Destabilizing Capital Flows Amid Global Inflation*

Julien Bengui
Swiss National Bank
and CEPR

Louphou Coulibaly
University of Wisconsin-Madison
and NBER

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Abstract

Over the latest monetary policy tightening cycle, capital has been flowing from low-inflation countries to high-inflation countries. This pattern of capital flows is consistent with the predictions of an open-economy model with nominal rigidities where cost-push shocks generate an inflationary episode and capital flows freely across countries. Yet, by raising demand for domestic non-tradable goods and services, capital inflows cause unwelcome upward pressure on firms' costs in countries most severely hit by these shocks. We find that a reverse pattern of capital flows would have improved the output-inflation trade-off globally, hence requiring a less aggressive monetary tightening in the most severely hit countries and delivering overall welfare gains.

Keywords: Inflation, current account adjustment, externalities, capital flow management policies, cost-push shocks

JEL Classifications: E32, E44, E52, F32, F41, F42

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1 Introduction

One of the most striking macroeconomic developments of the post-pandemic recovery has been an unprecedented and broad-based surge in inflation, shown in the left panel of Figure 1 for G7 economies. After a prolonged period of low interest rates, this inflation surge led many central banks to engage in their most aggressive tightening cycle in decades, as shown in the right panel of the figure. During this tightening cycle, capital has been flowing from economies with the lowest inflation and least aggressive hiking profiles to economies with the highest inflation and most aggressive hiking profiles. This fact is apparent in Figure 2, which shows that economies with higher inflation (panel a) and larger cumulative interest rate hikes (panel b) between October 2021 and March 2023 have tended to run more negative current account balances over this period.[1,2] Has this observed pattern of capital flows been a stabilizing force for the global economy's adjustment to the shocks likely behind the recent inflation surge, or has it instead been destabilizing?

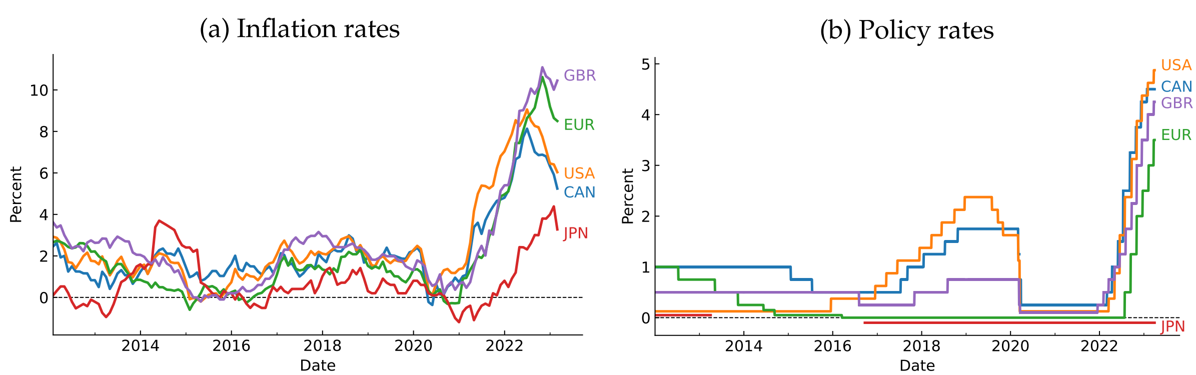

Figure 1: Inflation and policy rates in G7 countries.

Note: Data are from the BIS. The left panel shows annual (year-over-year) CPI inflation rates at monthly frequency. The right panel shows policy rates at daily frequency. See Appendix A for details.

In this paper, we argue that capital flows from low-inflation to high-inflation countries might be destabilizing and result in an excessive cross-country dispersion of monetary tightening. In other words, the pattern of capital flows observed in the latest tightening

[1]Among the bottom two quartiles of average inflation, over 75% of economies have been running surpluses, while among the top two quartiles over 75% of economies have been running surpluses. A similar pattern holds for interest rate hikes. See Figure A.2 in Appendix A.

[2]Figure A.4 shows that the same patterns linking capital flows, inflation, and changes in nominal rates emerged during the tightening episode of 2016-2019.

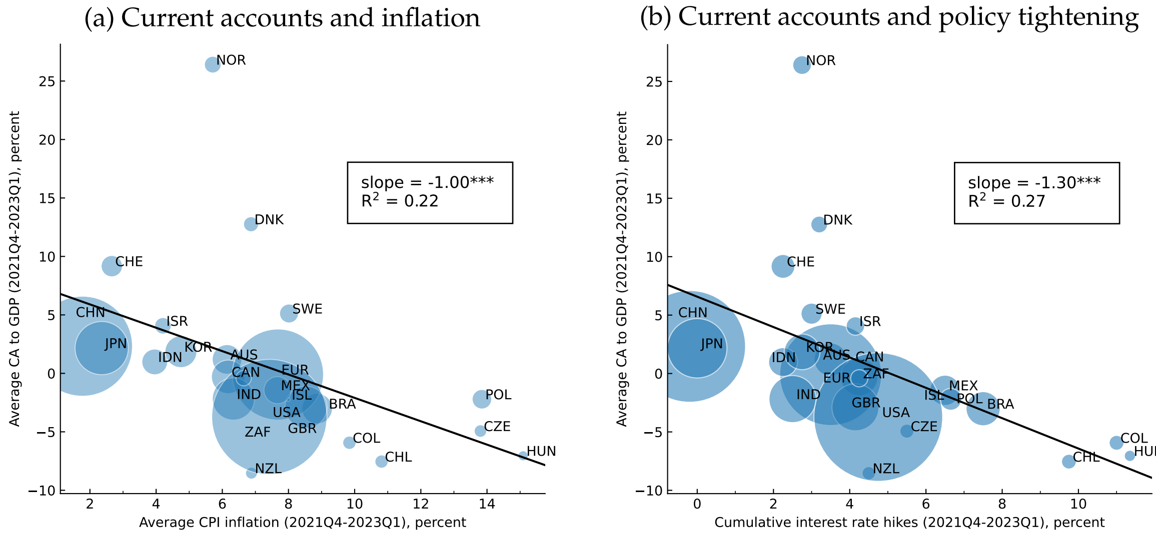

Figure 2: Capital flows, inflation, and monetary policy tightening.

Note: Data on CPI inflation rates and policy rates are from the BIS. Current account-to-GDP ratios are from the OECD's Main Economic Indicators. The size of the dots reflects the size of countries' dollar GDP in 2021, as reported in the World Bank's World Economic Indicators database. See Appendix A for details. *** indicates significance at the 1 percent level.

cycle likely resulted in excessive movements in inflation, as well as in low-inflation countries tightening too little and high-inflation countries tightening too much. Our argument builds on the insight that capital inflows exert upward pressure on the marginal costs of domestic firms by reducing the supply of non-tradable factors of production such as labor or by propping up the demand for non-tradable goods. In a high-inflation environment, this upward pressure on firms' marginal costs deteriorates the policy trade-off: to stabilize domestic inflation at a given level, monetary policy needs to be more contractionary when capital is flowing in. Individual agents, who borrow from international financial markets to smooth consumption when policy is contractionary, do not internalize the general equilibrium effects of their decision. As a result, they impose a macroeconomic externality on others and worsen the central bank's policy trade-off.

We formalize these ideas in a standard two-country general equilibrium model with nominal rigidities, whose building blocks form the backbone of more elaborate dynamic stochastic general equilibrium models used by most central banks for policy analysis. In the simplest version of the model featuring two tradable goods and identical consumption baskets across countries (Clarida, Gali and Gertler, 2002), the mechanism works through labor supply alone. By raising domestic consumption, capital inflows shift households' labor supply schedule up, thereby raising equilibrium wages. Higher wages in turn result in higher marginal costs for domestic firms. Hence, in times when monetary policy tightens to limit domestic inflation, the upward pressure on domestic marginal costs caused by additional capital inflows adds fuel to the fire. Either the central bank lets the rise in marginal costs translate into higher domestic inflation, or it is forced to depress economic activity further to achieve a given stabilization of inflation. Either way, the economy is worse off, and this adverse side effect of external borrowing is not adequately signaled to domestic agents by its price in an unregulated market.

In the presence of home bias in consumption, capital inflows also appreciate the terms of trade (i.e., the relative price of exports over imports). This appreciation of the terms of trade raises the purchasing power of domestic firms and attenuates the rise in their marginal costs caused by the aforementioned wealth effect. However, under a condition weaker than the well-known Marshall-Lerner condition, the wealth effect outweighs the terms of trade effect.[3]

In our baseline model, capital flows exert upward pressure on domestic costs only via a wealth effect on labor supply. But they do so more generally in the presence of non-tradable goods. To make this point, we consider two model extensions. First, we consider an extension featuring non-traded goods consumption and Greenwood, Hercowitz and Huffman (1988) preferences that eliminate the wealth effect on labor supply. In this case, capital inflows prop up the demand for non-tradable goods, raising labor demand in the non-tradable sector. Higher labor demand in turn leads to higher wages economy-wide. Hence, capital inflows raise domestic wages through a movement *along* the households' labor supply curve, rather than through a movement *of* the curve as in the baseline model featuring a wealth effect. Second, we consider a model extension where non-tradable goods are used by domestic firms as intermediate inputs in the spirit of Berka, Devereux and Engel (2018) and nominal wages are fully rigid. In that case, capital inflows exert upward pressure on domestic costs through a distinct intermediate input channel.

The mechanism we emphasize does not simply lead to inefficiencies at the margin. Indeed, it can be powerful enough to reverse the direction of capital flows. Indeed, we show that when the Marshall-Lerner condition holds, a free capital mobility regime features capital inflows into the region with the most acute inflationary pressures, while a managed capital flow regime accounting for the externality instead prescribes outflows from that region. Our analysis hence suggests that ostensibly wrong price signals in international financial markets can lead to *topsy-turvy* capital flows following cost-push shocks.

Going beyond describing optimal policy in target form and contrasting the behavior of

[3]This weaker condition states that the trade elasticity is larger than the degree of home bias, which is between zero and one. The Marshall-Lerner condition states that the trade elasticity is larger than one.

the trade balance under alternative capital account regimes, we illustrate the quantitative relevance of our findings when central banks follow standard Taylor rules. Following an inflationary cost-push shock in Home, capital flows from Foreign to Home under free capital mobility. Home experiences a significant rise in inflation and a large fall in output, while Foreign experiences a modest rise in output. Under a managed capital flow regime that instead features capital flows from Home to Foreign, Home inflation is reduced by 2 percentage points on impact, Foreign experiences a minor rise in inflation of about one percentage point, and the magnitude of the output gaps is reduced by one and a half percentage points in both countries. Free capital mobility also results in an excessive cross-country dispersion in monetary tightening. Under managed capital flows, the initial hike in the policy rate is 2 percentage points lower in Home than under free capital mobility, while in Foreign it is about one and half percentage points higher. Finally, owing to its stabilizing feature, the managed capital flow regime delivers welfare gains of 0.05% of permanent consumption.

Related Literature. Our paper builds on a long tradition in international macroeconomics of questioning the role of external imbalances during disinflation episodes. Early examples include the policy mix debate of the late Bretton-Woods era (Mundell 1971) and the 1980s (Sachs 1985), as well as the literature on inflation stabilization plans in developing countries (e.g., Vegh 1992). Following the Volker disinflation and into the Great moderation period, interest in these issues subsided, but the recent inflation surge led to a resurgence of attention. In this regard, two pieces of related work stand out. First, Fornaro and Romei (2022) show that, under free capital mobility, national monetary policies can be excessively tight in response to shocks that reallocate demand toward tradable goods. They find that closing the capital account may improve welfare by making non-cooperative monetary policy coincide with cooperative monetary policy. By contrast, we focus on capital flows under cooperative monetary policy and show that they can be destabilizing under free capital mobility. Second, Cho, Kim and Kim (2023) use a New Keynesian model to compare welfare under complete financial markets and autarky following an inflationary markup shock, and find higher welfare under autarky. Our paper formally identifies the underlying externality and characterizes the constrained efficient capital flow regime that accounts for it.

The externality we point to belongs to the class of aggregate demand externalities elegantly characterized in general terms by Farhi and Werning (2016).[4] It also relates to

[4]See also Schmitt-Grohe and Uribe (2016), Farhi and Werning (2017), Acharya and Bengui (2018), Fornaro and Romei (2019) and Bianchi and Coulibaly (2021).

pecuniary externalities, whose welfare consequences in incomplete markets environment were first discussed in Stiglitz (1982), Greenwald and Stiglitz (1986), Geanakoplos and Polemarchakis (1986).[5,6] As in the aggregate demand externality literature, the externality we outline occurs in a demand-constrained setting. Yet it is primarily mediated through the price system, like pecuniary externalities. More importantly, its practical implications subtly differ from those of aggregate demand externalities arising from explicit constraints on monetary policy.

When constraints on monetary policy prevent goods-specific labor wedges from being closed, the general policy prescription arising from aggregate demand externalities is to incentivize agents to shift wealth toward states of nature in which their spending on goods whose provision is most depressed is relatively high (Farhi and Werning 2016). Boosting spending on these goods is something monetary policy would like to achieve but is unable to, owing to constraints such as a fixed exchange rate (Farhi and Werning 2012, 2017, Schmitt-Grohe and Uribe 2016) or a zero lower bound (Farhi and Werning 2016, Korinek and Simsek 2016). In contrast, in our setup with unconstrained monetary policy subject to an output-inflation trade-off, it is usually optimal to tilt spending *away* from the country with the most depressed output. This is because rather than being designed to address demand shortages, policy interventions are motivated by a desire to relieve supply pressures. Our paper hence complements the existing literature by providing an insight specific to circumstances in which cost-push shocks may be creating policy trade-offs, as was the case after the latest inflation surge.

Our work also relates to a large body of theoretical research suggesting that capital flows might be excessively volatile due to imperfections in financial, goods or labor markets (Bianchi 2011, Farhi and Werning 2014, Schmitt-Grohe and Uribe 2016). A common thread between this work and ours is the idea that externalities might lead to inefficient capital flows. An important distinction, however, is that the supply side channel we emphasize does not necessarily imply excessive capital flow volatility. Indeed, under a unitary elasticities parametrization often adopted in the literature for its analytical tractability (Cole and Obstfeld 1991), capital flows are positive under a managed regime in our model, even though they would be zero under free capital mobility. This suggests that market

[5]For recent articulations of these ideas, see Caballero and Krishnamurthy (2001), Gromb and Vayanos (2002), Korinek (2007, 2018), Lorenzoni (2008), Jeanne and Korinek (2010, 2019, 2020), Bianchi (2011), Benigno, Chen, Otrok, Rebucci and Young (2013), Bengui (2014), Davila and Korinek (2017), and Bianchi and Mendoza (2018), among others.

[6]See Fornaro (2015), Ottonello (2021), Coulibaly (2023) and Basu, Boz, Gopinath, Roch and Unsal (2020) for examples of studies combining pecuniary externalities arising from financial frictions with aggregate demand externalities.

failures can occasionally lead to too little rather than too much capital flows. This insight is, to the best of our knowledge, new to the literature.

The remainder of the paper is organized as follows. Section 2 describes the model environment, Section 3 presents the theoretical analysis, and Section 4 conducts a quantitative analysis. Section 5 discusses model extensions and Section 6 concludes.

2 Model

The world economy is composed of two countries of equal size, Home and Foreign. In each country, households consume goods and supply labor, while firms hire labor to produce output. Variables pertaining to Foreign are denoted by asterisks.

2.1 Households

Our exposition focuses on Home households. The environment faced by Foreign households is symmetric. The Home country is populated by a continuum of households indexed by $h \in [0, 1]$. An household h has an infinite life horizon and preferences represented by

$$\int_0^\infty e^{-\rho t} \left[\log C_t(h) - \frac{N_t(h)^{1+\phi}}{1+\phi} \right] dt, \tag{1}$$

where ρ is the subjective discount rate, $C_t(h)$ is consumption, $N_t(h)$ is labor supply, and ϕ is the inverse Frisch elasticity of labor supply. The consumption good $C_t(h)$ is a composite of home and foreign goods, with a constant elasticity of substitution (CES):

$$C_t(h) \equiv \left[\left(\frac{1}{2}\right)^{\frac{1}{\eta}} (C_{H,t}(h))^{\frac{\eta-1}{\eta}} + \left(\frac{1}{2}\right)^{\frac{1}{\eta}} (C_{F,t}(h))^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}}, \tag{2}$$

where $C_{H,t}(h)$ and $C_{F,t}(h)$ are themselves CES aggregates over a continuum of goods produced respectively in Home and Foreign, with elasticity of substitution between varieties produced within a country equal to $\varepsilon > 1$. The elasticity of substitution between domestic and foreign goods is $\eta > 0$. The equal weighting of domestic and foreign goods in (2) indicates an absence of home bias in consumption. We study the implications of such home bias in Section 3.4.

Households can trade two types of nominal bonds: a domestic bond traded only domestically, and an international bond traded internationally. Domestic bonds are denominated in domestic currency, while the international bond is (arbitrarily) denominated in Home's currency (without loss of generality given perfect foresight). The household's budget constraint is given by

$$\dot{D}_t(h) + \dot{B}_t(h) = i_t D_t(h) + i_{B,t} B_t(h) + W_t(h) N_t(h) + \Pi_t - P_{H,t} C_{H,t}(h) - P_{F,t} C_{F,t}(h), \quad (3)$$

where $D_t(h)$ is domestic bond holdings, $B_t(h)$ is international bond holdings, i_t denotes the return on Home bonds, $i_{B,t}$ denotes the return on the international bond for Home households, $P_{H,t}$ is the price of the good produced domestically, $P_{F,t}$ is the price of imported good and $W_t(h)$ is household h's nominal wage. The consumer price index (CPI) follows from standard expenditure minimization and is given by

$$P_t = \left[\frac{1}{2} \left(P_{H,t} \right)^{1-\eta} + \frac{1}{2} \left(P_{F,t} \right)^{1-\eta} \right]^{1/(1-\eta)}. \quad (4)$$

Labor supply. Each household h is a monopolistically competitive supplier of its labor service and faces a CES demand function of $N_t(h) = (W_t(h)/W_t)^{-\varepsilon_t^w} N_t$, where ε_t^w is the elasticity of substitution among labor varieties, which is the same across households but may vary over time, W_t is the relevant (domestic) aggregate wage index, which is fully flexible, and N_t is aggregate employment. The household's optimal wage setting results in a wage markup over the marginal disutility of working per unit of consumption,

$$\frac{W_t(h)}{P_t} = \mu_t^w C_t(h) N_t(h)^{\phi}, \quad (5)$$

where $\mu_t^w \equiv \varepsilon_t^w / (\varepsilon_t^w - 1)$ is the gross wage markup. Variations in wage markups are the source of cost-push shocks that will give rise to a trade-off between stabilizing economic activity and inflation (see, e.g., Clarida et al., 2002 and Engel, 2011).

Foreign country. Foreign households face an environment symmetric to that of Home households. Variables pertaining to Foreign households are indexed by asterisks. To accommodate possible deviations from perfect capital mobility, we allow for (tax-induced) return differentials across countries on the international bond. Specifically, we assume that the return on the international bond has two components: a component that is common across countries $\underline{i_t}$ and a country-specific component (τ_t for Home and τ_t^* for Foreign) that captures taxes on international financial transactions financed by lump-sum taxes raised locally. We then define τ_t^D as being related to the wedge between the return on the international bond faced by Home and Foreign households via

$$\tau_t^D \equiv \frac{i_{B,t} - i^*_{B,t}}{2} = \frac{\tau_t - \tau_t^*}{2}. \tag{6}$$

Under free capital mobility, we have $\tau_t^D = 0$ as Home and Foreign households face the same interest rate on international bonds. When $\tau_t^D > 0$, Home households face a higher borrowing cost, while when $\tau_t^D < 0$, it is Foreign households who face a higher cost.

Optimality conditions. Given their labor supply, households choose consumption and bond holdings to maximize utility. The optimality conditions yield

$$\dot{C}_t = (i_t - \pi_t - \rho)\, C_t, \tag{7}$$

$$\dot{C}_t^* = (i_t^* - \pi_t^* - \rho)\, C_t^*, \tag{8}$$

$$i_t = i_t^* + \dot{e}_t + 2\tau_t^D. \tag{9}$$

where we can drop the h index because households are symmetric. $\pi_t \equiv \frac{\dot{P}_t}{P_t}$ and $\pi_t^* \equiv \frac{\dot{P}_t^*}{P_t^*}$ denote the CPI inflation rates in Home and Foreign and $\dot{e}_t$ is the depreciation rate of the nominal exchange rate E_t defined as the Home currency price of the Foreign currency. Condition (7) is the Home households' Euler equation for home bond and condition (8) is the counterpart for Foreign households.

Since households in each country have access to international bonds, there is a no-arbitrage condition that equates the return on real international bonds and domestic currency bonds, that is $i_t = i_{B,t}$ and $i_t^* = i^*_{B,t} - \dot{e}_t$. The interest parity condition (9) is obtained by combining these no-arbitrage conditions in Home and Foreign. It is worth noting that under free capital mobility (i.e., when $\tau_t^D = 0$), condition (9) collapses to the standard interest parity condition that equates the foreign interest rate to the domestic interest rate net of the depreciation of the domestic currency.

2.2 Firms

Final goods are CES aggregates over a continuum of goods produced domestically, with elasticity of substitution between varieties equal to $\varepsilon > 1$. While our description of the firm's problem focuses on Home firms, Foreign firms face a symmetric environment. Home Firms, indexed by $l \in [0,1]$, produce differentiated goods with a linear technology $Y_t(l) = N_t(l)$, and

$$N_t(l) \equiv \left(\int_0^1 N_t(h,l)^{\frac{\varepsilon_t^w - 1}{\varepsilon_t^w}} dh \right)^{\varepsilon_t^w / (\varepsilon_t^w - 1)}$$

is a composite of domestic individual household labor. Variables are defined analogously in Foreign, where the production function is given by $Y_t^*(l) = N_t^*(l)$.

Price setting. Firms operate under monopolistic competition and engage in infrequent price setting à la Calvo (1983). Prices are set in producers' currency, and the law of one price holds for each good. Each firm has an opportunity to reset its price when it receives a price-change signal, which itself follows a Poisson process with intensity $\rho_\delta \geq 0$. As a result, a fraction δ of firms receives a price-change signal per unit of time. These firms reset their price to maximize the expected discounted profits subject to the demand for their own good. Formally, a firm l solves

$$\max_{P_{H,t}(l)} \int_t^\infty \rho_\delta e^{-\rho_\delta(k-t)} \frac{\lambda_k}{\lambda_t} \left[P_{H,t}^r(l) - P_{H,k} MC_k\right] Y_{k|t}(l) dk, \quad \text{subject to} \quad Y_{k|t}(l) = \left(\frac{P_{H,t}^r(l)}{P_{H,k}}\right)^{-\varepsilon} Y_k$$

where $MC_k \equiv (1-\tau^N)W_k/P_{H,k}$ is the domestic real marginal cost with τ^N representing a time-invariant labor subsidy, and Y_k is domestic output. The time k marginal utility of consumption of the Home household is denoted by λ_k, so that the ratio λ_k/λ_t is the firm's relevant discount factor between time t and time $k \geq t$. In the limiting case of flexible prices (i.e. $\rho_\delta \to \infty$), firms are able to reset their prices continuously and optimal price setting reduces to a markup over the nominal marginal cost, i.e. $P_{H,t} = \mu^p(1-\tau^N)W_t$, where $\mu^p = \frac{\varepsilon}{\varepsilon-1}$ is the price markup. The pricing environment is symmetric in Foreign.

2.3 Equilibrium

Given paths for interest rates and taxes on international financial transactions, an equilibrium is a constellation in which all households and firms optimize and markets clear.

International "risk" sharing. Combining the Home and Foreign households' optimality conditions for the international bond yields an intertemporal sharing condition relating the two countries' marginal utility of consumption:

$$C_t = \Theta_t C_t^*, \tag{10}$$

where $\Theta_t \equiv \Theta_0 \exp\left[\int_0^t 2\tau_s^D ds\right]$ captures relative consumption, with Θ_0 being a constant related to initial relative wealth positions. Thus, under free capital mobility (i.e., when $\tau_t^D = 0$), Home and Foreign consumption are proportional to each other up to a time-invariant coefficient Θ_0 that only reflects the initial relative wealth positions. Taxes on international financial transactions alter intertemporal sharing and therefore capital flows between the two countries. More importantly, it makes relative consumption Θ_t, which we refer to as *demand imbalance*, a time-varying object.

Markets clearing. Market clearing for a good l produced in Home requires that the supply of the good equals the sum of the demand emanating from Home and Foreign:

$$Y_t(l) = \underbrace{\frac{1}{2}\left(\frac{P_{H,t}\left(l\right)}{P_{H,t}}\right)^{-\varepsilon}\left(\frac{P_{H,t}}{P_t}\right)^{-\eta} C_t}_{C_{H,t}(l)\text{:Home demand for Home variety } l} + \underbrace{\frac{1}{2}\left(\frac{P_{H,t}\left(l\right)}{P_{H,t}}\right)^{-\varepsilon}\left(\frac{P_{H,t}}{P_t^*}\right)^{-\eta} C_t^*}_{C_{H,t}^*(l)\text{:Foreign demand for Home variety } l} .$$

At the level of Home's aggregate output, defined as $Y_t \equiv \left[\int_0^1 Y_t(l)^{(\varepsilon-1)/\varepsilon} dl\right]^{\varepsilon/(\varepsilon-1)}$, market clearing hence requires

$$Y_t = \left(\frac{P_{H,t}}{P_t}\right)^{-\eta} \frac{1}{2}\left(C_t + C_t^*\right). \tag{11}$$

Similarly, market clearing for foreign goods requires

$$Y_t^* = \left(\frac{P_{F,t}^*}{P_t^*}\right)^{-\eta} \frac{1}{2}\left(C_t + C_t^*\right). \tag{12}$$

Market clearing for domestic bonds in each country requires $D_t = D_t^* = 0$. Finally, aggregate Home employment, defined as $N_t \equiv \int_0^1 N_t(l) dl$, relates to Home output according to $N_t = Y_t Z_t$, where $Z_t \equiv \int_0^1 (P_t^T(l)/P_t^T)^{-\varepsilon} dl$. An analogous relation holds between Foreign's employment and output.

