognlie, and Straub (2025); Kalemli-Ozcan, Soylu, and Yildirim (2025); Werning, Lorenzoni, and Guerrieri (2025), etc.

Model economy: starting point

- Small open economy New Keynesian setting with heterogeneous agents
  - Unconstrained (U) households maximise their utility over consumption, labour supply and asset holdings, subject to their budget constraint
  - Constrained (C) households spend all their disposable income within a period
  - Firms maximise profits, given production technology
  - Monopolistic competition and sticky prices in the domestic non-tradable goods sector

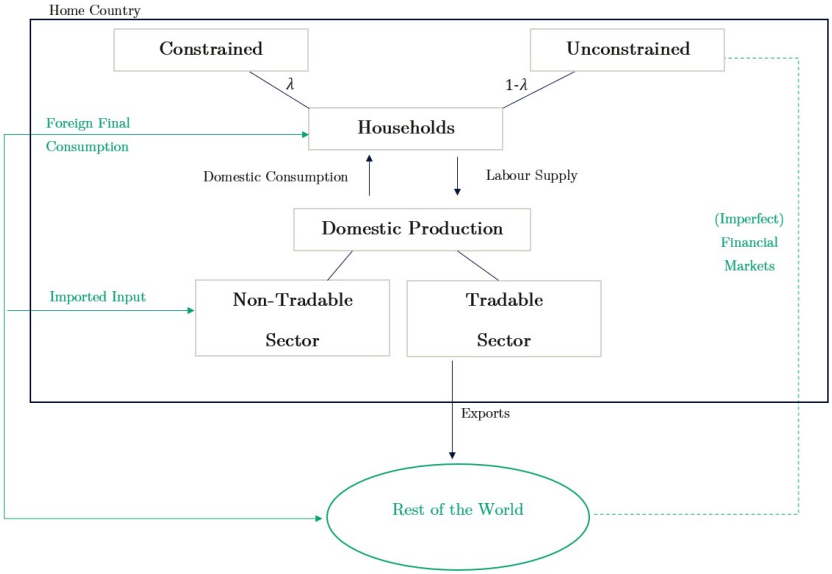
Model economy: financial markets and monetary policy

- Imperfect international risk sharing (different from Gali and Monacelli (2005))
  - Unconstrained households have access to a risk-free international asset
  - Convex cost of adjusting asset holdings (Schmitt-Grohe and Uribe (2003))
  - Constrained households have no access to domestic or international financial markets
- Monetary policy: Taylor rule responds to deviations of CPI inflation from target

Open economy setup

- Home (H) is a small open economy
- Trades consumption goods and imports foreign input
  - Rest of the world dynamics are assumed to be exogenous
- Trades domestic and international bonds
  - Trade is carried out by unconstrained households
  - Imperfect risk-sharing internationally: quadratic cost in changing the real bond position

Structure of the economy



Household preferences

- Households maximise expected lifetime utility

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left\{ \frac{(C_t^j)^{1-\sigma}}{1-\sigma} - \kappa_\ell \frac{(N_t^j)^{1+\phi}}{1+\phi} \right\}.$$

- Consumption basket is a CES aggregate of tradable and non-tradable goods:

$$C_t \equiv \left[(1-\varsigma)^{\frac{1}{\iota}} C_{T,t}^{\frac{\iota-1}{\iota}} + \varsigma^{\frac{1}{\iota}} C_{N,t}^{\frac{\iota-1}{\iota}} \right]^{\frac{\iota}{\iota-1}}$$

  - $1-\varsigma$ is the share of tradable goods in domestic consumption.

Household preferences: home and foreign goods

- $C_{T,t}$ is a bundle of domestically and foreign produced tradable consumption goods

$$C_{T,t} = \left[(1-\theta)^{\frac{1}{\mu}} C_{H,t}^{\frac{\mu-1}{\mu}} + \theta^{\frac{1}{\mu}} C_{F,t}^{\frac{\mu-1}{\mu}} \right]^{\frac{\mu}{\mu-1}}$$

  - $1-\theta$ is the home bias of the economy

- Non-tradable goods are given by:

$$C_{N,t} \equiv \left(\int_0^1 C_{N,t}(i)^{\frac{\epsilon-1}{\epsilon}} di \right)^{\frac{\epsilon}{\epsilon-1}}$$

where ϵ is the elasticity of substitution across varieties.

