Trade Fragmentation, Inflationary Pressures and Monetary Policy *

Ludovica Ambrosino† Jenny Chan ‡ Silvana Tenreyro §

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Abstract

How does trade fragmentation affect inflationary pressures? What is the response of monetary policy needed to sustain inflation at target? To answer these questions, we develop a heterogeneous agent, open-economy model featuring imperfect international risk-sharing. The model captures both the demand and supply side effects of fragmentation. It illustrates how the impact of fragmentation on inflationary pressures and the appropriate policy response depend not only on the direct effect of higher import prices on supply but, crucially, on how aggregate demand adjusts in response to lower real incomes and productivity.

Keywords: Monetary policy, trade fragmentation, open economies, inflation, heterogeneity, globalisation
JEL classification: F12, F15, F41, F62

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†London Business School. Contact: lambrosino@london.edu

‡Bank of England. Contact: jenny.chan@bankofengland.co.uk

§London School of Economics, UK; Centre for Macroeconomics, UK; CEPR, France. Contact: Tenreyro: Department of Economics and Centre for Macroeconomics, London School of Economics, Houghton Street, London, WC2A 2AE, United Kingdom; s.tenreyro@lse.ac.uk

1 Introduction

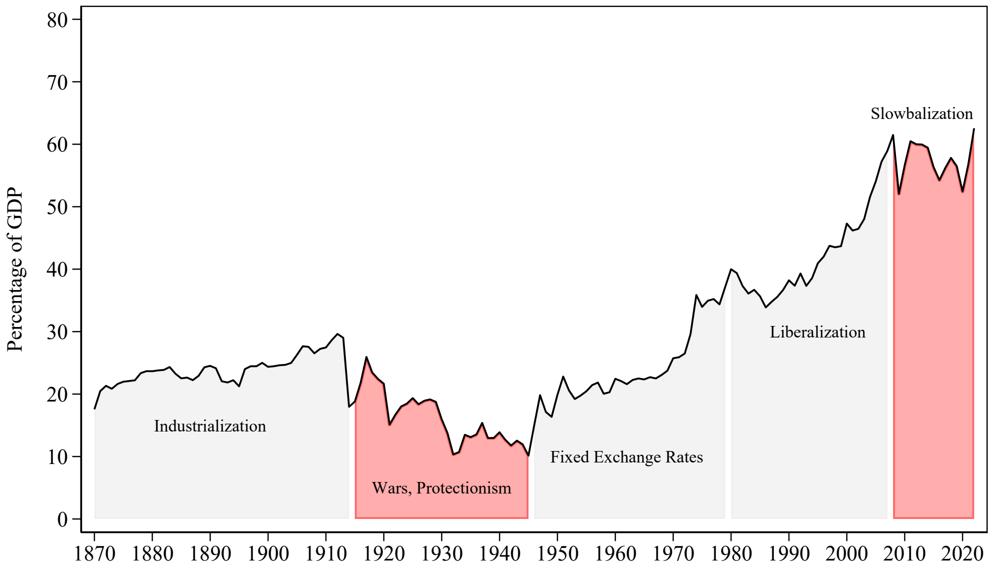
Global trends have shifted noticeably in recent decades. The protracted postwar increase in trade openness has stalled, amidst a resurgence in trade wars and protectionism. This shift is visible in Figure 1, which plots the long-term trajectory of global trade flows relative to world GDP, as well as in Figure 2, which tracks a broad index of economic fragmentation since the 1970s (Fernández-Villaverde, Mineyama, and Song, 2024). Both figures show a turning point around the global financial crisis, with trade openness plateauing and fragmentation steadily increasing, before rising sharply during the pandemic and Russia's invasion of Ukraine. The geopolitical factors driving these changes are likely to persist. New trade paradigms, such as friendshoring or fragmentation into trading blocs of geopolitically aligned countries are becoming normalized (Yellen, 2022). This reconfiguration of trade patterns raises concerns about potential losses in efficiency and aggregate output (Javorcik, Kitzmüller, Schweiger, and Yıldırım, 2024; Georgieva, 2023).

A key question for policymakers is how trade fragmentation will affect inflation dynamics and the optimal monetary policy response. The conventional view suggests that as nations retreat from global integration and supply chains duplicate, production costs will rise, exerting upward pressure on inflation (e.g., Lagarde (2023), Goodhart and Pradhan (2020)). The disinflationary trends of the 1990s and 2000s have often been linked to the rapid increase in trade integration during that period, leading to expectations that its reversal will be inflationary. However, this relationship remains contentious. Other forces besides globalisation may have contributed to the era of disinflation, including advances in manufacturing (IMF (2006)), the shift to inflation-targeting regimes (Roberts (2006)), and the lower bound constraint on interest rates in many countries (Attinasi and Balatti (2021)). Taking the United States as an example, estimates of the disinflationary effects of increased trade integration appear modest at best (Yellen (2006)).[1]

The conventional view is built around the direct or partial-equilibrium impact of trade integration on supply, abstracting from its indirect impact on aggregate demand. This paper addresses this gap by studying the broader, general equilibrium effects of trade fragmentation in a setting in which aggregate demand is also affected through changes in real incomes. Modelling fragmentation as an increase in the price of imported goods or, alternatively, as a fall in tradable sector productivity, we illustrate how the inflationary impact of fragmentation depends crucially on the adjustment of aggregate demand. Higher import prices or lower tradable sector productivity not only constrain supply through higher marginal costs, but also demand through lower real incomes and consumption - the general equilibrium effects. Consequently, the net impact on inflationary pressures is a priori ambiguous.

[1] Kamin, Marazzi, and Schindler (2004), for example, show that the impact of Chinese exports on global prices has been fairly modest. Moreover, these studies do not explicitly take into account real exchange-rate adjustments. As Kohn (2005) argues, during the second half of the 1990s, the dollar experienced a substantial appreciation, driven by increased investment flows drawn to the prospect of higher productivity growth. This

Figure 1: Sum of exports and imports,% of GDP



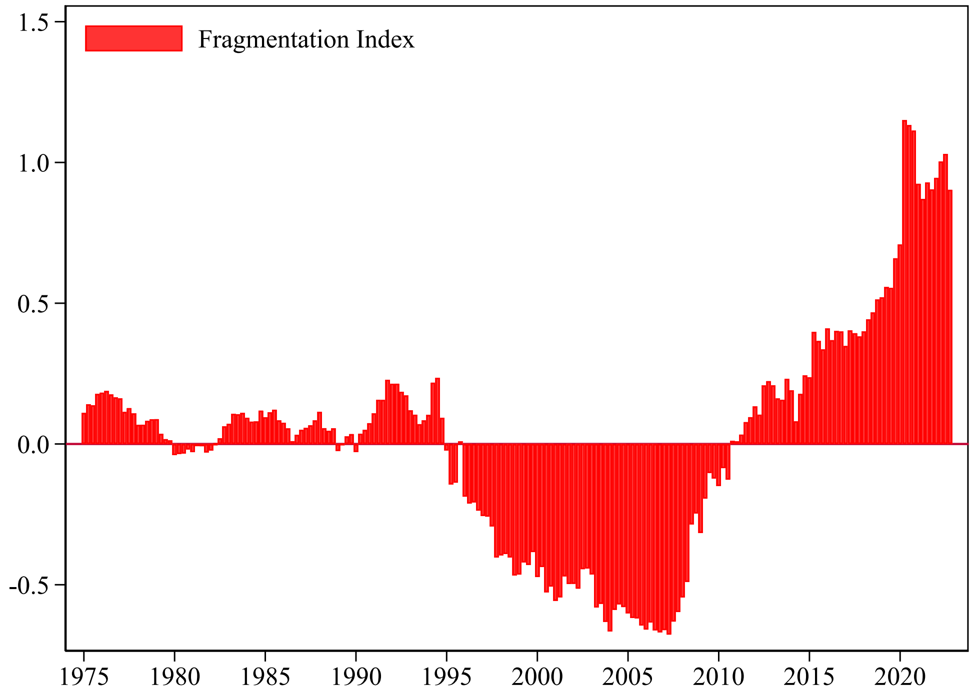
Source: Peterson Institute for International Economics; Jordà-Schularick-Taylor Macrohistory Database; Penn World Table (10.0); World Bank; OWID.

We capture these competing channels in a two-sector, open economy New Keynesian model featuring household heterogeneity and home bias in consumption. Specifically, following Debortoli and Galí (2017), the economy features two types of consumers. The first type consists of *unconstrained* agents, with access to international and domestic security markets. To account for frictions in international financial markets, we introduce imperfect international risk sharing: unconstrained agents trade risk-free foreign bonds, with a convex cost of holding assets in quantities that deviate from some long-run level (Schmitt-Grohé (2003)). The second type consists of *constrained* hand-to-mouth households, who consume only out of their labour income and have no access to financial markets. The domestic economy trades with the rest of the world, importing goods for direct consumption, for use as intermediate inputs, or both.

We consider three scenarios to show how different forms of fragmentation can have distinct macroeconomic implications. First, we consider a *gradual* (and permanent) increase in the price of imported goods. This yields a persistent increase in imported inflation, which lasts until the import price stabilises at a higher level in the medium-to-longer term. Aggregate consumption falls in response to fragmentation, as both financially constrained and unconstrained households suffer losses in real income: the real disposable income of hand-to-mouth consumers falls as a direct consequence of higher prices, restricting their spending; in turn, financially unconstrained households, who take into account their permanent-income losses also reduce their consumption in anticipation of lower future incomes. This further

may have amplified the downward trend in dollar prices of U.S. imports.

Figure 2: Fragmentation has increased since 2008.



Source: Fernández-Villaverde, Mineyama, and Song (2024)

accentuates the fall in aggregate demand, spilling over to hand-to-mouth consumers. Real wages fall both because of the negative terms-of-trade effect and because of the fall in domestic demand. Financially constrained households make up for some of the fall in income by increasing their labour supply. The fall in aggregate demand pushes down on domestic inflation. Aggregate CPI (consumer price index) inflation, a composite of domestic and imported goods inflation, falls, given the larger weight of domestic components on the basket. The reduction in demand is reflected in the real natural rate of interest, which decreases with the fragmentation shock. This suggests when demand adjusts, the overall effect is not inflationary. This scenario leads to a long period of stagnation, with low demand and low inflationary pressures. In this setting, monetary policy needs to loosen in order to bring inflation back to target.

Next, we consider a fully *front-loaded*, permanent increase in the price of imported goods.[2] The shock creates a sharp temporary trade-off, with inflation increasing and aggregate demand falling on impact. Both financially unconstrained and constrained households lower their consumption. The fall in real wages (relative to the price of imported inputs) triggers an increase in labour supply from hand-to-mouth consumers. On impact, the short-term real interest rate increases, which requires a tightening in monetary policy to bring inflation

[2]This is akin to the recent U.S. and E.U. tariffs on Chinese electric vehicles, reaching up to 100 percent and 38 percent, respectively.

back to target. The result is a temporary overshoot in inflation, with longer-term losses in income and consumption.

Finally, we study a fall in the total factor productivity (TFP) of tradable goods as a potential consequence of increased fragmentation. The fall is persistent, but not permanent, as TFP reverses over time. Real wages fall, alongside the fall in TFP. While financially unconstrained consumers can smooth the impact on consumption, constrained hand-to-mouth households lower their consumption and increase their labour supply in response to lower disposable incomes. In principle, the impact of this shock on the natural real rate is ambiguous. In our calibration, there is a small increase in the natural rate and demand and supply balance so that the shock is moderately inflationary.

In summary, all three fragmentation scenarios lead to a contraction in aggregate supply. However, they have different implications for the demand of goods and services. Conventional assessments of the impact of fragmentation on inflation often focus on its adverse supply-side effects, abstracting from the demand-side or general-equilibrium impact that fragmentation can have through lower real incomes. While the direct (or partial equilibrium) effect of fragmentation might be inflationary, the general equilibrium effect could dampen inflation, as lower real incomes weigh on aggregate demand. The effects of fragmentation on inflation dynamics and the direction of monetary policy cannot be decoupled from its impact on the natural real interest rate (r^*). As trade fragmentation affects the desired levels of savings and spending, the balance between these supply and demand forces ultimately determines the sign and size of changes in the natural rate of interest.

To sharpen our understanding of these dynamics, we vary two key parameters in our simulations: the share of hand-to-mouth agents and the degree of home bias in consumption. A higher share of hand-to-mouth households leads to a smaller fall in consumption on impact. This is because fewer forward-looking households anticipate the adjustment in consumption in response to the fall in their permanent income. The demand adjustment is still sufficient to lower domestic inflationary pressures and offset the increase in imported goods inflation. The extent of home bias in consumption appears to play a more important role. More open economies are more exposed to shocks in foreign prices, which is reflected in the responses of consumption and production. In the scenarios with a persistent increase in foreign prices, whether gradual or front-loaded, we see a deeper fall in the natural rate in the more open economy. This reverts in the case of negative TFP shock; this is because although the shock primarily affects the tradable sector, it is a direct shock to domestic production and consumption, affecting the consumption basket of the more closed economy to a greater extent. Instead, a more open economy can diversify away the domestic shock (Caselli, Koren, Lisicky, and Tenreyro, 2020).

To build intuition, we analyse a representative-agent New Keynesian (RANK) version of our model as a special case of our TANK baseline model, where there are no constrained households. We also consider an extension of the RANK model with nominal wage rigidities. This friction introduces additional supply-side constraints, leading to a fall in output in the non-tradable sector, moderating the degree of domestic inflationary pressure.

Related Literature We build on a rich literature studying monetary policy in small open economies (SOEs), including the seminal work of Benigno and Benigno (2003) and Gali and Monacelli (2005). Other important contributions to this line of research include but are not limited to, Santacreu (2005) and De Paoli (2009), who study tradable and non-tradable sectors in SOEs, and Schmitt-Grohé (2003), who introduce imperfect international risk sharing and price stability.

We also draw on an extensive literature that studies the impact of external shocks on macroeconomic outcomes using structural models, such as Romero (2008), Catao (2013), Hevia and Nicolini (2013), Wills (2014), Bergholt (2014), Ferrero and Seneca (2019), Drechsel, McLeay, and Tenreyro (2019), Siena (2021), Broadbent, Di Pace, Drechsel, Harrison, and Tenreyro (2023), and Guerrieri, Marcussen, Reichlin, and Tenreyro (2023).[3] Recent contributions to this literature have explored the transmission of external shocks in models with household heterogeneity (Ferra, Mitman, and Romei, 2020; Auclert, Rognlie, Souchier, and Straub, 2021; Auclert, Monnery, Rognlie, and Straub, 2023; Chan, Diz, and Kanngiesser, 2024).

Finally, we build on the vast literature that has examined the macroeconomic effects of globalisation. While increased competition in import prices has placed downward pressure on prices of manufactured goods, studies have shown that globalisation has had a negative, but economically small (if not negligible) effect on core inflation (Carluccio, Gautier, and Guilloux-Nefussi (2023)). Moreover, there is evidence that global disinflationary forces, such as the shift to inflation targeting regimes (Bank (2021), Roberts (2006), Attinasi and Balatti (2021)) or technological advances in manufacturing (IMF (2006)) may offer a better explanation for the observed disinflationary trends. Theoretical results provide support for these findings. Sbordone (2008) shows that in a model in which firms' desired markup is a function of its relative market share, an increase in the number of traded goods can generate real rigidities that affect the slope of the Philips curve. As the economy reaches a steady state with higher trade, the elasticity of demand that firms face increases, but the elasticity of the desired markup declines. These opposing forces determine how the inflation-marginal cost component of the Phillips curve slope varies. Estimates on trade data from 1960 to 2006 suggest that it remains uncertain whether trade growth observed during the globalisation era is sufficient to have driven a decline in this component of the slope. On the empirical front, Chen, Imbs, and Scott (2009) provide evidence of short-run pro-competitive effects from increased openness. They also show that trade liberalization can have ambiguous effects in the long run, as firms can respond to increased competition by locating to protected

[3]The balance between global demand and supply pressures shapes aggregate outcomes and inflationary dynamics. Guerrieri, Lorenzoni, and Werning, 2025 show that while individual central banks typically take global supply conditions as given, their collective actions influence global demand and the transmission of supply shocks to global inflation.

markets.[4]

Our paper also relates to the strand of literature pioneered by Rogoff (2003) and Rogoff (2007), which looks at how economic integration affects global inflationary trends. We abstract, however, from the political economy factors studied by Afrouzi, Halac, Rogoff, and Yared (2024), who suggest that globalisation would worsen the trade-offs faced by central banks, leading them to succumb to political pressures and deviate from or abandon their inflation targets. The question we ask in this paper is a different one: what would it take for central banks to bring inflation back to target under different fragmentation scenarios? As we show, in some scenarios, activity and inflation both fall, leading to stagnation (that is, without a trade-off); in others, activity and inflation move in opposite directions, creating short-term trade-offs or temporary stagflation. What is required of monetary policy to return inflation to target depends on how aggregate demand responds to lower incomes in general equilibrium. This is contingent on a number of structural parameters that we consider, as well as on the trajectory of fragmentation, particularly on the extent to which the impact on import prices is gradual or front-loaded.