2.4 Linearized Model

Following most of the literature, we focus on a first-order approximation of the equilibrium dynamics of the model around the non-distorted symmetric steady state. To ensure that the model's steady state is non-distorted, we assume that the time-invariant labor subsidy is set to $\tau^N = (\mu^p \mu^w - 1)/(\mu^p \mu^w)$ in both countries, so as to offset distortions from monopolistic competition. Since the only shocks we consider are markup shocks, the efficient allocation is time-invariant and coincides with the non-distorted steady-state allocation. Therefore, log deviations of variables from their steady-state value can also be interpreted as gaps from the efficient allocation. Denoting such log deviations from steady state by hats on lower case letters, e.g., $\widehat{y}_t = y_t - \bar{y}$, and noting that our normalization implies that output, employment, consumption, and the terms of trade are all equal to one in steady state (see

Appendix D), we have $\widehat{y}_t = y_t$. In what follows, we will therefore simply use lowercase letters to denote gaps from the efficient allocation.

Demand block. We define the terms-of-trade in Home and Foreign, $S_t \equiv E_t P^*_{Ft}/P_{H,t}$ and $S^*_t \equiv P^*_{Ht}/(E_t P_{F,t})$, as the price of imported goods to locally produced goods. Using these definitions and noting that $S^*_t = (S_t)^{-1}$ by the law of one price, the first-order approximations of the goods market-clearing conditions (11)-(12) yield

$$y_t = \frac{1}{2}\left(c_t + c^*_t + \eta s_t\right), \tag{13a}$$

$$y^*_t = \frac{1}{2}\left(c^*_t + c_t - \eta s_t\right), \tag{13b}$$

which indicate that output in each country rises with demand emanating from both countries and when the country's terms of trade deteriorate. A deterioration of the domestic terms of trade, that is a fall in the price of domestically produced goods relative to foreign goods, leads households in both countries to shift their demand towards domestic goods, raising domestic output at the expense of foreign output. The last component of the demand block is the intertemporal sharing condition (10), which can be written in log deviations as

$$c_t - c^*_t = \theta_t. \tag{14}$$

To study the properties of capital flows, we will need to keep track of trade imbalances. Home's net exports (or its trade balance) in units of the Home good is given by $NX_t \equiv Y_t - P_t C_t / P_{H,t}$. Linearizing this relationship around the non-distorted steady state, and using good market clearing conditions (13a)-(13b) and the intertemporal sharing condition (14), we can express the trade balance as

$$nx_t = \frac{1}{2}\left[(\eta - 1)s_t - \theta_t\right], \tag{15}$$

where nx_t denotes Home's trade balance normalized by its steady state level of output, $nx_t \equiv NX_t/\bar{Y}$. Thus, all else equal, a demand imbalance in favor of a particular country deteriorates its trade balance. Moreover, equation (15) shows that the effect of a terms of trade depreciation on the trade balance depends on whether the elasticity of substitution between domestic and foreign goods η is larger or smaller than one. We make the following assumption on this parameter.

Assumption 1. $\eta > 1$.

This assumption, in favor of which there is compelling empirical evidence (see, e.g., Head and Ries 2001 and Imbs and Mejean 2015), is assumed to hold for the rest of the paper.[7,8] In our baseline model, this assumption is equivalent to the Marshall-Lerner condition and ensures that a deterioration of the terms of trade improves the trade balance.[9]

Supply block. Turning to the supply side, the dynamics of the inflation rate of producer prices in both countries, derived from a first-order approximation of firms' optimality conditions, are described by

$$\rho\pi_{H,t} = \dot{\pi}_{H,t} + \kappa\left[\left((1+\phi)y_t - \frac{\eta}{2}s_t + \frac{1}{2}\theta_t\right) + \frac{1}{2}s_t + u_t\right], \tag{17a}$$

$$\rho\pi^*_{F,t} = \dot{\pi}^*_{F,t} + \kappa\left[\left((1+\phi)y^*_t + \frac{\eta}{2}s_t - \frac{1}{2}\theta_t\right) - \frac{1}{2}s_t + u^*_t\right], \tag{17b}$$

where the cost-push shocks $u_t \equiv \mu^w_t - \bar{\mu}^w$ and $u^*_t \equiv \mu^{w*}_t - \bar{\mu}^w$ are the log deviations of wage markups from their steady-state value, and $\kappa \equiv \rho_\delta(\rho + \rho_\delta)$. Conditions (17a) is the Phillips curve in Home which relates positively current PPI inflation to domestic firms' real marginal cost, where the latter has two components. The first component of the real marginal cost (collection of terms in brackets) is the real wage in terms of the consumer price index, which increases when households' income increases —that is, when output y_t is high or there is a demand imbalance in favor of Home $\theta_t > 0$— or when households' purchasing power increases (that is, when the terms of trade appreciate $s_t < 0$). This is because households reduce their supply of labor when their income is higher or their purchasing power increases, which puts upward pressure on real wages. Given that firms' real marginal costs are measured in units of home output, the second component of the marginal cost (last term) reflects the fact that an appreciation of the terms of trade raises the price of produced goods relative to the CPI and thus lowers firms' marginal costs for a given real wage. Condition (17b) is the counterpart in Foreign.

Note that while in this baseline model, the effect of demand imbalances on marginal

[7] Head and Ries (2001) document that the elasticity of substitution between U.S. and Canadian manufacturing goods η is between 7.9 and 11.4. Relying on the Tariff System of the United States (TSUSA), Broda and Weinstein (2006) find an average elasticity of subsititution of 7 at the three-digit (TSUSA) 17 at the seven-digit (TSUSA). Imbs and Mejean (2015) find that the *true* elasticity of substitution is more than twice larger than implied by aggregate data.

[8] In Section 3.4, we briefly discuss how the violation of this condition affects our results.

[9] The trade elasticity χ is defined as the sum of the absolute values of the price elasticity of imports and the price elasticity of exports, holding aggregate consumption constant. Formally,

$$\chi \equiv \left.\frac{-\partial \log C_{F,t}}{\partial \log P_{F,t}/P_{H,t}}\right|_{C_t} + \left.\frac{-\partial \log C^*_{H,t}}{\partial P^*_{H,t}/P^*_{F,t}}\right|_{C^*_t}. \tag{16}$$

In our baseline model $\chi = \eta$. In the model extension with home bias studied in Section 3.4, $\chi = 2(1-\alpha)\eta$ where $\alpha \in [0, \frac{1}{2}]$ is the relative weight on domestic goods in the consumer's basket.

costs is only mediated through the price of leisure (i.e., via a wealth effect on labor supply), a similar logic applies more generally via the price of other non-tradable goods.[10]

World and Difference formulation. Before we turn to a normative analysis of capital flows, we find it useful to follow Engel (2011) by rewriting the model in "world" and "difference" format. To this end, we respectively define the world output and the cross-country output differential as $y_t^W = \frac{1}{2}(y_t + y_t^*)$ and $y_t^D = \frac{1}{2}(y_t - y_t^*)$. Similarly, we define the world PPI inflation and cross-country PPI inflation differential as $\pi_t^W = \frac{1}{2}(\pi_{H,t}^T + \pi_{F,t}^{T*})$ and $\pi_t^D = \frac{1}{2}(\pi_{H,t}^T - \pi_{F,t}^{T*})$. Combining the expressions for inflation dynamics in Home and Foreign, (17a)-(17b), and noting by the market-clearing conditions (13a) and (13b) that the equilibrium terms of trade satisfies

$$\eta s_t = 2y_t^D, \tag{18}$$

we arrive at the following New Keynesian Phillips curves in world and difference formats

$$\dot{\pi}_t^W = \rho\pi_t^W - \kappa(1+\phi)y_t^W - \kappa u_t^W, \tag{19a}$$

$$\dot{\pi}_t^D = \rho\pi_t^D - \kappa\left[\left(\frac{1}{\eta} + \phi\right)y_t^D + \frac{1}{2}\theta_t\right] - \kappa u_t^D. \tag{19b}$$

As we will see below, this formulation allows us to restrict the analysis of the effects of capital flows to a narrow subset of macroeconomic variables.

3 Inflationary Pressures and Topsy-Turvy Capital Flows

In this section, we argue that while capital naturally flows toward the country with the most acute inflationary pressures, efficiency considerations would require capital to flow away from that country.

3.1 Welfare Criterion and Optimal Policy Problems

In order to make clear that inefficiencies associated with capital flows are a consequence of the trade-off faced by monetary policy rather than of monetary policy's possible sub-optimality, we choose to assume that Amonetary policy is set optimally under coordination

[10]We extend the model to include non-tradable goods and discuss this insight further in Section 5.1.

and commitment.[11] Using a second-order approximation of the households' utility function, we obtain the following loss function:[12]

$$\frac{1}{2}\int_0^\infty e^{-\rho t}\left[(1+\phi)\left(y_t^W\right)^2+\frac{\varepsilon}{\kappa}\left(\pi_t^W\right)^2+\left(\frac{1}{\eta}+\phi\right)\left(y_t^D\right)^2+\frac{\varepsilon}{\kappa}\left(\pi_t^D\right)^2+\frac{1}{4}\left(\theta_t\right)^2\right]dt \tag{20}$$

The period-loss function in (20) represents the difference between the utility under the efficient allocation (i.e., the maximum utility achievable) and the utility under market-determined levels of consumption and leisure. The first four terms featuring squared output gaps and inflation reflect sticky price distortions familiar from the closed economy literature. The last term reflects distortions specific to the open economy context and captures welfare losses stemming from an inefficient cross-country distribution of consumption caused by the demand imbalance θ_t.

We will contrast two policy regimes. In the first one, labeled the *free capital mobility* regime, we will assume optimal monetary policy with the demand imbalance exogenously set to $\theta_t = 0$ at all times. In this regime, the optimal (monetary) policy consists in choosing a path for $\{y_t^W, \pi_t^W\}$ and $\{y_t^D, \pi_t^D\}$ to minimize (20) subject to (19a) and (19b) with $\theta_t = 0$ for all $t \geq 0$. In the second one, labeled the *managed capital flows* regime, we will assume jointly optimal monetary and capital flow management policy. In that case, the optimal policy consists in choosing a path for $\{y_t^W, \pi_t^W\}$ and $\{y_t^D, \pi_t^D, \theta_t\}$ to minimize (20) subject to (19a) and (19b).

Conveniently, the characterization of monetary policy is the same in both regimes. In this baseline two-country model, optimal monetary policy is well known to be characterized in target form by:

$$\dot{y}_t^W + \varepsilon\pi_t^W = 0, \tag{21}$$

$$\dot{y}_t^D + \varepsilon\pi_t^D = 0. \tag{22}$$

This description of optimal cooperative monetary policy is analogous to that commonly encountered in complete markets open economy models with producer currency pricing (PCP). The targeting rules (21) and (22) indicate that, in both "world" and "difference" terms, optimal monetary policy strikes a balance between losses due to inflation and losses arising from deviations of output from its efficient level. The two targeting rules can be combined to deliver targeting rules for each country that depend only on the domestic

[11] In Section 4, we show that our main insight also applies when monetary policy follows a Taylor rule.

[12] To obtain this loss function, we take a second-order approximation of a symmetrically weighted average of households' utilities in Home and Foreign. See Appendix D for details.

output gap and PPI inflation – that is, $\dot{y}_t + \varepsilon\pi_{H,t} = 0$ and $\dot{y}^*_t + \varepsilon\pi^*_{F,t} = 0$ – a feature often referred to as *inward looking* monetary policy in the open-economy literature. It is worth stressing that this characterization does not rely on any particular assumption regarding the path of θ_t (other than it being exogenous, or chosen by policy). In particular, it holds both under free capital mobility and under managed capital flows.

Remark (Inward versus outward looking monetary policy)**.** When the path of the demand imbalance θ_t deviates from zero, asset markets are no longer complete and the inward lookingness of monetary policy in (21)-(22) contrasts with the *outward looking* rules derived in studies assuming either other forms of market incompleteness (e.g., Corsetti, Dedola and Leduc 2010, 2018), or pricing to market (e.g., Engel 2011).[13] In these studies, demand imbalances are endogenous variables whose fluctuations depend on the interaction of shocks and other variables influenced by monetary policy, such as the cross-country difference in the output gap. As a result, monetary policy can influence distortions caused by market incompleteness or pricing to market, and generally chooses to do so, which results in outward looking rules. In our case, in contrast, the demand imbalance is either exogenous or directly controlled by policy, so there is no scope for monetary policy to manage the market incompleteness distortion, hence the inward looking rules.

A notable implication of the targeting rules (21)-(22)Â L is the separation of "world" variables and "difference" variables, which mirrors that in the Phillips curves (19a)-(19b). Taken together, these separations mean that the "world" block of the model can be solved for independently from the behavior of the "difference" block, and most notably from that of the demand imbalance. This result is formalized in the Lemma below.

Lemma 1 (Irrelevance of capital flow regime for world variables)**.** *The paths of the world output gap and inflation $\{y^W_t, \pi^W_t\}$ are independent of the capital flow regime (i.e., the path of θ_t).*

Proof. In Appendix C.2 □

Lemma 1 implies that the capital flow regime matters only for the determination of cross-country "difference" variables.[14] Therefore, both from a positive and from a normative standpoint, an analysis of the role played by capital flows in the adjustment to shocks can legitimately center on the dynamics of cross-country difference variables y^D_t and π^D_t and the demand imbalance θ_t.

[13] The literature refers to outward looking monetary policy when targeting rules in open economy models also feature external variables, such as international relative prices or a demand imbalance term.

[14] See Groll and Monacelli (2020) for a similar result regarding the irrelevance of the exchange rate regime for the determination of "world" variables.

3.2 Free capital mobility

Under free capital mobility, the solution to the "difference" block of the model is obtained from the dynamic system consisting of the targeting rule (22) and the Phillips curve in difference (19b) with the demand imbalance θ_t set to 0.

Since our primary interest is to understand how capital flows shape the macroeconomic adjustment to cost-push shocks, it is useful to characterize their behavior. Using the equilibrium terms of trade expression (18), the trade balance in (15) can be expressed as

$$nx_t = \frac{\eta - 1}{\eta} y_t^D. \tag{23}$$

The intuition for this relationship comes from standard neoclassical motives for intertemporal trade (Cole and Obstfeld 1991): a temporarily lower income creates an incentive to borrow, but the appreciation of the terms of trade accompanying this lower income generates an incentive to save. When Assumption 1 holds ($\eta > 1$), terms of trade movements are modest and the first effect dominates. As a result, the country with the lowest output runs a trade deficit and the other country runs a trade surplus. Since a more depressed output is associated with more acute inflationary pressures, capital flows from the country with the least acute inflationary pressures to the country with the most acute ones.[15]

3.3 Managed Capital Flows

To question the (constrained) efficiency of the free capital mobility regime just described, we ask under what circumstances θ_t is set to a value different from zero when it can be freely chosen by policy.[16] The next proposition provides an answer to this question.

Proposition 1 (Targeting rule and trade balance)**.** *The managed capital flow regime is characterized by the rule*

$$\theta_t = 2y_t^D. \tag{24}$$

Moreover, in the managed capital flow regime, the country with the most depressed output runs a trade surplus

$$nx_t = -\frac{1}{\eta}\, y_t^D \tag{25}$$

Proof. In Appendix C.3 □

[15] A similar idea applies when monetary policy follows a Taylor rule, as the country with the strongest inflationary pressure tends to tighten monetary policy more strongly.

[16] See Appendix C.1 for a formal statement of the optimal policy problem.

Proposition 1 embodies our paper's main insight. To the extent that shocks generating an output-inflation trade-off generally result in a non-zero cross-country difference in output gaps, the targeting rule indicates that optimal capital flow management should induce capital flows toward the *least* depressed country (25). This is achieved by purposefully generating a demand imbalance in favor of that country and reallocating spending away from the most depressed country (24).[17] Because the most depressed country faces the highest inflationary pressure (see monetary policy rule (22)), an alternative interpretation is that optimal capital flow management should induce capital to flow away from the country with the *most acute* inflationary pressure. This outcome may appear counter-intuitive from an output stabilization perspective, but it makes perfect sense once the supply-side ramifications of capital flows are carefully considered.

A macroeconomic externality view. In the country with the most acute inflationary pressure, households borrow for consumption smoothing purposes as monetary policy attempts to curb inflation by depressing domestic output. A global planner recognizes that capital inflows reduce local labor supply through a wealth effect. For a given level of activity, this reduced labor supply raises the real wage and therefore firms' marginal costs. But the level of firms' marginal costs is the main lever available to monetary policy to fight off cost-push shocks. In an economy subject to an inflationary cost-push shock, monetary policy weakens demand so as to lower firms' marginal costs and thereby reduce inflationary pressures. In such circumstances, capital inflows complicate the central bank's job by exerting unwelcome upward pressure on firms' marginal costs. Consequently, optimal capital flow management consists of distorting spending away from the country with the most acute inflationary pressure by reducing capital inflows into that country.

Formally, consider a marginal increase in borrowing by Foreign from Home at date t, starting from the optimal monetary policy outcome under free capital mobility. This amounts to a perturbation $d\theta_t < 0$ at t (i.e., $\theta_t = \epsilon$ for some small $\epsilon < 0$, leaving $\theta_k = 0$ for all other $k \neq t$).[18] Using the envelope theorem, the change in the loss function $\mathcal{L}_t$ induced

[17]An immediate implication of this result is that the free capital mobility regime is not (constrained) efficient when monetary policy faces an output-inflation trade-off. This inefficiency result may in itself not come as a surprise in light of the existing literature on aggregate demand externalities in economies with nominal rigidities (e.g., Farhi and Werning 2016). However, the supply-side channel responsible for it has distinct policy implications. We elaborate further on this in Section 3.5.

[18]For the sake of the argument, we assume that this increase in borrowing is compensated by a change in the date 0 implicit transfer. More generally, what matters for the externality is that the balancing transaction occurs at a time when the multiplier on the Phillips curve (19b) has a value different from the one at time t.

by this perturbation is given by

$$d\mathcal{L}_t = -\frac{1}{2}\kappa\varphi_t^D \, d\theta_t, \tag{26}$$

where φ_t^D is the co-state variable associated with the Phillips curves in differences (19b), satisfying $\dot{\varphi}_t^D = -\frac{\varepsilon}{\kappa}\pi_t^D$ and $\varphi_0^D = 0$, and representing the cross-country difference in the stringency of the output-inflation trade-off.[19] Thus, equation (26) indicates that an increase in borrowing by Foreign increases global welfare when inflationary pressures are more acute (and thus output is more depressed) in Home ($\varphi_t^D < 0$) and the slope of the Phillips curve differs from zero ($\kappa \neq 0$).

The logic is that starting from an allocation under free capital mobility, inducing Foreign to borrow more from Home entails no first-order welfare costs. But to the extent that firms adjust prices to changes in marginal costs, it reduces the cross-country dispersion of inflation.[20] And because the welfare losses from inflation are convex, there are global welfare gains from reducing the cross-country dispersion of inflation, making it optimal for the global planner to stimulate capital inflows from Home to Foreign.[21]

Given that these effects of changes in external borrowing on the cross-country dispersion of inflation and welfare arise in general equilibrium, they are not internalized by atomistic agents and represent a macroeconomic externality associated with capital flows.

Topsy-Turvy capital flows. A key insight from Proposition 1 is that the country with the most acute inflationary pressure – and therefore the most depressed output – should run a trade surplus. Comparing (25) with its free capital mobility counterpart (23) points to qualitatively different patterns of trade imbalances under the two capital flow regimes, which we summarize in the following corollary.

Corollary 1 (Topsy-turvy capital flows)**.** *Suppose Assumption 1 holds. Then, the country with the most acute inflationary pressure runs a trade surplus in the managed capital flows regime, while it runs a trade deficit in the free capital mobility regime.*

Proof. The result follows directly from the expressions (23) and (25). □

Corollary 1 implies that in the presence of cross-country differences in the severity

[19] Under optimal monetary policy (22), $\varphi_t^D = \frac{1}{\kappa}y_t^D$. See Appendix C.1 for details.

[20] That is, it lowers inflation in Home and raises inflation in Foreign.

[21] To make this insight transparent, we purposefully abstracted from rent seeking motives in optimal policy problems by assuming cooperative policy. But as we show in Section 5.2, a similar logic applies when capital flows are managed in a non-cooperative fashion.

of (cost-push shock induced) inflationary pressures, capital flows are *topsy-turvy* under free capital mobility. Hence, rather than simply causing capital flows to be excessive, the macroeconomic externality discussed above is strong enough to flip their direction.

To better understand this Corollary, it is useful to distinguish the various motives for intertemporal trade under each capital flow regime. As explained in Section 3.2, in the free capital mobility regime, these motives are purely neoclassical and ultimately reflect the benefits of consumption smoothing for private households. In the managed capital flows regime, an additional Keynesian macroeconomic stabilization motive is also present. This motive calls for relaxing the output-inflation trade-off in the country where it is the most stringent.[22] Hence, when Home goods and Foreign goods are substitutes ($\eta > 1$), the neoclassical motives always call for a trade deficit for the country with the most depressed output under free capital mobility. However, under managed capital flows, the Keynesian effect more than offsets these motives and results in a trade surplus for that country.[23]

Excessive capital flow volatility? A large part of the normative literature on capital flows suggests that capital flows might often be excessive, or excessively volatile (e.g., Bianchi 2011, Schmitt-Grohe and Uribe 2016). The macroeconomic externality we point to does not generally lead to the same conclusion. In the limiting case of a unit intratemporal elasticity ($\eta \to 1$), trade is balanced at all times under free capital mobility, but capital flows from the country with the most acute inflationary pressures to the country with the least acute inflationary pressures under managed capital flows. Thus, in our model, external imbalances may be *insufficiently* (rather than *too*) volatile in response to shocks.

3.4 Generalization with Consumption Home Bias

The analysis so far assumed away home bias in consumption. However, the model can easily be extended to allow for it. Suppose that agents place a higher weight in utility on goods produced domestically, as in

$$C_t(h) \equiv \left[(1-\alpha)^{\frac{1}{\eta}} \left(C_{H,t}(h)\right)^{\frac{\eta-1}{\eta}} + (\alpha)^{\frac{1}{\eta}} \left(C_{F,t}(h)\right)^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}}, \tag{27}$$

[22]In Appendix E, we characterize the macroeconomic adjustment to a temporary cost-push shock.

[23]In the limit where $\eta \to \infty$, as long as $\alpha > 0$, the trade balance equals the difference in the output gap under free capital mobility, $nx_t = y_t^D$, but converges to zero in under managed capital flows, $nx_t = 0$.

where $\alpha \in [0, \frac{1}{2})$ and $1-2\alpha$ captures the degree of home bias. The intertemporal sharing condition in logs (14) now takes the form

$$c_t - c_t^* = (1-2\alpha)s_t + \theta_t, \tag{28}$$

where the first term on the right-hand side reflects real exchange rate movements associated with differences in the composition of the two countries' consumption baskets. Combining (28) with the goods market-clearing conditions leads to an expression for the equilibrium terms of trade (analogous to (18)) given by

$$\omega s_t = 2y_t^D - (1-2\alpha)\theta_t, \tag{29}$$

where $\omega \equiv \eta-(\eta-1)(1-2\alpha)^2$. Thus, with home bias ($\alpha < \frac{1}{2}$) demand imbalances are associated with movements in the terms of trade. For a given difference in output gaps y_t^D, a demand imbalance in favor of Home ($\theta_t > 0$) leads Home households to increase their demand for both goods. But since they have a bias for Home goods, that would lead to overproduction in the Home country, were it not for relative price adjustments — this is why the terms of trade improve $s_t < 0$ for given y_t^D.

Under free capital mobility, $\theta_t = 0$, the trade balance is now given by $nx_t = \frac{\omega-1}{\omega} y_t^D$. When Assumption 1 holds ($\omega > 1$), which implies that capital flows toward the country with the most depressed output. Next, we characterize capital flow in the constraint efficient regime. The optimal policy problem consists in choosing $\{y_t^W, \pi_t^W, y_t^D, \pi_t^D, \theta_t\}$ to solve[24]

$$\min \frac{1}{2}\int_0^\infty e^{-\rho t}\left[(1+\phi)\left(y_t^W\right)^2+\frac{\varepsilon}{\kappa}\left(\pi_t^W\right)^2+\left(\frac{1}{\omega}+\phi\right)\left(y_t^D\right)^2+\frac{\varepsilon}{\kappa}\left(\pi_t^D\right)^2+\alpha(1-\alpha)\frac{\eta}{\omega}\left(\theta_t\right)^2\right]dt$$

subject to

$$\dot{\pi}_t^W = \rho\pi_t^W - \kappa\,(1+\phi)\,y_t^W - \kappa u_t^W, \tag{30a}$$

$$\dot{\pi}_t^D = \rho\pi_t^D - \kappa\left[\left(\frac{1}{\omega}+\phi\right)y_t^D + \left(1-\frac{1-2\alpha}{\omega}\right)\frac{1}{2}\theta_t\right] - \kappa u_t^D, \tag{30b}$$

where the implementability constraints (30a) and (30b) are the Phillips curve in world and difference formats in the presence of home bias in consumption. As shown in Appendix C.4, the optimal monetary policy is still inward-looking and described by (21) and (22). In particular, the optimal monetary policy in each country trades off the domestic output gap with domestic PPI inflation independently of the degree of home bias in consumption.