Prices

- The aggregate CPI price level, P_t:

$$P_t \equiv \left[(1-\varsigma)P_{T,t}^{1-\iota} + \varsigma P_{N,t}^{1-\iota}\right]^{\frac{1}{1-\iota}}$$

- The tradable goods price level, $P_{T,t}$:

$$P_{T,t} \equiv \left[(1-\theta)P_{H,t}^{1-\mu} + \theta P_{F,t}^{1-\mu}\right]^{\frac{1}{1-\mu}}$$

Households: Unconstrained $(1-\lambda)$

- Unconstrained (U) households have access to international and domestic financial markets.
- Their budget constraint (in real variables)

$$C_t^U + b_t + \mathcal{S}_t b_t^* = b_{t-1}\frac{(1+i_{t-1})}{(1+\pi_t)} + \mathcal{S}_t b_{t-1}^*\frac{(1+i_{t-1}^*)}{(1+\pi_t^*)} + w_t N_t^U - \frac{\chi}{2}\mathcal{S}_t\left(b_t^* - \bar{b}^*\right)^2$$

  - b_{t-1}: risk-free one-period bond, paying nominal interest rate i_t (deflated by inflation rate π_t)
  - b_{t-1}^*: risk-free one-period bond in foreign currency; i_t^*: foreign interest rate
  - $\mathcal{S}_t$: exchange rate (in domestic relative to foreign currency terms)
  - w_t: wage rate
  - χ: cost of deviating from the real steady-state value of foreign bonds $\bar{b}^*$

Household's optimality: Unconstrained

- Labor supply relation

$$\kappa_l (N_t^U)^{\phi} = (C_t^U)^{-\sigma} w_t$$

- Euler equation

$$\frac{1}{(1+i_t)} = \beta \mathbb{E}_t \left[\left(\frac{C_{t+1}^U}{C_t^U} \right)^{-\sigma} \frac{1}{(1+\pi_{t+1})} \right]$$

where $\Pi_{t+1} = (1+\pi_{t+1}) = \frac{P_{t+1}}{P_t}$ denotes gross CPI inflation.

- Uncovered interest parity (UIP) condition

$$\chi(b_t^* - \bar{b}^*) = \mathbb{E}_t \left[\Lambda_{t,t+1}^U \left(\frac{(1+i_t^*)}{(1+\pi_{t+1}^*)} \frac{\mathcal{S}_{t+1}}{\mathcal{S}_t} - \frac{(1+i_t)}{(1+\pi_{t+1})} \right) \right]$$

where $\Lambda_{t,t+1}^U = \beta \left(\frac{C_{t+1}^U}{C_t^U} \right)^{-\sigma}$ is the stochastic discount factor.

Households: Constrained (λ)

- Constrained (C) households: no access to financial markets; cannot smooth their consumption over time.
- They consume their labour income each period:

$$C_t^C = \frac{W_t}{P_t} N_t^C$$

Non-Tradable sector

- Firm production technology is given by

$$Y_{N,t}(i) = A_{N,t} M_{F,t}^{\kappa}(i) N_{N,t}^{1-\kappa}(i)$$

  - $N_{Nt}(i)$: labor, with wage rate W_t
  - $M_{F,t}(i)$: imported input, with foreign price $P_{F,t}$

- Firms take W_t and $P_{F,t}$ as given; there is monopolistic competition in the market, with sticky pricing à la Rotemberg.

- The aggregate production function is given by

$$Y_{N,t} = \frac{A_{N,t} M_{F,t}^{\kappa} N_{N,t}^{1-\kappa}}{\Delta_t}$$

where $\Delta_t = \left(1 - \frac{\xi}{2}(\Pi_N - \bar{\Pi})^2\right)$ captures the price adjustment cost.

