A Theory of Fear of Floating*

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Abstract

Central banks with flexible exchange rate regimes are often reluctant to let their currency float, a phenomenon known as "fear of floating." We develop a framework in which a floating exchange rate may exacerbate vulnerability to self-fulfilling financial crises rather than provide the intended insulation against external shocks. A commitment to a crawling peg—where the currency can fluctuate within a predetermined band—can help mitigate the risk of self-fulfilling crises. In contrast to the Mundell-Fleming paradigm, the optimal exchange rate policy entails allowing the exchange rate to float in response to real shocks while maintaining it fixed in response to non-fundamental shocks.

Keywords: Exchange rates, self-fulfilling financial crises, monetary policy

JEL Codes: E44, E52, F33, F34, F36, F41, F45, G01

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1 Introduction

According to the Mundell-Fleming paradigm, a floating exchange rate plays a pivotal role in stabilizing economic fluctuations in open economies. As argued by Friedman (1953), movements in exchange rates help accommodate real shocks in the presence of nominal rigidities, allowing the economy to achieve the allocations that would prevail under flexible prices. In practice, however, many central banks around the world are reluctant to let their exchange rate float. Indeed, the seminal work of Calvo and Reinhart (2002) documented that "countries that say they allow their exchange rate to float mostly do not—there seems to be an epidemic case of fear of floating." More recent findings from Rey (2015), Ilzetzki, Reinhart, and Rogoff (2019, 2021), and Fukui, Nakamura, and Steinsson (2023) underscore that fear of floating remains pervasive today.[1]

Why are central banks reluctant to let the currency float? A common argument raised in many policy discussions is that sharp exchange rate fluctuations can destabilize financial markets. Although an extensive literature has explored how depreciations may trigger adverse balance-sheet effects and potentially reduce the desired volatility of the exchange rate, existing studies still suggest that allowing the exchange rate to serve as a shock absorber remains optimal (e.g., Krugman, 1999; Ottonello, 2021). Furthermore, addressing financial disruptions often necessitates an even larger nominal depreciation to stabilize aggregate demand (e.g., Céspedes, Chang, and Velasco, 2004).[2] Thus, we contend that our understanding of fear of floating remains incomplete.[3]

In this paper, we develop a theory of "fear of floating" based on the idea that letting the exchange rate float may expose the economy to a self-fulfilling financial crisis. Our framework builds on the model of self-fulfilling financial crises proposed by Schmitt-Grohé and Uribe (2021) by incorporating nominal rigidities and examining the role of the exchange rate regime. We show that using the nominal exchange rate as an anchor—specifically through the adoption of a crawling band—can effectively shield the economy from self-fulfilling crises. More broadly, our model highlights the desirability of a managed

[1] Ilzetzki, Reinhart, and Rogoff (2019) classify only 10% of the world economy as pure floaters and 51% of the countries as fixed exchange rates. Fukui, Nakamura, and Steinsson (2023) find that even currencies that Ilzetzki, Reinhart, and Rogoff classify as managed floats exhibit comovements similar to currencies they classify as very hard pegs.

[2] For example, Céspedes, Chang, and Velasco (2004) states that "..in spite of financial imperfections and balance sheet effects, flexible exchange rates do play a useful insulating role against real external shocks, and the conventional ranking of fixed and flexible exchanges survives."

[3] To be clear, the existing literature can rationalize the desirability of a fixed exchange rate or joining a monetary union, but for motives unrelated to financial instability (see e.g., Alesina and Barro, 2002 and the literature we discuss below).

float, in which the central bank permits the exchange rate to float in response to real shocks while fixing it in response to non-fundamental shocks.

Our model has two key ingredients: downward nominal wage rigidity in the non-tradable sector, following Schmitt-Grohé and Uribe (2016), and a borrowing constraint on households linked to the value of their income, following Mendoza (2002). The first element implies that a nominal exchange rate depreciation can help reduce unemployment in response to adverse real shocks, echoing the traditional arguments for a flexible exchange rate (Friedman, 1953; Mundell, 1960). The second element implies that households do not internalize that deleveraging leads to a depreciation of the real exchange rate, tightening the borrowing constraint for other households (Bianchi, 2011) and potentially opening the door to multiple equilibria (Schmitt-Grohé and Uribe, 2021).

The central question we address is how the choice of exchange rate regime influences the vulnerability to self-fulfilling financial crises. To illustrate the main forces at play, consider a situation in which households suddenly become pessimistic and deleverage. This collective reduction in borrowing lowers the demand for both non-tradable goods and domestic currency, thereby tightening the collateral constraint and potentially turning the initial deleveraging into a self-reinforcing contraction. If the central bank allows the exchange rate to depreciate, two opposing effects emerge. For a given level of borrowing, the depreciation triggers expenditure switching towards non-tradable goods, boosting employment. For a given level of employment, however, it tightens the borrowing constraint and depresses aggregate demand. In contrast to the Mundell–Fleming framework, we show that when the second effect dominates, a nominal depreciation can contract employment by tightening households' borrowing constraint. Crucially, committing to a fixed exchange rate can rule out the emergence of a self-fulfilling crisis.

However, for high values of debt, an exchange rate peg does not uniquely implement the good equilibrium. Following the approach by Bassetto (2005) and Atkeson, Chari, and Kehoe (2010), we derive a "sophisticated monetary policy" that can uniquely implement the good equilibrium. Interestingly, the policy resembles a *crawling band*. When households turn pessimistic and expect capital outflows, the central bank lets the exchange rate fluctuate within a band to relax collateral constraints, and this rules out self-fulfilling crisis equilibrium.

On the other hand, we find that, crucially, optimal monetary policy in the absence of central bank commitment magnifies the vulnerability to self-fulfilling crises. When faced with pessimistic expectations, capital flows contract, leading the central bank to allow the currency to depreciate in an effort to reduce unemployment. However, this depreciation tightens the borrowing constraint and reinforces households' pessimistic expectations. This result implies that a freely floating exchange rate regime may be suboptimal. We interpret this finding as a manifestation of fear of floating.

Our quantitative analysis reveals that incorporating self-fulfilling financial crises can overturn the classic desirability of a flexible exchange rate. To explore the trade-off between the financial stability benefits of fixing the exchange rate uncovered in the paper, and the traditional stabilizing benefits of a flexible exchange rate regime, we extend the model to include fundamental shocks. In the absence of self-fulfilling crisis equilibria, our findings indicate that a free-floating exchange rate regime is desirable, consistent with standard models. However, when self-fulfilling crises are present, a fixed exchange rate can become preferable. Additionally, we observe that, in the absence of self-fulfilling crises, the exchange rate exhibits substantially less volatility than observed in the data, highlighting the importance of non-fundamental factors.

Overall, the theory provides a new perspective on exchange rate regimes. In particular, our findings call for a reappraisal of the Mundell-Fleming paradigm, suggesting that central banks should let the exchange rate float in response to real shocks but fix it in response to non-fundamental shocks.

Related literature. This paper is related to a vast literature on optimal monetary policy in open economies. A key theme in the literature, going back to Friedman (1953) and Mundell (1960), is that a flexible exchange rate regime helps insulate the economy from domestic and external shocks (Schmitt-Grohé and Uribe, 2001, 2016; Gali and Monacelli, 2005; Obstfeld and Rogoff, 2000; Kollmann, 2002; Clarida, Gali, and Gertler, 2001).

The phenomenon of fear of floating has motivated a large literature, examining potential departures from the Mundell-Fleming paradigm. This includes studies that consider frictions on firms and financial institutions access to capital markets (e.g., Aghion, Bacchetta, and Banerjee, 2000, 2004; Caballero and Krishnamurthy, 2001; Lahiri and Végh, 2001; Céspedes, Chang, and Velasco, 2004; Cook, 2004; Christiano, Gust, and Roldos, 2004; Gertler, Gilchrist, and Natalucci, 2007; Braggion, Christiano, and Roldos, 2009; Fornaro, 2015; Du and Schreger, 2022; Devereux and Yu, 2017; Gourinchas, 2018; Cavallino and Sandri, 2022; Devereux, Young, and Yu, 2019; Jiao, 2023) and households' borrowing (Coulibaly, 2023; Ottonello, 2021; Basu, Boz, Gopinath, Roch, and Unsal, 2025; De Ferra, Mitman, and Romei, 2020; Farhi and Werning, 2016). Despite potential adverse balance sheet effects resulting from a nominal depreciation and currency mismatches, a common conclusion in this literature is that a flexible exchange rate remains desirable. The distinctive feature of our paper is that the risk of financial disruptions can make it optimal for the central bank to commit to fixing the nominal exchange rate.