[24] See Appendix D for a detailed derivation.

Moreover, while our main insight on the direction of capital flows in the constrained efficient allocation remains unchanged, the design of the optimal rule for capital flow management depends on the degree of home bias as presented in the proposition below.

Proposition 2 (Targeting rule and trade balance with home bias)**.** *The managed capital flow regime is characterized by the rule*

$$\theta_t = \left[1 - \frac{1-2\alpha}{2(1-\alpha)\eta}\right] 2y_t^D. \tag{31}$$

Moreover, in this regime, the country with the most depressed output runs a trade surplus:

$$nx_t = -\frac{\alpha}{\eta(1-\alpha)} y_t^D. \tag{32}$$

Proof. In Appendix C.4 □

Proposition 2 confirms our main finding that the managed capital flow regime requires capital to flow away from the country with the most acute inflationary pressure and most depressed output toward the country with the least acute inflationary pressure and least depressed output. This result does not depend on the elasticities of substitution or the degree of home bias in consumption.

The targeting rule for capital flow management (31) differs slightly from its counterpart absent home bias (24). This difference is captured by the purchasing power effect in (33) and reflects the influence of home bias on the externality underlying the optimal capital flow management policy. To see this, note that the change in the loss function associated with a marginal change in borrowing by Home from Foreign at date t, starting from the optimal outcome under free capital mobility, is now given by

$$d\mathcal{L}_t = -\frac{2\alpha(1-\alpha)\eta}{\omega}\left[\underbrace{1}_{\substack{\text{wealth}\\ \text{effect}}} - \underbrace{\frac{1-2\alpha}{2(1-\alpha)\eta}}_{\substack{\text{purchasing}\\ \text{power effect}}}\right]\kappa\varphi_t^D d\theta_t, \tag{33}$$

In addition to the wealth effect on labor supply already present in (26), the loss differential now also depends on a second term reflecting a purchasing power effect. With home bias, an increase in borrowing by Home from Foreign raises demand for Home goods relative to Foreign goods, leading to an appreciation of Home's terms of trade. For given real wages in terms of the countries' consumption baskets, this appreciation in turn lowers Home firms' marginal costs while raising Foreign firms' marginal costs. The strength of this

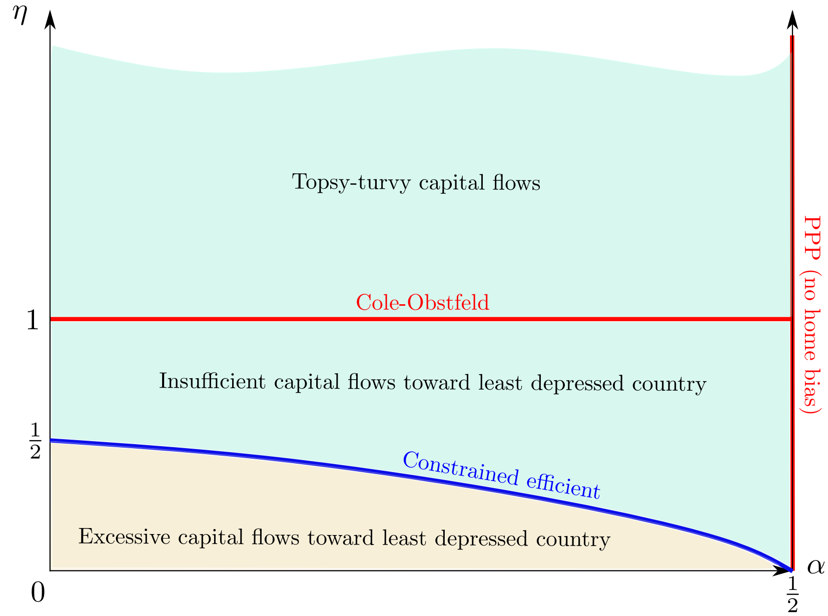

Figure 3: Capital flows under free capital mobility for different values of η.

effect is proportional to the ratio of the degree of home bias $1 - 2\alpha$ to the trade elasticity $2(1 - \alpha)\eta$. On the one hand, the stronger the home bias, the more changes in relative spending affect the relative price between Home and Foreign goods. On the other hand, the higher the trade elasticity, the smaller are price movements associated with a given change in relative spending.

Under Assumption 1, the said ratio is smaller than 1, so the wealth effect dominates the purchasing power effect in (33). Optimal capital flow management thus reallocates spending away from the most depressed country in order to induce capital outflows and alleviate inflationary pressures in that country, as in the baseline model without home bias.

When Assumption 1 is not satisfied, that is for $\eta < 1$ (at odds with the large body of empirical evidence), the most depressed country runs a trade surplus in the free capital mobility regime. As a result, the direction of capital flows is the same under managed capital flows and under free capital mobility. A general characterization of capital flows as a function of the parameters α and η is provided in Figure 3. The thick horizontal Cole-Obstfeld line depicts unitary elasticity cases where capital flows are zero under free capital mobility. Above this line, Assumption 1 is satisfied and capital flows are topsy-turvy: they go from the least depressed country to the most depressed country under free capital mobility, but the other way around under managed capital flows.

Below the Cole-Obstfeld line, capital flows from the most depressed to the least depressed country under both capital flow regimes. Within this area, the blue concave curve depicts the knife-edge cases in which the free capital mobility regime is constrained-efficient as a result of the wealth and purchasing power effects in (33) exactly offsetting each other. In the area above the concave curve (but below the Cole-Obstfeld line), the wealth effect dominates the purchasing power effect and capital flows from the most depressed to the least depressed country are inefficiently small under free capital mobility. In contrast, in the area under the concave curve, the purchasing power effect dominates and capital flows from the most depressed to the least depressed country are excessive.

3.5 Supply Pressure vs. Demand Shortage

Although the inefficiency we point to is ultimately caused by a friction of the same type as the one emphasized by Farhi and Werning (2016), the insight coming out of our analysis is complementary to theirs. Broadly speaking, in their applications inefficiencies arise from demand shortages, while in ours they are due to supply pressures. To clarify this point and emphasize its relevance, we resort to a simple scenario in which a demand shortage would lead in our model to a situation similar the one prevailing in Farhi and Werning (2016)'s applications.

To simplify matters, we posit a unit elasticity of substitution between Home and Foreign goods ($\eta = 1$), while allowing for home bias ($\alpha \leq 1/2$). Under the unit elasticity condition, trade is balanced under free capital mobility in response to both the cost-push shocks considered in our analysis above and the productivity shocks considered below.

In the context of our analysis stressing inefficiencies arising from supply pressures caused by cost-push shocks, the optimal capital flow regime is characterized by the targeting rule and trade balance expressions

$$\theta_t = \frac{1}{1-\alpha} y_t^D \qquad \text{and} \qquad nx_t = -\frac{\alpha}{1-\alpha} y_t^D. \tag{34}$$

Hence, in the country featuring the most depressed output, households consume too much under free capital mobility and they accordingly run a trade surplus under the managed capital flow regime.

Now, consider the same model but with an inefficiency arising from demand shortages rather than supply pressures. In particular, let us abstract from cost-push shocks and instead assume productivity shocks in a currency union context. For simplicity, further suppose that prices are fully rigid ($\kappa \to 0$). When asymmetric productivity shocks drive differences in natural interest rates across countries, a common monetary policy stance cannot tailor stimulus to each country's need. As a result, there will generally be a demand deficit (negative output gap) in one country and a demand surplus (positive output gap) in the other country. In this case, Appendix C.5 shows that the optimal capital flow management policy solves

$$\min \frac{1}{2} \int_0^\infty e^{-\rho t} \left\{ (1+\phi)(\tilde{y}_t^D)^2 + \alpha(1-\alpha)(\theta_t)^2 \right\} dt$$

subject to

$$2\dot{\tilde{y}}_t^D = -(r_t^n - r_t^{n*}) + (1-2\alpha)\dot{\theta}_t.$$

where $\tilde{y}$ now denotes the output gap, and r^n, r^{n*} respectively denote the natural rates of interest in Home and Foreign. The managed capital flow regime is then characterized by the targeting rule and trade balance expressions

$$\theta_t = -\frac{1-2\alpha}{2\alpha(1-\alpha)}(1+\phi)\tilde{y}_t^D \qquad \text{and} \qquad nx_t = \frac{1-2\alpha}{2(1-\alpha)}(1+\phi)\tilde{y}_t^D. \tag{35}$$

Comparing the signs in (35) with those in (34) reveals a fundamental difference in insights between the case of demand shortage à la Farhi and Werning (2016) and our analysis pointing to the implications of supply pressures. The expressions in (35) indicate that the country with the most depressed demand should be running a trade deficit, as long as there is some degree of home bias. The mechanism works through the demand side: if households spend more on domestic goods, a transfer from the overheated country to the depressed country diverts demand away from the oversupplied good and toward the undersupplied good. In contrast, in our framework featuring supply pressures, the direction of the inefficiency is flipped: the expressions in (34) indicate that the country with the most depressed demand should be running a trade surplus, regardless of the degree of home bias. Irrespective of spending patterns, a transfer from the most depressed country to the least depressed country reduces asymmetries in supply pressures through the real wage.

This discussion clarifies the originality of the practical insight of our analysis. While demand-side arguments suggest insufficient capital flows toward depressed economies, we argue that when depressed activity results from a central bank's optimal response to cost-push shocks, capital flows toward depressed economies may instead be excessive.

4 Quantitative Analysis

To further illustrate how a free capital mobility regime can exacerbate macroeconomic fluctuations following cost-push shocks, we quantitatively compare the response of macro variables to such shocks under free capital mobility to those under a managed capital flow regime. So as to emphasize that our insight does not critically depend on the assumption of optimal cooperative monetary policy, we assume that monetary policy follows standard Taylor rules in each country.

4.1 Calibration

Parameter values. The time period is one year, and our calibration of the structural parameters of the model largely follows that of Groll and Monacelli (2020). The home bias parameter, α, is set to 0.25, which implies a degree of home bias of 0.5. The trade elasticity, $\chi = 2(1-\alpha)\eta$, which plays a key role for our results, is conservatively set to 3, near the lower bound of the range of empirical estimates.[25] This value of the trade elasticity implies an elasticity of substitution between domestic and foreign goods η of 2. Consistent with much of the empirical evidence based on micro data, the probability of not being able to reset the price is set to 0.75, that is $\rho_\delta = 1 - 0.75^4$, implying an average duration of price contracts of four quarters. The discount rate parameter is set to its standard value $\rho = 0.04$, and the labor supply elasticity parameter ϕ is set to zero. The elasticity of substitution among differentiated intermediate goods ε is set to 7.66, corresponding to a 15% net markup. Finally, markup shocks are assumed to mean-revert at a rate of 0.42 per year, yielding an annual autocorrelation of 0.65. The model parameters are presented in Table 1.

Monetary policy and capital flow regimes. For robustness considerations, we depart from our assumption of optimal cooperative monetary policy and assume that monetary policy is instead set according to Taylor rules:

$$i_t = \rho + \phi_y y_t + \phi_\pi \pi_t, \tag{36a}$$

$$i_t^* = \rho + \phi_y y_t^* + \phi_\pi \pi_t^*, \tag{36b}$$

with coefficients set to the standard values $\phi_y = 0.25$ and $\phi_\pi = 1.5$.

[25] Simonovska and Waugh (2014) report a range of trade elasticity estimates from 2.7 to 4.4. Direct estimates of the elasticity of substitution η are found to be between 7 and 17 (see, e.g., Broda and Weinstein, 2006).

Table 1: Calibration

Description	Value
Discount factor	$\rho = 0.04$
Degree of trade openness	$\alpha = 0.25$
ES between home and foreign goods	$\eta = 2$
ES between differentiated goods	$\varepsilon = 7.66$
Probability of being able to reset price	$\rho_\delta = 1 - 0.75^4$
Persistence of Home markup shock	$\rho_\mu = 0.65$
Coefficient on inflation	$\phi_\pi = 1.50$
Coefficient on output gap	$\phi_y = 0.25$

We then compare the dynamics of macroeconomic variables and welfare losses under two alternative capital flow regimes: a free capital mobility regime and a managed capital flow regime where countries impose taxes on financial transactions to comply with the targeting rule (31) which, given our assumed parameter values, is equivalent to

$$\theta_t = \frac{5}{3}\, y_t^D. \tag{37}$$

Note that while this targeting rule would be optimal under cooperative monetary policy, it is not necessarily optimal under the Taylor rules (36a)-(36b). However, as we will see, this rule still yields higher welfare than the free capital mobility regime.

4.2 Capital Flow Regimes and Macroeconomic Adjustments

We now look into the implications of capital flow regimes for macroeconomic stabilization and welfare during a high inflation episode. We start by analyzing the response of macroeconomic variables to a cost-push shock under the two alternative regimes, before turning to their welfare implications.

4.2.1 Stabilization gains from managed capital flows

We hit the home country with an inflationary cost-push shock of 6.4%, which generates a peak CPI inflation rate of about 8.4% in Home. Figure 4 shows the response of the main macroeconomic variables to this shock under free capital mobility (blue solid lines) versus under managed capital flows (red dashed lines). The responses of the nominal interest rate in the two countries are shown in panels (a) and (b). Under both capital flow regimes, the Home central bank responds to the rise in inflation by tightening monetary policy.

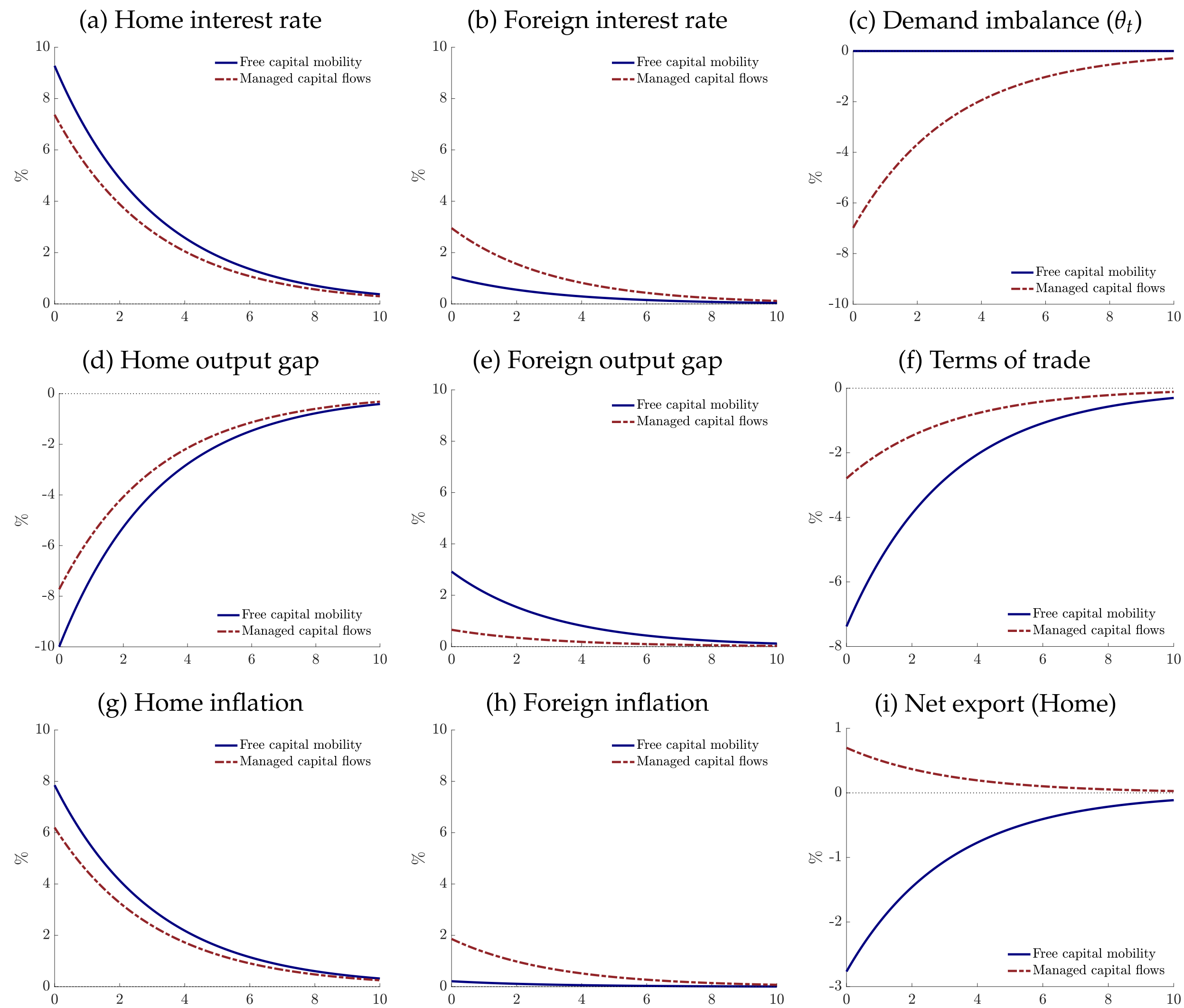

Figure 4: Impulse responses to an inflationary cost-push shock in Home

This reduces demand and hence activity in Home, thereby lowering marginal costs and ultimately limiting the rise in inflation. As expected from our theoretical analysis of Section 3, one of the main differences between the two regimes pertains to the "favorability" of the output-inflation trade-off.

Under free capital mobility, in Home, PPI inflation rises to 7.9% on impact, as shown in panel (g). The Home central bank responds to the spike in inflation by raising the nominal rate (panel [a]), generating a contraction in output of 10.0% (panel [d]) and a Home terms of trade appreciation (panel [f]). The latter in turn generates positive demand spillovers in Foreign, where the output gap is positive and reaches about 2.9% (panel [e]). Meanwhile, capital flows into Home, which runs a trade deficit of 2.8% of GDP on impact (panel [i]).

In contrast, in the managed capital flow regime, Home runs a trade surplus of about

0.7% of GDP on impact. This reversal of capital flows allows for a smoother macroeconomic adjustment. Capital outflows relieve cost pressures in Home, so inflation rises by less than under free capital mobility (panel [g]), despite a less negative output gap (panel [d]). On impact, Home PPI inflation rises to only 6.2% while the Home output gap is contained to -7.7%. This contrasts with 7.9% and -10.0% under free capital mobility. Meanwhile, in Foreign, capital inflows exert some cost pressures, to which the central bank responds by tightening its stance. In turn, this tighter stance, coupled with a less pronounced terms of trade deterioration, leads to a more stable output gap. The Foreign output gap reaches 0.6% on impact, versus 2.9% under free capital mobility.

Implication for Policy Rates. The prevailing capital flow regime has implications for the cross-country dispersion of policy rates following a cost-push shock. Under free capital mobility, the Taylor rule dictates an initial interest rate hike of nearly 9.3% in Home and of 1.1% in Foreign, after which interest rates are gradually cut to their long-run levels. Under managed capital flows, in contrast, the initial hike is only of 7.4% in Home but it is of 3.0% in Foreign. It therefore follows that, relative to the managed flows regime, free movements of capital push central banks in countries facing more severe inflationary pressures to raise interest rates too aggressively, while making central banks in countries with less severe inflationary pressures react insufficiently.

4.2.2 Welfare

The smaller fluctuations in macroeconomic variables in the managed capital flow regime suggest welfare benefits from actively managing capital flows during periods of high inflation. Indeed, we find that, relative to the free capital mobility regime, the managed capital flows regime delivers an average welfare gain of about 0.05% of permanent consumption or, equivalently, 1.16% of a year's consumption.[26,27]

In our baseline calibration, we conservatively used a value for the elasticity of substitu-

[26]Formally, the welfare gain γ of managed capital flows is defined as the percentage increase in permanent consumption required by an individual in an economy under free capital mobility to be as well off as an individual in an economy under managed capital flows. Formally, we have

$$\frac{1}{\rho}\log(1+\gamma) + \mathcal{W}^{\text{free}} = \mathcal{W}^{\text{managed}}, \quad \text{where } \mathcal{W} \equiv \int_0^\infty e^{-\rho t}\left[\log C_t - \frac{(N_t)^{1+\phi}}{1+\phi}\right] dt \approx -\mathcal{L}, \tag{38}$$

where *free* and *managed* respectively stand for free capital mobility and managed capital flows.

[27]Note that both countries are better off in the managed capital flow regime. This is because while capital inflows into Foreign raise inflation, they also reduce the output gap (see panels [e] and [h]). The welfare gain in Foreign is about 0.01% of permanent consumption as the benefit of bringing output closer to its efficient level slightly outweighs the cost of higher inflation.

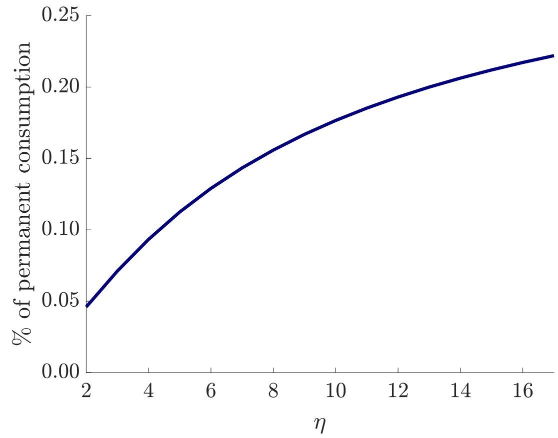

Figure 5: Welfare gains of managed capital flows.

tions between domestic and foreign goods (η) near the lower bound of the estimates from the empirical literature. In Figure 5, we plot the welfare gains of managed capital flows for values of the elasticity between 2 and 17, the upper bound of the range of empirical estimate by Broda and Weinstein (2006). Figure 5 shows that the welfare gains are monotonically increasing in the elasticity of substitution η. For $\eta = 10$, a value consistent with the trade elasticity estimated by Yi (2003) to match bilateral trade flows, the welfare gains of managed capital flows are about 0.18% of permanent consumption.[28]

4.3 Sensitivity Analysis with Wage Rigidity

Since the externality behind our main result works through labor supply, one might wonder about its relevance when wages are sticky and changes to households' marginal rates of substitution do not directly translate into changes into real wages. To address such concerns, we now analyze the sensitivity of our results to introducing wage rigidities. In particular, we follow Blanchard and Gali (2007) and assume that, as a result of unspecified frictions in labor markets, real wages respond sluggishly to labor market conditions according to[29,30]

$$\dot{w}_t = -\gamma w_t + \gamma mrs_t, \tag{39}$$

where mrs_t is the marginal rate of substitution (MRS) between consumption and leisure.

[28] Yi (2003) finds that to match the bilateral trade flows in the data, Armington-type models need a value of trade elasticity of 15. In our model, the trade elasticity is given by $\chi = 2(1-\alpha)\eta$.

[29] One could also introduce wage rigidity by assuming that nominal wages are downwardly rigid $\dot{w}_t \geq 0$, as in Schmitt-Grohe and Uribe (2016). However, due to the nature of the shocks we consider (i.e. inflationary cost push shocks), nominal wages grow at a positive rate and, as result, a downward rigidity on nominal wages would not bind in such an experiment.

[30] As argued by Blanchard and Gali (2007), the presence of real wage rigidities as in (39) helps account for some aspects of the empirical behavior of inflation, such as inflation inertia.

We set $\gamma = 0.8$ as in Blanchard and Gali (2007).

Figure B.1 in Appendix B presents the impulse response to an inflationary cost-push shock of 6.4% in Home. In response to the shock, Home monetary policy tightens. This tightening in turn reduces the Home households' MRS, reflecting an increased willingness to work. Absent wage rigidities, the reduced MRS translates one-to-one into a fall in firms' marginal cost (i.e., the real wage), helping to limit the inflation surge. However, when real wages respond sluggishly to labor market conditions, as in (39), monetary policy becomes less effective at taming inflation, which requires further policy tightening. But in either case, free capital mobility appears to worsen the output-inflation trade-off.

Panels (a), (d) and (g) of Figure B.1 illustrates this result. Under free capital mobility, Home experiences higher inflation and a deeper recession, relative to the baseline model, despite a larger hike in the interest rate: PPI inflation reaches 9.4% on impact (versus 7.9% in the baseline) and the output gap reaches -10.3%. Capital flows into the Home country, which runs a trade deficit of 3.0% of GDP on impact (panel [c]). The Home terms of trade appreciate, generating positive demand spillovers in Foreign which experiences a boom with a positive output gap of about 3.4% (panel [e]). In the managed capital flow regime where Home instead runs a trade surplus of 0.7% of GDP on impact, the fall in Home's real wage is more pronounced (panel [f]). As a result of this relief of cost pressures, inflation only rises to 6.2% on impact, versus 9.4% under free capital mobility. The Home recession is less severe, with an output gap of -7.7% (versus -10.3% under free capital mobility) and the Foreign boom is also less sizable, with an output gap of 0.6% (versus 3.4% under free capital mobility). Moreover, relative to the free capital mobility regime, the managed capital flows regime delivers an average welfare gain of about 0.04% of permanent consumption.