Tradable sector

- Firms in the tradable sector produce using $N_{H,t}$, taking W_t as given

$$Y_{H,t} = A_{H,t} N_{H,t}^{1-\zeta}, \quad \zeta \in (0,1)$$

- Profit maximization yields the demand

$$W_t N_{H,t} = (1-\zeta) Y_{H,t} P_{H,t}$$

- The tradable sector is internationally competitive, taking prices $P^*_{H,t}$ as given

! Note that labour is used in both sectors $N_t = N_{H,t} + N_{N,t} = N_t^C \lambda + N_t^U (1-\lambda)$

Calibration

Parameter	Benchmark Model	Description
β	0.99	Discount Factor
χ	0.2	Portfolio Adjustment cost
θ	0.6	Share of Foreign Tradables
μ	1	Elasticity of substitution between F & H
ι	1	Elasticity of substitution between T & NT
σ	2	Household risk aversion
κ	0.0003	Cobb-Douglas Weight on Foreign Input
ϕ_π	1.5	Taylor Rule Response to Inflation
ϕ_y	0	Taylor Rule Response to Output
ϵ	11	Elasticity of Substitution (NT)
ϕ	1	Inverse Frisch Elasticity
λ	0.3	Share of Constrained HH

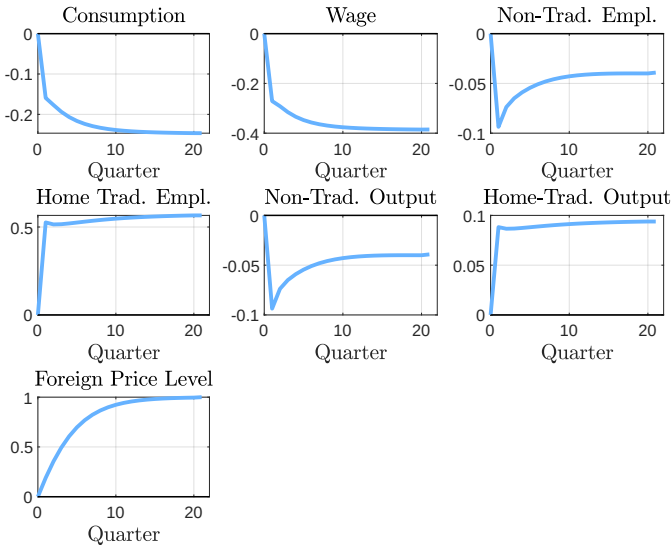
Three Fragmentation Scenarios

1. **Gradual Fragmentation**: price of imported goods ($p_{F,t}$) increases gradually and permanently, stabilising at higher levels in the medium-to-long term

2. **Front-loaded Fragmentation**: price of imported goods ($p_{F,t}$) increases immediately and permanently

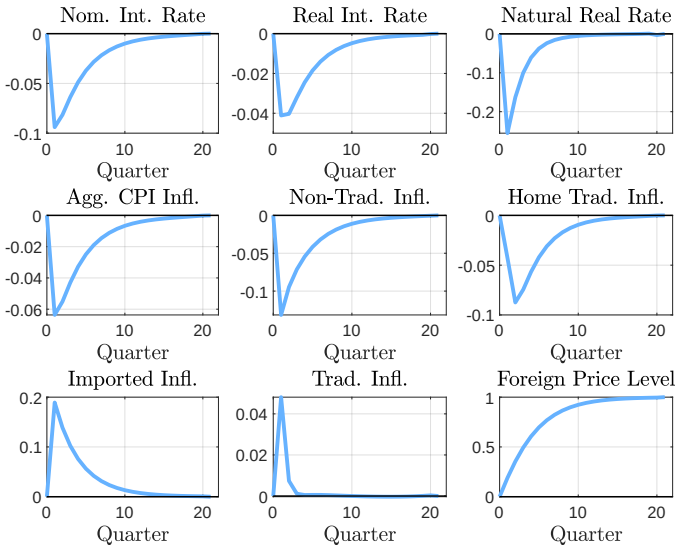
3. **Fall in Tradable Sector Productivity**: TFP in the tradable sector ($A_{T,t}$) falls persistently

Gradual import price increase I - RANK



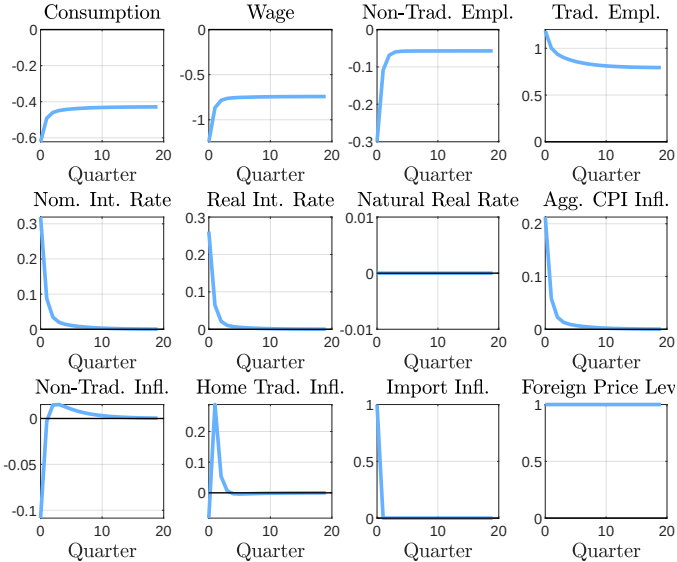
- The increase in foreign prices is anticipated
- Consumption falls, in anticipation of lower real incomes
- Wages fall with demand
- Labour effort increases (wealth effect)
- More labour effort and less consumption given worse terms of trade