Our model is closest to Ottonello (2021), who examines optimal monetary policy in a similar framework but abstracting from self-fulfilling crises. He shows that a central bank may find it optimal to depart from the full-employment allocation to help relax households' borrowing constraint. Specifically, whenever households' borrowing constraint binds, the central bank may opt to keep employment relatively more depressed in the non-tradable sector to induce an appreciation of the real exchange rate and an improvement in households' borrowing conditions. Our analysis makes two contributions. First, we show that under certain configurations there is no trade-off: an appreciation can simultaneously expand household borrowing and employment, uncovering the possibility of expansionary appreciations or *contractionary depreciations*—a possibility first raised by Diaz-Alejandro (1963).[4] Second, we show that the risk of financial disruptions can make it optimal for the central bank to commit to a fixed nominal exchange rate. While the analysis in Ottonello (2021) suggests that limiting exchange rate fluctuations is desirable—and in this sense captures a notion of fear of floating—it implies a flexible regime remains optimal. The novel form of fear of floating in our paper is that financial disruptions can make it optimal for the central bank to avoid floating altogether.

Our paper belongs to the "third-generation" crisis literature. Central to our paper is the idea that general equilibrium feedback that operates through the real exchange rate can lead to multiple equilibria, as in Krugman (1998), Schneider and Tornell (2004), Bocola and Lorenzoni (2020), and Schmitt-Grohé and Uribe (2021). By incorporating nominal rigidities, we study how the exchange rate regime influences vulnerability to self-fulfilling crises. Notably, our model indicates that a fixed exchange rate may reduce vulnerability to crises, contrasting with existing findings (Chang and Velasco, 2000; Devereux and Yu, 2017; Bianchi and Mondragon, 2022).

This paper is also related to the literature on aggregate demand externalities and pecuniary externalities, and their implications for capital flows and macroprudential policies. In particular, Schmitt-Grohé and Uribe (2016) and Farhi and Werning (2016)

[4] Céspedes, Chang, and Velasco (2004) show that a nominal exchange rate depreciation by the central bank can increase risk premia while Cook (2004) shows that a depreciation can reduce investment. However, in both cases, depreciation expands output. An exception featuring contractionary depreciations is Cavallino and Sandri (2022), but they model a depreciation through changes in interest on reserves rather than through conventional monetary policy. See also Tille (2001), Corsetti, Dedola, and Leduc (2022), and Auclert, Rognlie, Souchier, and Straub (2021) for models of contractionary depreciation through terms of trade channels, and Adrian, Erceg, Kolasa, Lindé, and Zabczyk (2022) for an adaptive expectation mechanism. On the empirical side, the question of whether depreciations are expansionary or contractionary remains unsettled (see Frankel, 2005; Edwards, 1985; Calvo, 2005; Uribe and Schmitt-Grohé, 2017; Fukui, Nakamura, and Steinsson, 2023).

provide welfare foundations for capital flow management in an environment where the central bank is assumed to follow a fixed exchange rate regime.[5] Our paper complements these studies by providing a theory of why the central bank finds it optimal to keep the exchange rate fixed.

An important literature has stressed other benefits from adopting a fixed exchange rate regime or joining a monetary union. This includes the reduction in inflationary bias (Alesina and Barro, 2002; Cook and Devereux, 2016; Corsetti, Kuester, and Müller, 2017; Chari, Dovis, and Kehoe, 2020) and the improvement in risk sharing (Neumeyer, 1998; Arellano and Heathcote, 2010; Fornaro, 2022; Itskhoki and Mukhin, 2023).[6] In particular, Fornaro (2022) provides a theory where fixing the exchange rate helps relax households' borrowing constraint because the government is prevented from reducing the value of lenders' collateral. However, in his model with investment complementarities, a fixed exchange rate leaves the government more vulnerable to a bad equilibrium. Our contribution lies in providing a distinct rationale for stabilizing the exchange rate, focusing on the reduced vulnerability to financial crises as a central motivation.

Outline. Section 2 presents the model. Section 3 presents the theoretical results on how the exchange rate regime affects vulnerability to self-fulfilling financial crises. Section 4 analyzes optimal policy, contrasting Markov equilibrium with the commitment solution. Section 5 concludes. All proofs are in the appendix.

2 Model

We consider a small open economy with two types of goods: tradables and non-tradables. Time is discrete and infinite. The economy features nominal rigidities and constraints on households' borrowing. Our baseline model is deterministic, but we later extend it to a stochastic setup.

[5] See also Bianchi and Lorenzoni (2021), which analyzes capital controls and reserve accumulation under a flexible exchange rate regime with costly fluctuations in exchange rates. For studies featuring a pecuniary externality similar to our setup, see for example, Bianchi (2011); Korinek (2018); Flemming, L'Huillier, and Piguillem (2019); Ottonello (2021); Mendoza and Rojas (2018); Rojas and Saffie (2022); Coulibaly (2023); Liu, Ma, and Shen (2024).

[6] In contemporaneous and independent work, Itskhoki and Mukhin (2023) also find that a crawling band is desirable. The key mechanism in their model is that stabilizing the exchange rate reduces risk premia, as international flows are intermediated by risk-averse arbitrageurs who face a currency mismatch.

2.1 Households

There is a continuum of identical households of measure one. Households have preferences of the form

$$\sum_{t=0}^{\infty} \beta^t \left[\log(c_t) + \chi \log\left(\frac{M_{t+1}}{P_t}\right) \right],$$

where $\chi \geq 0$ and $\beta \in (0,1)$ is the discount factor. The consumption good c_t is a composite of tradable consumption, c_t^T, and non-tradable consumption, c_t^N, according to a constant elasticity of substitution aggregator:

$$c_t = \left[\phi (c_t^T)^{\frac{\gamma-1}{\gamma}} + (1-\phi)(c_t^N)^{\frac{\gamma-1}{\gamma}} \right]^{\frac{\gamma}{\gamma-1}}, \quad \text{where } \phi \in (0,1).$$

For the most part, we will focus on an elasticity of substitution between tradable and non-tradable consumption, γ, below one, which is the empirically relevant case. For convenience, we use $u(c^T, c^N)$ to denote the utility as a function of the two consumption goods. Real money holdings provide liquidity services to households, where M_{t+1} represents the end-of-period money holdings and P_t is the ideal price index in period t. We denote by P_t^N and P_t^T the price of non-tradables and tradables (in terms of the domestic currency), respectively. The ideal price index satisfies

$$P_t = \left[\phi^\gamma \left(P_t^T\right)^{1-\gamma} + (1-\phi)^\gamma \left(P_t^N\right)^{1-\gamma} \right]^{\frac{1}{1-\gamma}}.$$

We assume that the law of one price holds for the tradable good and normalize the price of the tradable good in units of foreign currency to unity. This implies that $P_t^T = e_t$, where e_t is the nominal exchange rate defined as the price of the foreign currency in terms of the domestic currency.

Households supply $\bar{h}$ units of labor inelastically. Because of the presence of downward wage rigidity and rationing (to be described below), households' hours worked satisfy $h_t \leq \bar{h}$, which is taken as given by the individual household. Each period households receive a wage rate, W_t, and central bank transfers, T_t, both expressed in terms of domestic currency, which serves as the numeraire. They also receive an endowment y^T of tradable goods and trade one-period non-state-contingent nominal bonds in domestic and foreign currency.[7] The foreign currency bond has an exogenous return R. The domestic currency

[7] The assumption of a fixed supply of tradables has similar features as the assumption of sticky prices with invoicing in dollars where exports are insensitive to domestic devaluations. See Benigno, Chen, Otrok, Rebucci, and Young (2023) and Arce, Bengui, and Bianchi (2025) for analysis without production.

bond yields a return $\tilde{R}_t$ in units of domestic currency, determined endogenously. The budget constraint of the representative household is therefore given by

$$P_t^T c_t^T + P_t^N c_t^N + M_{t+1} + \tilde{b}_t + e_t b_t = P_t^T y^T + W_t h_t + M_t + \frac{\tilde{b}_{t+1}}{\tilde{R}_t} + \frac{e_t b_{t+1}}{R} + T_t, \tag{1}$$

where $\tilde{b}_t$ and b_t denote respectively the amount of domestic currency debt and foreign currency debt assumed in period $t-1$ and due in period t. The left-hand side represents total expenditures in tradable and non-tradable goods and purchases of bonds, while the right-hand side represents total income, including the returns from bond issuance.

We assume that domestic currency bonds are traded only domestically. This assumption is standard in the literature and in line with the empirical observation that foreign investors are reluctant to lend to the private sector in domestic currency (Eichengreen and Hausmann, 1999; Maggiori, Neiman, and Schreger, 2020). However, we note that the basic mechanism would still be operative with positive external domestic currency borrowing to the extent that there are constraints on this borrowing.[8]

Households face a borrowing constraint that limits foreign currency debt to a fraction κ of their individual current income:

$$\frac{e_t b_{t+1}}{R} \leq \kappa \left(P_t^T y^T + W_t h_t \right). \tag{2}$$

This borrowing constraint captures the idea that current earnings are a critical factor determining households' credit market access (Jappelli, 1990; Greenwald, 2018) and has been shown to be important for accounting for the dynamics of capital flows in emerging markets (Mendoza, 2002; Bianchi, 2011).[9,10] To ensure that the borrowing constraint is tighter than the natural debt limit, we assume $0 < \kappa < \frac{R}{R-1}$.