4.4 Inflation and Capital Flows: Model Predictions

To what extent is our model consistent with the motivating empirical patterns presented in Figure 2? To assess this, for each country j in our empirical sample, we follow the following procedure: (i) We construct rest-of-the-world aggregates for CPI inflation and nominal rates so as to obtain counterparts for the Foreign country's CPI inflation and nominal rate in the model;[31] (ii) We calibrate the size of the mean-reverting cost-push shocks in both

[31] To construct rest-of-the-world aggregates, we weight countries according to their 2021 current dollar GDP. For instance, if country j is the United States, we compute the rest-of-the-world inflation rate as the weighted average of the inflation of the remaining countries in the sample (excluding the United States), weighting each country i according to its relative GDP, $\frac{GDP_i}{\sum_i GDP_i}$

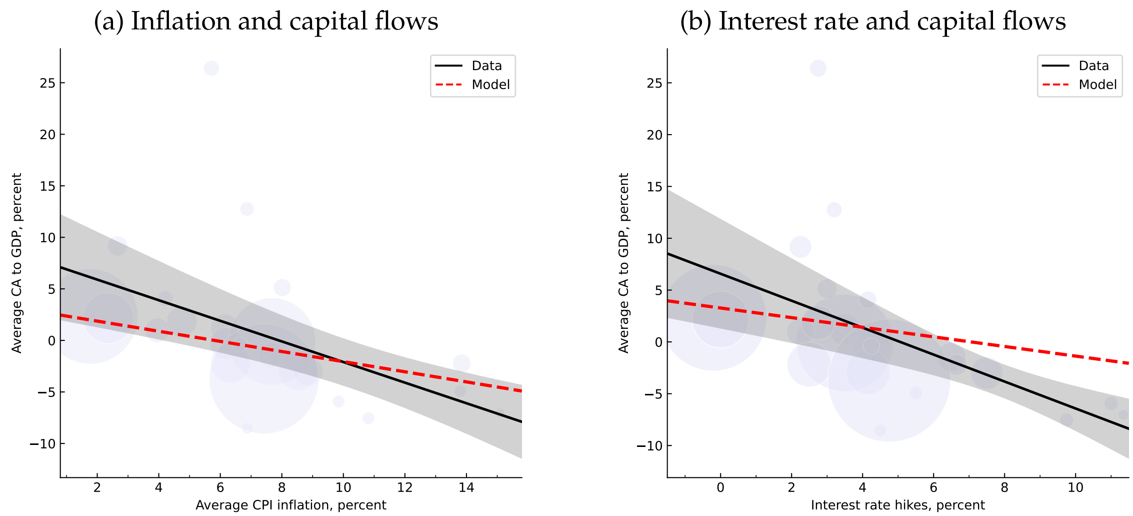

Figure 6: Data vs. model predictions

Note: The gray regions show 95% confidence interval.

Home and Foreign so as to match the average CPI inflation in the data, both for country j (Home) and for the rest-of-the-world aggregate (Foreign) under free capital mobility; (iii) Finally, we compute the model-implied current account-to-GDP.

The dashed red line in the left panel of Figure 6 shows the relationship between capital flows and CPI inflation implied by the model under free capital mobility. Consistent with the relationship observed in the data (solid black line), the model predicts a negative relationship between inflation and capital flows in the cross-section of countries. The dashed red line in the right panel of Figure 6 shows the relationship between nominal interest rate hikes and capital flows implied by the model. Here too, the model predicts a negative relationship, consistent with the data (solid black line).[32]

Demand and productivity shocks. Our baseline analysis focuses on cost-push (supply) shocks. We now examine how discount-factor (demand) and productivity shocks affect the joint behavior of capital flows and inflation. In response to such shocks, a monetary policy that tracks the natural rate of interest would stabilize inflation and implement the efficient allocation.[33] We depart from this benchmark and consider the case where monetary authorities do not respond aggressively enough to stabilize inflation. Under this suboptimal monetary policy response, adverse productivity and demand shocks generate

[32]Note that, in both scatter plots of Figure 6, the relationship between the variable on the x-axis and the current account is tighter than in the data. This is due to the fact that our model abstracts from a variety of other shocks and factors which influence monetary policy and exchange rates.

[33]With productivity shocks, the natural interest rates are $r_t^n = \rho + \dot{a}_t$ and $r_t^{n*} = \rho + \dot{a}_t^*$ in Home and Foreign. With discount-factor shocks, ζ_t and ζ_t^*, the natural rates are given by $r_t^n = \rho + \zeta_t$ and $r_t^n = \rho + \zeta_t^*$.

both positive inflation and output gaps, and induce capital to flow from low-inflation to high-inflation economies (see Figures I.1-I.4 in Appendix I), thereby reproducing qualitatively the negative cross-sectional relationship between inflation and capital flows in the data. Crucially, our central normative result proves robust across shock types: regardless of whether the underlying shocks are cost-push, demand shocks, or productivity in nature, redirecting capital flows away from the country with the most acute inflationary pressure improves welfare.

Real rates and capital flows. To conclude the comparison of the model with the data, we examine the relationship between real interest rates and capital flows in both the model and the data. To construct real rates, we follow Atkeson, Ohanian et al. (2001) and Fernández-Villaverde, Guerrón-Quintana, Rubio-Ramirez and Uribe (2011) and use lagged year-over-year CPI inflation to approximate expected inflation. The left panel of Figure 7 shows that countries experiencing the largest increases in real yields between October 2021 and March 2023 tended to receive capital flows, though the relationship is not statistically significant and the slope is modest (correlation of -0.19). In the model, real rates rise more strongly in the country more severely hit by cost-push shocks, since policymakers raise nominal rates more than one-to-one with inflation. This implies capital flows toward countries with higher real yields in line with the data (right panel), though the model generates a steeper slope than in the data.[34]

(a) Real interest rate and capital flows

(b) Model prediction

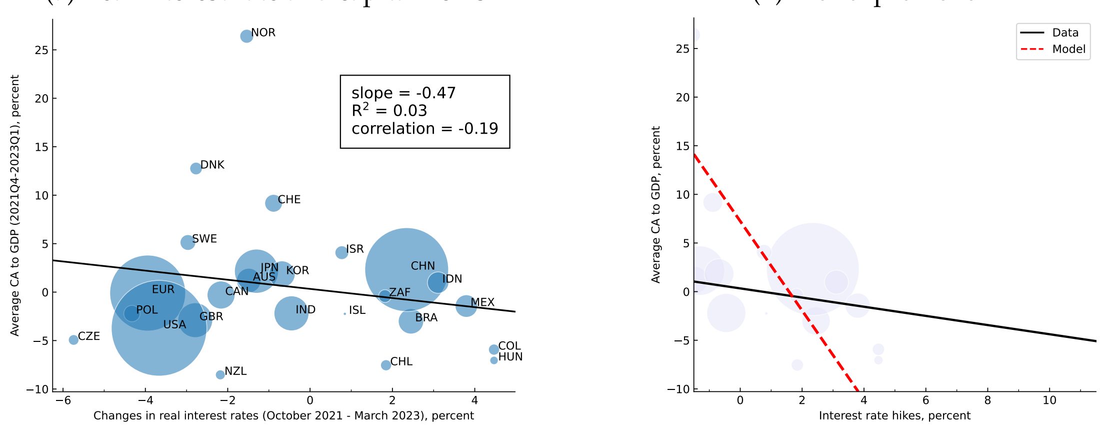

Figure 7: Real rates and capital flows

[34]The discrepancy in the steepness of the slope may reflect two factors. First, countries exhibit substantial heterogeneity in monetary policy frameworks and responses to inflation, which our benchmark model abstracts from. As we show in Appendix I.3, weaker policy responses to inflation flatten the slope of the relationship, bringing the model closer to the data. Incorporating such heterogeneity explicitly is a direction for future research. Second, real interest rates require constructing unobservable expected inflation, which introduces measurement error that creates attenuation bias toward zero (e.g., Woodridge, 2010).

5 Extensions

In our baseline model, capital flows exert upward pressure on domestic costs only via the wealth effect on labor supply and our analysis of capital flow management assumes cooperative policymaking. Our insight, however, is more general and applies similarly when we abstract away from wealth effects on labor supply and account for other non-tradable goods, as well when capital flow management is set non-cooperatively. In Section 5.1, we present a model extension that clarifies the first point. In Section 5.2, we consider non-cooperative policies.

5.1 Extension with Non-tradable Goods

This section extends our baseline model to an environment where households consume two kinds of goods: tradable and non-tradable goods. Tradable goods can be shipped across borders, while non-tradable goods have to be consumed domestically. To clarify that the wealth effect on labor supply is not necessary for our mechanism to operate in the presence of non-tradable consumption goods, we choose to use preferences that do not feature such an effect.

Preferences. Following Greenwood et al. (1988), the preferences of household h in Home are a function of its excess of consumption relative to its disutility of labor,

$$\int_0^\infty e^{-\rho t} \log \left(C_t(h) - \gamma N_t(h) + 1 \right) dt, \tag{40}$$

where the disutility of labor is linear in total hours, $N_t(h) = N_t^T(h) + N_t^N(h)$, with $N_t^T(h)$ and $N_t^N(h)$ respectively denoting hours worked in the tradable and non-tradable sectors. These preferences eliminate the wealth effect on labor supply by making the marginal rate of substitution between consumption and labor independent of the level of consumption. The consumption good, $C_t(h)$, is a composite of non-tradable consumption $C_t^N(h)$ and tradable consumption $C_t^T(h)$, according to

$$C_t(h) = \left(C_t^N(h) \right)^{1-\gamma} \left(C_t^T(h) \right)^{\gamma}, \tag{41}$$

where, as in Section 2, the tradable goods bundle is a CES aggregate of Home tradable goods and Foreign tradable goods

$$C_t^T(h) \equiv \left[\left(\frac{1}{2}\right)^{\frac{1}{\eta}} \left(C_{H,t}^T(h)\right)^{\frac{\eta-1}{\eta}} + \left(\frac{1}{2}\right)^{\frac{1}{\eta}} \left(C_{F,t}^T(h)\right)^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}}. \tag{42}$$

In addition to returns on bond holdings, households receive labor income and profits from firms in the tradable and non-tradable sectors. The environment faced by Foreign households is symmetric.

Firms. Tradable goods and non-tradable goods are produced by monopolistically competitive firms. The problem of a firm in the tradable goods sector is identical to the firm's problem in Section 2.2. In the non-tradable sector, firms produce differentiated goods $l \in [0,1]$ using a linear technology $Y_t^N(l) = AN_t^N(l)$, where A is the level of productivity, which we normalize to $\gamma/(1-\gamma)$ for convenience. To capture in a stylized manner the empirical fact that the degree of price stickiness is higher in the non-tradable sector than in the tradable sector (see, e.g., Nakamura and Steinsson, 2008), we consider a limiting case with fully rigid prices in the non-tradable sector, while retaining our Calvo (1983) sticky price assumption in the tradable goods sector (see Appendix G.1 for details).

Optimal capital flow management. As in our baseline model, we assume that monetary policy is set optimally, and we contrast the free capital mobility regime (where $\theta_t = 0$) and the managed capital flow regime (where the path of θ_t is chosen optimally). Under free capital mobility, net exports are now given by $nx_t = \frac{\eta-1}{\eta} y_t^{T,D}$, where $y_t^{T,D} \equiv \frac{1}{2}(y_t^T - y_t^{T*})$ is the difference between Home tradable output and Foreign tradable output. This implies that capital flows toward the country with the most depressed tradable goods output when $\eta > 1$ (i.e. under Assumption 1), as in our baseline model featuring only tradable goods. The optimal capital flow management policy problem for this model is laid out in Appendix G.1. There, we show that the optimal capital flow management policy targets

$$\theta_t = (1-\gamma)(y_t^{T,D} - y_t^{N,D}), \tag{43}$$

which implies $nx_t = -\frac{1}{\eta} y_t^{T,D}$.[35] That is, the optimal capital flow management policy requires capital to flow toward the country with the least depressed tradable goods output,

[35] Notice that, as in Fornaro and Romei (2022), the optimal cooperative policy induces $c_t^T = y_t^T$. However, this policy does not imply a balanced trade or closed capital account because home tradables and foreign tradables are imperfect substitutes in our environment. In the limiting case where domestic tradable and foreign tradable goods are perfect substitutes $\eta \to \infty$, there are no capital flows under the optimal policy, as is the case in Fornaro and Romei (2022).

unlike under free capital mobility. While the formalism in this model coincides with that of our baseline model of Section 2, the interpretation of the economic forces behind the results differs. To see this, suppose that an inflationary cost-push shock hits the Home country's tradable sector. To limit inflation, monetary policy depresses demand for Home's tradable output, inducing Home households to borrow from abroad to smooth consumption. But this external borrowing also leads to an increase in demand for non-tradable goods, which, given rigid prices, requires a higher production of non-tradables, raising labor demand. Higher labor demand in turn exerts upward pressures on wages and therefore on firms' marginal costs, exacerbating inflationary pressures in the tradable sector. In the managed capital flow regime, the global planner internalizes the unintended consequences of this macroeconomic externality and chooses to optimally redirect capital flows away from the country with the most acute inflationary pressure.

The key takeaway from this model extension is that the wealth effect on labor supply is by no means necessary for our main insight to apply: Capital inflows can also exert pressure on firms' marginal costs in the tradable sector simply by raising labor demand in the non-tradable sector and thereby putting upward pressure on domestic wages.

Intermediate inputs and nominal wage rigidity. Because, up to this point, we have considered labor to be the only factor of production, capital flows affect firms' marginal cost only to the extent that it affects nominal wages. In Appendix G.2, we consider an extension of the model where, in the spirit of Berka, Devereux and Engel (2018), non-tradable goods are used by domestic firms as intermediate inputs and nominal wages are fully rigid. In that environment, capital inflows exert upward pressure on domestic costs through a distinct intermediate input channel. Figure G.1 in Appendix G.2 shows that the response of macroeconomic variables to an inflationary cost-push shock in Home is qualitatively similar to that in our baseline model (Figure 4).

5.2 Non-Cooperative Capital Flow Management

To highlight the externality associated with capital flows in a high-inflation environment, our analysis so far has considered optimal capital flow management from a cooperative standpoint. This section considers the case where capital flows are managed optimally in a non-cooperative fashion. The approximation of non-cooperative policy games with linear-quadratic decision problems poses some notorious difficulties (Benigno and Benigno, 2006).[36] For this reason, in this section, we rely on linear approximations of targeting rules obtained from exact (non-linear) optimal policy problems. In turn, to make these non-linear problems tractable, we assume Rotemberg (1982) rather than Calvo (1983) pricing rigidities.[37] The non-linear policy problems and the approximation of their associated first-order conditions are presented in Appendix H.

Under free capital mobility, the trade balance is given by $nx_t = \frac{\eta-1}{\eta} y_t^D$ (regardless of monetary policy), so capital flows toward the most depressed country under Assumption 1. In order to abstract from well-known static terms-of-trade manipulation motives, we focus on the limiting case where $\eta \to 1$.[38] As discussed in Proposition 2, when policies are set cooperatively, the optimal cooperative capital flow management policy and the implied net exports of Home are respectively given by

$$\theta_t = \frac{1}{1-\alpha} y_t^D, \quad \text{and} \quad nx_t = -\frac{\alpha}{1-\alpha} y_t^D. \tag{44}$$

On the other hand, when both policies are set non-cooperatively, the targeting rule for capital flow management and the implied net exports of Home are given by

$$\theta_t = \underbrace{\left[1 + \frac{\alpha(2-\alpha)}{1-\alpha}\right]^{-1}}_{\Psi(\alpha)} \frac{1}{1-\alpha} y_t^D, \quad \text{and} \quad nx_t = -\Psi(\alpha) \frac{\alpha}{1-\alpha} y_t^D, \tag{45}$$

where $\Psi(\alpha) \in (0,1)$ and $\Psi'(\alpha) < 0$. Thus, our finding that a managed capital flow regime features flows opposite to those prevailing under free capital mobility equally holds under non-cooperative policy. As is the case under the cooperative policy (44), the country with the most acute inflationary pressure, and hence the most depressed output, experiences capital outflows in the *uncoordinated* managed capital flows regime.

One difference between the non-cooperative and cooperative outcomes is that the forces driving capital flows are weaker in the former case, as indicated by the coefficient $\Psi(\alpha) \in (0,1)$ in (45). This is because non-cooperative policymakers respond to dynamic terms-of-trade manipulation motives (Costinot, Lorenzoni and Werning, 2014) in addition

[36] In particular, it is not always given that the steady-state around which the approximation is taken satisfies the second-order conditions for being the outcome of the Nash game even if it is the efficient steady state in the cooperative case.

[37] It is worth noting that the linearized Phillips curve coincide under both price setting assumptions.

[38] Note that this limiting case, there is no motive for static terms-of-trade manipulation and the optimal cooperative monetary policy coincides with the optimal non-cooperative monetary policy. More specifically, monetary policy in each country targets: $\dot{y}_t + \varepsilon\pi_{Ht} = 0$ and $y_t^* + \varepsilon\pi_{Ft}^* = 0$, which corresponds to (21) and (22). Note also that these targeting rules describe the optimal monetary policy independently of whether the central banks have access to capital flow management policies.

to macroeconomic stabilization motives when managing capital flows. Macroeconomic stabilization motives induce countries with inflationary pressures to encourage capital outflows, and countries with deflationary pressures to encourage capital inflows. Since the strength of these motives is proportional to the severity of inflationary pressures, overall, it generates capital flows from countries with stronger inflationary pressures to countries with weaker inflationary pressures.

At the same time, dynamic terms-of-trade manipulation motives induce countries limit capital flows. As a result of the macroeconomic stabilization motive, the country with the strongest inflationary pressure experiences a trade surplus that shrinks over time. Since countries are monopolist suppliers of the goods they produce, policymaker perceives benefits from managing capital flows to extract rents from foreigners by exerting market power differentially across time periods. By reducing capital outflows and front-loading consumption, the policymaker contributes to smooth surpluses over time. This intertemporal reallocation of exports implies that the country can sell at higher prices during periods of high exports. The country with the least severe inflationary pressures faces a similar incentive to limit capital inflows.[39] In equilibrium, the dynamic terms of trade manipulation motive therefore leads to less capital flows than in the cooperative case. Note that this distortionary effect on capital flows is decreasing in the degree of home bias.

6 Conclusion

In this paper, we argue that the pattern of capital flows observed over the latest monetary policy tightening cycle may have led to an excessive cross-country dispersion in inflation and monetary tightening. Our argument builds on the insight that capital inflows raise firms' marginal costs by propping up the domestic price of non-tradable goods or factors of production. As a result, capital flows from low-inflation economies to high-inflation economies deteriorate policy trade-offs, leading to excessive macroeconomic fluctuations and lower welfare. Our analysis has implications beyond open economy macroeconomics. Indeed, the insight that privately optimal financial decisions may worsen policy trade-offs via externalities operating on the economy's supply side ought to apply more generally to other heterogeneous agents or multi-sector models with nominal rigidities. The studies of such phenomena are left for future research.

[39]This country experiences a trade deficit that shrinks over time. By reducing capital inflows, it can buy at lower prices during periods of high imports.

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APPENDIX

A Data

A.1 Data Description

This Appendix provides details on the sources and definitions of data used for the figures.

Data source. We use four data sources:

- Current account balance to GDP data is quarterly and comes from the OECD's Main Economic Indicators (MEI).
- Data on countries' 2021 GDP in US dollars are from the World Bank's World Development Indicators.
- Data on inflation are annual (year-over-year) CPI inflation rates at monthly frequency from the BIS.
- Data on policy rates are at a daily frequency and from the BIS.

List of countries. The sample used for the scatterplots of Figure 2 consists of all countries simultaneously present in the BIS and OECD MEI datasets, excluding Argentina, Russia and Turkey.[40] The jurisdictions included in our sample are Australia, Brazil, Canada, Chile, China, Colombia, Czech Republic, Denmark, Finland, Hungary, Iceland, India, Indonesia, Israel, Japan, Korea, Mexico, New Zealand, Norway, Poland, South Africa, Sweden, Switzerland, United Kingdom, United States, and the Euro Area (composed of 19 countries).

Description of Figure 2. In panel (a), the x-axis measures the average of year-on-year CPI inflation rates between October 2021 and March 2023. In panel (b), the x-axis is the cumulative interest hikes between October 1, 2021 and March 31, 2023, defined as the difference in the policy rate between March 31, 2023, and October 1, 2021. In both panels, the y-axis measures the average of the quarterly current account to GDP ratio over the 6 quarters from 2021Q4 to 2023Q1. The size of the dots reflects the size of countries' dollar GDP in 2021.

[40] Argentina and Turkey are excluded due to their extreme levels of inflation and unreliable official inflation figures, while Russia is excluded due to its monetary variables being largely driven by the war and associated sanctions over this period.

A.2 Additional Figures

Description of Figure A.1. This figure shows the same variables as in Figure 1, for the same time frame, with the addition of non-G7 countries in light gray.

(a) Inflation rates

(b) Policy rates

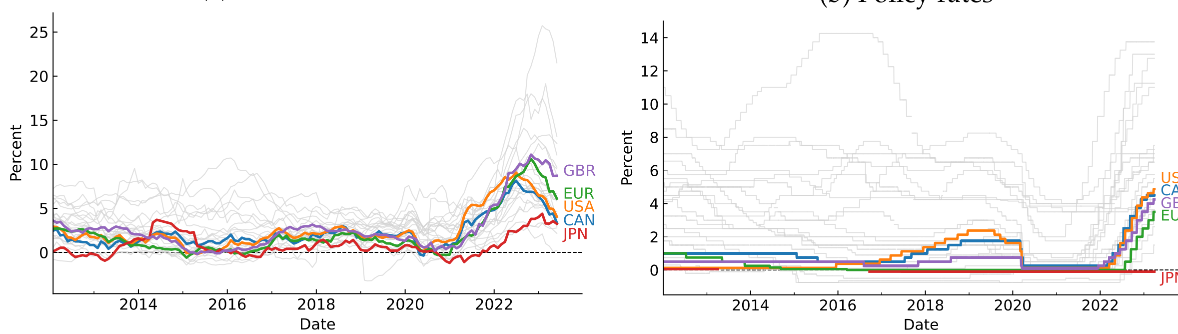


Figure A.1: Inflation and policy rates in G7 (bold) and remaining countries (light).

Description of Figure A.2. In panel (a), jurisdictions are grouped into four quartiles according to their average inflation from October 2021 to March 2023, while in panel (b), jurisdictions are grouped into four quartiles according to their cummulative rate hikes from October 1, 2021 to March 31, 2023. For each quartile, the box plot shows the mean (dot), the first quartile (bottom edge of the box), the second quartile (horizontal line inside the box) and the third quartile (top edge of the box) of the average current account to GDP ratio between 2021Q4 and 2023Q4.

(a) Current accounts and inflation.

(b) Current accounts and policy tightening.

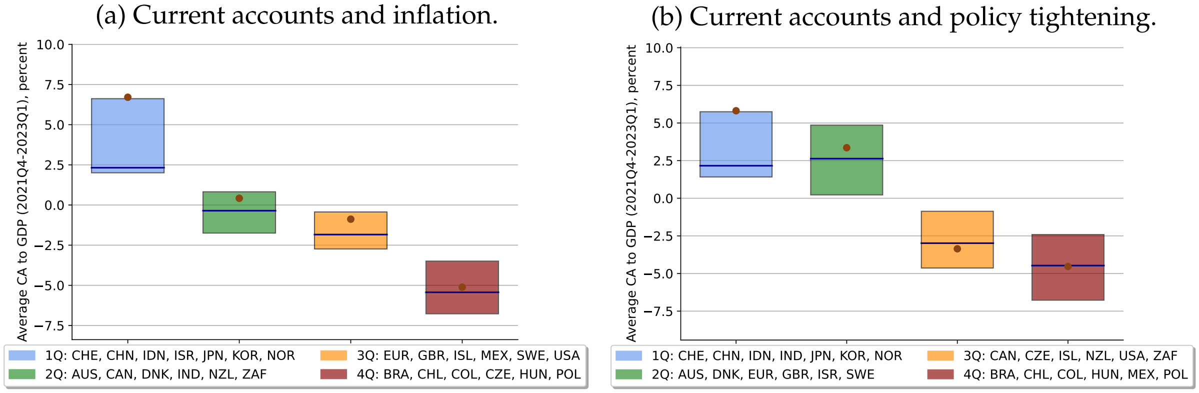
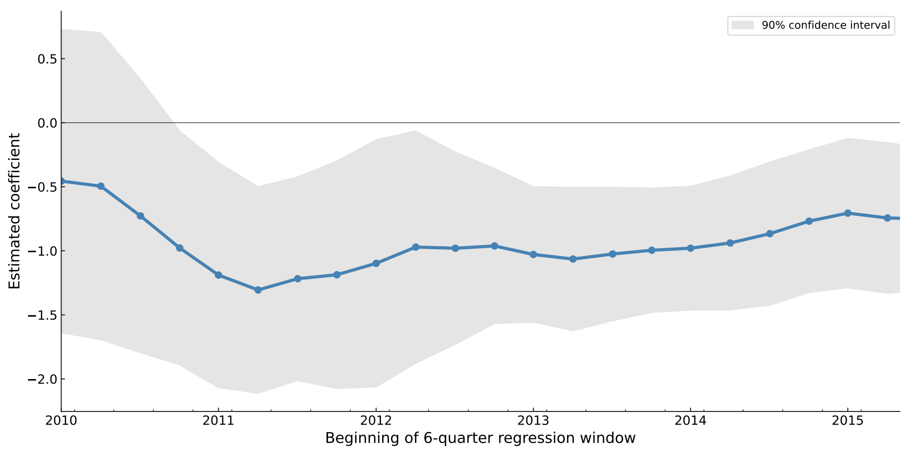


Figure A.2: Distribution of current accounts.

