

TRADE FRAGMENTATION, INFLATIONARY PRESSURES AND MONETARY POLICY

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The views expressed in this paper are those of the authors, and not necessarily those of the Bank of England.

GLOBALISATION HAS STALLED...

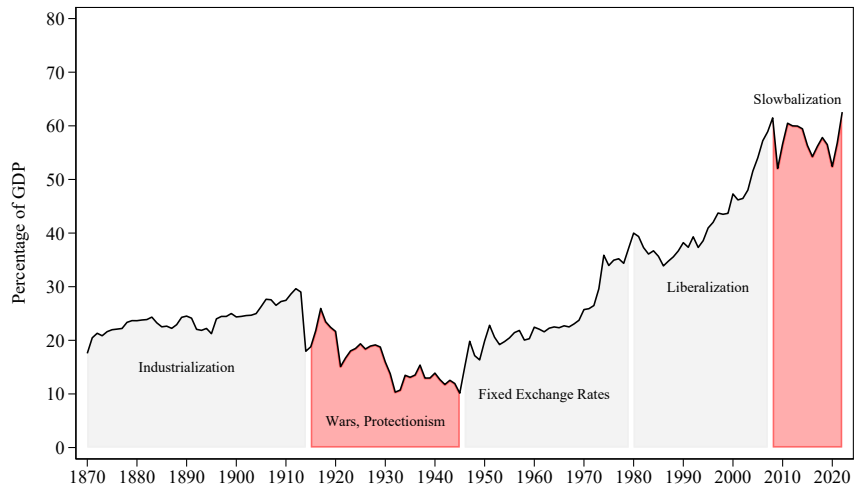


FIGURE: Sum of exports and imports, percentage of GDP

... AND TRADE IS INCREASINGLY INFLUENCED BY GEOPOLITICS

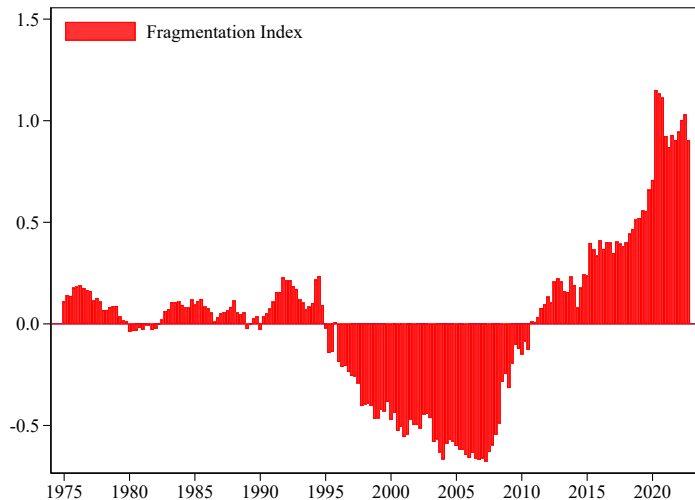


FIGURE: Fragmentation Index - Fernández-Villaverde, Mineyama, and Song (2024)

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 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); Schmitt-Grohe and Uribe (2003); Gali and Monacelli (2005); Santacreu et al. (2005); De Paoli (2009); etc.
- ▶ **External shocks on macroeconomic outcomes using structural models:** Romero et al. (2008); Catao and Chang (2013); Hevia and Nicolini (2013); Wills (2013); Bergholt (2014); Ferrero and Seneca (2019); 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); Lewis and Saleheen (2014); Comin and Johnson (2020); Attinasi and Balatti (2021); Carluccio, Gautier, and Guilloux-Nefussi (2022); etc.
- ▶ **Macroeconomic impact of tariffs:** Meng, Russ, and Singh (2023); Bergin and Corsetti (2023); Auclert, Rognlie, and Straub (2025); Bianchi and Coulibaly (2025); Cuba-Borda, Queralto, Reyes-Heroles, and Scaramucci (2025); Gnocoato, Montes-Galdon, and Stamato (2025); Kalemli-Ozcan, Soylu, and Yildirim (2025); Mehrotra and Waugh (2025); Mix and Hoang (2025); Werning, Lorenzoni, and Guerrieri (2025); Nispi-Landi and Moro (2025); etc.