[8]Under a fixed exchange rate, our baseline assumption that domestic currency bonds are only traded domestically is without loss of generality, as long as total debt is subject to constraint (2). Under a flexible exchange rate, an additional consideration is how depreciation reduces the real value of external domestic currency borrowing. We will discuss an extension with local currency debt in Appendix C.

[9]The credit constraint can be derived endogenously from a problem of limited enforcement under the assumption that household can default at the end of the current period and that upon default, households lose a fraction κ_t of the current income. The borrowing limit could also depend on future income or other variables. What is crucial for our results is that higher current income relaxes the borrowing limit.

[10]For evidence on firms' credit market access, see Lian and Ma (2020); Drechsel (2022).

Optimality conditions. First-order conditions with respect to c_t^T and c_t^N imply that

$$\frac{P_t^N}{e_t} = \frac{1-\phi}{\phi}\left(\frac{c_t^N}{c_t^T}\right)^{-\frac{1}{\gamma}}. \tag{3}$$

In addition, we have intertemporal Euler equations for domestic and foreign currency bonds

$$u_T(c_t^T, c_t^N) = \beta \tilde{R}_t \frac{e_t}{e_{t+1}} u_T\left(c_{t+1}^T, c_{t+1}^N\right), \tag{4}$$

$$(1-\mu_t)u_T(c_t^T, c_t^N) = \beta R u_T\left(c_{t+1}^T, c_{t+1}^N\right), \tag{5}$$

where μ_t λ_t and λ_t denote the Lagrange multipliers on the budget constraint (1) and borrowing constraint (2), respectively. Note that $\lambda_t = u_T(c_t^T, c_t^N)/P_t^T$ and μ_t must satisfy

$$\left[\kappa\left(y^T + \frac{W_t}{e_t}h_t\right) - \frac{b_{t+1}}{R}\right]\mu_t = 0. \tag{6}$$

Households' optimality condition for money balances yields the following money demand equation decreasing in the nominal interest rate:

$$\frac{M_{t+1}}{P_t} = \chi \frac{\tilde{R}_t}{U'(c_t)(\tilde{R}_t - 1)}. \tag{7}$$

Using the Euler equations for foreign currency bonds and domestic currency bonds and the law of one price, we obtain an interest parity condition, which relates the nominal returns on domestic and foreign currency bonds to the expected currency depreciation:

$$\frac{R}{1-\mu_t} = \tilde{R}_t \frac{e_t}{e_{t+1}}. \tag{8}$$

Notice that when the borrowing constraint binds, we have an endogenous deviation from uncovered interest parity.

2.2 Firms and Nominal Rigidities

The non-tradable good is produced by a continuum of firms in a perfectly competitive market. Each firm produces a non-tradable good according to a linear production technology given by $y_t^N = n_t$ and obtains profits given by $\phi_t^N = P_t^N n_t - W_t n_t$. Given the linear production function, we obtain that in equilibrium,

$$P_t^N = W_t. \tag{9}$$

An individual firm is therefore indifferent between any level of employment.

We assume there exists a minimum wage in nominal terms. Following Schmitt-Grohé and Uribe (2016), we assume that the current nominal wage is bounded below by the previous period nominal wage; that is, $W_t \geq W_{t-1}$.[11] If the market clearing wage exceeds W_{t-1}, equilibrium employment equals the aggregate endowment of labor. Otherwise, hours are determined by labor demand, $h_t < \bar{h}$ and $W_t = W_{t-1}$. These conditions can be summarized as

$$(W_t - W_{t-1})(h_t - \bar{h}) = 0. \tag{10}$$

2.3 Monetary Policy

We let M^s denote the money supply set by the central bank. The central bank's budget constraint is given by

$$T_t = M_{t+1}^s - M_t^s. \tag{11}$$

That is, the central bank rebates all revenues from the increase in money supply to the public in the form of lump-sum transfers.

2.4 Competitive Equilibrium

An equilibrium requires market clearing in the non-tradable sector, as well as market clearing for money and domestic currency bonds.

We can now define a sticky-wage competitive equilibrium

Definition 1 (Sticky-Wage Equilibrium)**.** Given initial conditions (B_0, W_{-1}), a sticky-wage equilibrium is defined by a set of government policies, prices $\{W_t, P_t^N, e_t, \tilde{R}_t\}_{t=0}^{\infty}$, and allocations $\{b_{t+1}, \tilde{b}_{t+1}, h_t, c_t^N, c_t^T\}_{t=0}^{\infty}$ such that

1. Households and firms optimize. That is, (1)-(9) hold;

[11] More generally, the wage rigidity constraint takes the form $W_t \geq \rho_w W_{t-1}$.

2. The market for non-tradable goods clear. That is,

$$y_t^N = c_t^N, \tag{12}$$

3. The markets for domestic currency bonds and money clear. That is,

$$\tilde{b}_{t+1} = 0,$$
$$\frac{M_{t+1}^s}{P_t} = \chi \frac{\tilde{R}_t}{U'(c_t)(\tilde{R}_t - 1)}$$

4. Households' hours worked are consistent with labor demand $h_t = n_t$, and (10) and $W_t \geq W_{t-1}$ hold;

5. The government budget constraint (11) holds.

Combining the budget constraints of households, firms, and the central bank, as well as market clearing conditions, we arrive at the resource constraint for tradables, or the balance of payments condition:

$$c_t^T - y^T = \frac{b_{t+1}}{R} - b_t, \tag{13}$$

Additionally, combining (3) and (9), we arrive at

$$c_t^N = \left(\frac{1-\phi}{\phi} \frac{e_t}{W_t} \right)^{\gamma} c_t^T. \tag{14}$$

These equations will play a central role in the model dynamics. In the event of a self-fulfilling deleveraging episode, the small open economy will have fewer tradable resources available. For a given relative price of non-tradables, this will lead to a reduction in the demand for non-tradable goods via (14). With flexible wages, W_t would fall until $h_t = c_t^N = \bar{h}$. But if the downward wage rigidity becomes binding, the economy will feature involuntary unemployment, which will in turn feed into consumption and the borrowing capacity through (2).

2.5 Steady-State Equilibrium

In this section, we consider the special case where $\beta R = 1$, which allows us to construct a steady-state equilibrium. We define a steady-state equilibrium as a competitive equilibrium where all allocations are constant.

Definition 2 (Steady-state equilibrium)**.** A steady-state equilibrium is a competitive equilibrium in which allocations are constant for all $t \geq 0$.

A constant consumption allocation under $\beta R = 1$ implies from (5) that the borrowing constraint is slack. Moreover, using (13) and $B_{t+1} = B_0$, it follows that $c_t^T = y^T - (1-\beta)B_0$.

We next define the range of values of initial debt that are consistent with a steady-state equilibrium. Towards this goal, we use households' optimality conditions (3) and (14) and the market clearing condition for non-tradables (12) to define the individual borrowing limit in period t as a function of aggregates (B_t, B_{t+1})

$$\bar{b}(B_{t+1}; B_t) = \kappa R \left[y^T + \frac{1-\phi}{\phi} \left(y^T - B_t + \frac{B_{t+1}}{R} \right)^{\frac{1}{\gamma}} (h_t)^{1-\frac{1}{\gamma}} \right]. \tag{15}$$

We can observe that a household's maximum borrowing capacity $\bar{b}(B_{t+1}; B_t)$ is decreasing in initial debt B_t and increasing in new debt issuances B_{t+1}. This reflects that higher aggregate consumption appreciates the real exchange rate, thereby relaxing individuals' borrowing constraints.

We let $\hat{B}$ denote the unique value of debt such that $\bar{b}(\hat{B}; \hat{B}) = \hat{B}$ when $h_t = \bar{h}$. The lemma below characterizes the existence of a steady-state equilibrium and the optimal monetary policy in a steady state.