Description of Figure A.3. The figure shows the slope coefficient and associated 90% confidence bands from rolling cross-country regressions of (i) average current account to GDP on average CPI inflation (panel [a]) and (ii) average current account to GDP on changes in nominal policy rates (panel [b]), over the period 2010-2015, with averages being computed over 6-quarter windows. During the 2010-2015 period, when many central banks were constrained by the zero lower bound, the cross-sectional variation in nominal rate changes was very small, resulting in imprecise estimates with large standard errors and estimated coefficients near zero in panel (b). In contrast, panel (a) shows that the regression coefficient of average current account to GDP on average CPI inflation hovers around -1.0 and is statistically significant at the 90% level for most of the period.

(a) Average CA/GDP and average CPI inflation



(b) Average CA/GDP and changes in nominal rate

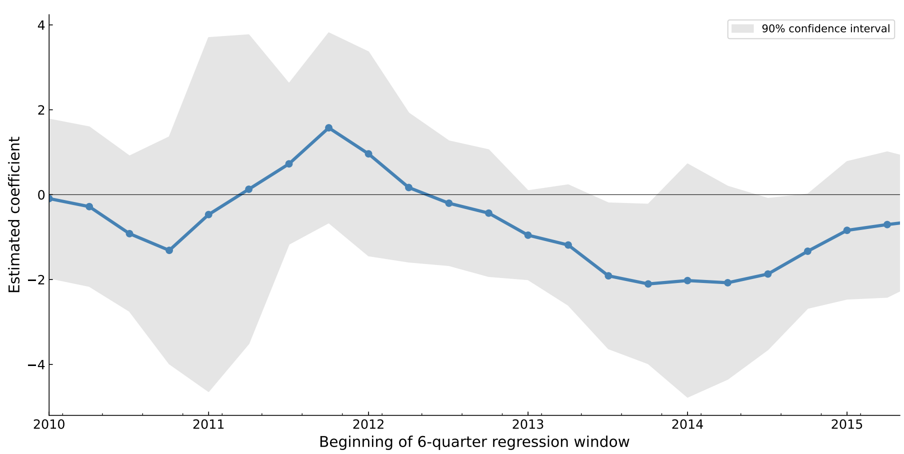


Figure A.3: Rolling regressions.

Description of Figure A.4. As in figure 2, this figure shows the correlation between inflation and capital flows (left panels) and between nominal rates and capital flows (right panels) over the period 2016-2019.

(a) Inflation (b) Nominal interest rate

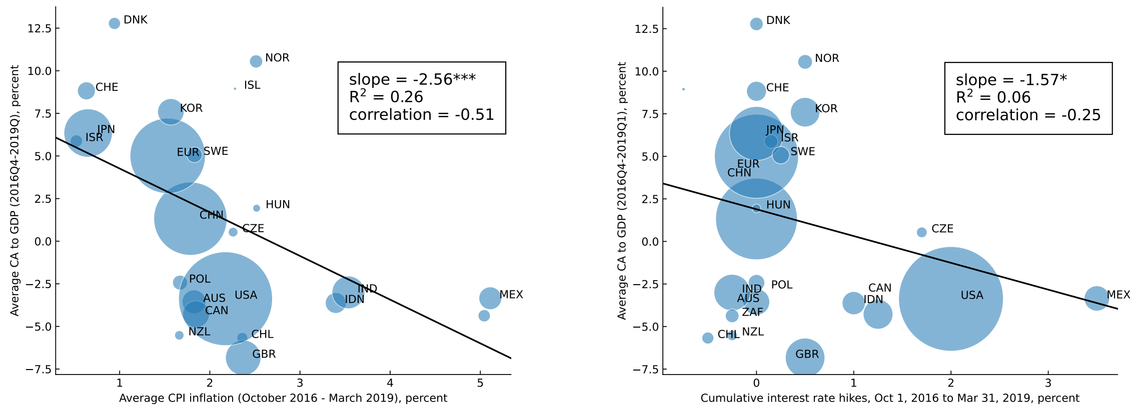


Figure A.4: Correlation between capital flows, inflation and nominal rates.

B Sensitivity analysis with real wage rigidities

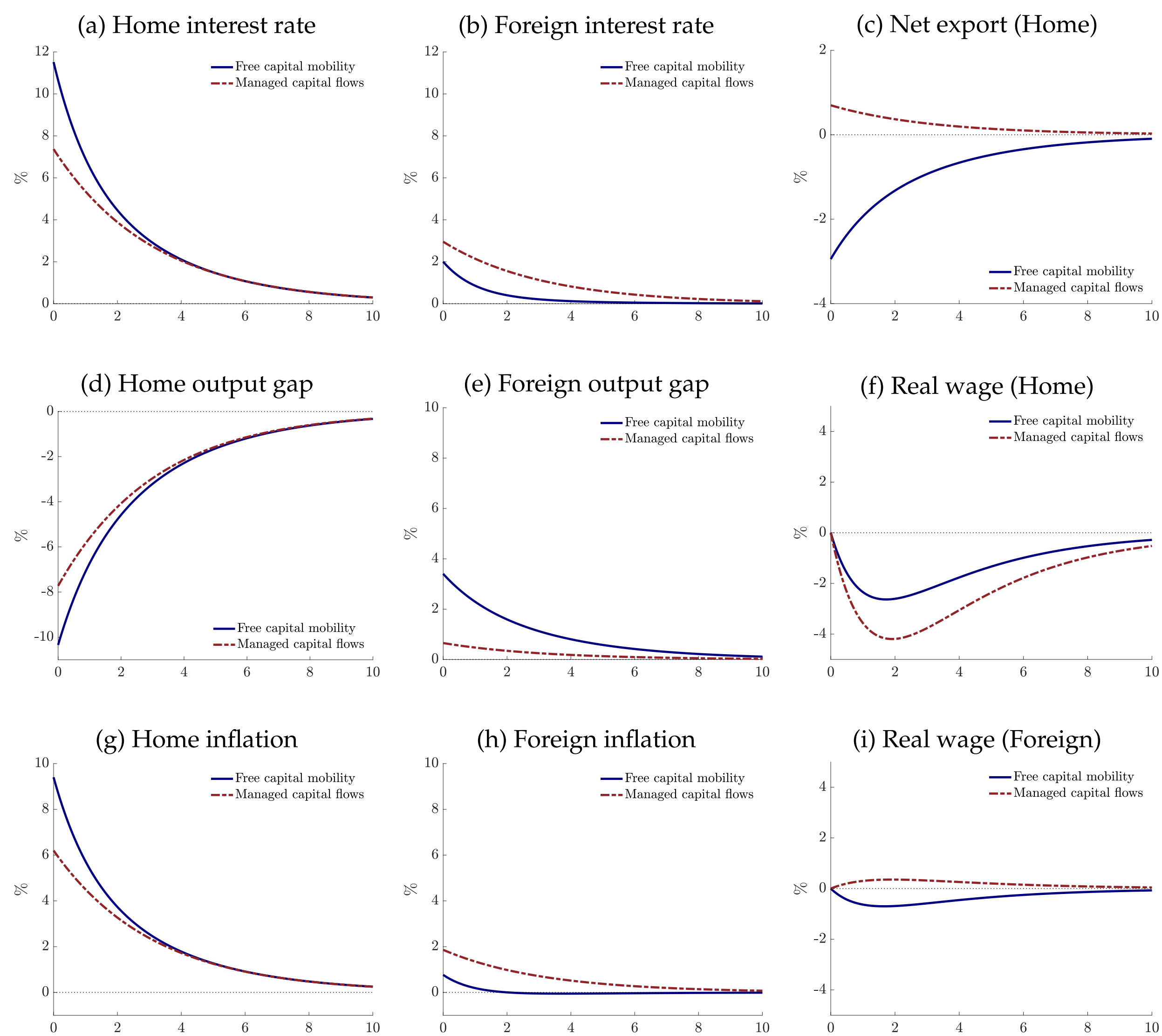


Figure B.1: Responses to an inflationary cost-push shock in Home with sticky real wages

Online Appendix to "Inflation and Capital Flows"

C Proofs

C.1 Derivations of (21) and (22)

The optimal policy solves (20) subject to (19a) and (19b). The Hamiltonian is given by

$$\mathcal{H} = \frac{1}{2}e^{-\rho t}\Bigg\{ \left[(1+\phi)(y_t^W)^2 + \frac{\varepsilon}{\kappa}(\pi_t^W)^2\right] + \left[\left(\frac{1}{\eta}+\phi\right)(y_t^D)^2 + \frac{\varepsilon}{\kappa}(\pi_t^D)^2 + \frac{1}{4}(\theta_t)^2\right] \tag{C.1}$$
$$+ \varphi_t^D\left[\rho\pi_t^W - \kappa(1+\phi)y_t^W - \kappa u_t^W\right] + \varphi_t^D\left[\rho\pi_t^D - \kappa\left[\left(\frac{1}{\eta}+\phi\right)y_t^D + \frac{1}{2}\theta_t\right] - \kappa u_t^D\right]\Bigg\}$$

with $\varphi_0^D = \varphi_0^W = 0$ and transversality conditions $\lim_{t\to\infty} e^{-\rho t}\varphi_t^D = \lim_{t\to\infty} e^{-\rho t}\varphi_t^W = 0$. First, note that the first-order conditions for π_t^W, y_t^W are respectively given by

$$\dot{\varphi}_t^W = -\frac{\varepsilon}{\kappa}\pi_t^W, \quad \text{and} \quad -y_t^W + \kappa\varphi_t^W = 0 \tag{C.2}$$

We then combine them to obtain $\dot{y}_t^W + \varepsilon\pi_t^W = 0$ which corresponds to (21). Similarly, the first-order conditions for π_t^D, y_t^D are respectively given by

$$\dot{\varphi}_t^D = -\frac{\varepsilon}{\kappa}\pi_t^D, \quad \text{and} \quad -y_t^D + \kappa\varphi_t^D = 0 \tag{C.3}$$

Combining these equations, we arrive at $\dot{y}_t^D + \varepsilon\pi_t^D = 0$ which correspond to (22).

C.2 Proof of Corollary 1

We differentiate (21) to get $\ddot{y}_t^W + \varepsilon\dot{\pi}_t^W = 0$ and use (19a) to arrive at

$$\ddot{y}_t^W - \rho\dot{y}_t^W - \varepsilon\kappa(1+\phi)y_t^W = \varepsilon\kappa u_t^W. \tag{C.4}$$

The solution of the second-order differential equation (C.4) takes the form

$$y_t^W = \vartheta_0 e^{z_1 t} + \vartheta_1\int_0^t e^{z_1(t-s)}u_s^W ds + \vartheta_2\int_t^\infty e^{z_2(t-s)}u_s^W ds. \tag{C.5}$$

where

$$z_1 = \frac{1}{2}\left(\rho - \sqrt{\rho^2 + 4\kappa\varepsilon(1+\phi)}\right) < 0 \quad \text{and} \quad z_2 = \frac{1}{2}\left(\rho + \sqrt{\rho^2 + 4\kappa\varepsilon(1+\phi)}\right) > 0,$$

Differentiating (C.5) and relating each term to (C.4), we get $\vartheta_1 = \vartheta_2 = -\frac{\varepsilon\kappa}{z_2 - z_1}$.
Next, from (C.5) for $t=0$, we get

$$\vartheta_0 = y_0^W + \frac{\varepsilon\kappa}{z_2 - z_1}\int_0^\infty e^{-z_2 s}u_s^W ds.$$

From (C.2), we have that $y_t^W = \kappa\varphi_0^W = 0$, and (C.5) therefore becomes

$$y_t^W = -\frac{\varepsilon\kappa}{z_2 - z_1}\left[e^{z_1 t}\int_0^t \left(e^{-z_1 s} - e^{-z_2 s}\right) u_s^W ds + \left(e^{z_2 t} - e^{z_1 t}\right)\int_t^\infty e^{-z_2 s} u_s^W ds\right]. \tag{C.6}$$

It thus follows that the path of y_t^W is independent of the path of θ_t. Furthermore, because by (21), $\pi_t^W = \frac{1}{\varepsilon}\dot{y}_t^W$, it also follows that the path of y_t^W is independent of the path of θ_t.

C.3 Proof of Proposition 1

Consider the optimal policy problem (C.1). The optimality condition for θ_t yields

$$\frac{1}{2}\theta_t - \kappa\varphi_t^D = 0 \tag{C.7}$$

Next, from (C.3) we have $\kappa\varphi_t^D = y_t^D$ which we substitute it into (C.7) to arrive at (24). To obtain (25), we first substitute (18) into (15) to obtain $nx_t = (1 - \frac{1}{\eta})y_t^D - \frac{1}{2}\theta_t$. We then use (24) to substitute for θ_t and get (25).

C.4 Proof of Proposition 2

Let φ_t^D be the co-state associated with (30b). The optimality conditions for y_t^D and θ_t yield

$$y_t^D = \kappa\varphi_t^D, \tag{C.8}$$

$$\alpha(1-\alpha)\frac{\eta}{\omega}\theta_t = \left(1 - \frac{1-2\alpha}{\omega}\right)\frac{1}{2}\kappa\varphi_t^D, \tag{C.9}$$

Combining (C.8) and (C.9) we arrive at

$$\theta_t = \frac{2(1-\alpha)\eta - (1-2\alpha)}{2(1-\alpha)\eta} 2y_t^D \tag{C.10}$$

which corresponds to (31). To derive (32), recall that $NX_t = Y_t - P_t C_t / P_{H,t}$. Linearizing it and using the linearized market clearing condition $y_t - c_t = 2\alpha(1-\alpha)s_t - \alpha\theta_t$, we obtain

$$nx_t = \frac{\omega - 1}{2}s_t - \alpha\theta_t \tag{C.11}$$

Finally, we substitute (29) and (C.10) into (C.11) to arrive at (32).

C.5 Proof of Section 3.5

We assume here time-varying productivity in both Home A_t and Foreign A_t^* and $\eta = 1$. We follow the same steps as in Online Appendix D to derive the loss function. First, it can be shown that the efficient allocation (with time-varying productivity) is given by

$$\begin{aligned} N_t^e &= N_t^{*e} = 1, \\ Y_t^e &= A_t, \quad Y_t^{*e} = A_t^*, \\ C_t^e &= A_t^{1-\alpha}\left(A_t^*\right)^{\alpha}, \quad C_t^{*e} = A_t^{\alpha}\left(A_t^*\right)^{1-\alpha}. \end{aligned}$$

For a given variable X_t, the lower-case letter x denotes the log deviations of X_t from the steady state and $\tilde{x}_t = x_t - x_t^e$ are log deviations from the efficient allocation. We rewrite the second-order approximation of the period utility around the efficient steady state here

$$v_t = -\frac{1}{1+\phi} + \frac{1}{2}\left[(c_t + c_t^*) - (n_t + n_t^*) - \frac{1+\phi}{2}\left((n_t)^2 + (n_t^*)^2\right) + o\left(||u||^3\right)\right],$$

which in deviations from the efficient allocation becomes

$$v_t - v_t^{max} = \frac{1}{2}\left[(\tilde{c}_t + \tilde{c}_t^*) - (\tilde{n}_t + \tilde{n}_t^*) - \frac{1+\phi}{2}\left((\tilde{n}_t)^2 + (\tilde{n}_t^*)^2\right) + o\left(||u||^3\right)\right] \tag{C.12}$$

Using a second-order approximation of goods market clearing conditions and expressing it in deviations from the efficient allocation, we get

$$\tilde{c}_t + \tilde{c}_t^* = \tilde{y}_t + \tilde{y}_t^* - \alpha(1-\alpha)\left(\theta_t\right)^2 + o(||u||^3). \tag{C.13}$$

$$\tilde{n}_t + \tilde{n}_t^* = \tilde{y}_t + \tilde{y}_t^* + z_t + z_t^* + o(||u||^3) \tag{C.14}$$

Because prices are fully rigid $z_t = z_t^* = 0$. Defining $\mathcal{L} = \int_0^\infty e^{-\rho t}(v_t - v_t^{max})dt$ and substituting (C.13), (C.14) into (C.12), and noting that $(\tilde{y}_t)^2 + (\tilde{y}_t^*)^2 = 2[(\tilde{y}_t^W)^2 + (\tilde{y}_t^D)^2]$, we arrive at

$$\mathcal{L} = \frac{1}{2}\int_0^\infty e^{-\rho t}\left\{(1+\phi)\left[(\tilde{y}_t^W)^2 + (\tilde{y}_t^D)^2\right] + \alpha(1-\alpha)(\theta_t)^2\right\}dt$$

Next, we turn to deriving the implementability constraint. In the context of currency unions, the optimality conditions for bond holdings are summarized by (7), (8) and (9) with $\dot{e}_t = 0$. By (D.8) and (D.9), we have to a first-order $\tilde{c}_t = \tilde{y}_t - \alpha\theta_t + \alpha\tilde{s}_t$ and $\tilde{c}_t^* = \tilde{y}_t^* + \alpha\theta_t - \alpha\tilde{s}_t$. Substituting these expressions into the linearized (7) and (8), we arrive at

$$\dot{\tilde{y}}_t^W = i_{Bt} - \frac{1}{2}(r_t^n + r_t^{n,*}) + \frac{1}{2}\dot{\theta}_t, \tag{C.15}$$

$$\dot{\tilde{y}}_t^D = -\frac{1}{2}(r_t^n + r_t^{n,*}) + \frac{1}{2}(1-2\alpha)\dot{\theta}_t. \tag{C.16}$$

where $r_t^n = \rho + \dot{a}_t$ and $r_t^{n*} = \rho + \dot{a}_t^*$. Because given quantities $\{\tilde{y}_t^W, \tilde{y}_t^D, \theta_t\}$, equation (C.15) can be used to back out i_{Bt}, the optimal policy problem reduces to

$$\min_{\tilde{y}_t^W} \frac{1}{2}\int_0^\infty e^{-\rho t}\left\{(1+\phi)(\tilde{y}_t^W)^2\right\}dt + \min_{\tilde{y}_t^D, \theta_t} \frac{1}{2}\int_0^\infty e^{-\rho t}\left\{(1+\phi)(\tilde{y}_t^D)^2 + \alpha(1-\alpha)(\theta_t)^2\right\}dt$$

subject to (C.16).

D Derivation of the Loss Function

The symmetrically weighted average of the period utility in the two countries is

$$v_t \equiv \frac{1}{2}\left[\log C_t - \frac{1}{1+\phi}(N_t)^{1+\phi}\right] + \frac{1}{2}\left[\log C_t^* - \frac{1}{1+\phi}(N_t^*)^{1+\phi}\right].$$

The loss relative to the efficient outcome is $v_t - v^{max}$, where v^{max} is the maximized welfare where C_t, C_t^*, N_t and N_t^* take on their efficient values. We derive the loss function for the general case with home bias in consumption (27). To do so, we first describe the efficient allocation and then derive a second-order approximation of the objective function.

Efficient Allocation. The socially optimal allocation solves the following static problem:

$$\max_{C_{H,t},C_{H,t}^*,C_{F,t},C_{F,t}^*,N_t,N_t^*} \frac{\eta}{\eta-1}\log\left[(1-\alpha)^{\frac{1}{\eta}}(C_{H,t})^{\frac{\eta-1}{\eta}} + \alpha^{\frac{1}{\eta}}(C_{F,t})^{\frac{\eta-1}{\eta}}\right] - \frac{(N_t)^{1+\phi}}{1+\phi}$$

$$+ \frac{\eta}{\eta-1}\log\left[(1-\alpha)^{\frac{1}{\eta}}(C_{F,t}^*)^{\frac{\eta-1}{\eta}} + \alpha^{\frac{1}{\eta}}(C_{H,t}^*)^{\frac{\eta-1}{\eta}}\right] - \frac{(N_t^*)^{1+\phi}}{1+\phi}$$

subject to

$$C_{H,t} + C_{H,t}^* = N_t, \tag{D.1}$$

$$C_{F,t} + C_{F,t}^* = N_t^*. \tag{D.2}$$

Let $\vartheta_{H,t}$ and $\vartheta_{F,t}$ denote the multipliers on (D.1) and (D.2). The first-order conditions are

$$[C_{H,t}] :: \quad \vartheta_{H,t} = (1-\alpha)^{\frac{1}{\eta}}(C_{H,t})^{-\frac{1}{\eta}}(C_t)^{\frac{1}{\eta}-1} \tag{D.3a}$$

$$[C_{F,t}] :: \quad \vartheta_{F,t}^* = \alpha^{\frac{1}{\eta}}(C_{F,t})^{-\frac{1}{\eta}}(C_t)^{\frac{1}{\eta}-1} \tag{D.3b}$$

$$[C_{H,t}^*] :: \quad \vartheta_{H,t} = \alpha^{\frac{1}{\eta}}(C_{H,t}^*)^{-\frac{1}{\eta}}(C_t^*)^{\frac{1}{\eta}-1} \tag{D.4a}$$

$$[C_{F,t}^*] :: \quad \vartheta_{F,t}^* = (1-\alpha)^{\frac{1}{\eta}}(C_{F,t}^*)^{-\frac{1}{\eta}}(C_t^*)^{\frac{1}{\eta}-1} \tag{D.4b}$$

$$[N_t] :: \quad (N_t)^{\phi} = \vartheta_{H,t} \tag{D.5a}$$

$$[N_t^*] :: \quad (N_t^*)^{\phi} = \vartheta_{F,t}^*. \tag{D.5b}$$

First, we combine (D.3a) and (D.3b), and also combine (D.4a) and (D.4b) to obtain

$$\vartheta_{H,t}C_{H,t} + \vartheta_{F,t}^*C_{F,t} = 1, \tag{D.6a}$$

$$\vartheta_{H,t}C_{H,t}^* + \vartheta_{F,t}^*C_{F,t}^* = 1. \tag{D.6b}$$

Substituting (D.1) and (D.2) into (D.5a) and (D.5b) yields $(N_t)^{1+\phi} + (N_t^*)^{1+\phi} = \vartheta_{H,t}(C_{H,t} + C_{H,t}^*) + \vartheta_{F,t}^*(C_{F,t} + C_{F,t}^*)$. Combining it with (D.6a) and (D.6b), we get

$$(N_t)^{1+\phi} + (N_t^*)^{1+\phi} = 2.$$

Using resource constraints (D.1) and (D.2) and by symmetry, we arrive at

$$C_t^e = C_t^{*e} = N_t^e = N_t^{*e} = 1,$$

where variables with a superscript e denote efficient values. Finally, from the aggregate production functions, we have $Y_t^e = 1$ and $Y_t^{*e} = 1$. In logs, we therefore have

$$c_t^e = c_t^{*e} = n_t^e = n_t^{*e} = y_t^e = y_t^{*e} = 0.$$

Loss Function. The second-order approximation of the period utility around the efficient steady state (using $\bar{N}^{1+\phi} = 1$) is given by

$$v_t = -\frac{1}{1+\phi} + \frac{1}{2}\left[(c_t + c_t^*) - (n_t + n_t^*) - \frac{1+\phi}{2}\left((n_t)^2 + (n_t^*)^2\right) + o\left(||u||^3\right)\right],$$

where $+o\left(||u||^3\right)$ indicate the 3^{rd} and higher order terms left out. In the efficient allocation $C_t^e = C_t^{*e} = N_t^e = N_t^{*e} = 1$, and thus $v_t^{max} = -1/(1+\phi)$. The period utility can be rewritten as

$$v_t - v_t^{max} = \frac{1}{2}\left[(c_t + c_t^*) - (n_t + n_t^*) - \frac{1+\phi}{2}\left((n_t)^2 + (n_t^*)^2\right) + o\left(||u||^3\right)\right] \quad \text{(D.7)}$$

We now need to substitute for c_t, c_t^*, n_t, n_t^*. Note that goods market-clearing are given by

$$Y_t = \left[(1-\alpha) + \alpha\,(S_t)^{1-\eta}\right]^{\frac{\eta}{1-\eta}}\left[(1-\alpha) + \alpha\Theta_t^{-1}S_t^{(1-2\alpha)(\eta-1)}\right]C_t.$$
$$Y_t^* = \left[(1-\alpha) + \alpha\,(S_t)^{\eta-1}\right]^{\frac{\eta}{1-\eta}}\left[(1-\alpha) + \alpha\Theta_t S_t^{(1-2\alpha)(1-\eta)}\right]C_t^*$$

where we use $C_t = \Theta_t S_t^{1-2\alpha} C_t^*$. Taking a second-order approximation around the efficient steady state (which coincides here with the efficient allocation), we get

$$y_t = c_t - \alpha\theta_t + \frac{\omega-1+2\alpha}{2}s_t + \frac{1}{2}\alpha(1-\alpha)\left\{(1-\eta)\eta(s_t)^2 + [\theta_t - (1-2\alpha)(\eta-1)s_t]^2\right\} \quad \text{(D.8)}$$
$$y_t^* = c_t^* + \alpha\theta_t - \frac{\omega-1+2\alpha}{2}s_t + \frac{1}{2}\alpha(1-\alpha)\left\{(1-\eta)\eta(s_t)^2 + [\theta_t - (1-2\alpha)(\eta-1)s_t]^2\right\} \quad \text{(D.9)}$$

where $\omega = \eta - (\eta-1)(1-2\alpha)^2$. We can combine (D.8) and (D.9) to get

$$c_t + c_t^* = y_t + y_t^* - \alpha(1-\alpha)\left\{(1-\eta)\eta(s_t)^2 + [\theta_t - (1-2\alpha)(\eta-1)s_t]^2\right\} + o(||u||^3). \quad \text{(D.10)}$$