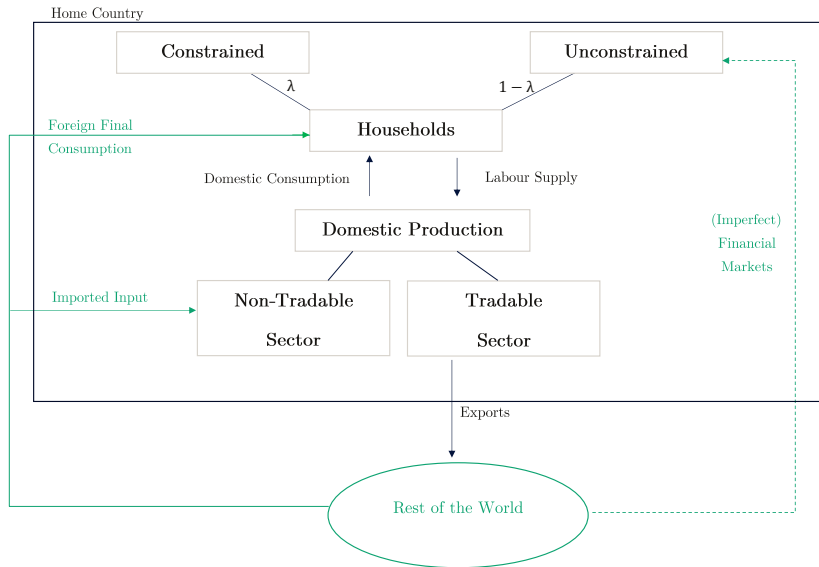
MODEL ECONOMY: STARTING POINT

- ▶ 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 constraints
 - ▶ Constrained (C) households spend all their disposable income within a period; they also supply labour
 - ▶ Firms maximise profits, given production technology
 - ▶ Monopolistic competition and sticky prices in the domestic non-tradable goods sector. Other prices are flexible

HOME (H) ECONOMY

- ▶ Trades consumption goods and imports foreign input
 - ▶ Rest of the world dynamics assumed to be exogenous
- ▶ Trades domestic and international bonds
 - ▶ Trade is carried out by unconstrained households; constrained households have no access to financial markets
 - ▶ Unconstrained households trade riskless domestic and foreign bonds - for the latter, there is a quadratic cost in changing the real asset position ([Schmitt-Grohe and Uribe \(2003\)](#))
- ▶ Monetary policy: Taylor rule responds to deviations of CPI inflation from the target

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, $P_{T,t}$:

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

- ▶ The nontradable goods price level, $P_{N,t}$:

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

HOUSEHOLDS: UNCONSTRAINED $(1 - \lambda)$

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

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

- ▶ 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)
- ▶ Ψ : real profits from the firms
- ▶ w_t : wage rate
- ▶ χ : cost of deviating from the real steady-state value of foreign bonds $\bar{b}^*$

OPTIMALITY CONDITIONS: UNCONSTRAINED HOUSEHOLDS

- ▶ 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.
- ▶ 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

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

- ▶ $N_{N,t}(i)$: 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 $N_t = N_{H,t} + N_{N,t} = N_t^C \lambda + N_t^U (1 - \lambda)$

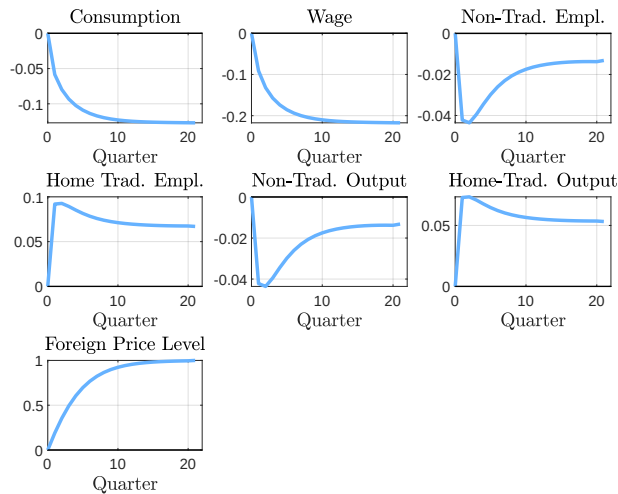
CALIBRATION

Parameter	Benchmark Model	Description
β	0.9877	Discount factor ($r_{ss} \approx 5\%$)
χ	0.01	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	$\approx 0; 0.3$	Cobb–Douglas share of 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
$1 - \zeta$	0.8	Labour share in T production