Lemma 1 (Steady-state equilibrium)**.** *If $B_0 \leq \hat{B}$, there is a steady-state equilibrium. Moreover, the optimal allocations satisfy $h_t = \bar{h}$ and can be implemented with*

$$e_t \geq W_{t-1} \frac{\phi}{1-\phi} \left[\frac{y^T - (1-\beta)B_0}{\bar{h}} \right]^{-\frac{1}{\gamma}}.$$

Given that the borrowing constraint is slack in a steady-state equilibrium, there is only one potential departure from the first-best allocation: the possibility of unemployment. It then follows that the optimal monetary policy achieves full employment. Full employment is achieved in this case by depreciating the currency enough that the nominal wage rigidity is not binding. We focus on a policy that delivers zero inflation for $t = 0, 1, \ldots$, implying a constant exchange rate $\bar{e}$ given by

$$\bar{e} \equiv W_{-1} \frac{\phi}{1-\phi} \left(\frac{\bar{c}^T}{\bar{h}} \right)^{-\frac{1}{\gamma}} \quad \text{where} \quad \bar{c}^T \equiv y^T - (1-\beta)B_0. \tag{16}$$

To maintain a constant exchange rate, the central bank needs to set a constant money supply $\overline{M}$.[12] From (7), the constant level of the nominal money supply is given by

$$\frac{\overline{M}}{\chi} = \frac{W_{-1}}{u_N(\bar{c}^T, \bar{h})} \frac{R}{R-1}. \tag{17}$$

Notice that the value of $\bar{e}$ and $\overline{M}$ depend on B_0. Namely, a higher B_0 implies a lower steady-state level of consumption and therefore requires a higher $\bar{e}$ for a given W_{-1}. Intuitively, when the level of consumption is lower, the real exchange rate is also lower, and achieving a reduction in the real wage requires a higher nominal exchange rate.

3 Self-Fulfilling Crises

A key feature of the model is that the borrowing capacity of households is increasing in their labor income. Because labor income is linked in equilibrium to the price of non-tradable goods, this implies that the borrowing capacity itself is linked to the price of non-tradables. In turn, because the price of non-tradables is increasing in the aggregate amount of borrowing, the borrowing capacity of an individual agent is increasing in the aggregate amount of borrowing. As shown formally by Schmitt-Grohé and Uribe (2021) in the context of a real model, when this complementarity is strong enough, there is a possibility of multiple equilibria.[13] That is, for a range of initial debt values, a steady-state equilibrium may coexist with another equilibrium in which households reduce their demand for borrowing, the real exchange rate depreciates, and tradable consumption falls. Following Schmitt-Grohé and Uribe (2021), we refer to the latter as a self-fulfilling crisis equilibrium.

Definition 3 (Self-Fulfilling Crisis Equilibrium)**.** Consider an initial debt level $B_0 < \hat{B}$. A self-fulfilling crisis equilibrium is a competitive equilibrium in which $B_1 < B_0$.

The possibility of multiplicity of equilibria depends on the strength of the complementarity between aggregate borrowing decisions and the individual borrowing limit. As we

[12] Given our assumption about the separability between consumption and money balances, we can guarantee that under a constant money supply, the steady-state equilibrium features a unique price level and exchange rate (Benhabib, Schmitt-Grohé, and Uribe, 2001). Modeling money explicitly allows us to set aside the nominal indeterminacy associated with interest rate pegs and focus instead on the real indeterminacy that arises in our framework.

[13] See also Mendoza (2005) for an early discussion of the possibility of multiple equilibria and Krugman (1998) for a related analysis.

will show formally below, the following assumption will be sufficient to guarantee this possibility.

Assumption 1. *The set of parameters satisfies*

$$\kappa \frac{1-\phi}{\phi} \left[\frac{y^T - \frac{R-1}{R}\hat{B}}{\bar{h}} \right]^{\frac{1}{\gamma}-1} > 1.$$

We assume that Assumption 1 holds throughout the paper. This assumption is consistent with a range of plausible parameter values from the data, as argued by Schmitt-Grohé and Uribe (2021). We note that, despite its stylized nature, the model has been shown to replicate key features of emerging market business cycles and financial crises (Mendoza, 2002; Bianchi, 2011; Schmitt-Grohé and Uribe, 2021; Ottonello, 2021).

Roadmap. We will study next how the exchange rate regime affects the vulnerability to self-fulfilling financial crisis equilibria. In the spirit of Poole (1970), we start by considering two regimes, one where the central bank sets the money supply and lets the exchange rate adjust and another where the central bank sets the exchange rate and lets the money supply adjust. We refer to these two regimes as flexible and fixed exchange rate regimes, respectively. In both cases, the central bank sets its policy before the uncertainty about the type of equilibrium has been resolved and is committed to following that policy. Subsequently, in Section 4 we will examine optimal exchange rate policy with and without commitment.

3.1 Floating Exchange Rate Regime

We consider first a regime where the central bank sets the money supply to $M_t^s = \bar{M}$ and lets the exchange rate float. For simplicity, refer to this regime as floating or flexible exchange rate regime. However, we note that an alternative flexible exchange rate regimes where where the central bank implements full employment at all times deliver similar results (see Appendix B).[14]

The lemma below shows that in a self-fulfilling crisis equilibrium, the economy experiences a nominal exchange rate depreciation and unemployment.

[14] The appendix also considers alternative a regime where the central bank sets the nominal interest rate. The comparison between these regimes and fixed exchange rates is similar to the one we focus on here with fixed money supply. In Section 4 we examine optimal policy.

Lemma 2 (Unemployment under flexible exchange rate)**.** *In a self-fulfilling crisis equilibrium, the exchange rate depreciates at $t = 0$, and there is unemployment.*

The mechanism behind the depreciation is as follows. When agents panic and borrow less, this reduces the demand for non-tradable goods and for domestic currency. Given a fixed supply of currency, this implies that the exchange rate must depreciate.

Let us illustrate graphically how self-fulfilling crises may emerge under a fixed-money supply. If we replace (14) in (15), we obtain

$$\bar{b}(B_1; B_0) = \kappa R \left[y^T + \left(\frac{1-\phi}{\phi} \right)^{\gamma} \left(\frac{W_{-1}}{e_0} \right)^{1-\gamma} \left(y^T - B_0 + \frac{B_1}{R} \right) \right], \tag{18}$$

where the equilibrium exchange rate e_0 clears the money market.[15]

The upward-sloping green dashed line in Figure 1 (panel [a]) represents $\bar{b}(B; B_0)$ as a function of B for a given initial debt level B_0, where $\bar{b}(B; B_0)$ is defined in (18). Recall that the higher is the aggregate level of new borrowing, the more appreciated is the real exchange rate and the higher the borrowing capacity. We then plot the borrowing limit as we vary both the initial and end-of period borrowing, $\bar{b}(B; B)$, which is represented by the downward-sloping grey solid line. Notice that by construction, this line intersects the 45-degree line at $\hat{B}$. The good equilibrium in the figure is represented by point G, which is also in the 45-degree line since B remains constant. Notice that this point is below the intersection between the grey and green lines, indicating that households are borrowing less than their individual limit.

When the upward-sloping dashed line intersects the 45-degree line, we have another equilibrium. This occurs at two points, F and F'. At that intersection, the amount of borrowing coincides with the borrowing limit, consumption falls and households' borrowing is constrained. Intuitively, when households panic and collectively reduce borrowing, their doing so leads to a reduction in aggregate demand and a currency depreciation. This implies that in equilibrium, households' borrowing constraint becomes tighter, validating the initial panic.

The proposition below characterizes the range of values for initial debt such that the economy can feature self-fulfilling crisis equilibria.

Proposition 1 (Self-fulfilling crises under floating)**.** *Suppose Assumption 1 holds and $\gamma < 1$. Under a flexible exchange rate with $\bar{M}$ given by* (17)*, we have that*

[15] Using (7), (8), (14) we obtain $u_N \left(y^T - B_0 + \frac{B_1}{R}, \left(\frac{1-\phi}{\phi} \frac{e_0}{W} \right)^{\gamma} \left(y^T - B_0 + \frac{B_1}{R} \right) \right) = \chi \frac{W}{\bar{M}} + \beta u_N \left(y^T - \frac{R-1}{R} B_1, \bar{h} \right)$.

i. *if* $B_0 \in ((1+\kappa)y^T, \hat{B})$*, the steady-state equilibrium coexists with a single self-fulfilling crisis equilibrium; moreover, we have that* $\hat{B} > (1+\kappa)y^T$*, and thus the interval is non-empty;*

ii. *if* $B_0 \in [\underline{B}^m, (1+\kappa)y^T)$*, there exist two self-fulfilling crisis equilibria that coexist with the steady-state equilibrium, where* $\underline{B}^m < (1+\kappa)y^T$ *is given by* (A.6)*.*

iii. *if* $B_0 < \underline{B}^m$*, we have one and only one equilibrium, which corresponds to the steady-state equilibrium.*

Part (i) indicates that when the initial debt level is sufficiently close to $\hat{B}$, there exists a self-fulfilling crisis equilibrium in addition to the steady-state equilibrium. This situation arises when B_0 exceeds the resources available when households can only leverage labor income, $(1+\kappa)y^T$.[16] Part (ii) states that there exists an interval $[\underline{B}^m, (1+\kappa)y^T)$ where two self-fulfilling crisis equilibria, in addition to the steady-state equilibrium, can occur. Finally, when B_0 is sufficiently low, the only equilibrium is the steady-state equilibrium. In this case, even if households panic, an individual household would still be able to maintain a high enough level of consumption such that the borrowing constraint would not bind, effectively preventing the downward spiral that leads to a crisis.