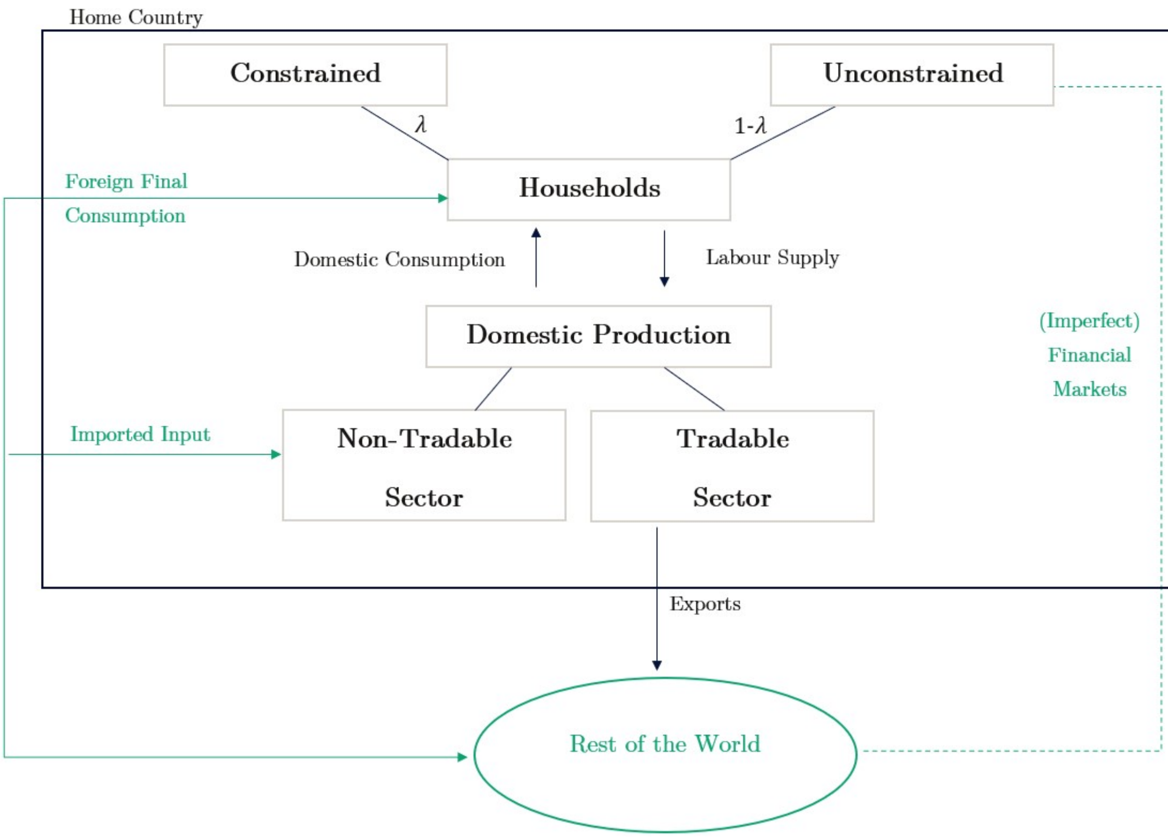
Outline Section 2 develops our theoretical framework. Section 3 calibrates the model and analyses shocks that are linked to trade fragmentation in a RANK and TANK framework. Next, Section 4 studies the relative importance of home bias in the policy response to trade fragmentation. Section 5 studies an extension with nominal wage rigidity. Finally, Section 6 presents concluding remarks and potential directions for future research.

2 Baseline Model

The goal of this section is to deliver qualitative insights into shocks associated with deglobalisation. We present a small open economy model that builds on Drechsel, McLeay, and Tenreyro (2019) and Ferrero and Seneca (2019). To capture a more realistic response of aggregate demand to international shocks, we introduce constrained and unconstrained households as in Debortoli and Galí (2017). Finally, to study the impact of fragmentation, we introduce an imported input used in the production of domestic goods. Figure 3 presents an illustration of the model described in this section.

[4]Recent developments in global trade policy have motivated a growing body of research on the macroeconomic effects of tariffs (**bianchi2024optimal**; Meng, Russ, and Singh, 2023; Bergin and Corsetti, 2023; Auclert, Rognlie, and Straub, 2025; Kalemli-Özcan, Soylu, and Yildirim, 2025; Werning, Lorenzoni, and Guerrieri, 2025). This paper studies the macroeconomic consequences of a realignment in global trading patterns that may be less efficient overall. While tariffs can contribute to this inefficiency, realignment may also reflect a reorientation toward less efficient suppliers, making our framework applicable to a range of factors that may increase import costs.

Figure 3: Model Structure from Home Country Perspective.



2.1 Households

There is a continuum of households with identical preferences at any given point in time t. A constant measure (1-λ) of households are *unconstrained* (U): they are able to smooth consumption through their access to international and domestic financial markets. The remaining fraction (λ) of households are fully *constrained* (C), meaning that they have no access to financial markets.

Each type of household $j \in \{U, C\}$ consumes C_t^j and supplies labour N_t^j, at wage W_t, leading to an expected utility given by

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

The parameters β, σ, and ϕ capture the discount factor, the inverse intertemporal elasticity of substitution and the inverse Frisch elasticity, respectively, while κ_ℓ is the disutility weight placed on labour.

Unconstrained households The period budget constraint of these households is given by:

$$P_t C_t^U + B_t + \mathcal{E}_t B_t^* = B_{t-1}(1+i_{t-1}) + \mathcal{E}_t B_{t-1}^*(1+i_{t-1}^*) + W_t N_t^U - \frac{\chi}{2} \mathcal{E}_t P_t^* \left(\frac{B_t^*}{P_t^*} - \bar{b}^* \right)^2 \quad (1)$$

where P_t is the aggregate price level, B_t denotes the holdings of a risk-free one-period nominal bond in domestic currency, which pays the nominal interest rate i_t. The risk-free one-period nominal bond in foreign currency is denoted by B_t^*, where i_t^* is the foreign interest rate and $\mathcal{E}_t$ is the nominal exchange rate (expressed in terms of domestic currency relative to foreign currency). Following Schmitt-Grohé (2003), we assume that there is a quadratic cost in changing the real bond position relative to a real steady-state value ($\bar{b}^*$) when trading in the foreign bond market. These costs are a common feature of small open economy models to ensure that the model returns to a unique steady-state net foreign asset position following a transitory shock. This cost (in terms of units of the consumption index) is denoted by a non-negative parameter, χ, while P_t^* is the aggregate price level in the foreign country. For simplicity, we can rewrite the budget constraint in real terms as

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

where $b_t = \frac{B_t}{P_t}, b_t^* = \frac{B_t^*}{P_t^*}, w_t = \frac{W_t}{P_t}$, and $\mathcal{S}_t = \frac{\mathcal{E}_t P_t^*}{P_t}$ is the real exchange rate.

Unconstrained households maximise their expected lifetime utility by choosing a sequence $\{C_t^U, N_t^U, b_t, b_t^*\}_{t=0}^{\infty}$ subject to the series of budget constraints (2). For unconstrained households, the first-order conditions with respect to C_t^U, N_t^U, b_t, b_t^* are respectively given by:

$$\begin{aligned}
(C_t^U)^{-\sigma} &= \delta_t \\
\kappa_\ell (N_t^U)^{\phi} &= \delta_t \frac{W_t}{P_t} \\
\delta_t &= \beta \mathbb{E}_t \left[\frac{(1+i_t)}{(1+\pi_{t+1})}\delta_{t+1}\right] \\
\delta_t[\mathcal{S}_t + \mathcal{S}_t \chi (b_t^* - \bar{b}^*)] &= \beta \mathbb{E}_t \left[\frac{(1+i_t^*)}{(1+\pi_{t+1}^*)}\mathcal{S}_{t+1}\delta_{t+1}\right]
\end{aligned}$$

where δ_t is the Lagrange multiplier on the budget constraint. Consequently, the optimality conditions are as follows,

$$\kappa_\ell (N_t^U)^{\phi} = (C_t^U)^{-\sigma}\frac{W_t}{P_t} \tag{3}$$

$$\frac{1}{(1+i_t)} = \beta \mathbb{E}_t \left[\left(\frac{C_{t+1}^U}{C_t^U}\right)^{-\sigma} \frac{1}{(1+\pi_{t+1})}\right] \tag{4}$$

$$\left[1 + \chi(b_t^* - \bar{b}^*)\right] = \beta \mathbb{E}_t \left[\left(\frac{C_{t+1}^U}{C_t^U}\right)^{-\sigma} \frac{1+i_t^*}{(1+\pi_{t+1}^*)}\frac{\mathcal{S}_{t+1}}{\mathcal{S}_t}\right] \tag{5}$$

where $\Pi_{t+1} = (1+\pi_{t+1}) = \frac{P_{t+1}}{P_t}$. We define $\Lambda_{t,t+1}^U = \beta\left(\frac{C_{t+1}^U}{C_t^U}\right)^{-\sigma}$ as the relevant stochastic discount factor, since only the unconstrained households have access to bonds. The household's optimality condition for labour yields the labour supply relation (3). The first order condition for b_t implies the Euler equation (4). Finally, households' choices of foreign and domestic bonds give rise to an uncovered interest rate parity condition which links the expected change in exchange rate to the differential between the domestic and foreign interest rate. The conditions on b_t and b_t^* imply equation (5), the deviation from the uncovered interest-rate parity (UIP). According to equation (5), international risk sharing will generally be imperfect, and aggregate demand across countries will fluctuate inefficiently.

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

Constrained households λ These households do not have access to financial markets and therefore they cannot smooth their consumption over time. Instead, they only consume their labour income in each period,

$$P_t C_t^C = W_t N_t^C$$

$$C_t^C = \frac{W_t}{P_t} N_t^C \tag{6}$$

and they supply their labour optimally,

$$\kappa_\ell (N_t^C)^\phi = (C_t^C)^{-\sigma} \frac{W_t}{P_t}. \tag{7}$$

Aggregate consumption is a weighted average of the consumption of the two types of households, $C_t = (1-\lambda)C_t^U + \lambda C_t^C$. Similarly, aggregate labour is $N_t = (1-\lambda)N_t^U + \lambda N_t^C$. Finally, we define the heterogeneity index as the ratio of unconstrained consumption to aggregate consumption,

$$\Gamma_t \equiv \frac{C_t^U}{C_t}. \tag{8}$$

Total consumption is a CES aggregate of domestic and foreign goods:

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

where ς is the share of non-tradable goods in domestic consumption. As in Santacreu (2005), aggregate consumption includes both *tradable* (T) and *non-tradable* (N) goods. Therefore, $C_{T,t}$ is a CES aggregate of tradable goods produced in the domestic and foreign economy,

$$C_{T,t} = \left[(1-\theta)^{\frac{1}{\mu}} C_{H,t}^{\frac{\mu-1}{\mu}} + \theta^{\frac{1}{\mu}} C_{F,t}^{\frac{\mu-1}{\mu}} \right]^{\frac{\mu}{\mu-1}} \tag{9}$$

where $1-\theta$ captures the home bias: smaller values of θ imply that the economy consumes less foreign goods.

The aggregate CPI price level, P_t and the tradable price level, $P_{T,t}$ are respectively given by

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

where $P_{F,t}$ is exogenous and follows $P_{F,t} = (P_{F,t}^{ss})^{\rho_F} P_{F,t-1}^{1-\rho_F}\epsilon_{F,t}$, and $\rho_F \in [0,1]$.

Aggregate prices depend on domestic prices and foreign prices according to the home bias of the country. In turn, domestic prices depend on traded and non-traded goods prices. The non-tradable goods and price index are given, respectively, by

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

Total consumption expenditure by households is given by the sum of the expenditures on domestic and foreign goods they consume,

$$P_t C_t = P_{T,t}C_{T,t} + P_{N,t}C_{N,t} = P_{H,t}C_{H,t} + P_{F,t}C_{F,t} + P_{N,t}C_{N,t}.$$

The system of demand functions is given by

$$C_{H,t} = (1-\theta)\left(\frac{P_{H,t}}{P_{T,t}}\right)^{-\mu} C_{T,t}$$
$$C_{F,t} = \theta\left(\frac{P_{F,t}}{P_{T,t}}\right)^{-\mu} C_{T,t}$$
$$C_{N,t} = \varsigma\left(\frac{P_{N,t}}{P_t}\right)^{-\iota} C_t$$
$$C_{T,t} = (1-\varsigma)\left(\frac{P_{T,t}}{P_t}\right)^{-\iota} C_t$$
$$C_{N,t}(i) = \left(\frac{P_{N,t}(i)}{P_{N,t}}\right)^{-\epsilon} C_{N,t}.$$

The terms of trade are defined as the price of imports in terms of the price of domestic goods.

$$\mathcal{T}_t \equiv \frac{P_{F,t}}{P_{H,t}}. \tag{10}$$

We assume that the law of one price holds for individual goods at all times,

$$\mathcal{S}_t \equiv \frac{\mathcal{E}_t P_t^*}{P_t} = \mathcal{T}_t^{1-\alpha},$$

where $\mathcal{S}_t$ is the real exchange rate.

2.2 Firms

Households supply labour to both the tradable and non-tradable sectors, such that

$$N_t = N_{H,t} + N_{N,t} = \lambda N_t^C + (1-\lambda) N_t^U. \quad (11)$$

Labour is completely mobile across sectors, therefore there is only one wage rate in equilibrium. In this version of the model, we do not allow for redistribution of firms' profits to households or across households. Indeed, in the baseline calibration, all real profits Ψ_t are assumed to accrue to foreign households who consume abroad.[5]

2.2.1 Non-tradable goods sector

Final Goods Producers Competitive final goods producers assemble intermediate goods $Y_{N,t}(i)$, where $P_{N,t}(i)$ is the price charged by the individual firm i. Their optimisation problem,

$$\max_{Y_{N,t}(i)} \int_0^1 P_{N,t}(i) Y_{N,t},$$

is subject to an aggregation technology with constant elasticity of substitution,

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

where $P_{N,t}(i)$ is the price charged by the individual firm i. This results in a downward-sloping demand function for firm i's product,

$$Y_{N,t}(i) = \left[\frac{P_{N,t}(i)}{P_{N,t}} \right]^{-\epsilon} Y_{N,t}. \quad (12)$$

Intermediate Goods Producers Intermediate goods firms use labour and an *intermediate imported input* $M_{F,t}$ in production,

$$Y_{N,t}(i) = A_{N,t} M_{F,t}^{\kappa}(i) N_{N,t}^{1-\kappa}(i) \quad (13)$$

where $A_{N,t} = (A_{N,t}^{ss})^{1-\rho_n} A_{N,t-1}^{\rho_n} \epsilon_{N,t}$, and $\rho_n \in (0,1]$. $M_{F,t}$ is the foreign country's final good that captures intermediate input utilisation in the production function.