THREE FRAGMENTATION SCENARIOS

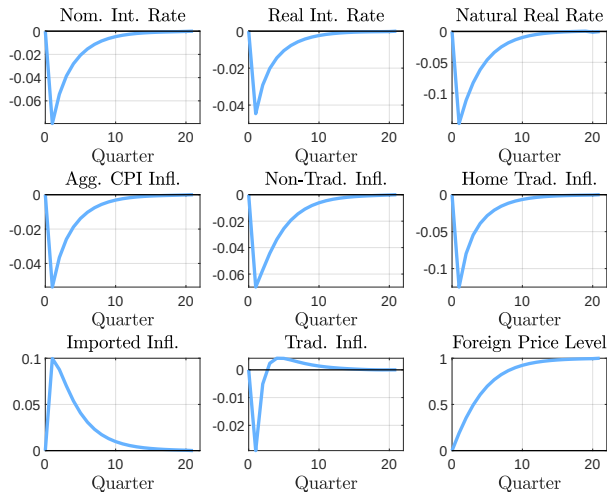
1. **Gradual Fragmentation:** price of imported goods ($p_{F,t}$) increases gradually and permanently, stabilising at higher levels in the medium-to-long term
2. **Front-loaded Fragmentation:** price of imported goods ($p_{F,t}$) increases immediately and permanently
3. **Fall in Tradable Sector Productivity:** TFP in the tradable sector ($A_{T,t}$) falls persistently

GRADUAL IMPORT PRICE INCREASE I - RANK



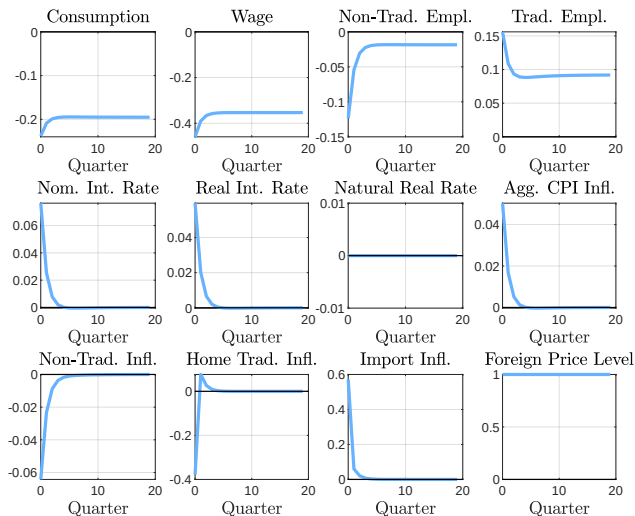
- ▶ The increase in foreign prices is anticipated
- ▶ Consumption falls, in anticipation of lower real incomes
- ▶ Labour demand falls while labour supply increases (wealth effect)
- ▶ Wages fall
- ▶ Less consumption and more labour effort given worse terms of trade

GRADUAL IMPORT PRICE INCREASE II - RANK



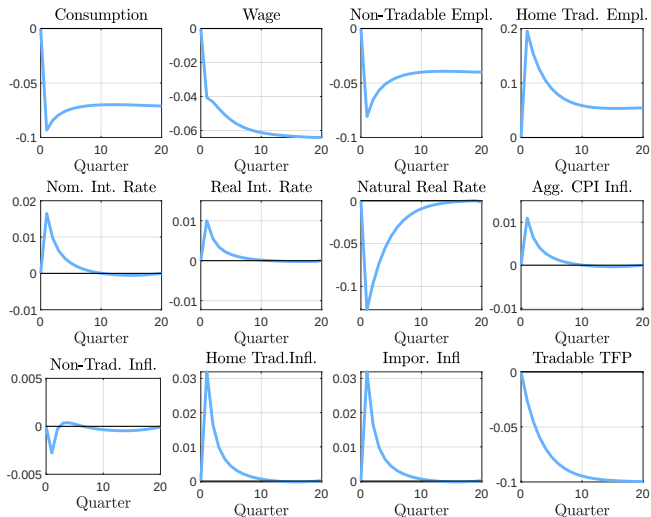
- ▶ Natural rate of interest falls
- ▶ Inflation falls as domestic components of inflation fall by more than the increase in imported components
- ▶ Monetary policy loosens to bring CPI inflation back to target