A notable implication of our analysis is that a financial crisis coincides with a currency crisis. The question we tackle next is whether a credible commitment to fixing the exchange rate can prevent a financial crisis.

3.2 Fixed Exchange Rate Regime

We now examine a fixed exchange rate regime in which the central bank sets $e_t = \bar{e}$, where $\bar{e}$ corresponds to the efficient steady-state level given by (16). The lemma below shows that in a self-fulfilling crisis equilibrium, the economy experiences unemployment.

Lemma 3 (Unemployment in Self-Fulfilling Crisis)**.** *In a self-fulfilling crisis, there is involuntary unemployment.*

The mechanism behind the emergence of unemployment is as follows: when agents panic and borrow less, this reduces the demand for non-tradable goods, which in turn

[16] To understand the role of Assumption 1 in this proposition, note that Assumption 1 states that at $B = \hat{B}$, the derivative of $\bar{b}(B, B_0)$ with respect to B exceeds one (i.e., an increase in aggregate borrowing raises individual borrowing capacity by more than one unit). By continuity, this implies that the slope of the dashed line at a B_0 close to $\hat{B}$ is also greater than one, as depicted in the figure. Thus, alongside the equilibrium point G, there is another equilibrium point F where the dashed line intersects the 45-degree line, indicating that the borrowing constraint becomes binding.

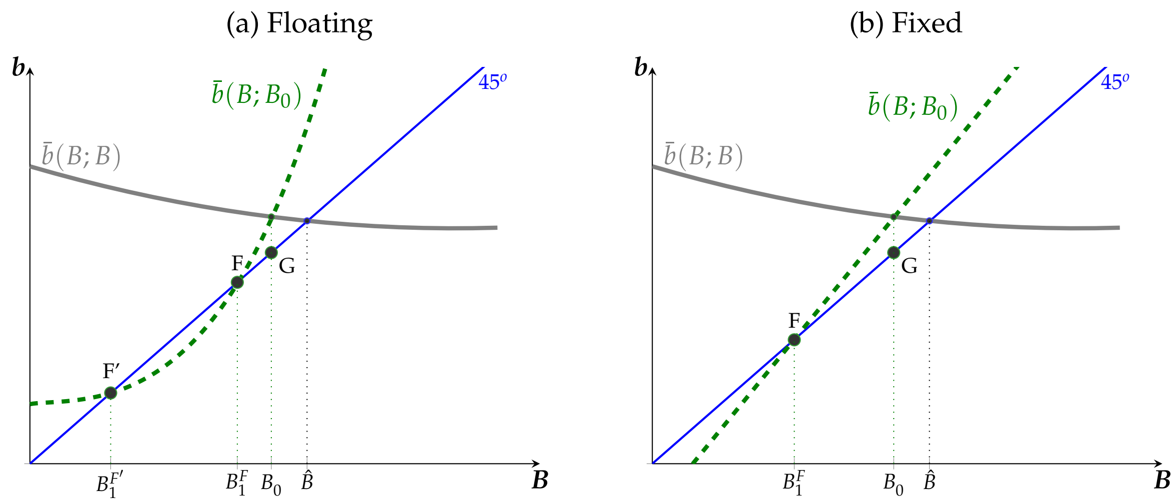

Figure 1: Self-fulfilling crisis equilibria

Note: Point G represents the good equilibrium. Points F and F' represent self-fulfilling crises.

contracts the demand for employment. Given a fixed exchange rate and downward rigid wages, this implies that $h_t < \bar{h}$. The reduction in employment, in turn, feeds back into the borrowing constraint. Now, using $e_0 = \bar{e}$ and substituting (14) into (15) we obtain

$$\bar{b}(B_1; B_0) = \kappa R \left[y^T + \left(\frac{1-\phi}{\phi} \right)^{\gamma} \left(\frac{W_{-1}}{\bar{e}} \right)^{1-\gamma} \left(y^T - B_0 + \frac{B_1}{R} \right) \right]. \tag{19}$$

Notice that now $\bar{b}$ is linear in b_1, as illustrated in Panel b in Figure 1. We can now see graphically that the economy displays at most one self-fulfilling financial crisis. Crucially, now the crisis region becomes smaller under a fixed exchange rate. That is, there is a narrower region of B_0 such that the economy can fall in a financial crisis. The next proposition summarizes these results.

Proposition 2 (Self-fulfilling crises under fixed)**.** *Suppose Assumption 1 holds and $\gamma < 1$. Under a fixed exchange rate policy with $\bar{e}$ given by (16), we have that*

i. there is a non-empty region of debt levels $B_0 \in ((1+\kappa)y^T, \hat{B})$ for which a single self-fulfilling crisis equilibrium coexists with the steady-state equilibrium;

ii. for $B_0 < (1+\kappa)y^T$, we have a unique equilibrium, and this equilibrium is the steady-state equilibrium.

Given the possibility of multiplicity, it is important to discuss how the central bank is able to uniquely implement the target exchange rate $\bar{e}$. In our model, this is guaranteed by the fact that the central bank has access to lump-sum taxes and transfers. Thus, by accommodating any changes in money demand by injecting or withdrawing currency, it can promise to buy and sell foreign currency at the announced exchange rate and implement the desired level. Notice that to the extent that the fixed exchange rate is credible, no actual foreign exchange intervention is needed to keep the exchange rate at $\bar{e}$.

3.3 Fixed versus Floating

Figure 2 presents the policy functions under the two regimes for a range of initial values of debt. The dotted line illustrates the steady-state equilibrium. The blue broken line indicates the self-fulfilling crisis equilibrium under a fixed exchange rate. The red solid line indicates the self-fulfilling crisis equilibria under a fixed money supply.

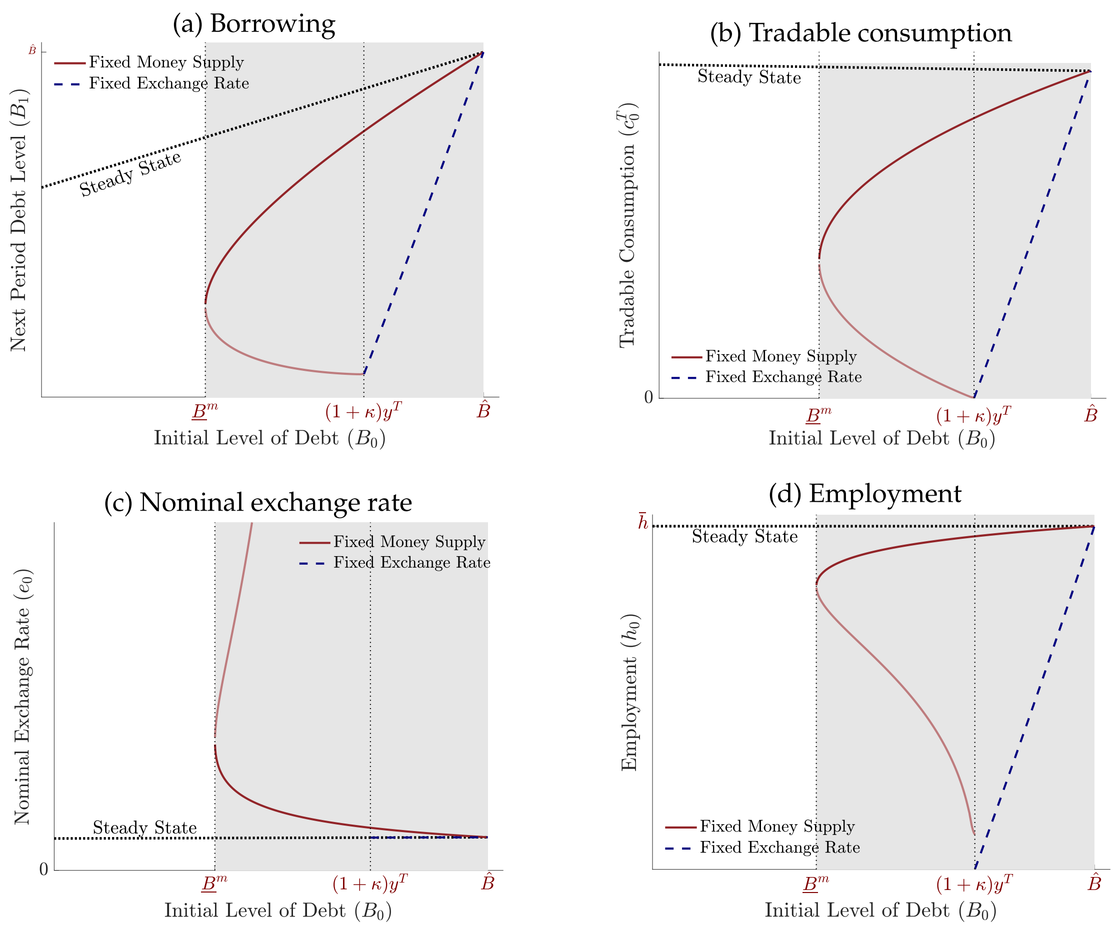

Figure 2: Policy functions

Note: The figure describes the possible equilibrium allocations for a range of initial values of debt. Parameter values are $\phi = 0.2$, $\kappa = 0.3$, $W_{-1} = 1$, $R = 1.04$, $\beta = 1/R$, $\gamma = 0.5$.