Firms are monopolistically competitive and adjust prices according to Rotemberg (1982), incurring an adjustment cost each time,

$$AC_t(i) = \frac{\xi}{2} \left(\frac{P_{N,t}(i)}{P_{N,t-1}(i)} - \bar{\Pi} \right)^2 Y_{N,t} P_{N,t},$$

[5]Including profits in the unconstrained agent's budget constraint or allowing for redistribution does not change our qualitative results. Our current assumption is consistent with foreigners owning the companies located in the home country and consuming all proceeds abroad.

where ξ summarises the degree of nominal rigidity in the economy. Let $\bar{\Pi}$ denote steady state inflation. Firm i in the non-tradable sector maximises profits

$$\max_{M_{F,t}(i),N_{N,t}(i),P_{N,t}(i)} P_{N,t}(i)Y_{N,t}(i) - (1-\tau)\left(P_{F,t}M_{F,t}(i) - W_tN_{N,t}(i)\right) - AC_t(i)$$

subject to its production technology (13) and the demand function for its product (12), where $\tau = \frac{1}{\epsilon}$ is a subsidy aimed at correcting for the inefficiency due to the presence of market power. This problem yields the following first-order conditions

$$(1-\tau)W_t = MC_t(i)(1-\kappa)\frac{Y_{N,t}(i)P_{N,t}(i)}{N_{N,t}(i)}, \tag{14}$$

$$(1-\tau)P_{F,t} = MC_t(i)\kappa\frac{Y_{N,t}(i)P_{N,t}(i)}{M_{F,t}(i)}, \tag{15}$$

where $MC_t(i)$ is the Lagrange multiplier on the technology constraint. We can interpret this multiplier as the shadow cost of producing an additional unit of good $Y_{N,t}(i)$, that is, the marginal cost. Substituting equations (14) and (15) into the production function we obtain demand functions for the two production inputs,

$$N_{N,t}(i) = \frac{Y_{N,t}(i)}{A_{N,t}}\left[\frac{1-\kappa}{\kappa}\frac{P_{F,t}}{W_t}\right]^{\kappa}, \quad M_{F,t}(i) = \frac{Y_{N,t}(i)}{A_{N,t}}\left[\frac{\kappa}{1-\kappa}\frac{W_t}{P_{F,t}}\right]^{1-\kappa}.$$

The total cost function is equal to

$$\begin{aligned} TC_t(i)\left(W_t, Y_{N,t}(i), P_{F,t}, A_{N,t}\right) &= (1-\tau)\left(W_tN_{N,t} + P_{F,t}M_{F,t}\right) \\ &= (1-\tau)\left(\frac{Y_{N,t}(i)}{A_t}W_t^{1-\kappa}P_{F,t}^{\kappa}\left[\left(\frac{\kappa}{(1-\kappa)}\right)^{1-\kappa} + \left(\frac{(1-\kappa)}{\kappa}\right)^{\kappa}\right]\right). \end{aligned} \tag{16}$$

Differentiation of the total cost function yields marginal cost,

$$MC_{N,t}(i) = (1-\tau)\frac{W_t^{1-\kappa}P_{F,t}^{\kappa}}{A_t}\left[\left(\frac{\kappa}{(1-\kappa)}\right)^{1-\kappa} + \left(\frac{(1-\kappa)}{\kappa}\right)^{\kappa}\right]. \tag{17}$$

Since equation (17) is solely a function of factor prices and productivity, $MC_{N,t}(i) = MC_{N,t}\ \forall i$. We can rewrite nominal marginal cost in real terms as follows,

$$MC^r_{N,t}(i) = \frac{MC_{N,t}}{P_t} = \frac{(1-\tau)}{A_t}\left(\frac{W_t}{P_t}\right)^{1-\kappa}\left(\frac{P_{F,t}}{P_t}\right)^{\kappa}\left[\left(\frac{\kappa}{(1-\kappa)}\right)^{1-\kappa} + \left(\frac{(1-\kappa)}{\kappa}\right)^{\kappa}\right]. \tag{18}$$

Taking the first order condition with respect to $P_{N,t}(i)$, we obtain the Phillips Curve for non-tradable goods,

$$\Pi_{N,t}\left(\Pi_{N,t} - \bar{\Pi}\right) = \mathbb{E}_t\left[\Lambda^U_{t,t+1}\Pi_{N,t+1}\left(\Pi_{N,t+1} - \bar{\Pi}\right)\frac{Y_{N,t+1}}{Y_{N,t}}\right] + \frac{\epsilon}{\xi}\left(MC_t - \frac{\epsilon-1}{\epsilon}\right), \tag{19}$$

where $\bar{\pi}$ is the steady state level of inflation. Using the demand relation and the labour market clearing condition $N_{N,t} = \int_0^1 N_{N,t}(i)di$, we can write the aggregate production function as

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

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

2.2.2 Tradable goods sector

The tradable sector is internationally competitive, therefore domestic firms in this sector take the prices as given at $P_{H,t} = \mathcal{E}_t P_{H,t}^*$. We assume that foreign price dynamics $(P_{H,t}^*)$ are driven by developments in world markets and therefore exogenous for a small open economy. Tradable sector production is given by

$$Y_{H,t} = A_{H,t}N_{H,t}^{1-\zeta}, \tag{20}$$

where $A_{H,t} = (A_{H,t}^{ss})^{1-\rho_h}A_{H,t-1}^{\rho_h}\epsilon_{H,t}$, and $\rho_h \in (0,1]$. Therefore, the problem of the tradable firm is to maximise profits

$$\max_{N_{H,t}} P_{H,t}Y_{H,t} - W_t N_{H,t}$$

subject to its production technology (20). This yields

$$\frac{W_t}{P_{H,t}} = (1-\zeta)A_{H,t}N_{H,t}^{-\zeta} \implies W_t N_{H,t} = (1-\zeta)Y_{H,t}P_{H,t} \tag{21}$$

which gives us profits $\Psi_{H,t} = (\zeta)P_{H,t}Y_{H,t}$.

2.3 Monetary Policy

The monetary authority sets the interest rate according to the following Taylor rule,

$$\frac{R_t}{R_{ss}} = \left(\frac{\Pi}{\bar{\Pi}}\right)^{\phi_\pi}\left(\frac{Y}{\bar{Y}}\right)^{\phi_y}\exp(\nu_m), \tag{22}$$

where $\nu_m \sim N(0, \sigma_m^2)$ is a monetary policy shock, which follows an AR(1) process, and $\bar{Y}$ is the steady state level of output.

2.4 Equilibrium

Given the tradable and foreign imported prices $P_{T,t}^*, P_{F,t}^*$, the monetary policy rule determining i_t, foreign output, inflation and interest rates Y_t^*, Π_t^*, i_t^*, and an initial condition on price dispersion, equilibrium in the economy is given by a sequence of quantities $\{C_{H,t}, C_{T,t}, C_{N,t},$

$C_{F,t}, C_t, C_t^U, C_t^C, N_t, N_{H,t}, N_{N,t}, B_{t+1}^H, B_{t+1}^*, Y_{N,t}, Y_{H,t}, M_{F,t}, \Psi_t\}_{t=0}^{\infty}$ and prices $\{\Lambda_{t,t+1}, \Pi_{H,t}, \Pi_{N,t}, \Pi_{T,t}, \Pi_{F,t}, \Pi_t, W_t, \mathcal{T}_t, \mathcal{S}_t, \mathcal{E}_t, \Delta_t\}_{t=0}^{\infty}$ such that firms and households maximise their objectives, and the goods, labour and financial markets clear, we obtain

$$
\begin{aligned}
Y_t &= C_{H,t} + C_{H,t}^* + C_{N,t} \\
Y_{H,t} &= C_{H,t} + C_{H,t}^* \\
C_{N,t} &= Y_{N,t} \\
B_t &= 0 \\
N_t &= N_{H,t} + N_{N,t} = N_t^C \lambda + N_t^U (1-\lambda) \\
Y_t^* &= C_t^*.
\end{aligned}
$$

We derive demand functions for $Y_{H,t}$ and $Y_{N,t}$ in order to obtain the market clearing conditions. Tradables are by definition consumed both domestically and in the rest of the world,

$$
\begin{aligned}
C_{H,t} &= (1-\theta)\left(\frac{P_{T,t}}{P_{H,t}}\right)^{\mu} C_{T,t} = (1-\theta)(1-\varsigma)\left(\frac{P_{T,t}}{P_{H,t}}\right)^{\mu}\left(\frac{P_t}{P_{T,t}}\right)^{\iota} C_t \\
C_{H,t}^* &= \theta\left(\frac{P_t}{P_{H,t}}\right)^{\mu} \mathcal{S}_t^{\mu} C_t^* \\
Y_{H,t} &= (1-\theta)(1-\varsigma)\left(\frac{P_{T,t}}{P_{H,t}}\right)^{\mu}\left(\frac{P_t}{P_{T,t}}\right)^{\iota} C_t + \theta\left(\frac{P_t}{P_{H,t}}\right)^{\mu} \mathcal{S}_t^{\mu} C_t^*
\end{aligned}
$$

where $C_{H,t}^*$, the foreign tradable demand, is derived by assuming symmetric preferences in the rest of the world. For non-tradables, instead, we calculate domestic demand as follows,

$$
C_{N,t} = \varsigma\left(\frac{P_t}{P_{N,t}}\right)^{\iota} C_t. \tag{23}
$$

Therefore, we can express domestic aggregate output as follows,

$$
Y_t = \varsigma\left(\frac{P_t}{P_{N,t}}\right)^{\iota} C_t + (1-\theta)(1-\varsigma)\left(\frac{P_{T,t}}{P_{H,t}}\right)^{\mu}\left(\frac{P_t}{P_{T,t}}\right)^{\iota} C_t + \theta\left(\frac{P_t}{P_{H,t}}\right)^{\mu} \mathcal{S}_t^{\mu} C_t^*. \tag{24}
$$

2.4.1 Natural Level of Output and Interest Rate

To understand the impact of our shocks and to determine the appropriate real policy interest rate, we calculate the natural level of output (Y_t^n) and the natural real interest rate (r_t^n).

Y_t^n is the level of output that would arise under flexible prices. To derive it, we need to determine the profit-maximizing flexible price for the domestic non-tradable good firms, which is the only sector facing nominal rigidities. Profit-maximising firms set the flexible optimal price in order to equalise the marginal cost to the marginal revenue. This is equivalent to setting the real marginal cost to the inverse of the desired markup,

$$
MC_{N,t} = \frac{\epsilon - 1}{\epsilon}.
$$

Using the real marginal cost in equation (18), we obtain

$$\frac{\epsilon-1}{\epsilon} = \frac{(1-\tau)}{A_{N,t}}\left(\frac{W_t}{P_t}\right)^{1-\kappa}\left(\frac{P_{F,t}}{P_t}\right)^{\kappa}\left[\left(\frac{\kappa}{(1-\kappa)}\right)^{1-\kappa}+\left(\frac{(1-\kappa)}{\kappa}\right)^{\kappa}\right]. \tag{25}$$

Under perfectly competitive labour markets, we can write the labour supply condition as follows[6]

$$\frac{W_t}{P_t} = C_t^{\sigma} N_t^{\phi}.$$

Therefore,

$$\frac{\epsilon-1}{\epsilon} = \frac{(1-\tau)}{A_{N,t}}\left((C_t^n)^{\sigma}(N_t^n)^{\phi}\right)^{1-\kappa}\left(\frac{P_{F,t}}{P_t}\right)^{\kappa}\left[\left(\frac{\kappa}{(1-\kappa)}\right)^{1-\kappa}+\left(\frac{(1-\kappa)}{\kappa}\right)^{\kappa}\right]. \tag{26}$$

Next, we express C_t in terms of C_t^*. Using the household's first-order condition on foreign bond holding, and assuming that the same conditions hold in the foreign economy,

$$\frac{1}{(1+i_t^*)} = \beta \mathbb{E}_t\left[\left(\frac{C_{t+1}^*}{C_t^*}\right)^{-\sigma}\frac{1}{(1+\pi_{t+1}^*)}\right]. \tag{27}$$

If $\pi = \pi^* = 1$ in steady state, then $r = r^* = \frac{1}{\beta}$. We can therefore write the international risk sharing condition,

$$\mathbb{E}_t\left[\left(\frac{C_t}{C_{t+1}}\right)^{\sigma}\right] = \mathbb{E}_t\left[\left(\frac{C_t^*}{C_{t+1}^*}\right)^{\sigma}\frac{\mathcal{S}_t}{\mathcal{S}_{t+1}}\right]\left[1+\chi(b_t^*-\bar{b}^*)\right], \tag{28}$$

which we can rewrite as

$$\mathcal{D}_t^{\frac{1}{\sigma}} = \frac{C_t}{C_t^*\mathcal{S}_t} \qquad \mathcal{D}_t^{\frac{1}{\sigma}} = (1+\chi(b_t^*-\bar{b})).$$

Using the goods market clearing equation and the assumption that international markets are incomplete, we can write

$$Y_t = \varsigma\left(\frac{P_t}{P_{N,t}}\right)^{\iota} C_t + (1-\theta)(1-\varsigma)\left(\frac{P_{T,t}}{P_{H,t}}\right)^{\mu}\left(\frac{P_t}{P_{T,t}}\right)^{\iota} C_t + \theta\left(\frac{P_t}{P_{H,t}}\right)^{\mu}\mathcal{S}_t^{\mu}C_t^*$$

$$Y_t = \left[\varsigma\left(\frac{P_t}{P_{N,t}}\right)^{\iota} + (1-\theta)(1-\varsigma)\left(\frac{P_{T,t}}{P_{H,t}}\right)^{\mu}\left(\frac{P_t}{P_{T,t}}\right)^{\iota} + \theta\left(\frac{P_t}{P_{H,t}}\right)^{\mu}\frac{\mathcal{S}_t^{\mu-1}}{\mathcal{D}_t^{\frac{1}{\sigma}}}\right] C_t$$

$$C_t = \frac{1}{\Sigma_{\varsigma\theta,t}} Y_t,$$

where $\Sigma_{\varsigma\theta,t} = \left[\varsigma\left(\frac{P_t}{P_{N,t}}\right)^{\iota} + (1-\theta)(1-\varsigma)\left(\frac{P_{T,t}}{P_{H,t}}\right)^{\mu}\left(\frac{P_t}{P_{T,t}}\right)^{\iota} + \theta\left(\frac{P_t}{P_{H,t}}\right)^{\mu}\frac{\mathcal{S}_t^{\mu-1}}{\mathcal{D}_t^{\frac{1}{\sigma}}}\right]$. The relationship between domestic consumption and aggregate domestic production is described by $\Sigma_{\theta,\gamma,t}$.

[6] Galí, López-Salido, and Vallés (2007).

In an open economy, these two variables do not move in lockstep; instead, their dynamics are influenced by the degree of openness to trade. A higher θ widens the wedge between consumption and production, attributable to the increased share of tradable goods destined for export.

Since $N_t^n = N_{N,t}^n + N_{H,t}^n$, we can write

$$N_t^n = \left(\frac{Y_{H,t}^n}{A_{H,t}}\right)^{\frac{1}{1-\zeta}} + Y_{N,t}^n \left(\frac{P_{F,t}}{P_{N,t}}\right)^{\frac{1-\kappa}{\kappa}} \kappa^{-\frac{\kappa}{1-\kappa}} A_{N,t}^{-\frac{1}{1-\kappa}}.$$

Substituting back in equation (26), we obtain

$$Y_t^n = \Sigma_{\varsigma\theta,t} \left\{ \left(A_{N,t}^{\frac{1}{1-\kappa}} \Gamma^{-\frac{1}{1-\kappa}} p_{F,t}^{-\frac{\kappa}{1-\kappa}} \right) \left[N_{H,t}^n + N_{NT,t}^n \right]^{-\phi} \right\}^{\frac{1}{\sigma}}. \tag{29}$$

Equation (29) describes the natural level of output, which can vary with technology in both sectors, relative prices of input and foreign demand. Finally, the natural real interest rate is the risk-free real interest rate consistent with the Euler equation when output is at its natural level at all times,

$$(C_{t+1}^n)^\sigma = \beta(1 + r_t^n)(C_t^n)^\sigma,$$
$$(1 + r_t^n) = \frac{1}{\beta} \left(\left(\frac{Y_{t+1}^n}{Y_t^n} \right) \frac{\Sigma_{\varsigma\theta,t}}{\Sigma_{\varsigma\theta,t+1}} \right)^\sigma,$$

where we have used $C_t = \frac{1}{\Sigma_{\varsigma\theta,t}} [Y_t]$.

3 Calibration

We calibrate the model at a quarterly frequency. Our aggregate baseline calibration is standard, as several preferences and technology parameters are shared with the standard New Keynesian literature. For our baseline scenario, we set the share of hand-to-mouth consumers in the population equal to 30%, following Kaplan, Violante, and Weidner (2014), Kaplan, Moll, and Violante (2018), Kaplan and Violante (2022). To allow for a more realistic representation of the households' optimisation problem, we set the elasticity of intertemporal substitution $\sigma = 2$. This aligns with recent literature (Jones (2023), Kimball, Reck, Zhang, Ohtake, and Tsutsui (2024), etc.) that discusses the limitations of log-utility assumptions in economics models. For simplicity, we consider unitary elasticities of substitution between foreign and domestic tradable goods (μ), and between tradable and non-tradable goods (ι), and the Frisch elasticity.[7] In the baseline model, θ equals 0.6, which implies a weight on

[7] However, results are robust to usual variation (Corsetti, Dedola, and Leduc (2009)) in these parameters. See Appendix A.1.

foreign goods in the economy of approximately 0.25, following Harrison and Oomen (2010). We set κ, the income share of foreign primitive input in the production of non-tradable goods, close to 0 in the baseline. However, a positive κ (around 0.3 to match the labour share of income) amplifies the quantitative impact of the fragmentation scenarios we study, while leaving the qualitative interpretation unchanged. Finally, we calibrate ς, the share of non-tradable goods in the consumption basket to be 0.6.

Parameter	Definition	Value	Source / Target
β	Household discount factor	0.9994	Annual net nominal rate $r_{ss} \approx 2.25\%$
σ	Household risk aversion	2	Corsetti, Dedola, and Leduc (2009)
κ_ℓ	Labour Disutility	1.97	Literature
ϕ	Inverse Frisch elasticity	1	Gali and Monacelli (2005)
λ	Share of constrained households	0.3	Kaplan, Moll, and Violante (2018)
θ	Share of Foreign Tradables	0.6	Harrison and Oomen (2010)
ς	Share of Non-Tradables	0.6	Literature
μ	Elasticity of substitution Home and Foreign goods	1	Literature
ι	Elasticity of substitution Tradables and Non-tradables	1	Literature
ϵ	Elasticity of substitution for Non-tradables	11	10% gross final markup
ϕ_π	Interest sensitivity to inflation	1.5	Literature
ϕ_y	Interest sensitivity to output	0	Literature
ξ	Rotemberg Adjustment cost	57	Avg Lifetime of prices 3Q
ζ	Labour share in Tradables	0.8	Literature
κ	Foreign Input share in Non-Tradables	≈ 0	Literature
ρ_s	Persistence coefficient	0.9	$s \in \{N, Y*, r*\}$
ρ_H	Tradable TFP Persistence coefficient	0.85	
$(1-\rho_F)$	Persistence coefficient of Foreign Price - Gradual Scenario	0.75	
$(1-\rho_F)$	Persistence coefficient of Foreign Price - Front-loaded Scenario	1	
χ	Portfolio Adjustment Cost	0.2	

Table 1: This table presents the baseline calibration. Note: ρ_s where $s \in \{T, a_N, a_T, i, y^*\}$.