Gradual import price increase II - RANK



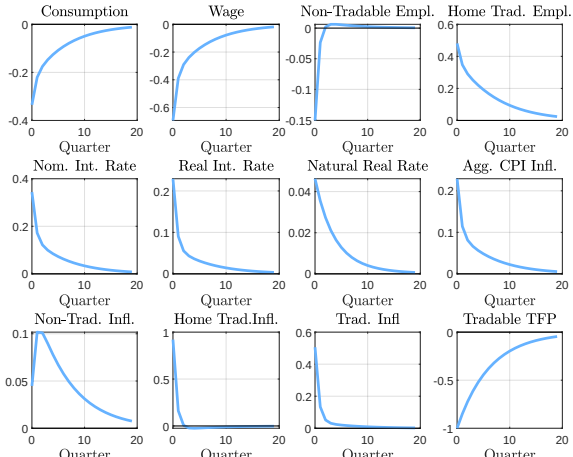
- Natural rate of interest falls
- Inflation falls as demand falls faster than supply
- Monetary policy loosens to bring CPI inflation back to target

Front-loaded increase in import prices - RANK



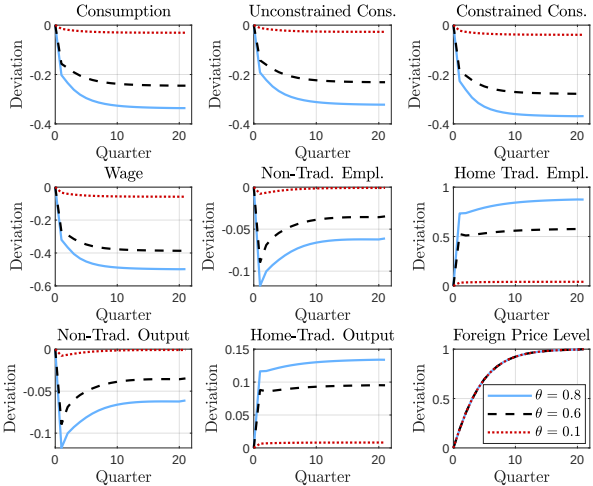
- Foreign price level permanently higher
- Consumption drops
- Monetary policy ends up tightening to keep inflation at target

Tradable TFP Shock - RANK



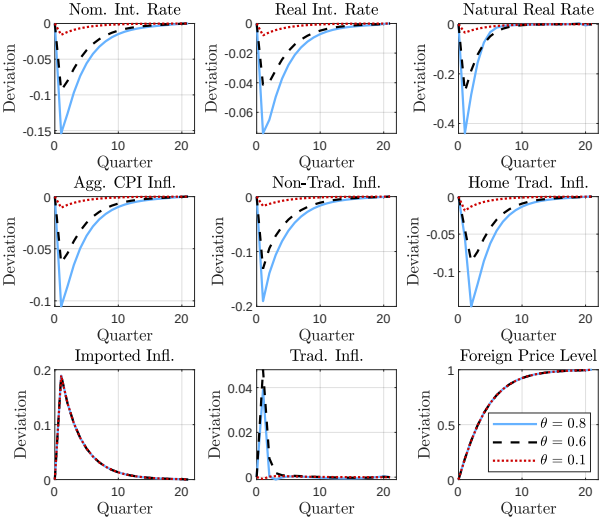
- Lower productivity in tradable sector leads to lower wages and lower consumption
- Increased price pressures in tradable sector, moderate price pressures in non-tradable sector
- Upward pressure on CPI inflation