There are three distinct regions, in line with Propositions 1 and 2. First, for values of debt $B_0 < \underline{B}^m$, all regimes feature the steady-state equilibrium as the unique equilibrium. Second, for $B_0 \in [\underline{B}^m, (1+\kappa)y^T)$, a flexible exchange rate regime is vulnerable to a self-fulfilling crisis, while a fixed exchange rate regime is not. Thus, it is clear that for such initial debt levels, a fixed exchange rate regime dominates a flexible exchange rate regime in terms of welfare. In this scenario, allowing the nominal exchange rate to float leads to destabilizing price and output movements, which increase the economy's vulnerability to a self-fulfilling financial crisis. Instead of acting as a shock absorber, exchange rate fluctuations undermine both macroeconomic and financial stability. It is in this sense that the central bank experiences a fear of floating.[17]

Finally, for values of debt $B_0 \in ((1+\kappa)y^T, \hat{B})$, the two regimes are vulnerable. For debt levels higher than $(1+\kappa)y^T$ and lower than $\hat{B}$, a self-fulfilling crisis equilibrium emerges for all policy regimes considered. As the figure shows, in this region, a fixed exchange rate regime experiences more deleveraging than a floating exchange rate regime, suggesting that floating is preferable in this case.[18]

Before concluding this section, it is worth connecting our analysis to that of Poole (1970). He examines the optimal choice of policy instruments under different types of economic shocks, highlighting the importance of which instrument provides better state contingency. He showed fixing the money supply provides superior outcomes when shocks are primarily real whereas fixing the nominal interest rate or the exchange rate is preferable when shocks are primarily monetary. Our analysis follows the same spirit as Poole (1970), but we instead consider an economy driven by self-fulfilling beliefs.

[17] In Appendix C, we extend the framework to allow a share of debt to be denominated in domestic currency. Under a floating exchange rate, a depreciation then reduces the real burden of this debt. We find that for high levels of debt, local currency debt mitigates vulnerability to self-fulfilling crises, consistent with Mendoza and Rojas (2018). However, for intermediate levels of debt, local currency debt can backfire by increasing vulnerability.

[18] When we turn to optimal policy in Section 4, we will show, however, that a commitment to a form of crawling band would uniquely implement the steady-state equilibrium and dominate a floating exchange rate regime.

3.4 Contractionary Depreciations

To shed further light on why depreciations are contractionary, let us substitute the borrowing constraint with equality in (14) and then totally differentiate to obtain

$$\frac{dc_0^N}{de_0} = \frac{c_0^N}{e_0}\left[\gamma + \frac{e_0}{c_0^T}\cdot\frac{1}{R}\frac{d\bar{b}_1(e_0,B_1;B_0)}{de_0}\right], \tag{20}$$

where

$$d\bar{b}_1(e_0,B_1;B_0) = \kappa\frac{W_{-1}}{e_0}\left[dy_0^N - \frac{y_0^N}{e_0}de_0\right]. \tag{21}$$

Expression (20) elucidates two channels through which a nominal exchange depreciation affects the demand for non-tradable consumption goods. First, given a level of resources, a depreciation shifts expenditure toward domestically produced goods. This is the standard expenditure-switching channel that makes depreciations expansionary.

Second, through general equilibrium effects, a depreciation also influences resources via the collateral channel, as characterized in (21). By lowering real wages, a depreciation raises the employment demanded by firms (given an aggregate amount of borrowing). At the same time, a depreciation reduces the relative value of non-tradable output in terms of tradables (given employment). Thus, the collateral channel can be expansionary or contractionary. If it is expansionary, the overall effect of a depreciation is to increase output, as the collateral effect reinforces the expenditure-switching channel. On the other hand, if the collateral channel is contractionary, the overall effect depends on the strength of this channel relative to that of the expenditure-switching channel. The dominance of these effects can be determined by noting that in equilibrium $dy_0^N = dc_0^N$ and by combining (20) and (21) to solve for dy_0^N and $d\bar{b}$. The proposition below exploits these results to characterize when a depreciation is contractionary.

Proposition 3 (Contractionary Depreciations)**.** *Assume a level of debt B_0 such that the borrowing constraint binds and $\gamma < 1$. Let $y^N(B_0, e_0)$ be the equilibrium level of output as a function of the initial exchange rate e_0 for an initial debt level B_0. Then, we have that*

i) If $B_0 < (1+\kappa)y^T$, $y^N(B_0, e_0)$ is decreasing in e_0 for $e_0 \in [\bar{e}, \underline{e}]$, where $\bar{e}$ is given by (16) *and $\underline{e}$ is defined as in* (A.8).

ii) if $B_0 > (1+\kappa)y^T$ or $e_0 \notin [\bar{e}, \underline{e}]$, $y^N(B_0, e_0)$ is increasing in e_0.

Notice that result (i) in this proposition expands upon the results from the previous section. The previous section showed that when the central bank fixes the money supply, a switch in beliefs can lead to deleveraging, an exchange rate depreciation, and a contraction in output. Proposition 3 shows instead that, in the intermediate debt region $B_0 < (1+\kappa)y^T$ where self-fulfilling financial crisis occurs under flexible exchange rates (and not under fixed), a policy-induced depreciation can lead to a decrease in output.[19]

We also note that the proposition does not use Assumption 1. That is, while contractionary depreciations are linked to our result on the higher vulnerability under floating exchange rates, there are also configurations where depreciations are contractionary while the economy displays a unique equilibrium. Given these results, it is useful to connect to the "credit access-unemployment tradeoff" of Ottonello (2021). [20] He considers parameterizations featuring a unique equilibrium and shows quantitative simulations in which the Ramsey optimal policy reduces the volatility of consumption and the real exchange rate, relative to the full-employment allocations. A central theoretical result in his model is that the optimal exchange rate policy does not necessarily implement the full employment allocation. This is because a departure from full employment can be associated with a more appreciated real exchange rate and a more relaxed borrowing limit, *for given tradable consumption*. This can be seen from the fact that the borrowing capacity can be written as $\kappa\left[y^T + \frac{1-\phi}{\phi}\left(c^T\right)^{\frac{1}{\gamma}} h^{\frac{\gamma-1}{\gamma}}\right]$, which is decreasing in h if $\gamma < 1$ for given c^T. However, the change in employment affects c^T through the borrowing constraint. Our results show that once we take into account this channel, it is possible that an appreciation is actually expansionary. When an appreciation expands the borrowing capacity, this raises demand for consumption, and this collateral channel can offset the expenditure-switching channel, in line with equations (20) and (21). That is, an appreciation achieves, *at the same time*, an increase in employment and an improvement in credit market access. Therefore, as highlighted in Proposition 3, an appreciation can be expansionary (and a depreciation is contractionary).

3.5 The Costs of Floating

So far, our analysis has focused on a deterministic environment where the only possible source of fluctuation is the emergence of a self-fulfilling crisis equilibrium. To explore the trade-off between the financial stability benefits of fixing the exchange rate, as uncovered

[19] In this experiment, the money supply accommodates to implement the policy-induced depreciation.

[20] This trade off is also an important feature in the analysis in Coulibaly (2023), Basu, Boz, Gopinath, Roch, and Unsal (2025), and one of the applications in Farhi and Werning (2016).

above, and the traditional stabilizing benefits of a flexible regime, we now extend the model to include fundamental shocks.

We will compare a fixed exchange rate policy $e = \bar{e}$ (where $\bar{e}$ is normalized to one) with a floating regime in which the central bank adjusts the money supply to achieve full employment, $h_t = \bar{h} = 1$; see Appendix B.1 for details on this regime. Our focus is on comparing these two regimes to assess how the costs and benefits of fixing the exchange rate depend on the presence of self-fulfilling crises. Specifically, we consider two equilibrium selection rules when the economy lies in a region of indeterminacy. In one case, we always select the good equilibrium, defined as the one with the lowest current account reversal; we refer to the simulations under this case as the *baseline*. In the other case, we always select the worst equilibrium, defined as the one with the highest current account reversal; we refer to the corresponding simulations as *self-fulfilling crises*.[21]

Calibration. We calibrate the model at an annual frequency using data for Argentina. We follow the approach in Bianchi (2011), except that we consider an elasticity of substitution $\gamma = 0.5$, as in Schmitt-Grohé and Uribe (2021). Shocks to the endowment of tradables y_t^T follow an AR(1). Using data for Argentina, we obtain $\ln y_t^T = 0.53 \ln y_{t-1}^T + \varepsilon_t$where $\varepsilon_t \sim N(0, 0.058)$.[22] The world risk-free interest rate is set at 4%. In addition, we assume that downward nominal wage rigidity takes the form $W_t \geq \rho_w W_{t-1}$, as in Schmitt-Grohé and Uribe (2016). We set $\rho = 0.96$ in our annual calibration, implying that nominal wages can fall by up to 4% per year, which is in the range of their empirical estimates.