3.1 Special Case: RANK

To establish basic intuition for our results, we conduct our three main exercises in a representative agent model. This corresponds to a special case of our baseline model, where the share of constrained households is $\lambda = 0$ (implying a heterogeneity index of $\Gamma_t = 1$).

Gradual Fragmentation To simulate a gradual shift towards a more restrictive trade environment, Figure 4 plots the impulse response functions (IRFs) of various macroeconomic aggregates to a gradual increase in import prices ($P_{F,t}$). In this scenario, import prices stabilise in the medium term, with a cumulative increase of 100 percent. The price of imported goods, $P_{F,t}$, will affect demand directly, both through the consumption basket $C_{F,t}$ and through imported inputs ($M_{F,t}$) in non-tradable goods production. Additionally, it indirectly affects demand through real wages.

An increase in imported inflation follows from the gradual increases in the price of foreign goods. This places upward pressure on CPI inflation, but is more than offset by the fall in domestic inflation, which declines due to the falls in both non-tradable and tradable inflation. This fall in domestic inflation is driven by the fall in consumption, which responds to the drop in households' permanent real income. Households partly compensate for the fall in real wages by increasing labour supply, which mitigates the impact of higher import prices on aggregate supply. Overall, the anticipation effect of lower real incomes leads to demand falling more than supply, and consequently, to a fall in domestic inflation. CPI inflation, which is a composite of domestic and imported good inflation, falls on balance. This is reflected in a decrease in the natural real rate of interest, indicating that when demand materially adjusts in anticipation, the effect can be disinflationary. This prompts the central bank to ease policy, by lowering the nominal interest rate, in line with the rule characterising its reaction function.

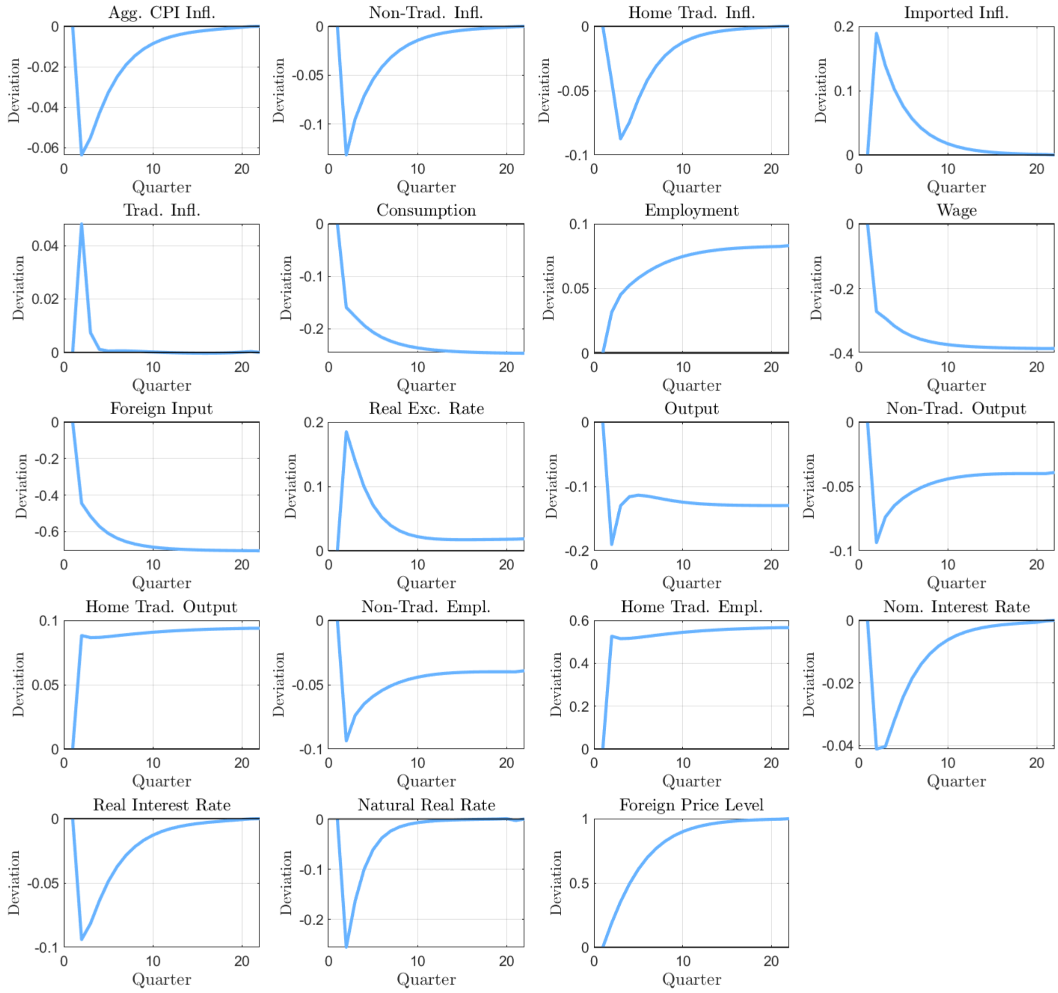
Front-loaded Fragmentation Figure 5 shows the effect of a permanent and immediate increase in foreign prices $P_{F,t}$. This type of shock is intended to capture rapid 'fragmentation events' like price increases or indirectly, tariff increases.[8]

The increase in the price of foreign goods leads to a sharp increase in imported inflation, which quickly reverts to its steady-state level. Aggregate consumption falls on impact and stabilises at a lower steady state. Non-tradable inflation falls at first, following the fall in consumption. As non-tradable firms gradually pass on higher marginal costs, non-tradable inflation increases temporarily. Domestic tradable inflation also falls initially, following the fall in consumption. Tradable inflation rises sharply, reflecting the surge in import inflation. Altogether, this leads to a significant spike in aggregate CPI inflation. Non-tradable output falls temporarily as the higher price of the foreign input restricts supply, but then recovers as households increase labour supply to compensate for losses in real income. The economy enters a temporary period of stagflation, with prices increasing and consumption decreasing. Unlike the gradual scenario, there is no movement in the natural real rate. The Taylor rule followed by the central bank leads to an increase in the nominal rate in order to return inflation to target.

Fall in Tradables Productivity $A_{T,t}$ We consider an additional shock that can result from "trade fragmentation": a persistent decrease in the productivity of the tradable goods sector, which makes domestic production of tradable goods less competitive in the global market. In Figure 6, we show the response to a negative one standard deviation shock of total factor productivity in the tradable sector, $A_{T,t}$ (equivalent to 100 percentage-point deviation from

[8]A caveat is in order: our analysis does not account for the use of fiscal proceeds from tariffs. One way to justify this would be to assume that proceeds from tariffs are used to stimulate supply and demand in equal amounts, without affecting the output gap or inflation. Alternatively, we can assume that import restrictions take the form of non-tariff barriers (which comprise the majority of trade restrictions), in which case there is no tax revenue to be rebated. More broadly, this exercise is intended to capture the realignment of trade, whereby geopolitics forces domestic firms to switch from low-cost to geopolitically friendly suppliers, leading to efficiency losses.

Figure 4: IRFs to a Gradual Increase in Foreign Price Level.

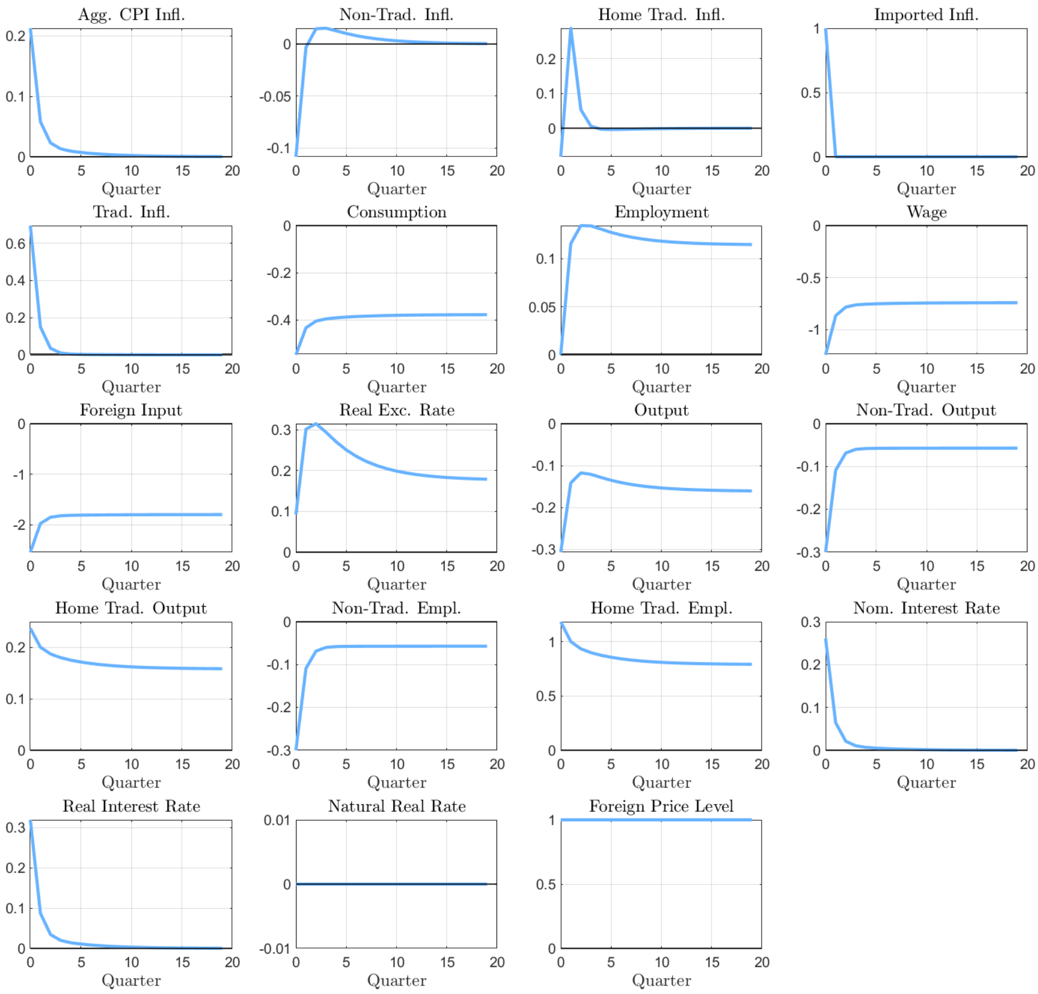


Notes: IRFs to a 100% gradual positive foreign price shock. The results are generated under a RANK calibration ($\lambda = 0$). All the other parameters are calibrated according to Table 1.

the steady state). The shock is persistent but not permanent, as it reverts back to steady state in the medium-to-long term.

As in the standard New Keynesian model, this constraint on supply results in a fall in tradable output and an increase in tradable goods inflation as marginal costs rise. The fall in tradable output leads to a decrease in labour demand in this sector. Households cut consumption in response to the negative income effect of lower incomes. They also increase their labour supply to compensate for losses in real income. For tradable goods firms, the fall in wages reduces production costs, offsetting the loss in productivity. However, the increase in household labour supply is not enough to counteract the negative income effect. On im-

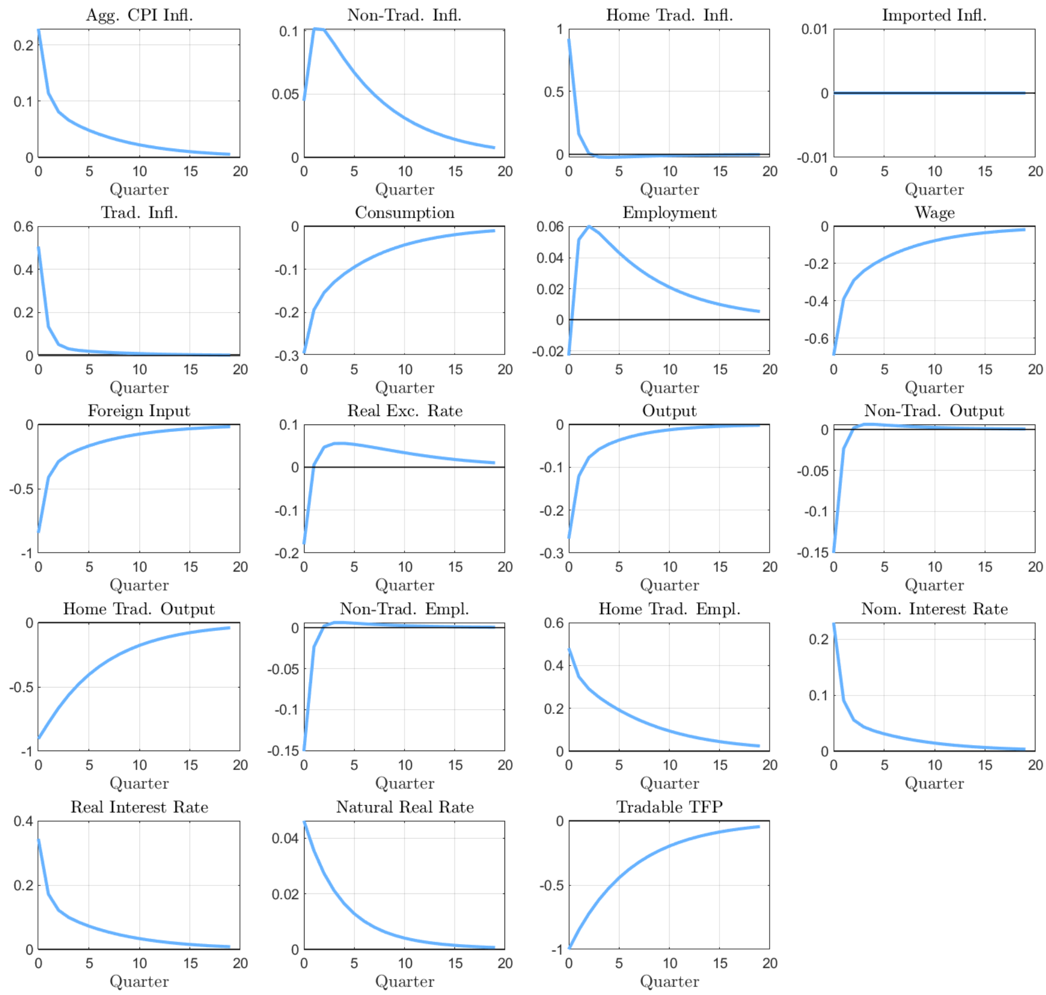
Figure 5: IRFs to a Front-loaded Increase in Foreign Price Level.



Notes: IRFs to a 100% front-loaded positive foreign price shock. The results are generated under a RANK calibration ($\lambda = 0$). All the other parameters are calibrated according to Table 1.

pact, as employment and foreign input decrease, so does non-tradable output. However, as income and consumption recover, household demand for non-tradable goods, which are the relatively cheaper good, leads to inflationary pressure in the non-tradable sector. Domestic tradable and aggregate CPI inflation both increase in this scenario. Monetary policy is contractionary to bring inflation back to target. On impact, the natural rate increases, but returns to steady state as the economy recovers.

Figure 6: IRFs to a Negative Shock to Tradable TFP.



Notes: IRFs to a negative TFP shock in the tradable sector. The results are generated under a RANK calibration ($\lambda = 0$). All the other parameters are calibrated according to Table 1.

To summarise, since all three scenarios consider shocks that constrain supply capacity, the supply side effects are unambiguous. Marginal costs increase initially and are passed through only gradually to prices due to price rigidities. In partial equilibrium, as nominal expenditures are fixed, this leads to a fall in household demand for goods from the unaffected sector. To capture general equilibrium effects, this section uses a simple framework to demonstrate how aggregate demand adjusts differently in various scenarios that model aspects of trade fragmentation. In the gradual fragmentation scenario, a steady increase in import prices reduces the purchasing power of labour income, through an increase in the price of imported consumption goods as well as through a fall in nominal wages. If this change is expected to be permanent, then households also expect a permanent fall in purchasing power, leading to a fall in consumption spending. Therefore, a fall in permanent labour income leads to a fall in demand, which affects the price level response to the initial increase in import prices. This scenario leads to stagnation, with lower real incomes and low inflationary pressures. In contrast, a front-loaded fragmentation scenario, which takes the form of a sharp permanent increase in import prices, may create a short-term tradeoff for policymakers. Finally, a fall in tradable sector productivity may be neutral for inflation, but it is moderately inflationary in our calibration.

These results suggest that the form in which fragmentation materialises, the extent to which it is anticipated by households, and households' ability to smooth consumption over time, all matter. The next section will consider the case where a proportion of households are unable to smooth consumption in response to changes in their permanent income.

3.2 TANK Case

An important factor in gauging how inflation will respond to these trade-related shocks is the degree of forward-looking behaviour in demand. Specifically, it hinges on the extent to which households can effectively smooth consumption in the presence of a shock. Therefore, this section considers a more general framework that allows for household heterogeneity.