Aggregate employment is given by $N_t = Y_t Z_t$, with $Z_t = \int_0^1 \left(P_{Ht(l)}/P_{Ht}\right)^{-\varepsilon} dl$ and we have

$$n_t + n_t^* = y_t + y_t^* + z_t + z_t^* + o(||u||^3) \tag{D.11}$$

Substituting (D.11) into (D.7) we obtain

$$v_t - v_t^{max} = \frac{1}{2}\Big[(c_t + c_t^*) - (y_t + y_t^*) - (z_t + z_t^*) - \frac{1+\phi}{2}((y_t)^2 + (y_t^*)^2) + o(||u||^3)\Big] \tag{D.12}$$

Next, plugging (D.8) and (D.9) into (D.12), we arrive at

$$\begin{aligned} v_t - v_t^{max} = -\frac{1}{2}\Big[&(z_t + z_t^*) + \frac{1}{2}(1+\phi)((y_t)^2 + (y_t^*)^2) + \alpha(1-\alpha)(1-\eta)\eta(s_t)^2 \\ &+ \alpha(1-\alpha)\left(\theta_t - (\eta-1)(1-2\alpha)s_t\right)^2\Big] + o(||u||^3). \end{aligned} \tag{D.13}$$

The objective of the policy maker is to minimize the loss function $\mathcal{L} = \int_0^\infty e^{-\rho t}(v_t^{max} - v_t)dt$ where $v_t - v_t^{max}$ is given by (D.13). Then, using

$$\int_0^\infty e^{-\rho t} z_t dt = \int_0^\infty e^{-\rho t}\frac{\varepsilon}{2}\text{var}_l\left(P_{H,t}(l)\right), \tag{D.14}$$

$$\int_0^\infty e^{-\rho t} z_t^* dt = \int_0^\infty e^{-\rho t}\frac{\varepsilon}{2}\text{var}_l\left(P_{F,t}^*(l)\right)dt, \tag{D.15}$$

where it can be shown that

$$\int_0^\infty e^{-\rho t}\text{var}_l\left(P_{H,t}(l)\right)dt = \frac{1}{\kappa}\int_0^\infty e^{-\rho t}\left(\pi_{H,t}\right)^2 dt,$$

$$\int_0^\infty e^{-\rho t}\text{var}_l\left(P_{F,t}^*(l)\right)dt = \frac{1}{\kappa}\int_0^\infty e^{-\rho t}\left(\pi_{F,t}^*\right)^2 dt,$$

Finally, using our definition of world and difference variables we obtain

$$\begin{aligned} \mathcal{L} = \frac{1}{2}\int_0^\infty e^{-\rho t}\Big[&\frac{\varepsilon}{\kappa}\left((\pi_t^W)^2 + (\pi_t^D)^2\right) + (1+\phi)\left((y_t^W)^2 + (y_t^D)^2\right) \\ &+ \alpha(1-\alpha)(1-\eta)\eta(s_t)^2 + \alpha(1-\alpha)\left(\theta_t - (\eta-1)(1-2\alpha)s_t\right)^2\Big] \end{aligned} \tag{D.16}$$

We then use the expression for the equilibrium terms of trade $\omega s_t = 2y_t^D - (1-2\alpha)\theta_t$ to simplify (D.16) and obtain

$$\mathcal{L} = \frac{1}{2}\int_0^\infty e^{-\rho t}\left\{\left[(1+\phi)(y_t^W)^2 + \frac{\varepsilon}{\kappa}(\pi_t^W)^2\right] + \left[\left(\frac{1}{\omega}+\phi\right)(y_t^D)^2 + \frac{\varepsilon}{\kappa}(\pi_t^D)^2 + \alpha(1-\alpha)\frac{\eta}{\omega}(\theta_t)^2\right]\right\}dt$$

Notice that absent home bias, that is for $\alpha = \frac{1}{2}$, we also have $\omega = \eta$ and we arrive at (20).

E Capital Flows Regimes and Output-Inflation Tradeoff

This section presents a graphical illustration of the adjustment to an unanticipated temporary markup shock under the two capital flow regimes. To allow for a sharp graphical characterization of the adjustment under the two capital flow regimes, suppose that Home is subject to an inflationary markup shock such that $u_t = 2\bar{u} > 0$ for some $\bar{u} > 0$ for $t \in [0, T)$ and $u_t = 0$ for $t \geq T$, while Foreign is not hit by any shock (i.e., $u_t^* = 0$ for $t \geq 0$). In world and difference format shocks, we have

$$u_t^W = u_t^D = \begin{cases} \bar{u} > 0 & \text{for} \quad t \in [0, T) \\ 0 & \text{for} \quad t \geq T. \end{cases} \tag{E.1}$$

Under this scenario, monetary policy cannot perfectly stabilize the economy. It trades off output gap and inflation distortions according to (21) and (22).

E.1 Free Capital Mobility

In the free capital mobility regime, $\theta_t = 0$. Accounting for this fact (19b) becomes:

$$\dot{\pi}_t^D = \rho \pi_t^D - \kappa \left(\frac{1}{\eta} + \phi \right) y_t^D - \kappa u_t^D. \tag{E.2}$$

Meanwhile, differentiating the targeting rule (22) with respect to time yields

$$\dot{y}_t^D = -\varepsilon \pi_t^D. \tag{E.3}$$

(E.2) and (E.3) form a dynamical system in π_t^D and y_t^D whose solution encapsulates the dynamics of the cross-country block of the model. π_t^D is a jump variable, and although y_t^D could in principle jump, under the optimal plan it is predetermined at $y_0^D = 0$.The system is thus saddle-path stable and the solution can be conveniently represented in a phase diagram. The $\dot{y}_t^D = 0$ locus is described by $\pi_t^D = 0$, while the $\dot{\pi}_t^D = 0$ locus is described by $\rho \pi_t^D = \kappa \left(\frac{1}{\eta} + \phi \right) y_t^D + \kappa u_t^D$. Given our shock scenario, in the (y_t^D, π_t^D) space, the $\dot{y}_t^D = 0$ locus is therefore always a flat line at 0, while the $\dot{\pi}_t^D = 0$ locus is an upward sloping straight line with slope $\kappa \left(\frac{1}{\eta} + \phi \right) / \rho$ and intercept $\kappa \bar{u} / \rho > 0$ in the short-run (i.e., for $t \in [0, T)$) and intercept 0 in the long-run (i.e., for $t \geq T$).

Figure E.1 represent the loci, where y_t^D rises (diminishes) south (north) of the $\dot{y}_t^D = 0$ locus and π_t^D rises (diminishes) west (east) of the $\dot{\pi}_t^D = 0$ locus. The fictional saddle-path associated with the system being permanently governed by the short-term loci is

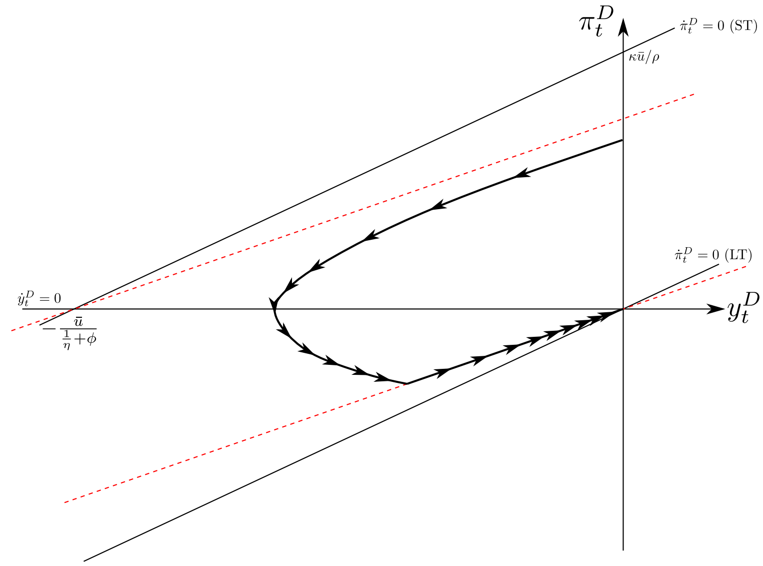


Figure E.1: Output-inflation trade-off under free capital mobility.
Note: (ST) denotes short-term $\dot{\pi}_t^D = 0$ locus, (LT) denotes long-term $\dot{\pi}_t^D = 0$ locus.

represented by the upper dashed upward-sloping line, while that associated with the system being permanently governed by the long-term loci is represented by the lower dashed upward-sloping line. The actual saddle path is represented by the thick curve with arrows.

The inflationary markup shock in Home causes a cross-country difference in inflation on impact. But the initial jump in inflation differential is limited by monetary policy's commitment to generate a more negative output gap in Home than in Foreign in the future, with the difference in output gaps displaying a hump shape. To support this path for the output gap differential, the terms of trade need to follow a similar hump shape, indicating persistently misaligned and appreciated terms of trade throughout the episode.

E.2 Managed Capital Flows

Under managed capital flows, the path of θ_t satisfies the targeting rule (24). Accounting for this fact and substituting it into (19b) yields:

$$\dot{\pi}_t^D = \rho\pi_t^D - \kappa\left[\frac{1}{\eta} + \phi + 1\right] y_t^D - \kappa u_t^D, \tag{E.4}$$

The last extra term (when comparing (E.4) to its counterpart (E.3) under free capital mobility) reflects the optimal management of the demand imbalance. (E.4) and (E.2) now form the dynamical system in π_t^D and y_t^D whose solution represents the dynamics of the cross-country block of the model. Again, π_t^D is a jump variable, and y_t^D is predetermined at $y_0^D = 0$ under the optimal plan. The system is again saddle-path stable and is represented with a phase diagram in Figure E.2.

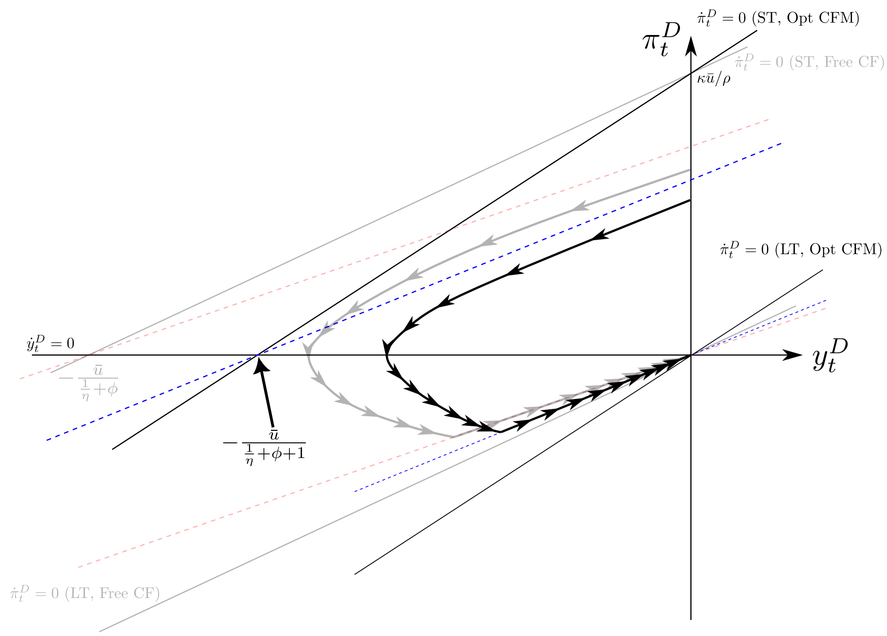


Figure E.2: Output-inflation trade-off under optimal CFM.
Note: (ST) denotes short-term $\dot{\pi}_t^D = 0$ locus, (LT) denotes long-term $\dot{\pi}_t^D = 0$ locus.

As under free capital mobility, the $\dot{y}_t^D = 0$ locus is described by $\pi_t^D = 0$. But this time, the $\dot{\pi}_t^D = 0$ locus is described by $\rho\pi_t^D = \kappa \left[\frac{1}{\eta} + \phi + 1\right] y_t^D + \kappa u_t^D$. The only difference with the phase diagram of Figure E.1 is that the $\dot{\pi}_t^D = 0$ locus now has a steeper slope of $\kappa \left[\frac{1}{\eta} + \phi + 1\right] / \rho$. This slope is strictly steeper. The phase diagram shows that optimal capital flow management results in a more favorable trade-off between the stabilization of the cross country difference in the output gap and the cross-country difference in domestic inflation, regardless of the direction of the inefficiency.

As the path for the cross-country difference in the output gap again displays a hump-shape, (25) indicates that a hump-shaped trade surplus arises. As a result, capital flows are topsy-turvy: throughout the stagflation episode, Home runs a trade deficit under free capital mobility, while it runs a trade surplus under managed capital flows.

F Equilibrium under Taylor Rules

We define in this section the equilibrium under the Taylor rules (36a) and (36b).

Definition 1. *Given central banks' policies* $\{i_t, i_t^*\}_{t\geq 0}$ *and a capital flow regime* $\{\theta_t\}_{t\geq 0}$*, an equilibrium is an allocation* $\{\pi_t^W, \pi_t^D, y_t^W, y_t^D, c_t^W, c_t^D, s_t\}$ *satisfying*

$$\dot{c}_t^W = i_t^W - \pi_t^W - \rho \tag{F.1}$$

$$\dot{c}_t^D = i_t^D - \pi_t^D - \alpha \dot{s}_t \tag{F.2}$$

$$c_t^W = y_t^W \tag{F.3}$$

$$2c_t^D = \theta_t + (1-2\alpha)\, s_t \tag{F.4}$$

$$\omega s_t = 2y_t^D - (1-2\alpha)\,\theta_t \tag{F.5}$$

$$\dot{\pi}_t^W = \rho\pi_t^W - \kappa(1+\phi)y_t^W - \kappa u_t^W \tag{F.6}$$

$$\dot{\pi}_t^D = \rho\pi_t^D - \kappa\left[\left(\frac{1}{\omega}+\phi\right)y_t^D + \left(1-\frac{1-2\alpha}{\omega}\right)\frac{1}{2}\theta_t\right] - \kappa u_t^D \tag{F.7}$$

Using (36a), (36b), and substituting (i) (F.3) into (F.1), and (ii) (F.4) into (F.5) and (F.2), the equilibrium conditions reduces to the following system of ODEs

$$\begin{aligned}
\dot{y}_t^W &= (\phi_\pi - 1)\pi_t^W + \phi_y y_t^W \\
\dot{y}_t^D &= \frac{\omega}{1-2\alpha\phi_\pi}\left[(\phi_\pi - 1)\pi_t^D + \phi_y y_t^D\right] - \frac{1}{2}\left[\frac{\omega}{1-2\alpha\phi_\pi} - (1-2\alpha)\right]\dot{\theta}_t \\
\dot{\pi}_t^W &= \rho\pi_t^W - \kappa(1+\phi)y_t^W - \kappa u_t^W \\
\dot{\pi}_t^D &= \rho\pi_t^D - \kappa\left[\left(\frac{1}{\omega}+\phi\right)y_t^D + \left(1-\frac{1-2\alpha}{\omega}\right)\frac{1}{2}\theta_t\right] - \kappa u_t^D
\end{aligned}$$

where $\theta_t = 0$ under free capital mobility and θ_t given by (31) under managed capital flows. The boundary conditions are $\lim_{t\to\infty} y_t^W = \lim_{t\to\infty} y_t^D = \lim_{t\to\infty} \pi_t^W = \lim_{t\to\infty} \pi_t^D = 0$. Note that, under free capital mobility $\theta_t = 0$, the system of ODEs simplifies to

$$\begin{aligned}
\dot{y}_t^W &= (\phi_\pi - 1)\pi_t^W + \phi_y y_t^W \\
\dot{y}_t^D &= \frac{\omega}{1-2\alpha\phi_\pi}\left[(\phi_\pi - 1)\pi_t^D + \phi_y y_t^D\right] \\
\dot{\pi}_t^W &= \rho\pi_t^W - \kappa(1+\phi)y_t^W - \kappa u_t^W \\
\dot{\pi}_t^D &= \rho\pi_t^D - \kappa\left(\frac{1}{\omega}+\phi\right)y_t^D - \kappa u_t^D
\end{aligned}$$

G Extensions with Non-tradable Goods

G.1 GHH Preferences

We start by presenting the equilibrium conditions of the model and the efficient allocation. Then, we derive the loss function and characterize the optimal policy.

Linearized equilibrium conditions. Given GHH preferences (40), the optimal labor supply decisions of households in Home and Foreign yields $w_t - p_t = 0$ and $w_t^* - p_t^* = 0$. The optimality conditions for consumption and bonds (in Home and Foreign) imply

$$c_t^N = c_t^T + p_t^T - p_t^N \quad \text{and} \quad c_t^{N*} = c_t^{T*} + p_t^{T*} - p_t^{N*} \tag{G.1}$$

$$\dot{\tilde{c}}_t = i_t - \pi_t - \rho \quad \text{and} \quad \dot{\tilde{c}}_t^* = i_t^* - \pi_t^* - \rho \tag{G.2}$$

$$\dot{\tilde{c}}_t = i_{Bt} - \pi_t - \rho \quad \text{and} \quad \dot{\tilde{c}}_t^* = i_{Bt}^* - \dot{e}_t - \pi_t^* - \rho \tag{G.3}$$

where $\tilde{C}_t \equiv C_t - N_t + 1$ and $\tilde{C}_t^* \equiv C_t^* - N_t^* + 1$. From (G.3), we have

$$\tilde{c}_t = \theta_t + \underbrace{(1-\gamma)\left[(p_t^{N*} - p_t^{T*}) - (p_t^N - p_t^T)\right]}_{q_t} + \tilde{c}_t^* \tag{G.4}$$

The optimality conditions of firms in the tradable goods sector lead to the following New-Keynesian Phillips curves for Home and Foreign:

$$\dot{\pi}_{Ht}^T = \rho \pi_{Ht}^T - \kappa \left[(1-\gamma)(p_t^N - p_t^T) + \frac{1}{2} s_t + u_t\right] \tag{G.5a}$$

$$\dot{\pi}_{Ft}^{T*} = \rho \pi_{Ft}^{T*} - \kappa \left[(1-\gamma)(p_t^{N*} - p_t^{T*}) - \frac{1}{2} s_t + u_t^*\right] \tag{G.5b}$$

where we use

$$mc_t = \underbrace{w_t - p_t}_{=0} + \underbrace{(1-\gamma)(p_t^N - p_t^T) + \frac{1}{2} s_t}_{p_t - p_{Ht}^T}$$

$$mc_t^* = \underbrace{w_t^* - p_t^*}_{=0} + \underbrace{(1-\gamma)(p_t^{N*} - p_t^{T*}) - \frac{1}{2} s_t}_{p_t^* - p_{Ft}^{T*}}$$

Note that because prices are fully rigid in the non-tradable sector, we have $p_t^N = p_t^{N*} = 0$. Finally, market clearing for non-tradable goods and tradable goods requires

$$y_t^N = c_t^N, \quad \text{and} \quad y_t^{N*} = c_t^{N*} \tag{G.6}$$

$$y_t^T = \frac{1}{2} c_t^T + \frac{1}{2} c_t^{T*} + \frac{1}{2} \eta s_t \quad \text{and} \quad y_t^{T*} = \frac{1}{2} c_t^{T*} + \frac{1}{2} c_t^T - \frac{1}{2} \eta s_t \tag{G.7}$$

Efficient allocation. The socially optimal allocation maximizes:

$$v_t \equiv \frac{1}{2}\log\left(\left(Y_t^N\right)^{1-\gamma}\left[(1-\alpha)^{\frac{1}{\eta}}\left(C_{H,t}^T\right)^{\frac{\eta-1}{\eta}}+\alpha^{\frac{1}{\eta}}\left(C_{F,t}^T\right)^{\frac{\eta-1}{\eta}}\right]^{\frac{\gamma\eta}{\eta-1}}-\gamma\left(\frac{Y_t^N}{A}+Y_t^T\right)+1\right) \tag{G.8}$$
$$+\frac{1}{2}\log\left(\left(Y_t^{N*}\right)^{1-\gamma}\left[(1-\alpha)^{\frac{1}{\eta}}\left(C_{F,t}^{T*}\right)^{\frac{\eta-1}{\eta}}+\alpha^{\frac{1}{\eta}}\left(C_{H,t}^{T*}\right)^{\frac{\eta-1}{\eta}}\right]^{\frac{\gamma\eta}{\eta-1}}-\gamma\left(\frac{Y_t^{N*}}{A}+Y_t^{T*}\right)+1\right)$$

subject to

$$Y_t^T = C_{H,t}^T + C_{H,t}^{T*} \tag{G.9}$$
$$Y_t^{T*} = C_{F,t}^T + C_{F,t}^{T*} \tag{G.10}$$

with $A=\frac{\gamma}{1-\gamma}$. First, note that the first-order conditions for Y_t^N and Y_t^{N*} yield

$$C_t = Y_t^N \qquad \text{and} \qquad C_t^* = Y_t^{N*} \tag{G.11}$$

from which it also follows $C_t^T = Y_t^N = C_t$ and $C_t^{T*} = Y_t^{N*} = C_t^*$. Using this relationship, we can express the optimality conditions for C_{Ht}^T, C_{Ft}^T as

$$1 = \left[(1-\alpha)\frac{C_t^T}{C_{H,t}^T}\right]^{\frac{1}{\eta}}, \qquad \frac{\tilde{C}_t}{\tilde{C}_t^*} = \left[\alpha\frac{C_t^T}{C_{F,t}^T}\right]^{\frac{1}{\eta}} \tag{G.12}$$

and the optimality conditions for C_{Ht}^T, C_{Ft}^T as

$$1 = \left[(1-\alpha)\frac{C_t^{T*}}{C_{F,t}^{T*}}\right]^{\frac{1}{\eta}}, \qquad \frac{\tilde{C}_t^*}{\tilde{C}_t} = \left[\alpha\frac{C_t^{T*}}{C_{H,t}^{T*}}\right]^{\frac{1}{\eta}} \tag{G.13}$$

from which we arrive at $C_{Ft}^{T,e} = C_{Ht}^{T*,e} = \alpha$ and $C_{Ht}^{T,e} = C_{Ft}^{T*,e} = 1-\alpha$ (where superscript e indicate efficient values) and

$$Y_t^{N,e} = C_t^{T,e} = C_t^e = Y_t^{T,e} = 1$$
$$Y_t^{N*,e} = C_t^{T*,e} = C_t^{*,e} = Y_t^{T*,e} = 1$$

Linear-Quadratic representation. Next, we derive the loss function. As in Appendix D, the loss relative to the efficient outcome is given by $v_t - v^{max}$, where v^{max} is the maximized v_t in the efficient allocation. We follow the same steps as in Appendix D. First, the second-order approximation of the period loss is given by

$$2(v_t - v_t^{max}) = \gamma\left[c_t^T + c_t^{T*} - (y_t^T + y_t^{T*}) - (z_t + z_t^*)\right] - \frac{1}{2}\gamma(1+\gamma)\left[\left(y_t^T\right)^2 + \left(y_t^{T*}\right)^2\right] \tag{G.14}$$
$$-\frac{1}{2}\gamma(1-\gamma)\left[\left(y_t^N\right)^2 + \left(y_t^{N*}\right)^2\right] + \gamma(1-\gamma)\left(c_t^T y_t^N + c_t^{T*} y_t^{N*}\right) + \gamma^2\left(c_t^T y_t^T + c_t^{T*} y_t^{T*}\right)$$

where $z_t \equiv \int_0^1 \left(\frac{P_{Ht}^T(l)}{P_{Ht}^T}\right)^{-\varepsilon} dl$ and $z_t^* \equiv \int_0^1 \left(\frac{P_{Ft}^{T*}(l)}{P_{Ft}^{T*}}\right)^{-\varepsilon} dl$ (we ignore $+o(||u||^3)$ indicating higher order terms are left out). Note that the second-order approximation of the market clearing condition for tradable goods in Home and Foreign

$$
\begin{aligned}
Y_t^T &= \left[\left(\frac{1}{2}+\frac{1}{2}\left(S_t\right)^{1-\eta}\right)^{\frac{1}{1-\eta}}\right]^{\eta}\left[\frac{1}{2}C_t^T+\frac{1}{2}C_t^{T*}\right] \\
Y_t^{T*} &= \left[\left(\frac{1}{2}+\frac{1}{2}\left(S_t\right)^{\eta-1}\right)^{\frac{1}{1-\eta}}\right]^{\eta}\left[\frac{1}{2}C_t^{T*}+\frac{1}{2}C_t^T\right]
\end{aligned}
$$

are respectively given by

$$y_t^T = \frac{1}{2}c_t^T+\frac{1}{2}c_t^{T*}+\frac{1}{2}\eta s_t+\frac{1}{8}\left(c_t^T-c_t^{T*}\right)^2-\frac{1}{8}\eta(\eta-1)\left(s_t\right)^2, \tag{G.16a}$$

$$y_t^{T*} = \frac{1}{2}c_t^T+\frac{1}{2}c_t^{T*}-\frac{1}{2}\eta s_t+\frac{1}{8}\left(c_t^T-c_t^{T*}\right)^2-\frac{1}{8}\eta(\eta-1)\left(s_t\right)^2. \tag{G.16b}$$

Using (G.16a) and (G.16b), we can express (G.14) in the difference and world format as

$$
\begin{aligned}
2(v_t-v_t^{max}) = &-\gamma\left[\left(c_t^{T,D}\right)^2+\left(\frac{1}{\eta}-1\right)\left(y_t^{T,D}\right)^2+\left(z_t+z_t^*\right)\right]-\gamma(1+\gamma)\left[\left(y_t^{T,W}\right)^2+\left(y_t^{T,D}\right)^2\right] \quad \text{(Go)} \\
&-\gamma(1-\gamma)\left[\left(y_t^{N,W}\right)^2+\left(y_t^{N,D}\right)^2\right]+2\gamma(1-\gamma)\left[y_t^{T,W}y_t^{N,W}+c_t^{T,D}y_t^{N,D}\right]+2\gamma^2\left[\left(y_t^{T,W}\right)^2+c_t^{T,D}y_t^{T,D}\right]
\end{aligned}
$$

where we use $\eta s_t = y_t^T - y_t^{T*}$, and recall that for any variable x_t, we have $x_t^W = \frac{1}{2}(x_t+x_t^*)$ and $x_t^D = \frac{1}{2}(x_t-x_t^*)$. Finally, we use (G.1), $\tilde{c}_t = c_t^T - y_t^T$ and $\tilde{c}_t^* = c_t^{T*} - y_t^{T*}$, to rewrite (G.4) as

$$c_t^{T,D} = \frac{1}{2}\theta_t + (1-\gamma)y_t^{N,D} + \gamma y_t^{T,D} \tag{G.17}$$

Substituting (G.17) into (Go), we arrive at

$$
\begin{aligned}
v_t - v_t^{max} = -\frac{1}{2}\gamma\Bigg[&\left(z_t+z_t^*\right)+(1-\gamma)\left(y_t^{T,W}\right)^2+(1-\gamma)\left(y_t^{N,W}\right)^2+\left(\frac{1}{\eta}+\gamma(1-\gamma)\right)\left(y_t^{T,D}\right)^2 \\
&+\gamma(1-\gamma)\left(y_t^{N,D}\right)^2-2(1-\gamma)\left(y_t^{T,W}y_t^{N,W}+\gamma y_t^{T,D}y_t^{N,D}\right)+\frac{1}{4}\left(\theta_t\right)^2\Bigg].
\end{aligned}
$$

Finally, noting that $\int_0^\infty e^{-\rho t} z_t dt = \frac{\varepsilon}{\kappa}\int_0^\infty e^{-\rho t}\left(\pi_{Ht}^T\right)^2 dt$ and $\int_0^\infty e^{-\rho t} z_t^* dt = \frac{\varepsilon}{\kappa}\int_0^\infty e^{-\rho t}\left(\pi_{Ft}^{T*}\right)^2 dt$, we can write the loss function $\mathcal{L} = \int_0^\infty e^{-\rho t}(v_t^{max} - v_t)dt$ as

$$
\begin{aligned}
\mathcal{L} = \frac{\gamma}{2}\int_0^\infty e^{-\rho t}\Bigg[&\frac{\varepsilon}{\kappa}\left(\pi_t^W\right)^2+\frac{\varepsilon}{\kappa}\left(\pi_t^D\right)^2+(1-\gamma)\left(y_t^{T,W}-y_t^{N,W}\right)^2 \\
&+\frac{1}{\eta}\left(y_t^{T,D}\right)^2+\gamma(1-\gamma)\left(y_t^{T,D}-y_t^{N,D}\right)^2+\frac{1}{4}\left(\theta_t\right)^2\Bigg]dt
\end{aligned} \tag{G.18}
$$

where we have defined $\pi_t^W \equiv \frac{1}{2}(\pi_{Ht}^T + \pi_{Ft}^{T*})$ and $\pi_t^D \equiv \frac{1}{2}(\pi_{Ht}^T - \pi_{Ft}^{T*})$.