We set $\beta = 0.91$ and $\phi = 0.26$. With these values, the average net foreign asset position to GDP is -29% and the share of tradable output in total output is 26% in the model without self-fulfilling crises and a full-employment policy, both of which fall within the range of observed values in the data. Finally, we set the collateral coefficient , as in Bianchi (2011). With this value and given all model parameters, this implies a 2% probability that the probability of the economy falling in the borrowing constrained region in the floating regime under the baseline simulations.

Long-run moments. Table 1 presents the results, showing the volatility of macroeconomic variables and other key statistics. It compares the baseline economy without self-fulfilling

[21] It is possible to enrich the selection mechanism by allowing for sunspot equilibria in which the probabilities of good and worst outcomes are non-degenerate.

[22] The tradable output, y_t^T, is measured with the cyclical component of value added in agriculture, mining, fishing, and manufacturing from the World Development Indicators between 1965 and 2022.

Table 1: Long-Run Statistics

	Baseline		Self-Fulfilling Crises		Data
	Fixed	Floating	Fixed	Floating	
Volatility (%)					
Consumption	10.6	1.1	10.6	6.6	6.0
Real Exchange Rate	5.4	6.1	5.4	25.4	7.9
Nominal Exchange Rate	0.0	8.4	0.0	37.5	27.5
Current Account-GDP	2.7	0.04	2.7	7.5	2.9
Prob. of crises (%)	0.6	1.9	0.6	9.9	
Prob. of self-fulfilling crises (%)	-	-	0.0	8.0	
Welfare gains (%)					
Fixing exchange rate	-	-1.0	-	0.9	
No self-fulfilling crises	0.0	2.9	-	-	

Note: Baseline corresponds to the scenario where the good equilibrium is always selected. The columns "Baseline" and "Self-fulfilling Crises" correspond, respectively, to the cases in which the good equilibrium and the self-fulfilling crisis equilibrium are selected whenever the economy is vulnerable. Data corresponds to Argentina data from 1965 to 2022, except for the nominal exchange rate for which we consider data from 2002 to 2022 due to the convertibility plan pre-2002 that pegged the Argentine peso to the U.S. dollar. To compute the moments in the data, we use the cyclical component of the HP-detrended series. The probability of crises is defined as the probability of a binding borrowing constraint and the increase in net capital outflows exceeds one standard deviation.

crises to the case with crises under both exchange rate regimes.

The first key takeaway is that the baseline simulations under a floating regime fall short of explaining the volatility of the current account and the real exchange rates for both regimes. Additionally, the model under the floating exchange rate regime displays a very low volatility of the nominal exchange rate. With self-fulfilling crises, we observe a substantial increase in the volatility of the current account and the real exchange rate, reflecting the more frequent disruptions of capital flows that arise in such crises. Moreover, in the absence of self-fulfilling crises, the volatility of the current account is higher under a fixed exchange rate, but this ranking reverses once crises are introduced.

The second key takeaway is that the desirability of fixing the exchange rate crucially depends on whether the economy experiences self-fulfilling financial crises. In the baseline simulations without self-fulfilling crises, fixing the exchange rate results in an average welfare loss of 1.0% of permanent consumption, consistent with existing literature.[23] That is, starting from the ergodic distribution under a fixed exchange rate, households would

[23] As highlighted by Ottonello (2021), implementing the full-employment allocation is not the optimal policy under collateral constraints. However, this policy delivers higher welfare than a fixed exchange rate.

be willing to forgo 1.0% of their consumption bundle across all future states to switch to a flexible exchange rate. Conversely, in the presence of self-fulfilling crises, fixing the exchange rate yields a welfare gain of 0.9% of permanent consumption. These gains emerge because a fixed exchange rate significantly reduces the region with self-fulfilling crises.

The third takeaway is that the economy exhibits markedly different exposure to crises—defined as episodes in which the borrowing constraint binds and the increase in net capital outflows exceeds one standard deviation—across monetary regimes and depending on whether self-fulfilling crises are possible. In the baseline simulations (good equilibrium always selected), the probability of a crisis is about 1.9% under floating versus 0.6% under fixed. This gap reflects stronger precautionary saving under a fixed exchange rate, which lowers the likelihood that the constraint binds. In the presence of self-fulfilling crises, floating again yields a higher crisis probability; moreover, a sizable share of crises are self-fulfilling. Specifically, the probability of a self-fulfilling crisis is 8% under floating, while there is no self-fulfilling crisis under fixed.

These results suggest that accounting for self-fulfilling crises can significantly alter the welfare comparison between fixed and flexible exchange rate regimes. While flexible exchange rates are desirable in the absence of self-fulfilling crises, a commitment to a fixed exchange rate can be beneficial when such crises are present.

Event analysis. Figure 3 compares the dynamics of an economy under floating exchange rate subject to self-fulfilling crises and the baseline economy without self-fulfilling crises. (We study below a rule that uniquely implements the good equilibrium). We construct comparable nine-year event windows as follows. First, we simulate the economy under free floating for 1,000,000 periods. Second, we identify episodes of self-fulfilling crises and plot the average of all macro variables within the window. This is represented by the blue dashed-dotted line in panels (b)-(d). Third, for each episode, we take the initial bond position at $t-4$ and the sequence of shocks observed over the window and feed them through the policy functions of the rule that uniquely implements the good equilibrium. This is represented by the red dashed line in panels (b)-(d). The purple area in panel (c) represents the crawling peg that implements the good equilibrium, as we will analyze in Section 4.

Panel (a) shows that self-fulfilling crisis episodes are typically preceded by a decline in tradable output, which leads to an increase in external indebtedness (panel [b]). When a

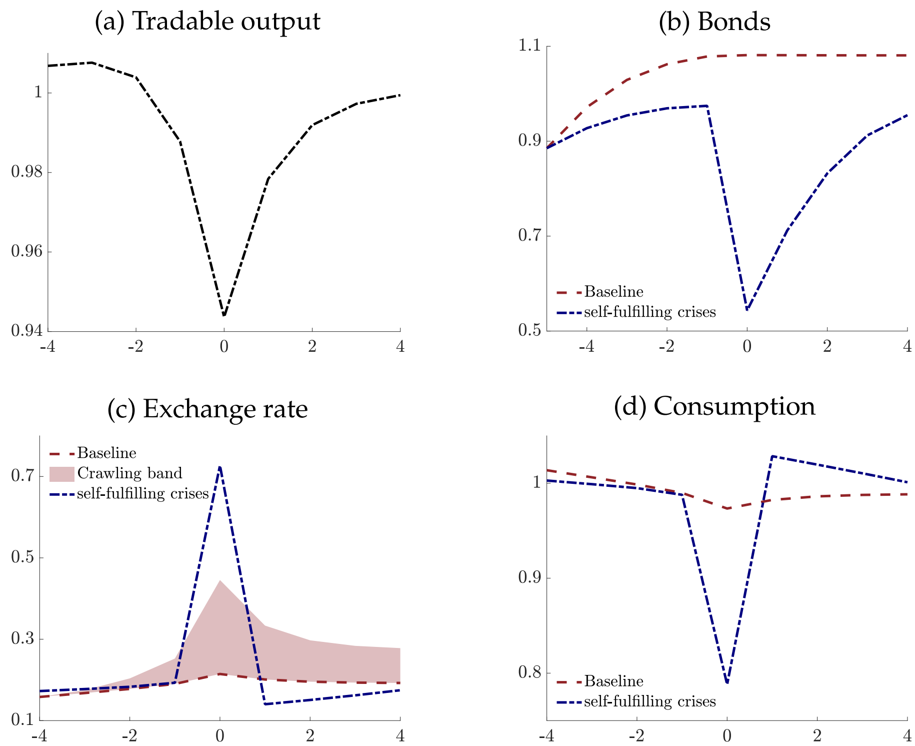

Figure 3: Event analysis

Note: The baseline corresponds to the floating exchange rate regime without self-fulfilling crises

self-fulfilling crisis occurs, this leads to a sharp exchange rate depreciation (panel [c]) and a deep contraction in economic activity. Crucially, in the absence of self-fulfilling crises, borrowing would increase even more as agents would reduce their precautionary savings. Moreover, despite the higher level of borrowing, the decline in the tradable endowment in period 0 leads only to a modest decline in consumption.

3.6 Discussion on Testable Implications

The theory yields several predictions. Here, we discuss some suggestive empirical evidence that is consistent with our model's predictions.