Relative to the previous section, the presence of constrained households introduces agents who cannot smooth consumption in response to the shock, although they can adjust their labour supply. The fall in real incomes affects these households directly, while the fall in labour demand and aggregate demand by unconstrained households affects them indirectly. As in the previous section, we consider three scenarios to show how the form of fragmentation will affect the demand-side adjustment.

We also explore how much the extensive margin of household heterogeneity matters by considering two cases: an economy in which roughly one-third of households are constrained (hand-to-mouth) ($\lambda = 0.3$) compared with an economy where more than half of households are constrained (hand-to-mouth) ($\lambda = 0.6$). We find that for this degree of variation, heterogeneity does not alter the main results. Financially unconstrained households, even in small shares, can trigger a fall in demand, which spills over to the financially constrained households.[9]

The fall in permanent income highlighted in the previous section will be mitigated by the proportion of constrained households. While all households consume out of permanent income in a RANK model, only a proportion λ of households do so in a TANK model. The presence of constrained households lessens the adverse demand side effect since they cannot cut consumption in anticipation of the shock.[10]

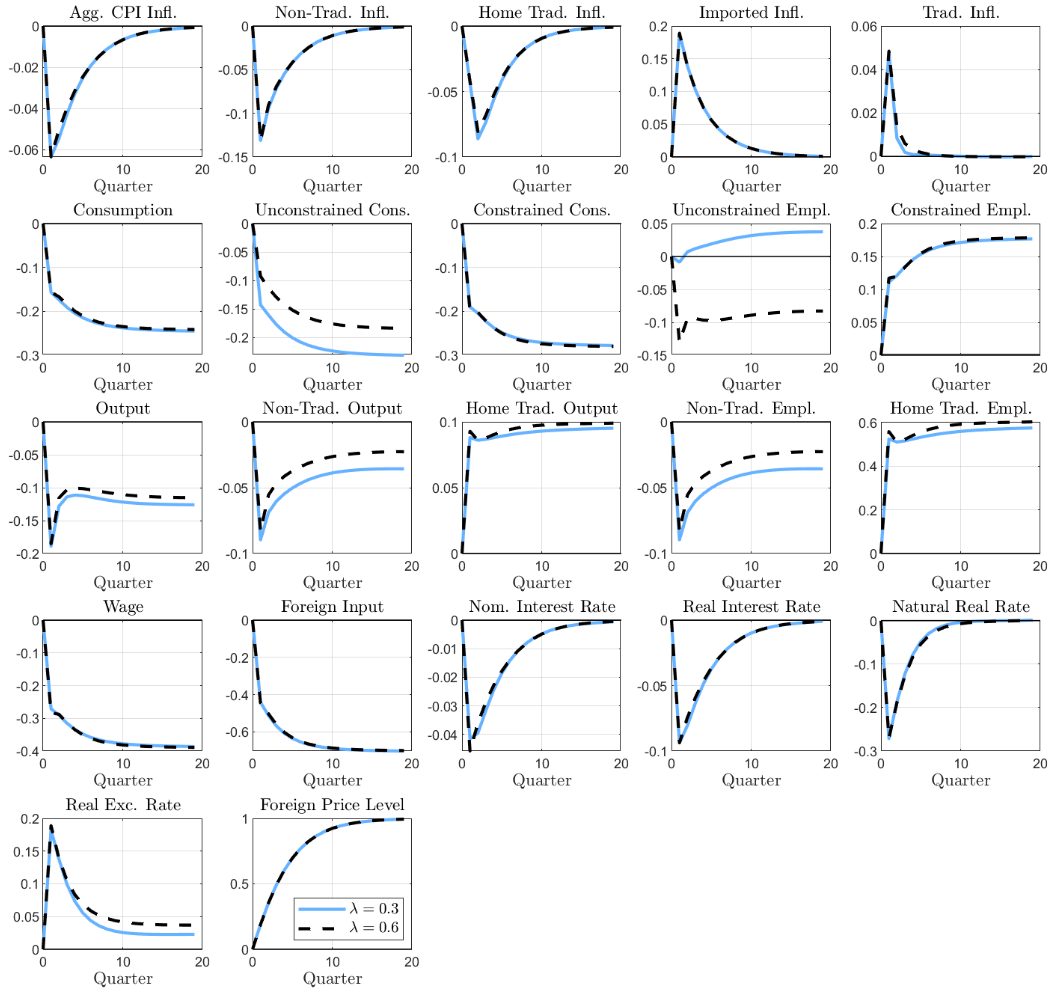
Gradual Fragmentation To simulate a gradual shift towards a more restricted trade environment, Figure 18 plots the impulse response functions to an increase in the price of imported goods, which stabilises at a 100 percent higher level in the medium term. As in the RANK case, the price of imported goods, $P_{F,t}$, affects demand directly, both through the consumption basket $C_{F,t}$ and through imported inputs $M_{F,t}$ in production. Additionally, it indirectly affects demand through real wages.

The response of real and nominal variables with a lower share of constrained agents ($\lambda = 0.3$) is similar to the RANK case (Figure 4). In both cases shown here, unconstrained households, who can borrow to smooth consumption, cut consumption by less. Comparing the two cases, a greater share of constrained households mitigates the adverse effect of the shock: hours worked and output falls by less in the non-tradable sectors and increase by more in the tradable sector. Constrained households partly compensate for the loss in real wages by increasing labour supply, mitigating the impact of higher import prices on aggregate supply. Overall, the anticipation effect of lower real incomes on demand by unconstrained households leads to demand falling more than supply, and consequently, to a fall in domestic inflation. The fall in domestic inflation more than offsets the persistent increase in imported inflation, leading to a fall in aggregate CPI. The natural real rate of interest falls, suggesting that when demand adjusts in anticipation, the effect can be disinflationary. The nominal interest rate falls in response, in line with the rule characterising its reaction function.

[9]The standard transfer rule assumed in the literature is not innocuous. As a technical assumption intended to simplify the steady state solution, this redistribution mutes the effect of household heterogeneity in our model. We therefore neutralise the effects of transfers by assuming profits are ”lost at sea”.

[10]The rise in import prices could potentially affect aggregate demand through distributional effects if the two households differ in their sources of income. The contractionary demand-side effect of fragmentation may be larger if labour income falls and profit income increases. Elasticities of substitution between production inputs determine the magnitude of the demand-side effect of energy price shocks in Auclert, Monnery, Rognlie, and Straub (2023) and Chan, Diz, and Kanngiesser (2024), while trade elasticities affect the real income channel of exchange rate depreciations in Auclert, Rognlie, Souchier, and Straub (2021). We abstract from these effects here in assuming unitary elasticity of substitution between inputs in nontradables production and the same between home and foreign goods in consumption (in addition to profits ”lost at sea”). This is consistent with the view that trade fragmentation entails a shift from low-cost suppliers to friendly suppliers, or that elasticities of substitution are high in the medium to long run (if fragmentation is a permanent, phased-in process).

Figure 7: IRFs to a Gradual Increase in Foreign Price Level.



Notes: $\lambda = 0.3$ in blue, $\lambda = 0.6$ in grey dashed line. All the other parameters are calibrated according to Table 1.

Front-loaded Fragmentation Figure 8 shows the effect of a permanent and immediate increase in foreign prices $P_{F,t}$. The responses of real and nominal variables with a lower share of constrained agents ($\lambda = 0.3$, dashed grey lines) are again similar to the RANK case (Figure 5). In the case of $\lambda = 0.6$, aggregate consumption falls more on impact due to the larger response of the hand-to-mouth, who cannot smooth the shock away.

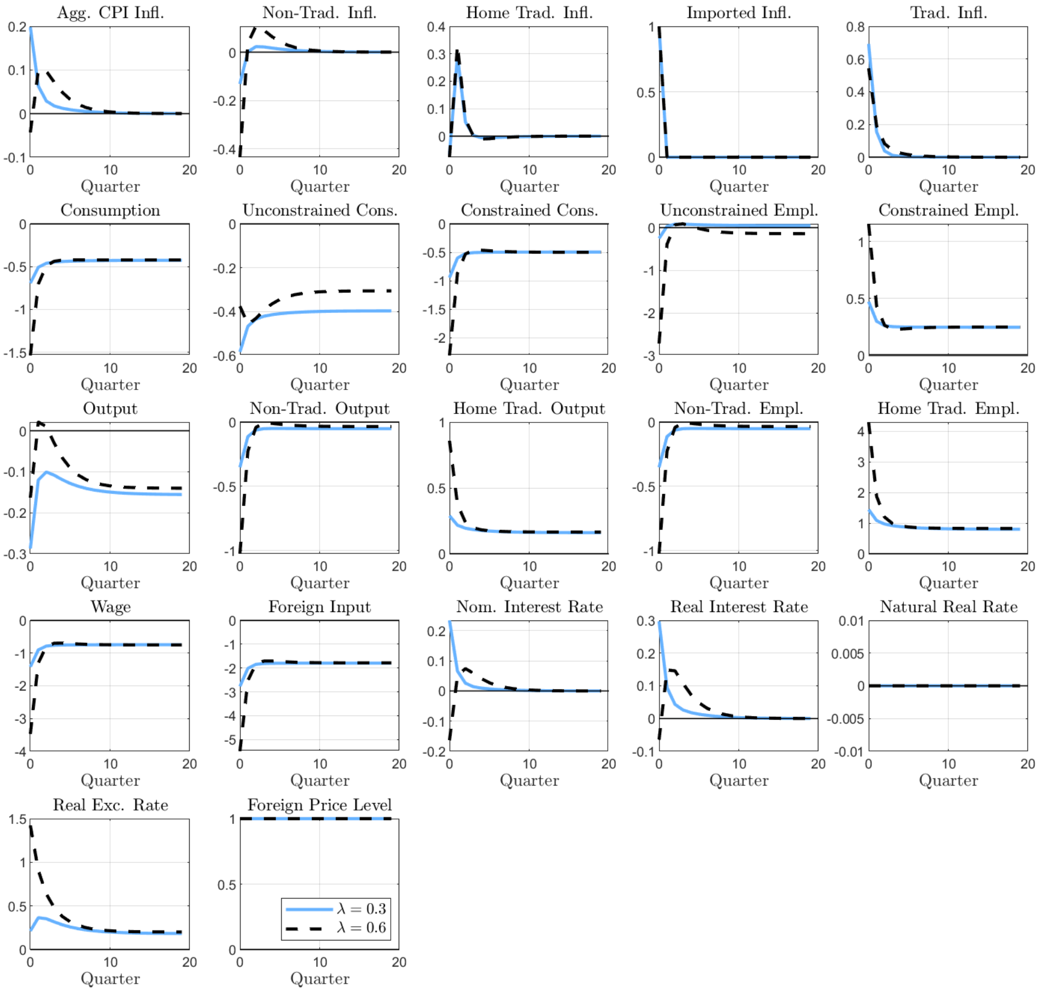
This scenario leads to a sharp increase in imported inflation, which quickly reverts back to the steady-state level. This frontloaded price shock adversely affects the consumption of constrained households immediately, as they are unable to smooth consumption. The initial sharp fall in consumption is driven by the constrained households who react to the fall in purchasing power by increasing labour supply. However, as constrained households respond by increasing labour supply to compensate for lower incomes, constrained consumption does not fall as much and it recovers to a new steady state level. On impact, consumption goes below steady state, before settling at a lower steady state level for both constrained and unconstrained consumers. Aggregate consumption therefore falls on impact and stabilises at a lower steady state value. Non-tradable output and employment fall temporarily as the higher price of the foreign input restricts supply, but both recover as households increase their labour supply to compensate for income losses. In the case where $\lambda = 0.3$, aggregate inflation increases, driven by largely by the surge in imported inflation, and the economy enters a temporary period of stagflation. However, a higher share of constrained households ($\lambda = 0.6$) pushes down strongly on consumption, which exerts downward pressure on domestic inflation. In this case, the monetary policy response is expansionary to return inflation to target. The natural real rate remains neutral.

Fall in Tradables Productivity Finally, we consider a persistent decrease in the productivity of the tradable goods sector, which makes domestic production of tradable goods less competitive in the global market. Figure 9 plots the responses of all variables to a one standard deviation negative shock to total factor productivity in the tradable sector, $A_{T,t}$. The shock is persistent but not permanent, as it reverts back to steady state in the medium-to-long term.

As expected, tradable output decreases, while tradable inflation increases. This is due to the rise in the marginal cost of production caused by the fall in productivity. A larger share of constrained households mitigates the fall in tradables output. Consumption decreases, almost entirely driven by the constrained agents. Financially unconstrained households also adjust their consumption downwards, but because they can smooth over time and since the shock is not permanent, the adjustment in consumption is very small. The adjustment in consumption also reflects a negative income effect coming from lower wages, as constrained households increase their labour supply in response to the losses on real income.

For tradable goods firms, higher labour supply partially compensates for the loss of productivity. As a result, labour demand in this sector increases, leading to an increase in tradable employment. While constrained agents substantially increase their labour supply, this is not enough to counteract the negative income effect. The drop in consumption also temporarily affects non-tradable demand and inflation adversely. Tradable output recovers over time as productivity improves. Inflation falls in the non-tradable sector to offset the increase in inflation in the tradable sector, moderating the upoward pressure on aggregate inflation. On impact, the natural rate increases moderately, and more so when the share of constrained households is higher.

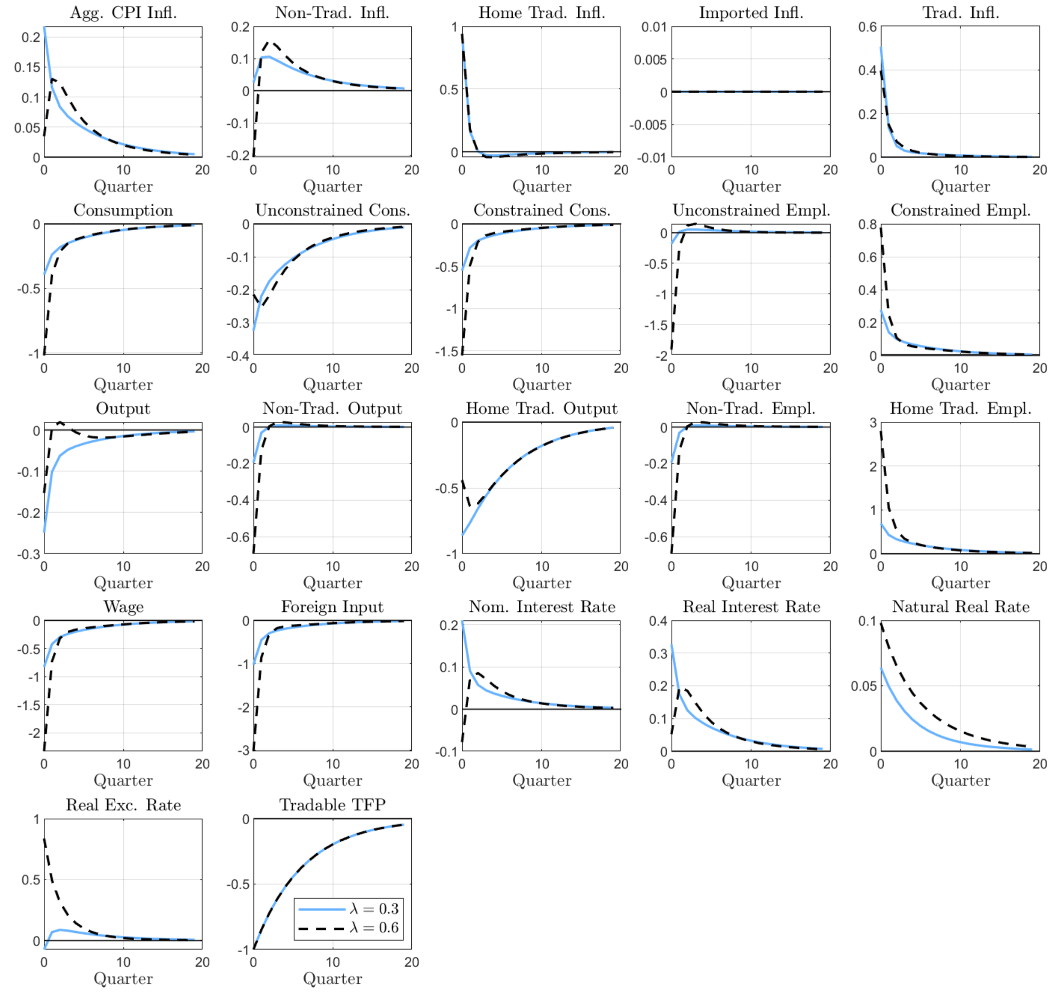
Figure 8: IRFs to a Front-loaded Increase in Foreign Price Level.



Notes: $\lambda = 0.3$ in blue, $\lambda = 0.6$ in grey dashed line. All the other parameters are calibrated according to Table 1.