Optimal policy. The optimal policy problem minimizes (G.18) subject to (G.1), (G.5a), (G.5b), (G.6), (G.17), $c_t^{T,W} = y_t^{T,W}$ and $\eta s_t = 2y_t^{T,D}$. Noting that $\frac{1}{2}(p_t^T + p_t^{T*}) = \frac{1}{2}(p_{Ht}^T + p_{Ft}^{T*})$ and $\frac{1}{2}(p_t^T - p_t^{T*}) = \frac{1}{2}(p_{Ht}^T - p_{Ft}^{T*}) + \frac{1}{2}s_t$, the optimally policy problem can be expressed as

$$\min \frac{1}{2}\int_0^\infty e^{-\rho t}\left[\frac{\varepsilon}{\kappa}(\pi_t^W)^2 + \frac{\varepsilon}{\kappa}(\pi_t^D)^2 + (1-\gamma)\left(y_t^{T,W} - y_t^{N,W}\right)^2 \right.$$
$$\left. + \frac{1}{\eta}(y_t^{T,D})^2 + \gamma(1-\gamma)\left(y_t^{T,D} - y_t^{N,D}\right)^2 + \frac{1}{4}(\theta_t)^2\right]dt$$

subject to

$$y_t^{N,W} = y_t^{T,W} + p_t^W \tag{G.19}$$
$$\gamma y_t^{N,D} = \left(\frac{1}{\eta} + \gamma\right) y_t^{T,D} + \frac{1}{2}\theta_t + p_t^D \tag{G.20}$$
$$\dot{\pi}_t^W = \rho \pi_t^W - \kappa\left[(1-\gamma)(y_t^{T,W} - y_t^{N,W}) + u_t^W\right] \tag{G.21}$$
$$\dot{\pi}_t^D = \rho \pi_t^D - \kappa\left[(1-\gamma)\left(\frac{1}{2}\theta_t - \gamma y_t^{N,D} + \gamma y_t^{T,D}\right) + u_t^D\right] \tag{G.22}$$
$$\dot{p}_t^W = \pi_t^W \tag{G.23}$$
$$\dot{p}_t^D = \pi_t^D \tag{G.24}$$

where we have defined $p_t^W \equiv \frac{1}{2}(p_{Ht}^T + p_{Ft}^{T*})$ and $p_t^D \equiv \frac{1}{2}(p_{Ht}^T - p_{Ft}^{T*})$. Let λ_t^W and λ_t^D denote the multipliers on (G.19) and (G.20), and φ_t^W, φ_t^D, v_t^W and v_t^D denote the costate variables on (G.21), (G.22), (G.23) and (G.24). The optimality condition for θ_t is

$$\frac{1}{2}\theta_t - (1-\gamma)\,\kappa\varphi_t^D + \lambda_t^D = 0. \tag{G.25}$$

Combining it with the optimality conditions for y_t^N, which is given by

$$\gamma(1-\gamma)\left(y_t^{N,D} - y_t^{T,D}\right) + \gamma\,(1-\gamma)\,\kappa\varphi_t^D - \gamma\lambda_t^D = 0,$$

we arrive at the targeting rule

$$\theta_t = 2(1-\gamma)\left(y_t^{T,D} - y_t^{N,D}\right). \tag{G.26}$$

Substituting (G.26) into (G.17), we get $c_t^{T,D} = y_t^{T,D}$ which together with $c_t^{T,W} = y_t^{T,W}$ yields $c_t^T = y_t^T$ and $c_t^{T*} = y_t^{T*}$. Finally, note that to a first-order, $NX_t = Y_t^T - \frac{P_t^T}{P_{Ht}^T}C_t^T$ are given by

$$nx_t = \underbrace{y_t^T - c_t^T}_{=0} - \frac{1}{2}s_t = -\frac{1}{\eta}y_t^{T,D}. \tag{G.27}$$

G.2 Fully Rigid Nominal Wages and Intermediate Inputs

In our baseline, we consider that labor is the only factor of production. In this section, we incorporate intermediate inputs and show how our results extend to the case where the nominal wage is rigid.

Household's preferences continue to be described by (1), that is

$$\int_0^\infty e^{-\rho t}\left[\log C_t - \frac{1}{1+\phi}N_t^{1+\phi}\right]dt,$$

where C_t is an aggregate of non-tradable consumption C_t^N and tradabe consumption C_t^T according to (41) and the tradable consumption bundle C_t^T is a CES aggregate of home tradable goods C_{Ht}^T and foreign tradable goods C_{Ft}^T according to (42). Finally, aggregate hours is a linear combination of hours worked in the tradable and non-tradable sector $N_t = \gamma N_t^N + (1-\gamma)N_t^N$. The budget constraint of the household is given by

$$\dot{D}_t + \dot{B}_t = i_t D_t + i_{B,t}B_t + WN_t + \Pi_t - P_t^T C_t^T - P_t^N C_t^N, \tag{G.28}$$

Nominal wages are fully rigid $W_t = W$ for all t. Because nominal wages are fully rigid, households are off their labor supply. The key optimality conditions are given by

$$\dot{C}_t = (i_t - \pi_t - \rho)C_t \tag{G.29}$$

$$\frac{P_t^N}{P_t^T} = \frac{1-\omega}{\omega}\frac{C_t^T}{C_t^N} \tag{G.30}$$

Linearizing (G.29) and (G.30), and using $c_t = (1-\gamma)c_t^N + \gamma c_t^T$ and $\pi_t = (1-\gamma)\pi_t^N + \gamma\pi_t^T$, we arrive at

$$\dot{c}_t^T = i_t - \pi_t^T - \rho \tag{G.31}$$

$$c_t^N = p_t^T - p_t^N + c_t^T \tag{G.32}$$

The problem of households in Foreign is symmetric. Combining the Euler equations for international bonds by Home households and Foreign households, and using (G.32) with its Foreign counterpart, we get

$$c_t^T - c_t^{T*} = \theta_t + (1-2\alpha)s_t. \tag{G.33}$$

Firms in the nontradable sector. Firms produce differentiated goods $l \in [0,1]$ using a decreasing return to scale technology that uses only labor inputs, $Y_t^N(l) = (N_t^N(l))^{1-\wp}$.

These firms also engage in infrequent price setting à la Calvo and receive a constant subsidy that offset monopoly power. To a first order, the optimal pricing decision is given by

$$\dot{\pi}_t^N = \rho \pi_t^N - \kappa \left[\frac{\wp}{1-\wp} y_t^N - p_t^N \right] \tag{G.34}$$

where we used the fact that nominal wages are rigid. The Foreign counterpart is

$$\dot{\pi}_t^{N*} = \rho \pi_t^{N*} - \kappa \left[\frac{\wp}{1-\wp} y_t^{N*} - p_t^{N*} \right] \tag{G.35}$$

Firms in the tradable sector. As in Berka et al. (2018), we assume that production of tradables requires non-tradable inputs. In particular, each firm in the tradable sector produces a differentiated goods $l \in [0,1]$ using a constant return to scale technology $Y_t^T(l) = (X_t^N(l))^{\mu}(N_t^T(l))^{1-\mu}$ where X_t^N denotes non-tradable inputs. The minimized unit cost of production yields the following real marginal cost

$$MC_t = \frac{1}{P_{Ht}^T} \left(\frac{P_t^N}{\mu} \right)^{\mu} \left(\frac{W}{1-\mu} \right)^{1-\mu}, \quad \text{and} \quad W N_t^T(l) = \frac{1-\mu}{\mu} P_t^N X_t^N(l) \tag{G.36}$$

As in Section 2.2, firms in the tradable sector engage in infrequent price setting à la Calvo and receive a constant production subsidy that offset monopoly power. To a first order, the optimal pricing decision is now given by

$$\dot{\pi}_{Ht}^T = \rho \pi_{Ht}^T - \kappa \left[\mu \Big(\underbrace{c_t^T - c_t^N}_{p_t^N - p_t^T} + \underbrace{\alpha s_t}_{p_t^T - p_{Ht}^T} \Big) - (1-\mu) p_{Ht}^T + u_t \right] \tag{G.37}$$

The Foreign counterpart is

$$\dot{\pi}_{Ft}^{T*} = \rho \pi_{Ft}^{T*} - \kappa \left[\mu (c_t^{T*} - c_t^{N*} - \alpha s_t) - (1-\mu) p_{Ft}^{T*} + u_t^* \right] \tag{G.38}$$

Markets clearing. Markets clearing for nontradables requires $Y_t^N = C_t^N + X_t^N$ and $Y_t^{N*} = C_t^{N*} + X_t^{N*}$. Markets clearing for tradables imply $y_t^T = (1-\alpha)c_t^T + \alpha c_t^{T*} + 2\alpha(1-\alpha)\eta s_t$ and $y_t^{T*} = (1-\alpha)c_t^{T*} + \alpha c_t^T - 2\alpha(1-\alpha)\eta s_t$ which imply

$$\omega s_t = y_t^T - y_t^{T*} - (1-2\alpha)\theta_t. \tag{G.39}$$

Using (G.33) and (G.39), we can express (G.37) and (G.38) in "difference" format as

$$\dot{\pi}_t^{T,D} = \rho \pi_t^{T,D} - \kappa \left[\frac{\mu}{\omega} y_t^{T,D} + \left(1 - \frac{1-2\alpha}{\omega} \right) \frac{\mu}{2} \theta_t - \mu c_t^{N,D} - (1-\mu) p_t^{T,D} + u_t^D \right] \tag{G.40}$$

Notice how similar to (30b), for given outputs, higher θ_t raises marginal costs in Home relative to Foreign.

Calibration. We close the model by assuming central banks follow standard Taylor rules

$$i_t = \rho + \phi_\pi(\pi_t^T + \pi_t^N) + \phi_y(y_t^T + y_t^N)$$
$$i_t^* = \rho + \phi_\pi(\pi_t^{T*} + \pi_t^{N*}) + \phi_y(y_t^{T*} + y_t^{N*})$$

and we compare two capital flow regimes $\theta_t = 0$ (free capital mobility regime) and $\theta_t = \wp \cdot y_t^{T,D}$ (managed capital flow regime) where $\wp = 2\left[1 - \frac{1-2\alpha}{2(1-\alpha)\eta}\right] = \frac{5}{3}$ as in (37). We solve the model quantitatively and, as in Schmitt-Grohe and Uribe (2016), we set $\gamma = \frac{1}{2}$. We set to $1 - \mu = 0.6$ as in Berka, Devereux and Engel (2018) and set $\wp = 0.3$ which imply an aggregate labor share of 66%. The remaining parameter values are presented in Table 4. Figure G.1 shows the managed capital flow regime delivers important stabilization gains and the welfare gain is 0.01% of permanent consumption.

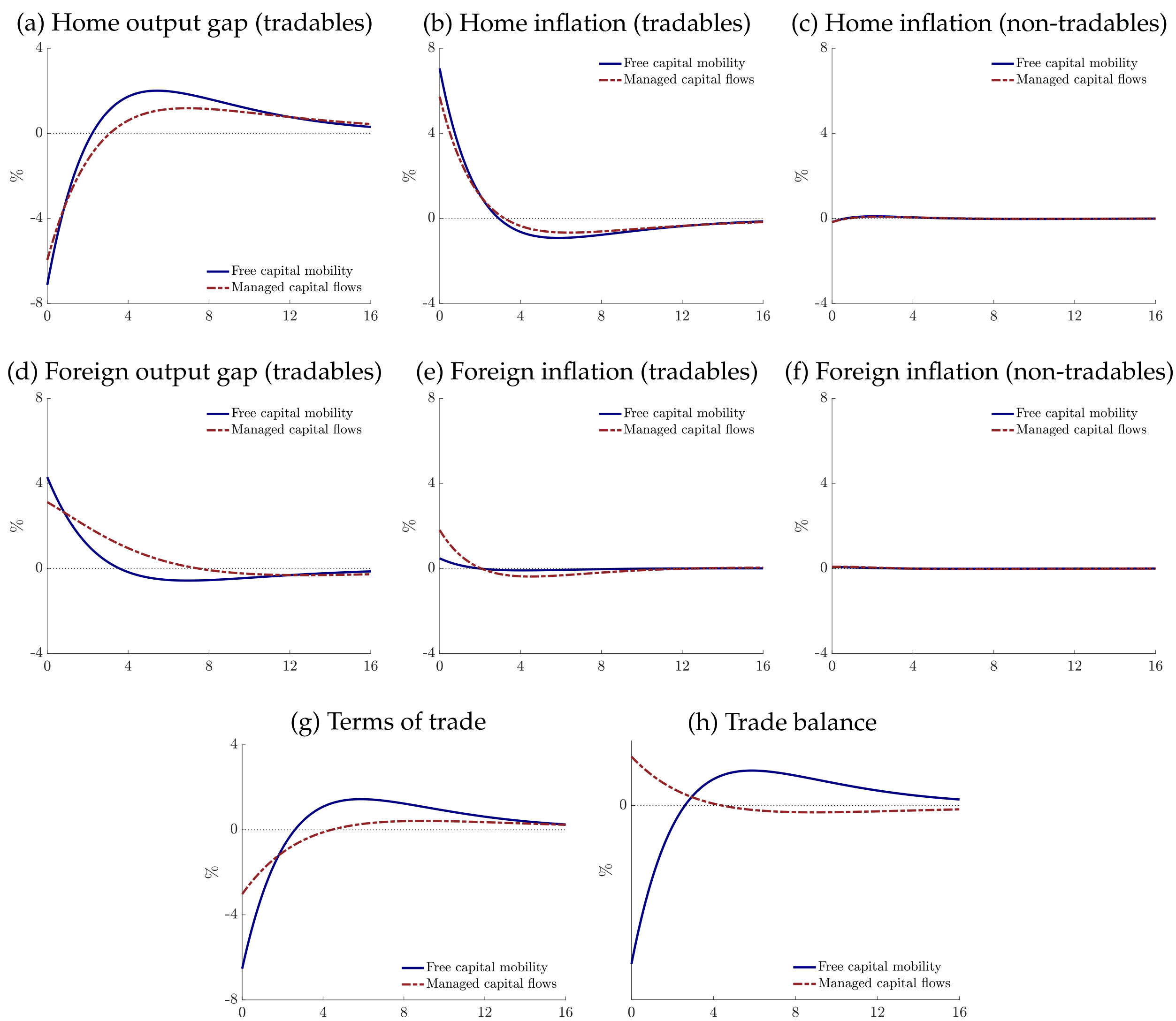


Figure G.1: Impulse responses to an inflationary cost-push shock in Home

H Non-Cooperative Policy

As explained in Section 5, to make the model tractable, we assume nominal rigidities in the form of Rotemberg adjustment costs. Specifically, we assume that firms face costly price adjustments. Under our producer currency pricing assumption, a firm sets a single price in its own currency, and the law of one price holds, i.e. $P^*_{Ht}(l) = \frac{1}{\mathcal{E}_t} P_{Ht}(l)$. The problem of the firm in the Home country consists in choosing the price of its variety $P_{Ht}(l)$ to solve

$$\max_{P_{Ht(l)}} \int_0^\infty \frac{e^{-\rho t}}{P_t C_t} \left\{ \left((1+\tau^y) P_{Ht}(l) - \mathcal{MC}_t \right) \left(\frac{P_{Ht}(l)}{P_{Ht}} \right)^{-\varepsilon} C_{Ht} - \frac{\chi}{2} \left(\pi_{Ht}(l) \right)^2 P_{Ht} C_{Ht} \right\} dt,$$

$$\text{subject to} \quad \pi_{Ht}(l) = \frac{\dot{P}_{Ht}(l)}{P_{Ht}(l)} \tag{H.1}$$

where τ^y is a constant production subsidy set to offset firms' monopoly power. Letting v_t denote the costate on (H.1), the first-order conditions are

$$\dot{v}_t - \left(\rho + \pi_t + \frac{\dot{C}_t}{C_t} \right) v_t = \left[(1+\tau^y)(\varepsilon - 1) - \varepsilon \frac{\mathcal{MC}_t}{P_{Ht}(l)} \right] C_{Ht}(l) - \pi_{Ht}(l) v_t \tag{H.2}$$

$$P_{Ht}(l) v_t = \chi \pi_{Ht}(l) P_{Ht} C_{Ht} \tag{H.3}$$

Differentiating (H.3) then substituting it into (H.2), we arrive at

$$\dot{\pi}_{Ht} = \rho \pi_{Ht} - \kappa \left[C_t \left(N_t \right)^{\phi} \left(S_t \right)^{\alpha} - \xi_t \right] \tag{H.4}$$

where we use (7) and $\frac{\dot{C}_{Ht}}{C_{Ht}} = \frac{\dot{C}_t}{C_t} + \pi_t - \pi_{Ht}$,and where $\kappa \equiv \frac{\varepsilon}{\chi}$ and ξ_t is the cost-push shock. The problem of the firm in Foreign is analogous and the optimal pricing decision yields

$$\dot{\pi}^*_{Ft} = \rho \pi^*_{Ft} - \kappa \left[C^*_t \left(N^*_t \right)^{\phi} \left(S_t \right)^{-\alpha} - \xi^*_t \right]. \tag{H.5}$$

where ξ^*_t is the cost-push shock in Foreign.

Markets clearing. Aggregate output satisfies $Y_t = N_t$ in Home and $Y_t = N^*_t$ in Foreign. Goods market clearing in both countries requires

$$Y_t = \Delta_{Ht} \Big[\underbrace{(1-\alpha) \left(\mathcal{S}_t \right)^{\alpha} C_t}_{C_{Ht}} + \underbrace{\alpha \left(\mathcal{S}_t \right)^{1-\alpha} C^*_t}_{C^*_{Ht}} \Big]$$

$$Y^*_t = \Delta^*_{Ft} \Big[\underbrace{(1-\alpha) \left(\mathcal{S}_t \right)^{-\alpha} C^*_t}_{C^*_{Ft}} + \underbrace{\alpha \left(\mathcal{S}_t \right)^{\alpha-1} C_t}_{C_{Ft}} \Big]$$

where $\Delta_{Ht} = \left[1 - \frac{\chi}{2}(\pi_{Ht})^2\right]^{-1}$ and $\Delta_{Ft} = \left[1 - \frac{\chi}{2}(\pi^*_{Ft})^2\right]^{-1}$.

Using the international sharing condition, $C_t = \Theta_t (S_t)^{1-2\alpha} C^*_t$, demand can be expressed as

$$C_t = \left[\frac{Y_t}{(1-\alpha+\alpha\Theta_t^{-1})\Delta_{Ht}}\right]^{1-\alpha} \left[\frac{\Theta_t Y^*_t}{(1-\alpha+\alpha\Theta_t)\Delta^*_{Ft}}\right]^{\alpha} \tag{H.6}$$

$$C^*_t = \left[\frac{Y^*_t}{(1-\alpha+\alpha\Theta_t)\Delta^*_{Ft}}\right]^{1-\alpha} \left[\frac{\Theta_t^{-1} Y_t}{(1-\alpha+\alpha\Theta_t^{-1})\Delta_{Ht}}\right]^{\alpha} \tag{H.7}$$

Notice that the efficient allocation continues to be given by $C^e_t = C^{*e}_t = N^e_t = N^{*e}_t = 1$. Next, we re-derive the optimal cooperative solution and show that it corresponds to the one in the log-linearized model. Then, we derive the non-cooperative solution.

Cooperative policy. The problem of the planner under cooperative policy is given by

$$\max_{Y_t, Y^*_t, \pi_{Ht}, \pi^*_{Ft}, \Theta_t} \int_0^\infty e^{-\rho t} \left\{ \left[\log\left(\frac{Y_t}{\Delta_{Ht}}\right) - \frac{(Y_t)^{1+\phi}}{1+\phi}\right] - \log\left(1-\alpha+\alpha\Theta_t^{-1}\right) + \left[\log\left(\frac{Y^*_t}{\Delta^*_{Ft}}\right) - \frac{(Y^*_t)^{1+\phi}}{1+\phi}\right] - \log\left(1-\alpha+\alpha\Theta_t\right) \right\} dt$$

subject to

$$\dot{\pi}_{Ht} = \rho\pi_{Ht} - \kappa\left[\frac{(Y_t)^{1+\phi}}{(1-\alpha+\alpha\Theta_t^{-1})\Delta_{Ht}} - \xi_t\right] \tag{H.8}$$

$$\dot{\pi}^*_{Ft} = \rho\pi^*_{Ft} - \kappa\left[\frac{(Y^*_t)^{1+\phi}}{(1-\alpha+\alpha\Theta_t)\Delta^*_{Ft}} - \xi^*_t\right] \tag{H.9}$$

We let μ_t and μ^*_t denote the costate on the implementability constraints (H.8) and (H.9). The first-order conditions for Y_t, Y^*_t, π_{Ht} and π^*_{Ft} are respectively given by

$$(1+\phi)\kappa\mu_t = \frac{(1-\alpha+\alpha\Theta_t^{-1})\Delta_{Ht}}{(Y_t)^{1+\phi}}\left[1-(Y_t)^{1+\phi}\right] \tag{H.10}$$

$$(1+\phi)\kappa\mu^*_t = \frac{(1-\alpha+\alpha\Theta_t)\Delta^*_{Ft}}{(Y^*_t)^{1+\phi}}\left[1-(Y^*_t)^{1+\phi}\right] \tag{H.11}$$

$$\dot{\mu}_t = \chi\Delta_{Ht}\pi_{Ht} - \frac{(Y_t)^{1+\phi}}{1-\alpha+\alpha\Theta_t^{-1}}\kappa\,\chi\pi_{Ht}\mu_t \tag{H.12}$$

$$\dot{\mu}^*_t = \chi\Delta^*_{Ft}\pi^*_{Ft} - \frac{(Y^*_t)^{1+\phi}}{1-\alpha+\alpha\Theta_t}\kappa\,\chi\pi^*_{Ft}\mu^*_t \tag{H.13}$$

and the optimality condition for Θ_t is given by

$$\frac{\alpha\Theta_t^{-2}}{1-\alpha+\alpha\Theta_t^{-1}}-\frac{\alpha}{1-\alpha+\alpha\Theta_t}-\frac{\alpha\Theta_t^{-2}(Y_t)^{1+\phi}}{(1-\alpha+\alpha\Theta_t^{-1})^2\Delta_{Ht}}\kappa\mu_t+\frac{\alpha(Y_t^*)^{1+\phi}}{(1-\alpha+\alpha\Theta_t)^2\Delta_{Ft}^*}\kappa\mu_t^*=0 \tag{H.14}$$

Using (H.10) to substitute for μ_t in (H.12) and linearizing it around the efficient steady-state allocation (where $Y_t^e = 1$ and $\pi_{Ht}^e = 0$) yields

$$\dot{y}_t = -\varepsilon\, \pi_{Ht} \tag{H.15}$$

where we use the fact that, to a first-order, $1-(Y_t)^{1+\phi} = -(1+\phi)y_t$. Similarly, using (H.11) to substitute for μ_t^* in (H.12) and linearizing it around the efficient allocation yields

$$\dot{y}_t^* = -\varepsilon\, \pi_{Ft}^* \tag{H.16}$$

Finally, noting that a first-order approximation of (H.10) and (H.11) around the efficient stead-state imply $\mu_t = \frac{\chi}{\varepsilon}y_t$ and $\mu_t^* = \frac{\chi}{\varepsilon}y_t$, we obtain that the first-order approximation of (H.14) around the efficient allocation yields

$$2(1-\alpha)\theta_t = y_t - y_t^* \tag{H.17}$$

which corresponds to (44).