FRONT-LOADED INCREASE IN IMPORT PRICES - RANK



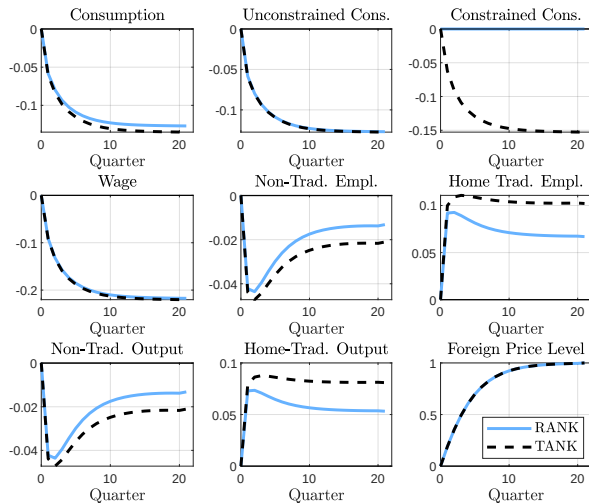
- ▶ Foreign price level suddenly and permanently higher
- ▶ Consumption and wages fall
- ▶ The natural rate of interest doesn't change
- ▶ CPI inflation increases (even though domestic components of inflation fall)
- ▶ Monetary policy ends up tightening in response to CPI inflation

GRADUAL TRADABLE TFP SHOCK - RANK



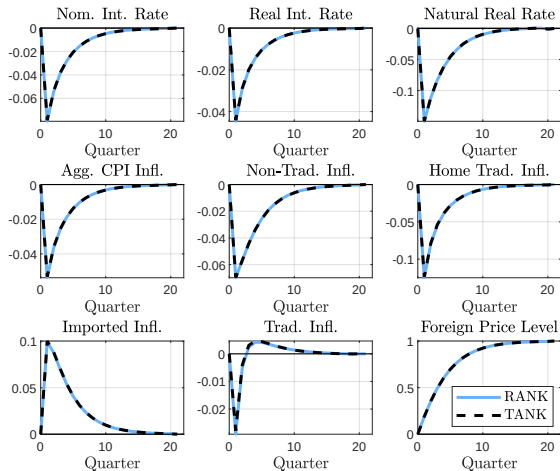
- ▶ Gradual fall in tradable sector TFP
- ▶ Consumption falls
- ▶ Natural rate of interest falls
- ▶ Initial increase in CPI, followed by permanent falls
- ▶ Monetary policy tightens first and then loosens

GRADUAL IMPORT PRICE INCREASE - TANK vs RANK



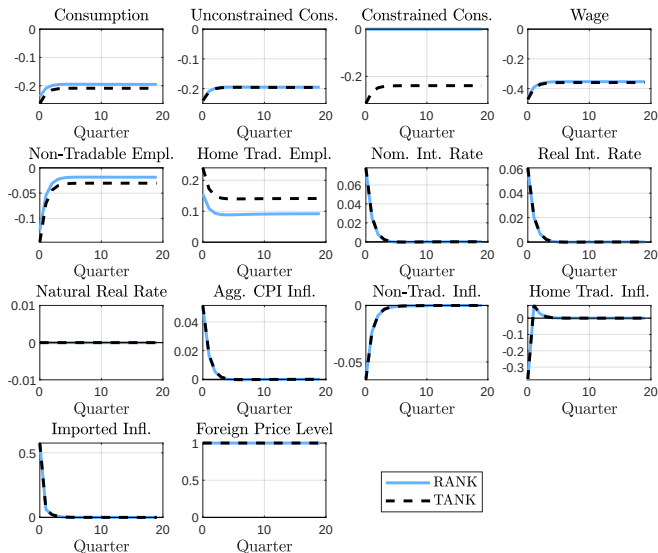
- ▶ Consumption and wages fall slightly more with hand to mouth consumers
- ▶ Two opposite effects: there is less anticipation (consumption falls less); but there are bigger aggregate demand spillovers (consumption falls more)
- ▶ Bigger reallocation from nontradables to tradables