In summary, the form in which fragmentation takes place will matter for the balance of supply and demand. The sudden implementation of tariffs will have different effects compared to a gradual implementation or an adverse shock to tradables productivity. The presence of fewer forward-looking agents mitigates the fall in aggregate demand, and more so in the scenario where the permanent increase in foreign prices takes place gradually.

Figure 9: IRFs to a Negative Shock to Tradable TFP.



Notes: $\lambda = 0.3$ in blue, $\lambda = 0.6$ in grey dashed line. All the other parameters are calibrated according to Table 1.

4 Different Degrees of Openness

This section explores the impact of the initial level of trade openness on the macroeconomic response to fragmentation. We therefore consider the same set of fragmentation scenarios while varying the level of home bias, denoted by $1 - \theta$. This adjustment allows us to capture how different economies experience trade shocks with varying degrees of intensity, and how policy responses may differ depending on the level of openness. A lower value of θ indicates a less open economy: the consumption basket and price index are *less* influenced by foreign prices and goods. Consequently, consumption relies more heavily on domestic production.

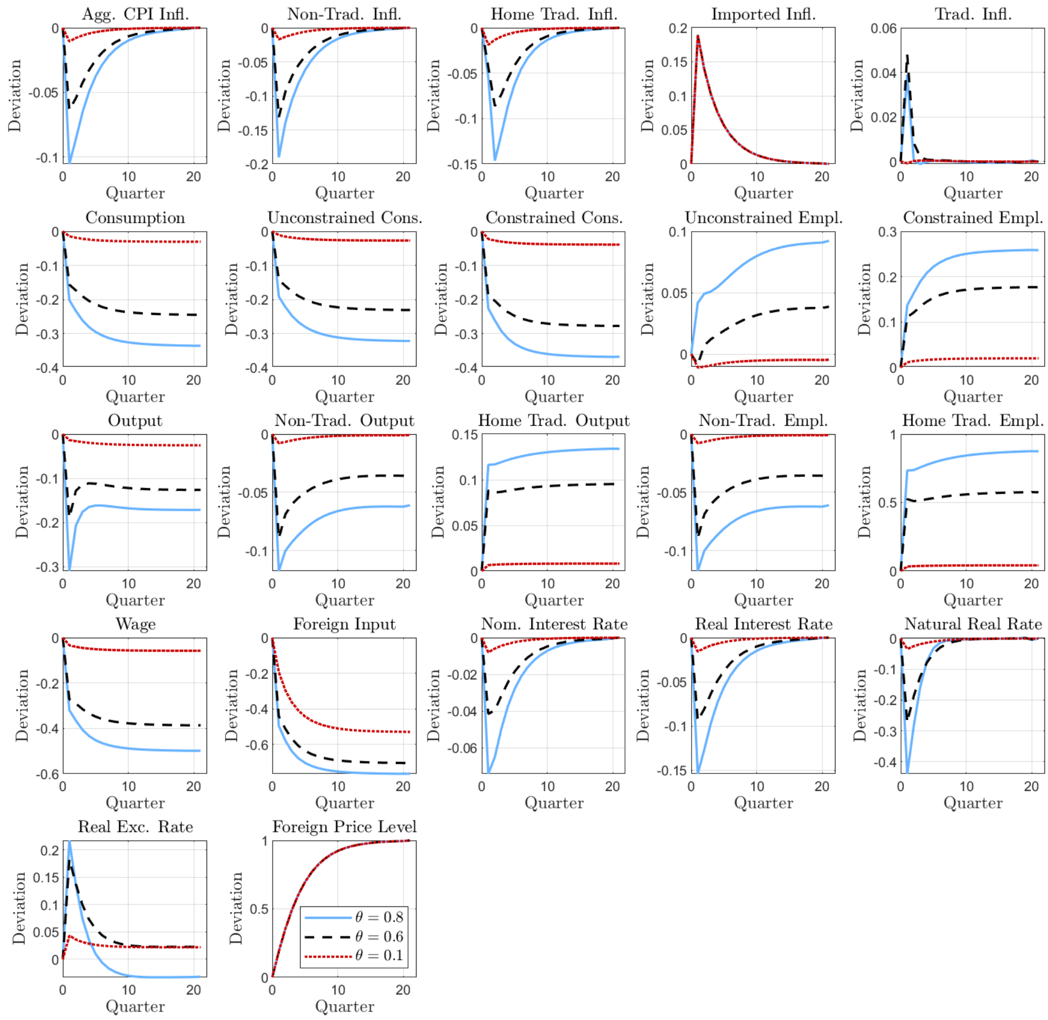
The degree of home bias in consumption appears to play a crucial role. Economies that are more open tend to be more exposed to fluctuations in foreign prices, which affects their consumption and production responses. In the scenarios involving sustained increases in foreign prices, whether gradual or front-loaded, the more open economy experiences a more pronounced decline in the natural rate of interest. Conversely, this trend reverses in the event of a negative TFP shock. Although the shock primarily affects the tradable sector, it directly affects domestic production and consumption, particularly the consumption basket of less open economies. In contrast, more open economies can mitigate the impact by diversifying away from domestic shocks through trade with foreign suppliers (and buyers).

Gradual Fragmentation Figure 10 shows that the open economies ($\theta = 0.6$ and $\theta = 0.8$) respond differently from the relatively closed economy ($\theta = 0.1$), in a gradual fragmentation scenario. Aggregate inflation has the same behaviour in all three cases; however, the underlying mechanisms differ quantitatively.

A useful benchmark to start with is the relatively closed economy case ($\theta = 0.1$, red dotted lines). Here, imported inputs are used mainly as an intermediate input for the production of non-tradable goods and the consumption basket of domestic households consists mainly of domestically produced tradable and non-tradable goods. As the price of imported intermediate inputs increases, imported inflation increases and the use of the imported input falls. Non-tradable employment moves in line with non-tradable output, which falls slightly before returning to steady state. Employment increases for constrained households and real wages fall. The adverse effect on labour income leads to a fall in consumption for both types of households. The fall in aggregate consumption leads to downward pressure domestic inflation and aggregate CPI inflation.

Next, consider the open economies ($\theta = 0.6$ and $\theta = 0.8$, dashed black lines and solid blue lines), where imported goods are not only used as intermediate inputs in the production of non-tradable goods but also comprise part of the consumption basket (as foreign tradable goods). More openness leads to a larger domestic adjustment in response to the import price shock. The additional fall in non-tradable goods inflation relative to the case of $\theta = 0.1$ is due to the fall in real income and domestic consumption, which now exerts additional downward pressure on domestic inflation. The fall in home tradables inflation counters the sharp rise in imported inflation, leading to a fall in tradables inflation overall. More openness also leads to a larger domestic adjustment in response to the import price shock. The import price shock leads households to substitute towards relatively cheaper domestically produced goods and production factors, which moderates the fall in domestic demand and labour demand. While there is a moderate and permanent fall in non-tradable employment and output, the opposite is true for the domestic tradable sector: employment and output both increase here. As exposure to foreign shocks intensifies with a lower home bias (higher θ), the natural rate of interest falls by more in the open economies.

Figure 10: IRFs to a Gradual Increase in Foreign Price Level.



Notes: The share of foreign tradables in the domestic household's consumption basket is denoted by θ. We show simulations for a relatively closed economy ($\theta = 0.1$) with a red dotted line, a moderately open economy ($\theta = 0.6$) with a black dashed line, and a very open economy ($\theta = 0.8$) with a blue line.

Front-loaded Fragmentation In the front-loaded fragmentation scenario, openness also plays a significant role in the responsiveness to changes in the level of $P_{F,t}$ (Figure 11). Notably, in the more open economy, non-tradable inflation exhibits a more pronounced decline immediately following the shock, moderating the sharp increase in aggregate CPI inflation.

Consider the case of a relatively closed economy, where the import price shock mainly affects intermediate inputs in the production of non-tradable goods ($\theta = 0.1$). As the price of foreign inputs rises, theres is a decrease in demand for these inputs, leading to a moderate fall in non-tradable output, non-tradable employment, and real wages. As a result, aggregate consumption also falls moderately.

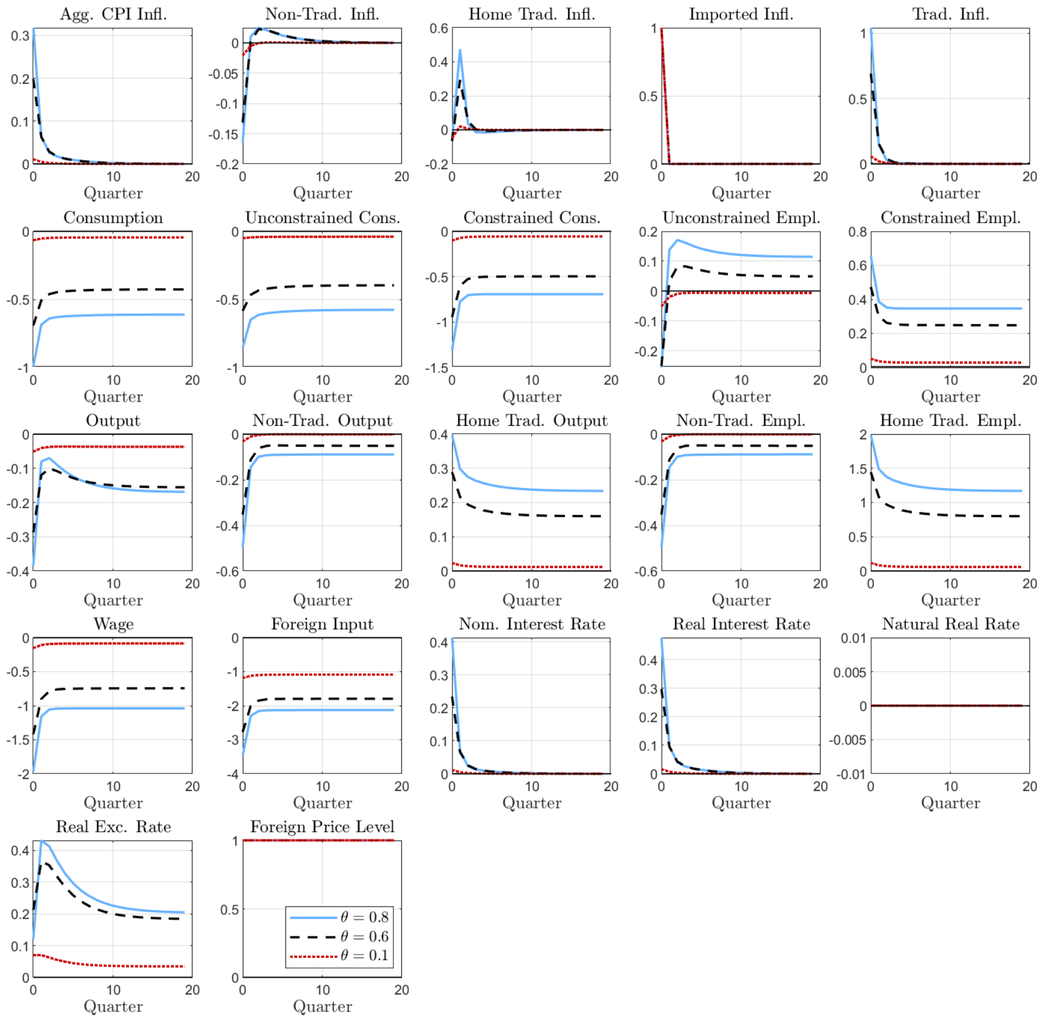
The same dynamics are more pronounced in the open economies ($\theta = 0.6$ and $\theta = 0.8$, dashed black lines and solid blue lines). However, imported goods are now also part of the consumption basket. The import price shock therefore also stimulates the domestic economy, and to a greater degree in the more open economy, as households substitute towards relatively cheaper domestically produced goods. Output and employment increase in the tradable sector, while the output and employment non-tradables sector recover quickly from the shock. The fall in consumption, which would occur as a result of more expensive foreign goods, is mitigated by the increase in domestic demand and labour income.

Fall in Tradables Productivity Figure 12 shows the impulse response functions for a one-standard deviation fall in TFP for the tradable sector. As before, consider first the $\theta = 0.1$ specification (red dotted lines). In this case, imported inputs are mainly used in the production of non-tradable goods. An adverse productivity shock in the tradables sector leads to a fall in tradable output. Each unit of tradable output now requires more labour to produce, and hours worked increase gradually due to higher labour demand. The adverse TFP shock leads to an increase in marginal costs in the tradable sector, which initially leads to upward pressure on tradable inflation. The fall in real wages leads to a fall in consumption, which is largely driven by a fall in constrained households' consumption, as unconstrained households can borrow to smooth over the transitory shock. Constrained households are unable to borrow to smooth consumption, increasing their labour supply instead.

The fall in consumption also affects the non-tradable sector, where output falls. Non-tradable output falls, and to the same extent, so does employment in this sector. However, since the non-tradable sector is unaffected by the adverse productivity shock, it can increase output by substituting towards labour as real wages fall. Non-tradable output recovers quickly and rises slightly over time as a result, through an increase in the intensive margin of labour and a fall in the use of the foreign input. The fall in non-tradable inflation is short-lived, and it increases alongside a much larger surge in tradable inflation. As a result, aggregate CPI inflation increases.

In a more open economy ($\theta = 0.6$ and $\theta = 0.8$), the adverse effect of the productivity shock on overall consumption is smaller on impact, relative to the closed economy. Employment in the tradable sector increases, compensating for part of the losses in productivity (given the Cobb-Douglas specification, the scope for labour substitutability is limited). The fall in productivity leads to a fall in the real wage on impact. As in the $\theta = 0.1$ case, the adverse productivity shock in the tradables sector has some spillovers for the non-tradables sector, with non-tradable employment and output falling sharply but recovering quickly. Changes in tradable inflation, combined with moderate increases in non-tradable inflation, lead to a transitory increase in aggregate CPI inflation.

Figure 11: IRFs to a Front-loaded Increase in Foreign Price Level.

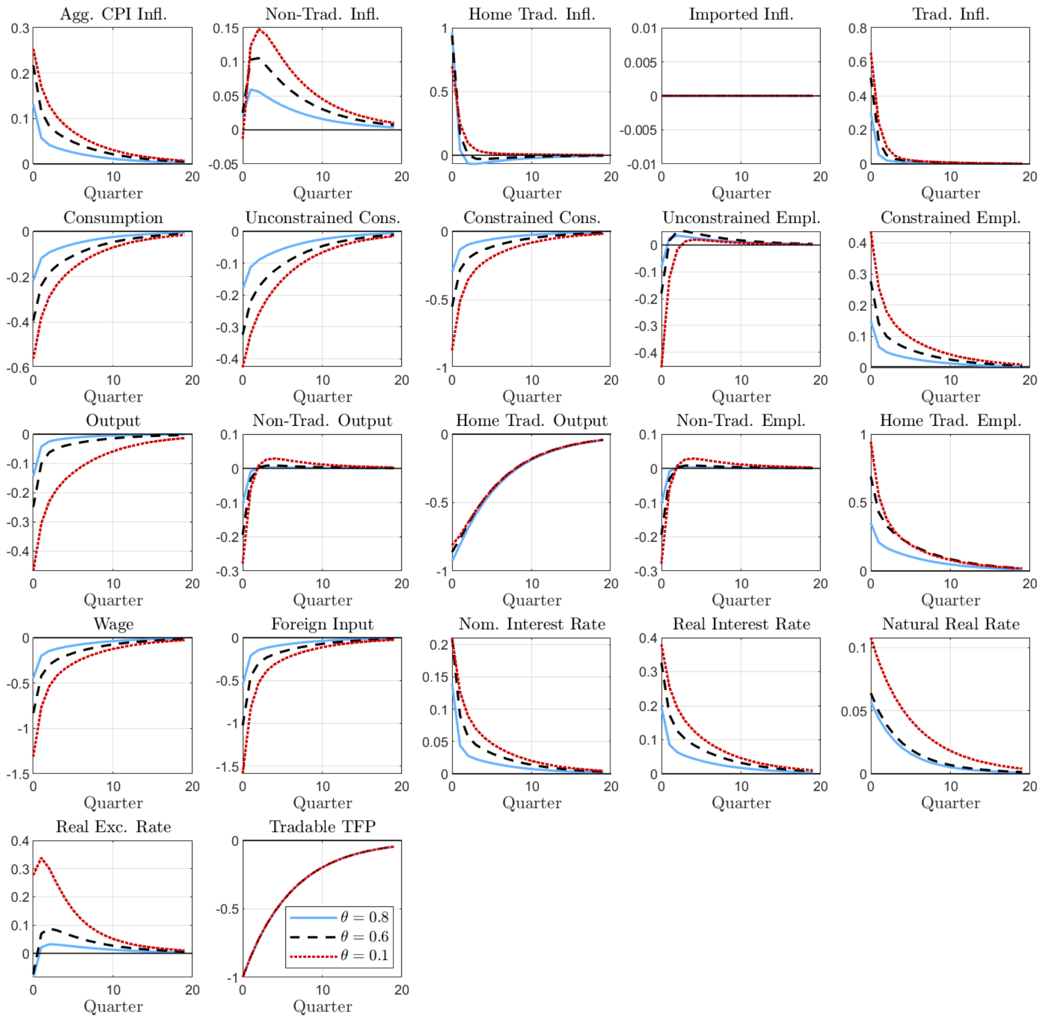


Notes: The share of foreign tradables in the domestic household's consumption basket is denoted by θ. We show simulations for a relatively closed economy ($\theta = 0.1$) with a red dotted line, a moderately open economy ($\theta = 0.6$) with a black dashed line, and a very open economy ($\theta = 0.8$) with a blue line.