Gradual import price increase I



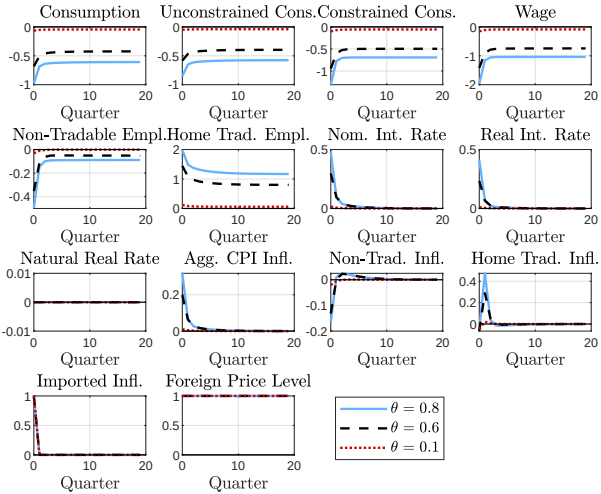
- Less home-bias (more trade openness) leads to bigger fall in wages, bigger increase in employment and output

Gradual import price increase II



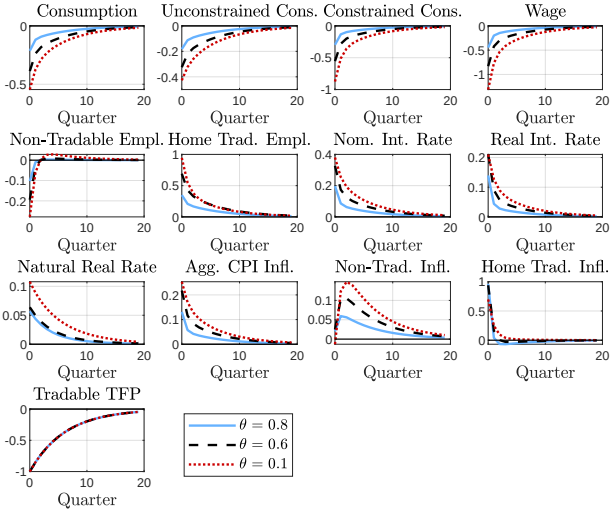
- Higher exposure causes larger domestic adjustment
- Bigger fall in domestic inflation

Front-loaded increase in Import Prices



- Higher exposure leads to lower wages and higher employment response

Tradable TFP Shock



- Higher openness mitigates the impact of the domestic shock
- Consumption falls by less

Further Exercises

- Greater use of foreign goods in production
  - Exacerbates fall in real wages and increase in employment
  - Natural rate reacts more
- Higher share of hand-to-mouth consumers
  - Consumption falls by less on impact due to less anticipation
  - Overall, negligible differences in inflation or natural rates
- Wage stickiness
  - Composition of domestic inflationary pressures differ
  - Same conclusions for policy response

Tentative conclusions

- Fragmentation may lead to higher import prices and lower supply, lowering real incomes
- The impact on domestic and aggregate CPI inflation depends on how demand adjusts to lower incomes, which in turn depends on the nature of fragmentation
  - **Gradual fragmentation** could lead to stagnation: with lower real incomes and low inflationary pressures, monetary policy might need to loosen
  - **Frontloaded fragmentation** could create a short-term trade-off or temporary stagflation, calling for tightening
  - Persistent **falls in tradable sector productivity** might end up being neutral for inflation
- How monetary policy should respond depends on the balance of demand and supply: policy direction is a priori ambiguous

Next Steps

- Study optimal monetary policy, rather than suboptimal Taylor rules
- Other shapes of fragmentation: unanticipated, sustained increases in import prices
- Big omissions:
  - lags in policy transmission
  - fiscal policy response
  - non-rational inflation expectations

Outside of the Model

- Other policies suitable to tackle geopolitical trends and shocks
- Need for a "real-side" policy strategy to prevent, mitigate and/or cope with the economic impact of geopolitical developments

1. Investment on technological diversification, focused on low-substitutability inputs or technologies (Koren and Tenreyro, 2010)
2. Deeper trade integration with low geopolitical-risk countries to lower exposure to shocks to specific suppliers/buyers (whether domestic or foreign), reducing volatility (Caselli, Koren, Lisicky, and Tenreyro, 2020). Reshoring increases risk exposure and volatility, reducing resilience
3. Inventory base to prepare for shortages in critical inputs (energy, water, etc.)

Thank you!