GRADUAL IMPORT PRICE INCREASE - TANK vs RANK II



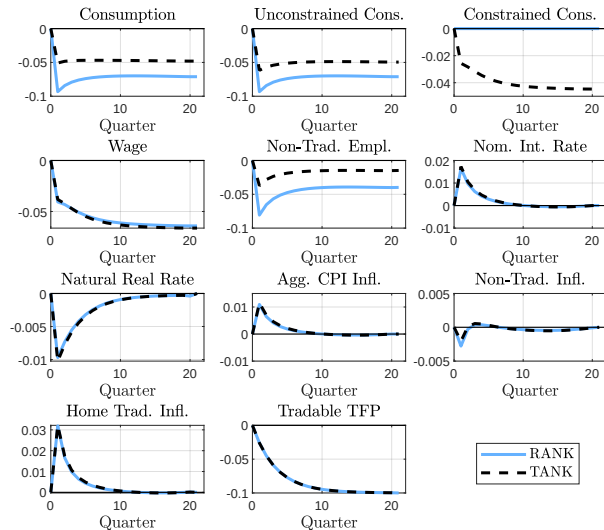
- ▶ Anticipation and demand spillovers combined lead to similar balances as in RANK
- ▶ CPI inflation decreases by roughly similar magnitudes as fall in nontradable/domestic components of inflation dominate
- ▶ Natural rate falls by roughly similar amounts

FRONT-LOADED INCREASE IN IMPORT PRICES - TANK vs RANK



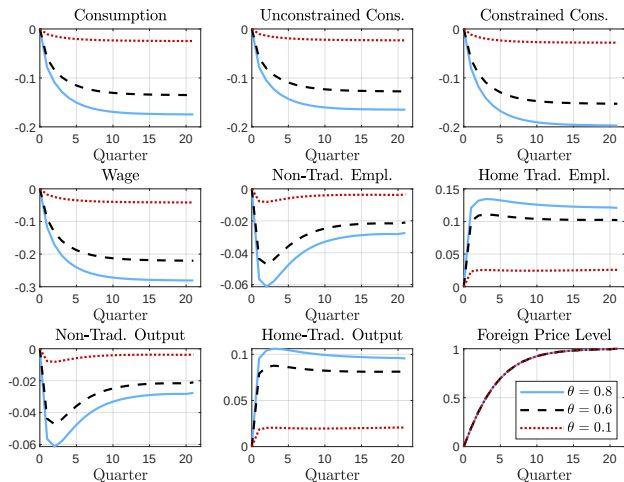
- ▶ Slightly larger fall in consumption and reallocation towards tradables
- ▶ TANK and RANK models lead to fairly similar macroeconomic effects
- ▶ No difference in inflation or the natural real rate.
- ▶ The central bank tightens in response to CPI inflation

GRADUAL DECREASE IN TFP - TANK vs RANK



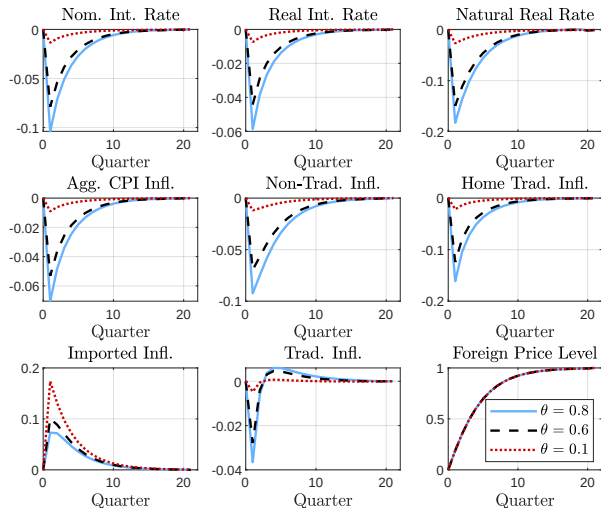
- ▶ TANK and RANK models lead to fairly similar consumption, price and wage effects
- ▶ Natural rate falls as before