5 Extensions

In this section, we extend the RANK model introduced in Section 3.1 to incorporate nominal wage rigidities.

Figure 12: IRFs to a Negative Shock to Tradable TFP.



Notes: The share of foreign tradables in the domestic household's consumption basket is denoted by θ. We show simulations for a relatively closed economy ($\theta = 0.1$) with a red dotted line, a moderately open economy ($\theta = 0.6$) with a black dashed line, and a very open economy ($\theta = 0.8$) with a blue line.

5.1 Households

Relative to the RANK model in Section 3.1, the key difference we introduce is that the labour supply chosen by households is provided to a union in return for a nominal wage W_t. The union allocates the workers into categories or varieties indexed by $j \in [0, 1]$ and sells these units of labour varieties, $N_t(j)$, at wage $W_t(j)$. Due to imperfect substitutability among labour types, the union can act as a monopolist over each variety.

Labour Packers Varieties $N_t(j)$ are in turn combined by labour "packers" according to a CES production function,

$$N_t = \left[\int_0^1 N_t(j)^{1-\frac{1}{\epsilon_w}} dj\right]^{\frac{1}{1-\frac{1}{\epsilon_w}}}.$$

$N_t(j)$ denotes the demand for a specific labour variety j, while N_t denotes aggregate labour demand. The elasticity of substitution between labour varieties is ϵ_w. After labour packers assemble the labour bundle, they supply it to firms at wage W_t to firms, which is then used in the production process. Labour packers maximise the following objective,

$$\max_{N_t(j)} \left\{ W_t N_t - \int_0^1 N_t(j) W_t(j) dj \right\},$$

subject to the CES production function. The first-order condition,

$$W_t N_t^{\frac{1}{\epsilon_w}} N_t(j)^{-\frac{1}{\epsilon_w}} - W_t(j) = 0,$$

leads to following expression for labour demand,

$$N_t(j)^d = \left(\frac{W_t(j)}{W_t}\right)^{-\epsilon_w} N_t.$$

As the labour packers are perfectly competitive, we can use the zero-profit condition to calculate the wage index,

$$\begin{aligned} W_t N_t - \int_0^1 N_t(j) W_t(j) dj = 0 \implies \\ W_t N_t = \int_0^1 \left(\frac{W_t(j)}{W_t}\right)^{-\epsilon_w} N_t W_t(j) dj, \\ W_t = \left(\int_0^1 W_t(j)^{1-\epsilon_w} dj\right)^{\frac{1}{1-\epsilon_w}}. \end{aligned}$$

Labour Unions The labour union maximises

$$\max_{W_t(j)} \delta_t N_t^d W_t(j) - \frac{N_t^{1+\phi}}{1+\phi}$$

subject to

$$N_t(j)^d = \left(\frac{W_t(j)}{W_t}\right)^{-\epsilon_w} N_t^d.$$

This is equivalent to the maximisation of household utility subject to the budget constraint and the demand for labour. The first order condition is given by

$$\delta_t \left(\frac{W_t(j)}{W_t}\right)^{-\epsilon_w} (1-\epsilon_w) N_t^d + \epsilon_w \left[\left(\frac{W_t(j)}{W_t}\right)^{-\epsilon_w} N_t^d\right]^{\phi} \left(\frac{W_t(j)}{W_t}\right)^{-\epsilon_w - 1} \frac{N_t^d}{W_t} = 0,$$

which yields

$$W_t(j) = \frac{\epsilon_w}{\epsilon_w - 1} \frac{(N_t^d)^\phi}{C_t^\sigma},$$

where $\frac{\epsilon_w}{\epsilon_w - 1} = \mathcal{M}^w$ and $mc_t^w = \frac{(N_t^d)^\phi}{C_t^\sigma}$. This characterizes the flexible wage setting. To introduce nominal and real wage stickiness, we assume that with probability θ_w, a union cannot reoptimise its wage and is instead bound to a wage that is indexed to a composite price index from the previous period,

$$W_t(j) = \begin{cases} W_{t-1}(j) \left((\Pi_w^{ss})^{1-\xi_w} (\Pi_{t-1}^w)^{\xi_w} \right) & \text{with prob } \theta_w \\ W_t^*(j) & \text{with prob } 1 - \theta_w \end{cases}.$$

Therefore,

$$W_{t+s}(j) = W_t^*(j) \left(\Pi_{ss}^W \right)^{s(1-\xi_w)} \left(\prod_{g=0}^{s-1} \left(\left(\Pi_{t+g}^W \right)^{\xi_w} \right) \right) = W_t^*(j) \left[\left(\Pi_{ss}^W \right)^{s(1-\xi_w)} \left(\frac{W_{t+s-1}}{W_{t-1}} \right)^{\xi_w} \right].$$

Given this demand constraint and assuming that a union j always meets the demand for its labour at the current wage, labour unions solve the following optimisation problem,

$$\max_{W_t^*(j)} E_t \sum_{s=0}^{\infty} (\theta_w)^s \Lambda_{t,t+s} P_{t+s} \left[\left(\frac{W_t^*(j)}{P_{t+s}} - mc_{t+s}^W \right) \left(\frac{W_t^*(j)}{W_{t+s}} \right)^{-\frac{M_w}{M_w - 1}} N_{t+s} \right]. \tag{30}$$

Taking the derivative with respect to $W_t^*(j)$ delivers the familiar wage inflation schedule,

$$\begin{aligned}
\frac{f_t^{W,1}}{f_t^{W,2}} \mathcal{M}_w &= w_t^* = \frac{W_t^*}{W_t} = \left(\frac{1 - \theta_w \left(\zeta_t^W \right)^{\frac{1}{M_w - 1}}}{1 - \theta_w} \right)^{1 - \mathcal{M}_w}, \\
f_t^{W,1} &= N_t \frac{mc_t^W}{w_t} + \theta_w E_t \left[(\Lambda_{t,t+1}) \left(\frac{\Pi_{t+1}^W}{\Pi_{t+1}^{CPI}} \right) \left(\frac{\Pi_{t+1}^W}{\Pi_{ss}^W} \right)^{\frac{M_w}{M_w - 1}} f_{t+1}^{W,1} \right], \\
f_t^{W,2} &= N_t + \theta_w \beta E_t \left[(\Lambda_{t,t+1}) \left(\frac{\Pi_{t+1}^W}{\Pi_{t+1}^{CPI}} \right) \left(\frac{\Pi_{t+1}^W}{\Pi_{ss}^W} \right)^{\frac{1}{Mw - 1}} f_{t+1}^{W,2} \right], \\
\zeta_t^W &= \Pi_t^W / \Pi_{ss}^W, \\
w_t &= \Pi_t^W / \Pi_t w_{t-1}, \\
\mathcal{D}_t^W &= (1 - \theta_w) \left(\frac{1 - \theta_w \left(\zeta_t^W \right)^{\frac{1}{M_w - 1}}}{1 - \theta_w} \right)^{\mathcal{M}_w} + \theta_w \left(\zeta_t^W \right)^{\frac{M_w}{M_w - 1}} \mathcal{D}_{t-1}^W,
\end{aligned}$$

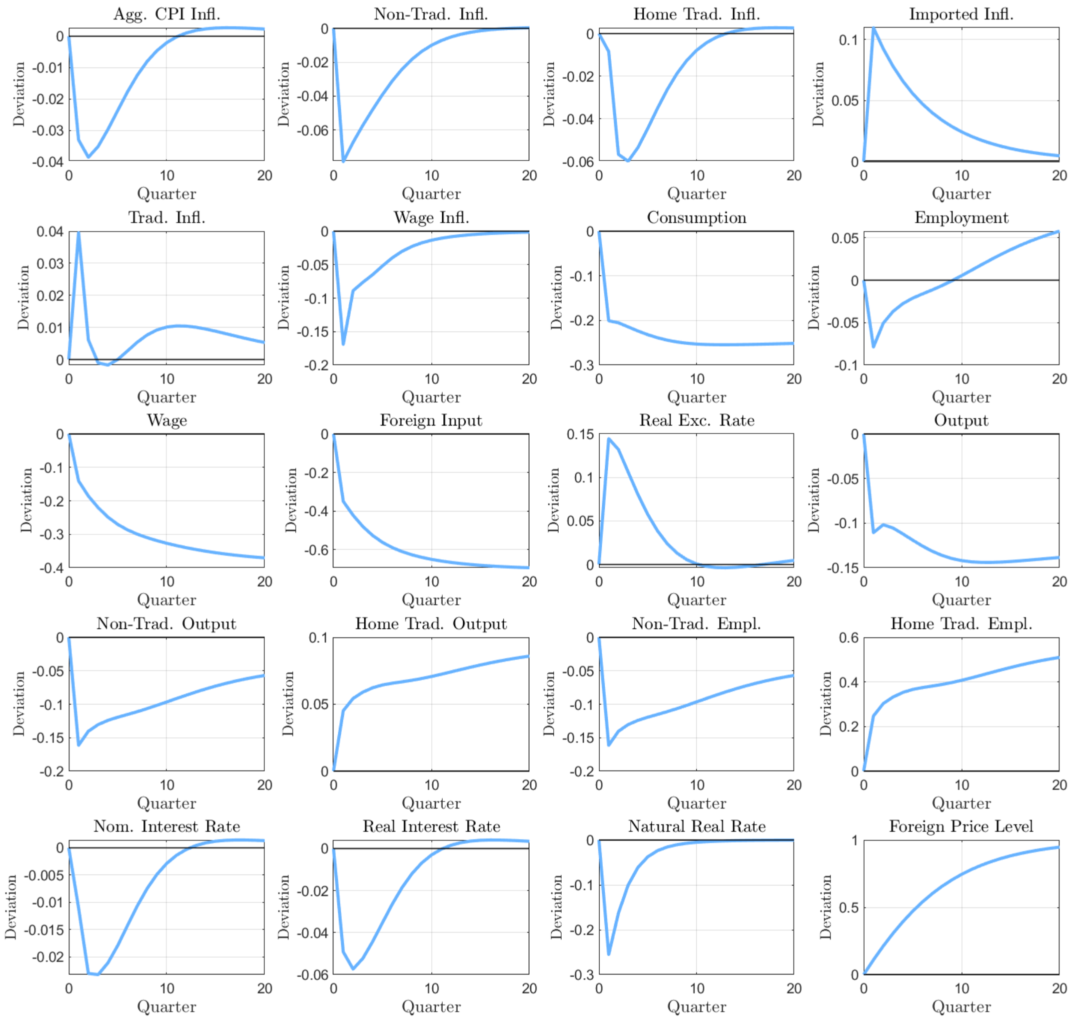
where D_t^W is wage dispersion. We calibrate $\theta_w = 0.92,\ \xi_w = 0,\ \epsilon_w = 11$ as in Schmitt-Grohé and Uribe (2006) and Chan, Diz, and Kanngiesser (2024).

Gradual Fragmentation The impact of a gradual import price shock on aggregate CPI inflation and domestic inflation with wage rigidities (Figure 13) is similar to the case without wage rigidities (Figure 4). However, the fall in aggregate CPI inflation is more moderate, which reflects weaker downward pressure on domestic inflation. A salient feature of this extension relative to the flexible wage case is the decline in non-tradable output and employment, which gradually recovers to a lower steady-state. Higher import prices lead non-tradable goods firms to cut production. While the real wage trajectory is quantitatively similar to the flexible wage case, the shock has a larger effect on hours worked. Aggregate hours worked falls to a much greater extent than in the flexible wage case, largely due to the decline in hours worked in the non-tradables sector. Despite the more moderate fall in the real wage, aggregate consumption falls to a greater extent initially.

Front-loaded Fragmentation Relative to the flexible-wage case (Figure 5), nominal wage rigidities mitigate the fall in wage inflation (Figure 14). As aggregate price inflation rises, real wages fall, reducing real incomes. The increase in intermediate input costs leads to a fall in non-tradable output and hours worked. This is counteracted by a moderate increase in tradables sector output and employment. Overall, wage rigidities lead to a fall in aggregate hours worked, in contrast to the increase observed under flexible-wages. Aggregate consumption falls due to lower real incomes. Compared to the flexible wage case, aggregate CPI inflation increases by more, driven by stronger domestic inflationary pressures originating in the non-tradables sector.

Fall in Tradables Productivity Figure 15 presents the responses to an adverse productivity shock in the tradable goods sector. As in the case of an import price shock, nominal wage rigidities mitigate the fall in wages that would otherwise occur under flexible wages, resulting in a more moderate decrease in the real wage. The increase in marginal costs leads to a sharper contraction in tradable output, while the increase in tradable employment is more modest compared to the flexible-wage case. Notably, non-tradable output and employment now increase over time, reflecting a reallocation of resources across sectors. Aggregate consumption falls by less in the sticky-wage case, as real wages decline by less. Aggregate CPI inflation is higher, driven by stronger inflationary pressures in the non-tradable sector.

Figure 13: IRFs to a Gradual Increase in Foreign Price Level.



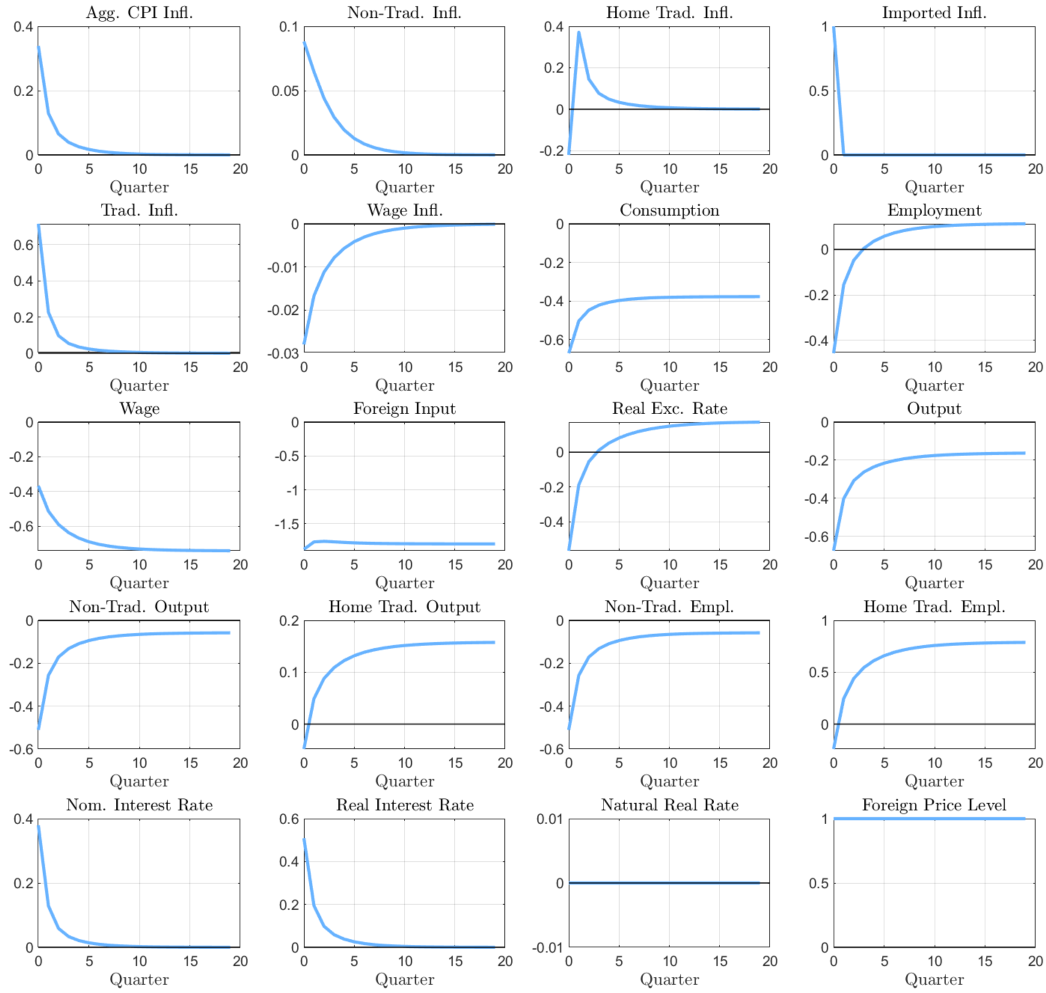
Notes: IRFs to a 100% gradual positive foreign price shock.

6 Conclusion

There is a broad consensus that a realignment of trading patterns is taking place. While trade fragmentation is likely to result in higher imported goods prices and lower real incomes, we show that the inflationary impact and the appropriate monetary policy response depend crucially on how demand adjusts to lower incomes, which in turn, depends on the form that fragmentation takes.

We study the macroeconomic effects of fragmentation using a two-sector, open economy New Keynesian model featuring imperfect risk sharing and heterogeneous households. We

Figure 14: IRFs to a Front-loaded Increase in Foreign Price Level.