Non-cooperative policy. The problem of the central bank in Home is given by

$$\max_{Y_t, Y_t^*, \pi_{Ht}, \pi_{Ft}^*, \Theta_t} \int_0^\infty e^{-\rho t}\Bigg\{ \left[(1-\alpha)\log\left(\frac{Y_t}{\Delta_{Ht}}\right)+\alpha\log\left(\frac{Y_t^*}{\Delta_{Ft}^*}\right)\right] - \frac{(Y_t)^{1+\phi}}{1+\phi} \\ -(1-\alpha)\log\left(1-\alpha+\alpha\Theta_t^{-1}\right)-\alpha\log\left(1-\alpha+\alpha\Theta_t\right)\Bigg\}dt$$

subject to

$$\dot{x}_t^* = i_t^* - \pi_{Ft}^* - \rho \tag{H.18}$$

$$x_t^* = \log\left(\frac{Y_t^*}{(1-\alpha+\alpha\Theta_t)\Delta_{Ft}^*}\right) \tag{H.19}$$

$$\dot{\pi}_{Ht} = \rho\pi_{Ht} - \kappa\left[\frac{(Y_t)^{1+\phi}}{(1-\alpha+\alpha\Theta_t^{-1})\Delta_{Ht}} - \xi_t\right] \tag{H.20}$$

$$\dot{\pi}_{Ft}^* = \rho\pi_{Ft}^* - \kappa\left[\frac{(Y_t^*)^{1+\phi}}{(1-\alpha+\alpha\Theta_t)\Delta_{Ft}^*} - \xi_t^*\right] \tag{H.21}$$

$$0 = \int_0^\infty e^{-\rho t}\alpha\left(\Theta_t^{-1}-1\right)dt \tag{H.22}$$

We denote by λ_t, Λ_t, Γ_H the multipliers on (H.18), (H.19) and (H.22), and by μ_{Ht} and μ^*_{Ht} the costates on (H.20), (H.21) respectively. The first-order conditions for Y_t and Y^*_t are

$$(1-\alpha) - (Y_t)^{1+\phi} = \kappa \left[\frac{(Y_t)^{1+\phi}}{(1-\alpha+\alpha\Theta_t^{-1})\Delta_{Ht}} \right] (1+\phi)\mu_{Ht} \tag{H.23}$$

$$\alpha + \Lambda_t = \kappa \left[\frac{(Y^*_t)^{1+\phi}}{(1-\alpha+\alpha\Theta_t)\Delta^*_{Ft}} \right] (1+\phi)\mu^*_{Ht} \tag{H.24}$$

and the optimality condition for Θ_t is given by

$$\frac{\alpha(1-\alpha)\Theta_t^{-2}}{1-\alpha+\alpha\Theta_t^{-1}} + \frac{\alpha(1-\alpha)\Theta_t^{-2}}{(1-\alpha)\Theta_t^{-1}+\alpha} - \frac{\alpha}{1-\alpha+\alpha\Theta_t}\Lambda_t - \frac{\alpha\Theta_t^{-2}(Y_t)^{1+\phi}}{(1-\alpha+\alpha\Theta_t^{-1})^2\Delta_{Ht}}\kappa\mu_{Ht} + \frac{\alpha(Y^*_t)^{1+\phi}}{(1-\alpha+\alpha\Theta_t)^2\Delta^*_{Ft}}\kappa\mu^*_{Ht} - \alpha\Theta^{-2}\Gamma_H = 0$$

which, using (H.23), can be rewritten as

$$\frac{1-\alpha}{1-\alpha+\alpha\Theta_t^{-1}} + \frac{1-\alpha}{(1-\alpha)\Theta_t^{-1}+\alpha} + \frac{\alpha\Theta_t^2}{1-\alpha+\alpha\Theta_t} - \frac{(Y_t)^{1+\phi}}{(1-\alpha+\alpha\Theta_t^{-1})^2\Delta_{Ht}}\kappa\mu_{Ht} - \alpha\Gamma_H = 0 \tag{H.25}$$

The problem of the central bank in Foreign is given by

$$\max_{Y_t, Y^*_t, \pi_{Ht}, \pi^*_{Ft}, \Theta_t} \int_0^\infty e^{-\rho t} \Bigg\{ \left[(1-\alpha)\log\left(\frac{Y^*_t}{\Delta^*_{Ft}}\right) + \alpha\log\left(\frac{Y_t}{\Delta_{Ht}}\right) \right] - \frac{(Y^*_t)^{1+\phi}}{1+\phi} - (1-\alpha)\log(1-\alpha+\alpha\Theta_t) - \alpha\log\left((1-\alpha)\Theta_t+\alpha\right) \Bigg\} dt$$

subject to

$$\dot{x}_t = i_t - \pi_{Ht} - \rho \tag{H.26}$$

$$x_t = \log\left(\frac{Y_t}{(1-\alpha+\alpha\Theta_t^{-1})\Delta_{Ht}} \right) \tag{H.27}$$

$$\dot{\pi}_{Ht} = \rho\pi_{Ht} - \kappa \left[\frac{(Y_t)^{1+\phi}}{(1-\alpha+\alpha\Theta_t^{-1})\Delta_{Ht}} - \xi_t \right] \tag{H.28}$$

$$\dot{\pi}^*_{Ft} = \rho\pi^*_{Ft} - \kappa \left[\frac{(Y^*_t)^{1+\phi}}{(1-\alpha+\alpha\Theta_t)\Delta^*_{Ft}} - \xi^*_t \right] \tag{H.29}$$

$$0 = \int_0^\infty e^{-\rho t}\alpha(\Theta_t - 1)dt \tag{H.30}$$

We denote by λ_t^*, Λ_t^*, Γ_F^* the multipliers on (H.26), (H.27) and (H.30), and by μ_{Ft} and μ_{Ft}^* the costates on (H.28), (H.29) respectively. The first-order conditions for Y_t and Y_t^* are

$$(1-\alpha) - (Y_t^*)^{1+\phi} = \kappa \left[\frac{(Y_t^*)^{1+\phi}}{(1-\alpha+\alpha\Theta_t)\Delta_{Ft}^*} \right] (1+\phi)\mu_{Ft}^* \tag{H.31}$$

$$\alpha + \Lambda_t^* = \kappa \left[\frac{(Y_t)^{1+\phi}}{(1-\alpha+\alpha\Theta_t^{-1})\Delta_{Ht}} \right] (1+\phi)\mu_{Ft} \tag{H.32}$$

and the optimality condition for Θ_t is

$$-\frac{\alpha(1-\alpha)}{1-\alpha+\alpha\Theta_t} - \frac{\alpha(1-\alpha)}{(1-\alpha)\Theta_t+\alpha} + \frac{\alpha\Theta_t^{-2}}{1-\alpha+\alpha\Theta_t^{-1}}\Lambda_t^*$$
$$- \frac{\alpha\Theta_t^{-2}(Y_t)^{1+\phi}}{(1-\alpha+\alpha\Theta_t^{-1})^2\Delta_{Ht}}\kappa\mu_{Ft} + \frac{\alpha(Y_t^*)^{1+\phi}}{(1-\alpha+\alpha\Theta_t)^2\Delta_{Ft}^*}\kappa\mu_{Ft}^* + \alpha\Gamma_F^* = 0$$

which, using (H.32), can be rewritten as

$$-\frac{1-\alpha}{1-\alpha+\alpha\Theta_t} - \frac{1-\alpha}{(1-\alpha)\Theta_t+\alpha} - \frac{\alpha\Theta_t^{-2}}{1-\alpha+\alpha\Theta_t^{-1}} + \frac{(Y_t^*)^{1+\phi}}{(1-\alpha+\alpha\Theta_t)^2\Delta_{Ft}^*}\kappa\mu_{Ft}^* + \Gamma_F^* = 0 \tag{H.33}$$

To solve for the capital flows management policy in the non-cooperative equilibrium, first notice that by (H.23) and (H.31) that

$$\frac{\varepsilon}{\chi}\left[\frac{(Y_t^*)^{1+\phi}}{(1-\alpha+\alpha\Theta_t)\Delta_{Ft}^*} \right]\mu_{Ft}^* - \frac{\varepsilon}{\chi}\left[\frac{(Y_t)^{1+\phi}}{(1-\alpha+\alpha\Theta_t^{-1})\Delta_{Ht}} \right]\mu_{Ht} = \frac{1}{1+\phi}\left[(Y_t)^{1+\phi} - (Y_t^*)^{1+\phi} \right] \tag{H.34}$$

Then, we combine the optimality conditions for Θ_t in Home (H.25) and Foreign (H.33) and use (H.34) to get

$$\frac{1-\alpha}{1-\alpha+\alpha\Theta_t^{-1}} + \frac{1-\alpha}{(1-\alpha)\Theta_t^{-1}+\alpha} + \frac{\alpha\Theta_t^2}{1-\alpha+\alpha\Theta_t} - \Gamma_H + \Gamma_F^*$$
$$-\frac{1-\alpha}{1-\alpha+\alpha\Theta_t} - \frac{1-\alpha}{(1-\alpha)\Theta_t+\alpha} - \frac{\alpha\Theta_t^{-2}}{1-\alpha+\alpha\Theta_t^{-1}} + \frac{1}{1+\phi}\left[(Y_t)^{1+\phi} - (Y_t^*)^{1+\phi} \right] = 0 \tag{H.35}$$

Linearizing (H.35) around the efficient allocation, we arrive at

$$2\left[(1-\alpha)+\alpha(2-\alpha)\right]\theta_t = y_t - y_t^* \tag{H.36}$$

which corresponds to (45).

I Sensitivity

I.1 Model Prediction with Demand Shocks

In this section, we examine the model prediction for the relationship between capital flows and inflation when economies are hit by demand shocks and monetary policy does not respond optimally.[41] We introduce demand shocks in the form of discount factor shocks. So equations (F.1) and (F.2) become

$$\dot{c}_t^W = i_t^W - \pi_t^W - \rho - \zeta_t^W, \tag{I.1}$$

$$\dot{c}_t^D = i_t^D - \pi_t^D - \alpha \dot{s}_t - \zeta_t^D, \tag{I.2}$$

where ζ_t and ζ_t^* are the discount factor shocks in Home and Foreign, and $\zeta_t^W \equiv (\zeta_t + \zeta_t^*)/2$ and $\zeta_t^D \equiv (\zeta_t - \zeta_t^*)/2$. Figure I.1 presents impulse responses to demand shocks under free capital mobility when central banks follow the Taylor rules (36a) and (36b).

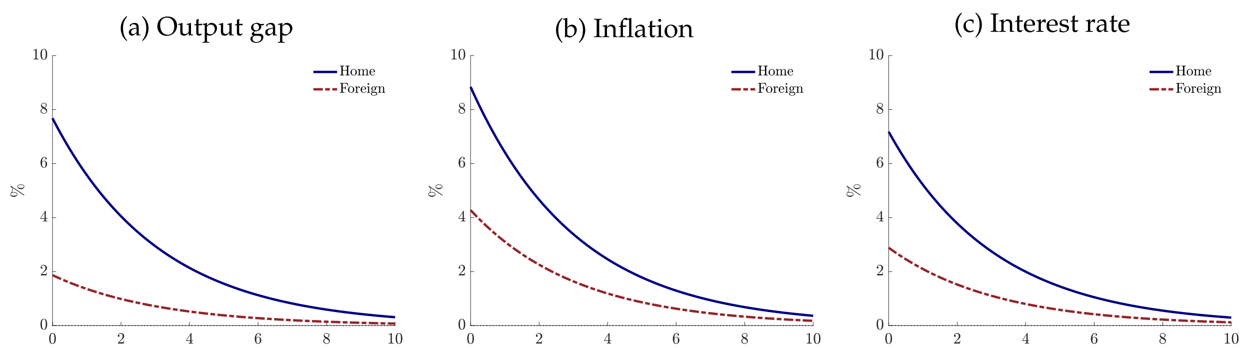


Figure I.1: Impulse responses to demand shocks under free capital mobility.

The key difference with the case of cost-push shocks (see Figure 4) is that when inflation arises because of a suboptimal response of monetary policy to demand shocks, the inflation rate and the output gap have the same sign. That is, countries experience simultaneously high inflation and a positive output gap. In contrast, in response to an inflationary cost-push shock, countries experiencing high inflation also experience a negative output gap.

Note that, as is standard in the New Keynesian literature, the impulse response of the macro variables presented in Figure 4 are in deviations from the efficient (flexible-price) allocation. Below, we present the response of net exports both in deviation from the steady state and in deviation from the efficient (flexible-price). The former represents whether the

[41] Notice that, in response to demand shocks, optimal monetary policy perfectly stabilize the economy by simultaneously stabilizing inflation and closing the output (i.e. $\pi_{Ht} = y_t = 0$ in Home and $\pi_{Ft}^* = y_t^* = 0$ in Foreign) and thus restore efficiency.

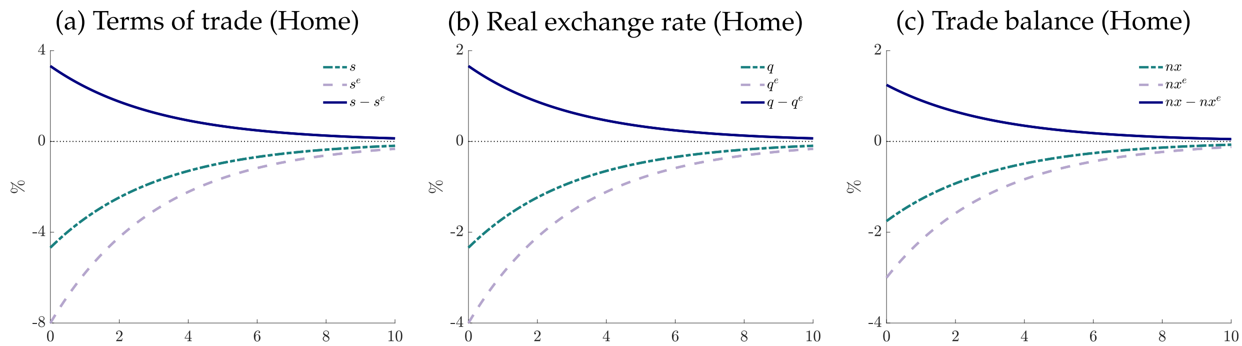


Figure I.1b: Terms of trade and trade balance in Home under free capital mobility.

Notes: For each variable X_t, note that x_t denote current allocation in deviation from steady state and x_t^e denote flexible price allocation in deviation from steady state.

country run a trade deficit or a trade surplus relative to pre-shock (steady-state) allocation, while the latter represents whether the country runs a larger deficit relative to what would prevail under flexible prices. Figure I.1b shows that following an adverse demand (discount factor) shock in Home, the country runs a trade deficit, although smaller than the deficit that would prevail under flexible price allocation. We also find that a capital flow management policy that follows the rule (37) generates welfare gains of about 0.03% of permanent consumption. Figure I.2 compares the model predictions and the data in this scenario where inflation is the result of a suboptimal response to demand shocks.

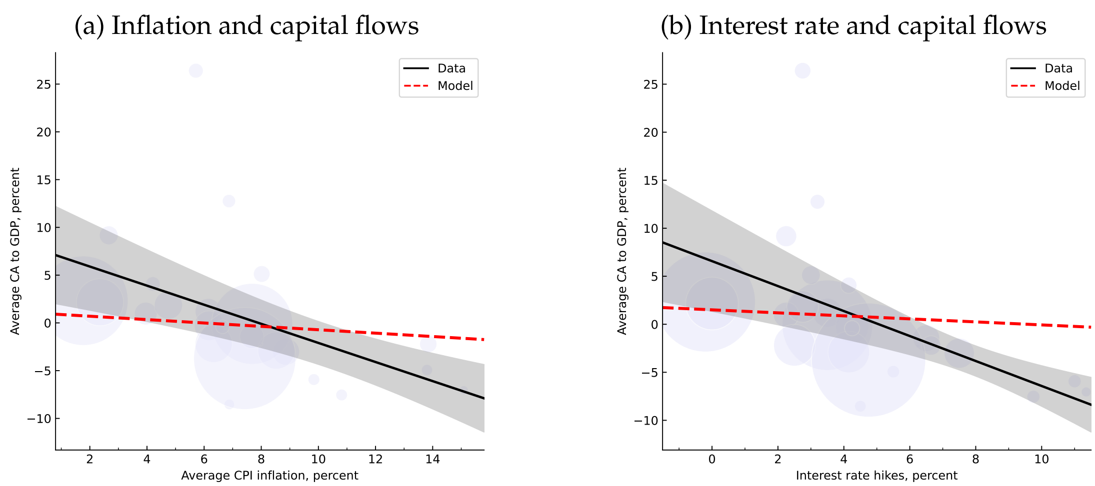


Figure I.2: Data vs. model prediction with demand shocks.

I.2 Model Prediction with Productivity Shocks

We examine now the model prediction for the relationship between capital flows and inflation when economies are hit by productivity shocks and monetary policy does not respond optimally.[42] As shown in Appendix C.5, the natural allocation with time-varying productivity is given by

$$N_t^e = N_t^{*e} = 1,$$
$$Y_t^e = A_t, \quad Y_t^{*e} = A_t^*,$$
$$C_t^e = A_t^{1-\alpha}\left(A_t^*\right)^{\alpha}, \quad C_t^{*e} = A_t^{\alpha}\left(A_t^*\right)^{1-\alpha}.$$

Figure I.3 presents the impulse response to productivity shocks under free capital mobility when central banks follow (36a) and (36b). The key difference with the inflationary cost-push shocks case (Figure 4) is that when inflation arises because of a suboptimal response of monetary policy to productivity shocks, inflation and output gap have the same sign.

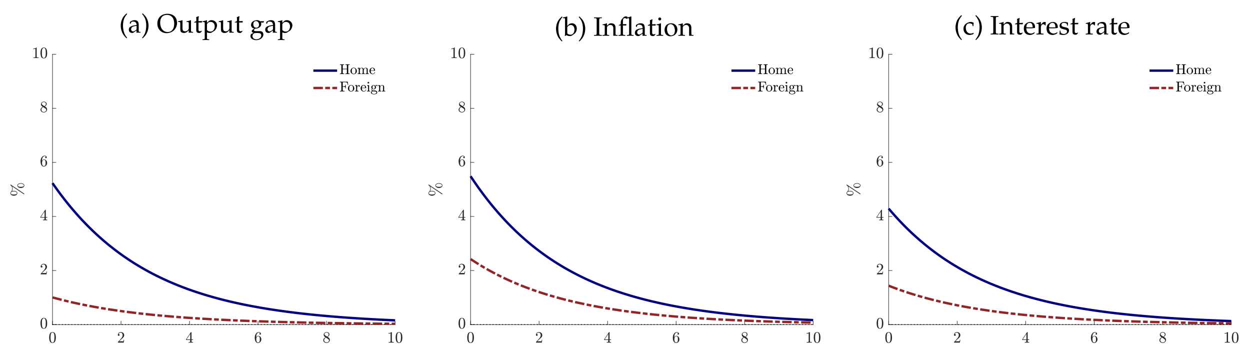


Figure I.3: Impulse responses to demand shocks under free capital mobility.

Again, the impulse response of the macro variables presented in Figure 4 are in deviations from the efficient (flexible-price) allocation. Similar to Figure I.1b with demand shocks, we present below the response of the trade balance both in deviation from the steady state and in deviation from the efficient (flexible-price).

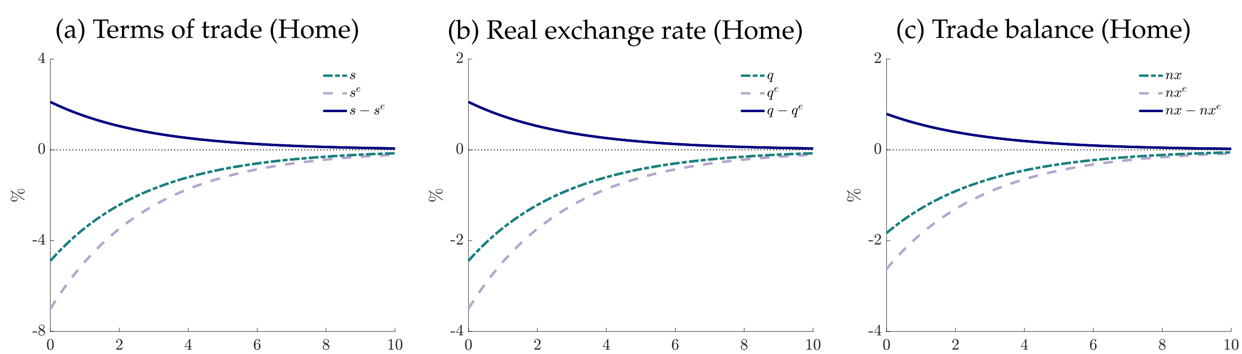


Figure I.3b: Terms of trade and trade balance in Home under free capital mobility.

[42]Notice that, in response to productivity shocks, optimal monetary policy perfectly stabilize the economy by simultaneously stabilizing inflation and closing the output and thus restore efficiency.

Figure I.3b shows that following a negative productivity shock in Home, the country runs a trade deficit, although smaller than the deficit that would prevail under flexible price allocation (panel[c]). We also find that a capital flow management policy that follows the rule (37) generates welfare gains of about 0.02% of permanent consumption. Figure I.4 compares the model predictions and the data in this scenario where inflation is the result of a suboptimal response to productivity shocks.

(a) Inflation and capital flows (b) Interest rate and capital flows

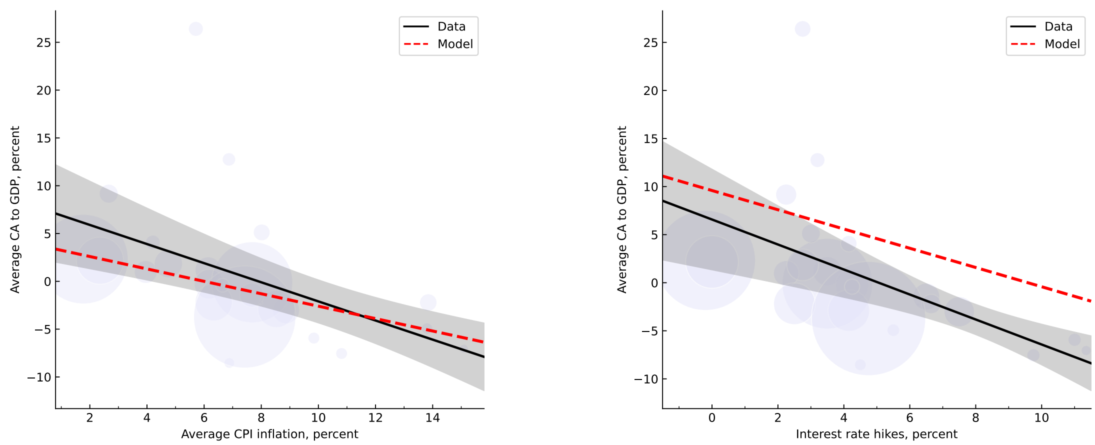


Figure I.4: Data vs. model prediction with productivity shocks.

I.3 Real rate and capital flows: sensitivity with alternative rules

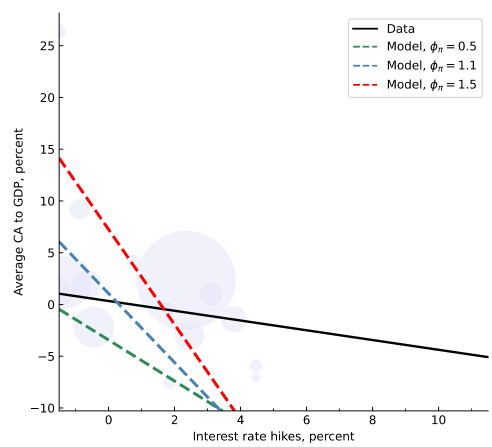


Figure I.5: Real rate and capital flows: data vs. model prediction.

Notes: The figure compares the predictions of the model and the data different values of ϕ_π in the Taylor rule. For $\phi_\pi = 0.5$, we characterize the minimum state variables and use the method of indeterminate coefficient to solve for the solution.