VARYING OPENNESS: GRADUAL IMPORT PRICE INCREASE I



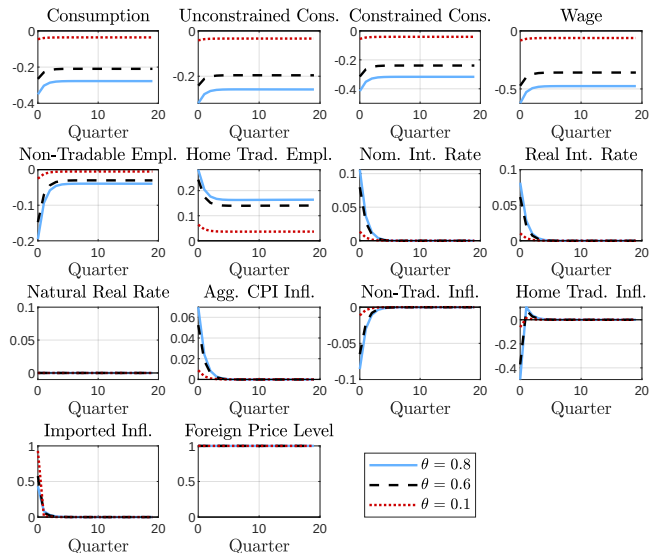
- Higher exposure to foreign shock as trade openness increases
- Less home-bias (more trade openness) leads to larger falls in consumption and wages
- Greater reallocation towards the home-tradable sectors

VARYING OPENNESS: GRADUAL IMPORT PRICE INCREASE II



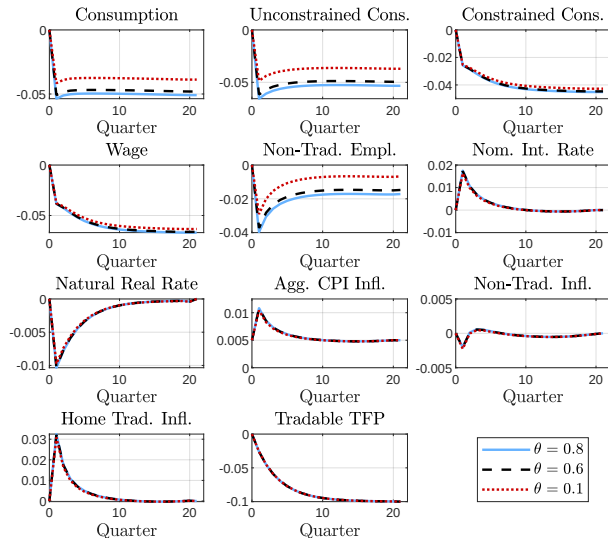
- ▶ Higher exposure causes larger domestic adjustment in prices
- ▶ Larger fall in domestic components of inflation and the natural rate of interest

VARYING OPENNESS: FRONT-LOADED INCREASE IN IMPORT PRICES



- Higher exposure leads to a more difficult tradeoff: lower demand and wages, and higher CPI inflation.
- The natural real rate does not change

VARYING OPENNESS: GRADUAL TRADABLE TFP SHOCK



- When the shock is to domestic production openness matter less

EXTENSIONS

- ▶ Higher share of foreign inputs in production
 - ▶ Exacerbates fall in consumption and real wages in response to increase in foreign prices
 - ▶ Factor substitution (towards labour) not enough to stimulate aggregate demand
- ▶ Wage stickiness
 - ▶ Moderates the fall in real wages, but leads to a larger decline in employment
 - ▶ Gradual scenario is less disinflationary, given the fall in output
 - ▶ Frontloaded scenario: aggregate CPI inflation is slightly higher on impact and more persistent, worsening the policy tradeoff
- ▶ More flexible prices
 - ▶ Increases disinflationary pressures in the gradual scenario
 - ▶ Lessens policy tradeoff in the frontloaded scenario
- ▶ Non-unitary elasticities of substitution
 - ▶ Leads to less stagnation in the gradual scenario

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 a temporary tightening in CPI-targeting central banks.
 - ▶ Persistent **falls in tradable sector productivity** can also lead to stagnation and lower natural interest rates
- ▶ How monetary policy should respond depends on the balance of demand and supply: policy direction is a priori ambiguous.

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!