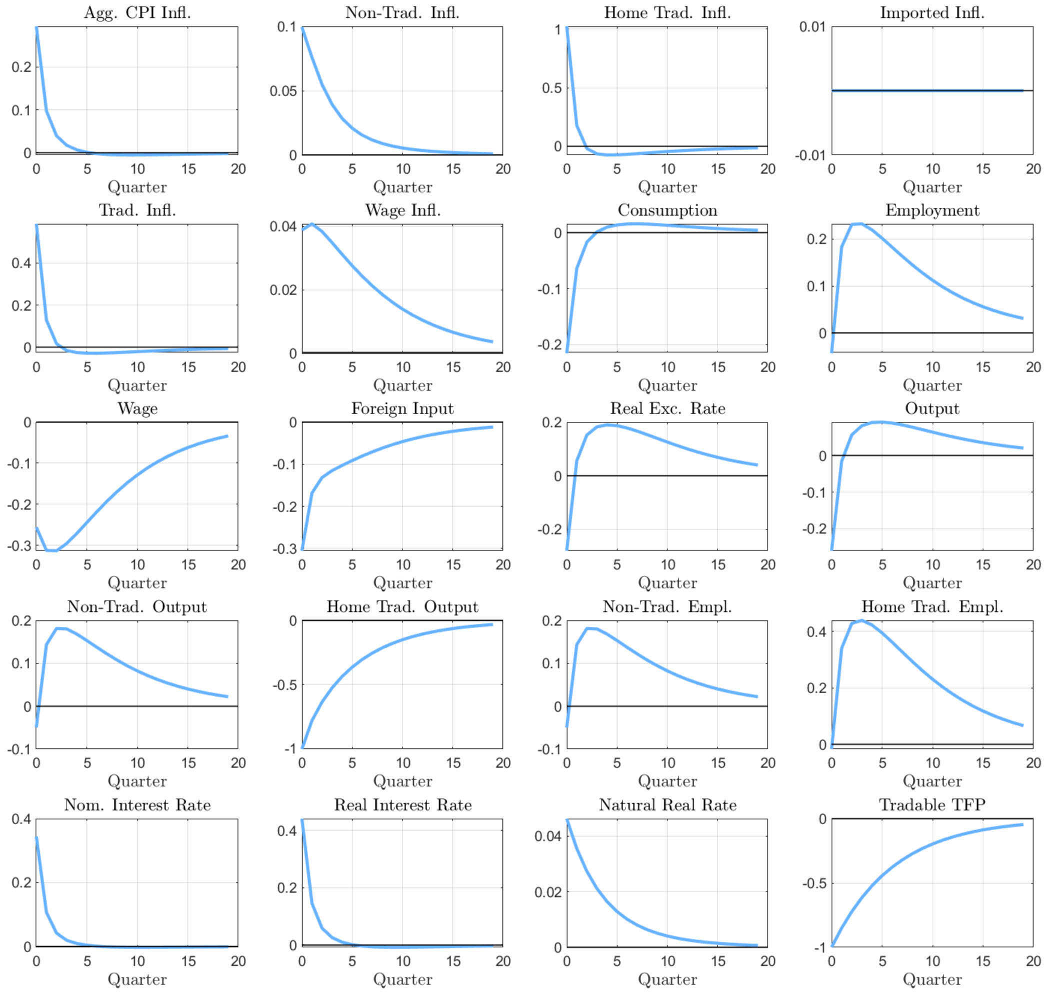


Notes: IRFs to a 100% front-loaded positive foreign price shock.

consider different fragmentation scenarios by varying the speed at which foreign prices adjust to a permanently higher level, as well as a negative shock to tradable sector productivity. The scenarios we consider capture the usual supply-side channels whereby higher input prices affect inflation, but emphasize how the overall effect on inflation depends on the adjustment of demand to lower real incomes. The balance between supply and demand differs in each of the scenarios, which has implications for inflation, and hence, monetary policy.

Our results suggest that trade fragmentation is not necessarily inflationary. In our first scenario, the gradual and permanent increase in foreign prices yields a persistent increase in imported inflation; the pass-through to aggregate inflation is counteracted by a fall in

Figure 15: IRFs to a Negative Shock to Tradable TFP.



Notes: IRFs to a negative TFP shock in the tradable sector.

domestic inflation. The key mechanism for this result is that forward-looking households reduce their spending in anticipation of more restrictive future supply, as they respond to lower permanent income by smoothing consumption. The natural rate of interest decreases, suggesting that, when we allow for demand to adjust, the overall effect is not inflationary. The economy enters a period of stagnation, with lower real incomes, lower demand and lower inflationary pressures. In our second scenario, a front-loaded and persistent increase in the price of imported goods leads to a temporary period of stagflation, with lower consumption and higher inflationary pressures. Finally, a fall in the productivity of tradable goods leads to lower tradable output and an increase in tradable inflation, in addition to a modest increase in non-tradable inflation driven.

To understand the various channels shaping the response of demand and inflation to fragmentation, we vary the proportion of constrained households and the home bias in these three scenarios. We find that as the share of hand-to-mouth agents in the economy increases, demand falls by less in the gradual fragmentation scenario, as fewer unconstrained households anticipate the future fall in real incomes. More open economies are more exposed to shocks in foreign prices, which is reflected in the response of consumption and production. In both the front-loaded and gradual increase in imported prices scenarios, we see an amplification of these responses. However, this reverts in the case of a negative TFP shock, which is a domestic shock. In this scenario, more openness allows the economy to diversify away the impact of a domestic shocks on the economy, dampening the impact of the shock. Wage rigidities introduce additional supply-side constraints through the domestic labour market, leading to a sharp fall in output in the non-tradable sector and a limited increase in output in the domestic tradable sector, with implications for the magnitude of aggregate CPI inflation.

In future work, we plan to formalise the policy tradeoffs posed by fragmentation, study optimal monetary policy, and explore settings with higher inertia in price setting and lags in the transmission of monetary policy.

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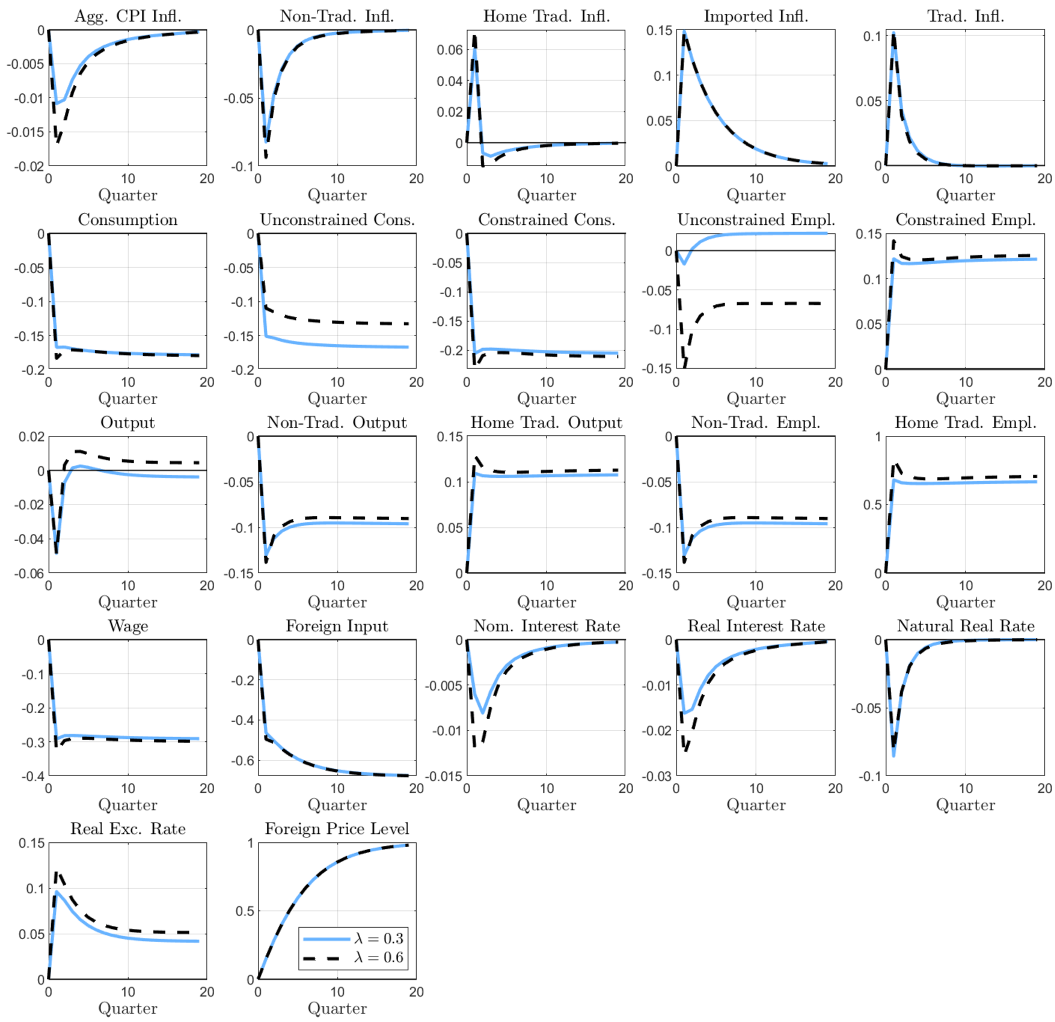
A Appendix

A.1 Different Elasticity of substitution

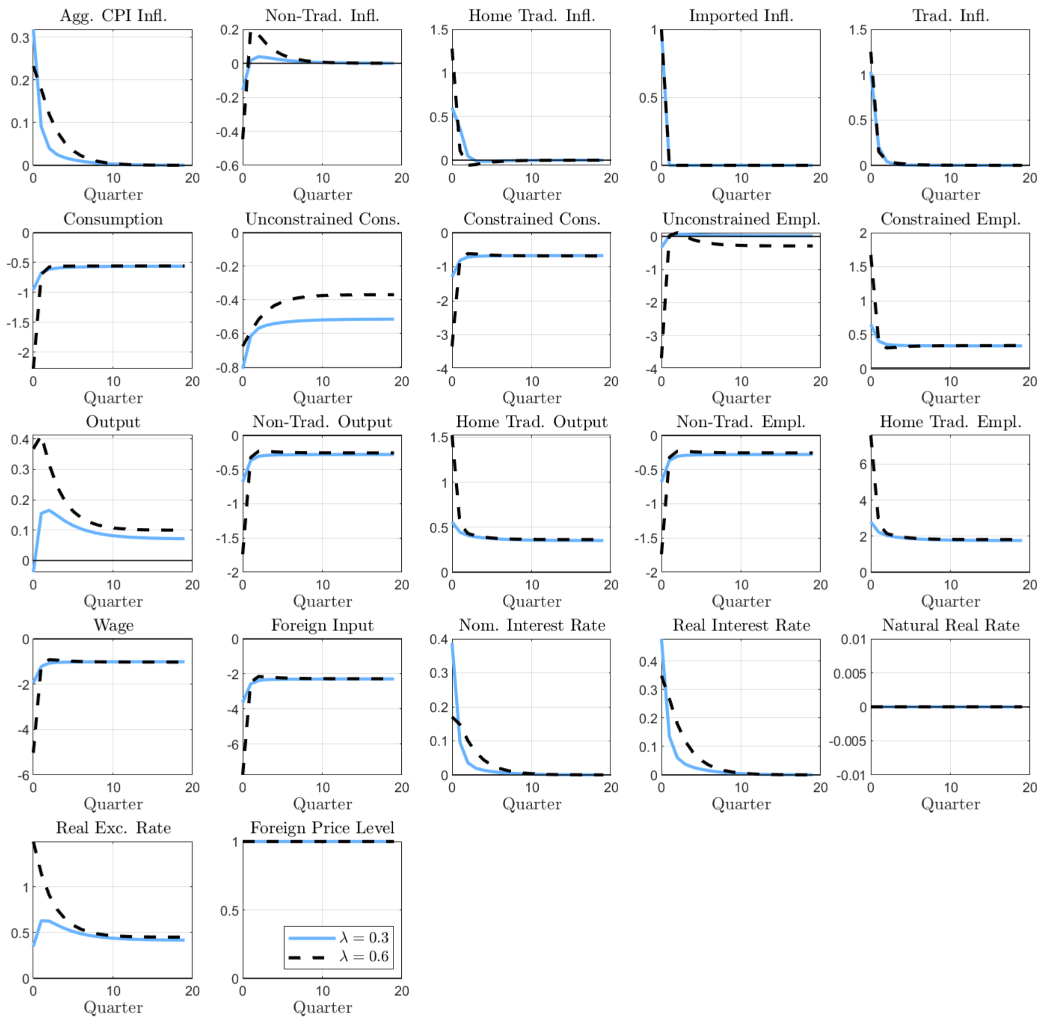
In this section we show our main results for an elasticity of substitution between tradable goods (μ) equal to 6 and between tradable and non-tradable goods (ι) equal to 0.55. The rest of our calibration remain unchanged.

Figure 16: IRFs to a Gradual Increase in Foreign Price Level.



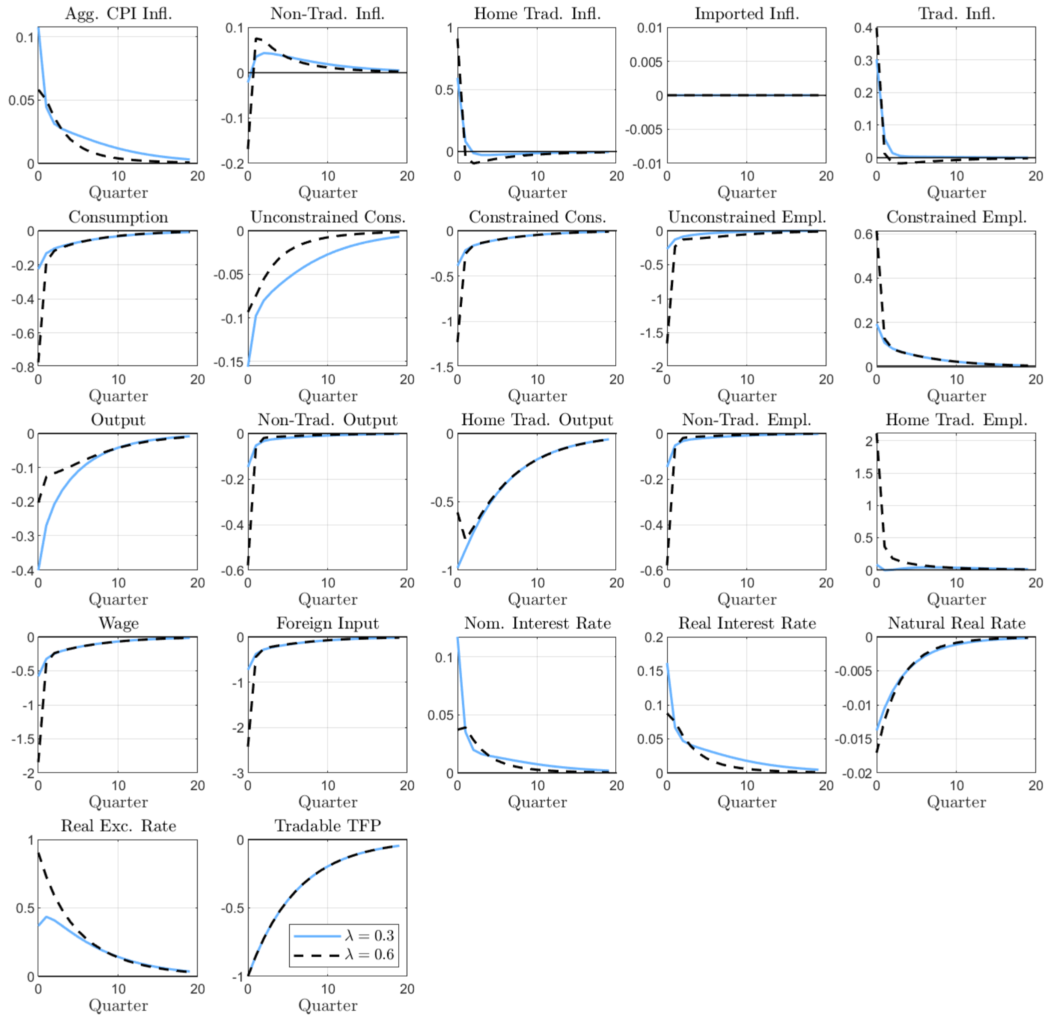
Notes: $\lambda = 0.3$ in blue, $\lambda = 0.6$ in grey dashed line. All the other parameters are calibrated according to Table 1.

Figure 17: IRFs to a Front-loaded Increase in Foreign Price Level.



Notes: $\lambda = 0.3$ in blue, $\lambda = 0.6$ in grey dashed line. All the other parameters are calibrated according to Table 1.

Figure 18: IRFs to a Negative Shock to Tradable TFP.



Notes: $\lambda = 0.3$ in blue, $\lambda = 0.6$ in grey dashed line. All the other parameters are calibrated according to Table 1.