First, in contrast to the Mundell–Fleming framework, our model predicts that, all else equal, countries with higher labor rigidities may find it optimal to adopt a *less* flexible exchange rate regime. To examine this in the data, we measure downward nominal wage rigidity following Matschke (2024) and Schmitt-Grohé and Uribe (2016), and correlate it with the degree of exchange rate flexibility using the classification of Ilzetzki, Reinhart, and Rogoff (2019). As shown in Table C.1 in the appendix, countries with greater downward nominal wage rigidity tend to have less flexible exchange rate regimes.

Second, the model implies that countries with relatively low debt levels are less vulnerable to self-fulfilling crises under a fixed exchange rate. Therefore, all else equal, floating should be relatively less prevalent among countries with low debt levels. Figure D.1 shows that countries with more flexible exchange rates tend to have lower net foreign assets (i.e., higher debt), in line with the model. We note, however, that the relationship is mostly apparent among countries in classifications 4–6 of Ilzetzki, Reinhart, and Rogoff (2019), compared with those in the more rigid classifications 1–3. While this evidence aligns with our model, it is worth noting that other theories also predict a positive relationship between the degree of floating and the level of debt (e.g., Schmitt-Grohé and Uribe, 2016; Bianchi and Mondragon, 2022).

Finally, our analysis of contractionary depreciation suggests that a depreciation should be less expansionary in countries with relatively high debt levels, all else equal. To examine this, we follow the empirical approach of Fukui, Nakamura, and Steinsson (2023) and augment their specification with an interaction term between depreciation and the level of net foreign assets. The results indicate that low net foreign assets dampen the expansionary effects of a nominal depreciation.

Overall, these patterns are consistent with the model's predictions. Nonetheless, we view them as suggestive, and a more systematic investigation is left for future work.

4 Optimal Policy: The Role of Commitment

Until now, we have focused on the equilibrium outcomes when the central bank sets an instrument, either the money supply or the exchange rate, at the beginning of time. We now study a situation where the central bank chooses the exchange rate optimally. Our analysis crucially distinguishes between the case in which the central bank operates under discretion and the one in which it operates under commitment.

4.1 Exchange Rate Policy without Commitment

We start by analyzing the case in which the central bank chooses monetary policy optimally without commitment. We consider the following timing within period 0: (i) households choose b'; (ii) the central bank chooses e (or equivalently M); (iii) households choose

$\{c^T, c^N, m\}$ and firms choose h.[24]

Markov perfect equilibrium. We solve for the Markov perfect equilibrium (MPE) by backward induction. For any initial value of debt B and any possible B' chosen by households, abstracting from the utility of money balances to compute welfare, we can express the problem of the central bank as follows:

$$\max_{c^T, e, h \leq \bar{h}, W \geq W_{-1}} u(c^T, h) + \frac{\beta}{1-\beta} u\left[y^T - \frac{R-1}{R} B', \bar{h}\right], \tag{22}$$

subject to

$$c^T = y^T - B + \frac{B'}{R} \tag{23}$$

$$h = \left(\frac{1-\phi}{\phi} \frac{e}{W}\right)^{\gamma} c^T \tag{24}$$

$$\frac{B'}{R} \leq \kappa \left[y^T + \left(\frac{1-\phi}{\phi}\right)^{\gamma} \left(\frac{W}{e}\right)^{1-\gamma} c^T\right], \tag{25}$$

where the continuation value reflects that the economy is in a stationary equilibrium with debt level B'. An inspection of this problem reveals that the central bank must choose a level of employment and associated exchange rate level that induces a feasible level of borrowing for the household. Moreover, the central bank finds it optimal to choose the highest level of employment consistent with a valid continuation equilibrium. Letting $S \equiv (B, W_{-1})$ summarize the aggregate state of the economy at the beginning of the period, we summarize this result in the following proposition.

Proposition 4 (Optimal Policy in a MPE)**.** *For any $B' \leq B$, the optimal monetary policy $\mathcal{E}(B'; S)$ in a Markov perfect equilibrium implements an employment policy such that*

$$\mathcal{H}\left(B'; S\right) = \min\left\{\left[y^T - B + \frac{B'}{R}\right]^{\frac{1}{1-\gamma}} \left[\frac{\kappa(1-\phi)}{\phi(\frac{B'}{R} - \kappa y^T)}\right]^{\frac{\gamma}{1-\gamma}}, \bar{h}\right\}, \tag{26}$$

where

$$\mathcal{E}(B'; S) = \bar{e}\left[\frac{y^T - (1-\beta) B}{\bar{h}}\right]^{\frac{1}{\gamma}} \left[\kappa \frac{1-\phi}{\phi} \frac{R(y^T - B) + B'}{B' - R\kappa y^T}\right]^{\frac{1}{1-\gamma}} \geq \bar{e}. \tag{27}$$

Given the central bank policy and the aggregate level of debt B', we can formulate the

[24] We assume that a self-fulfilling crisis may only occur in period 0.

individual household problem as:

$$\max_{c^T, c^N, b', M'} u(c^T, c^N) + \chi \log\left(\frac{M'}{P}\right) + \beta V(b', S'), \tag{28}$$

subject to

$$\mathcal{E}(B';S)c^T + W(B';S)c^N + b + M' = \mathcal{E}(B';S)y^T + \mathcal{W}(B';S)\mathcal{H}(B';S) + \mathcal{E}(B';S)\frac{b'}{R} + M + T(B';S)$$

$$\frac{b'}{R} \leq \kappa\left[y^T + \frac{\mathcal{W}(B';S)}{\mathcal{E}(B';S)}\mathcal{H}(B';S)\right].$$

A *Markov perfect equilibrium* (MPE) can be characterized by a central bank exchange rate policy $\mathcal{E}(B';S)$ and a law of motion for aggregate debt $B' = \Gamma(B,S)$ such that: (i) $b'(b,B;S) = \Gamma(B,S)$ and $c^N(b,B;s) = y^N$ solve the household's problem (28); and (ii) $\mathcal{E}(B';S)$ solve the central bank problem (22).

We next show that the model features a continuum of Markov perfect equilibria. As illustrated in Figure 4, the set of equilibria is convex. Specifically, given any two debt levels that constitute a Markov equilibrium, any convex combination of those debt levels is also a Markov equilibrium. The figure further shows that the range of debt levels for which a self-fulfilling crisis equilibrium is possible is wider compared to the fixed money supply and fixed exchange rate regimes. Additionally, the current account reversal associated with the fixed money supply and fixed exchange rate regimes is lower than the most severe crisis observed under Markov equilibrium.

The proposition below formalizes these results.

Proposition 5 (Set of Self-fulfilling MPE)**.** *Suppose Assumption 1 holds and $\gamma < 1$. For any $B_0 < \hat{B}$, the set of debt levels B' that constitutes an MPE with self-fulfilling crises is convex. Moreover, the MPE with the lowest and highest borrowing features full employment.*

The key insight is that the inability to commit to an exchange rate policy leaves the central bank in a fragile situation. When faced with pessimistic expectations, capital flows contract, leading the central bank to allow the currency to depreciate in an effort to reduce unemployment. However, this depreciation tightens the borrowing constraint and reinforces households' pessimistic expectations. We interpret this result as an argument for why a freely floating exchange rate regime is undesirable, in line with the fear of floating phenomenon. We next explore how commitment can help avoid this situation and help to live with the fear of floating.

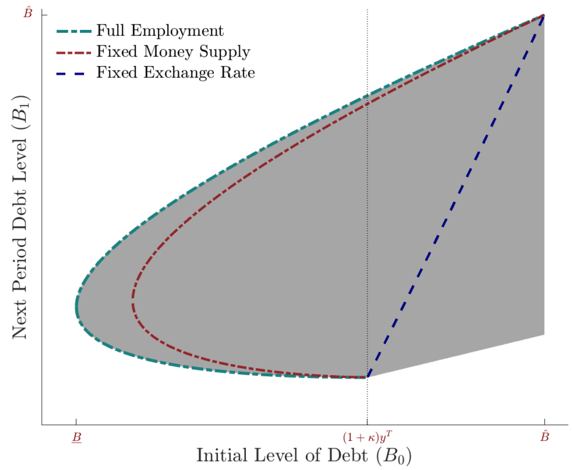

Figure 4: Set of Markov perfect equilibria

Note: Parameter values are $\phi = 0.2$, $\kappa = 0.3$, $W_{-1} = 1$, $R = 1.04$, $\beta = 1/R$, $\gamma = 0.5$.

4.2 Exchange Rate Policy under Commitment

In Section 3, we analyzed the case when the central bank commits to a fixed value for a monetary instrument and show how this policy can help avert self-fulfilling financial crises. In particular, we have shown that fixing the exchange rate can help avert self-fulfilling crises for a wider range of debt than when fixing the money supply. For $B_0 \in ((1+\kappa)y^T, \hat{B})$, however, a simple commitment to a fixed exchange rate or money supply does not uniquely implement the good equilibrium. Motivated by these results, we now consider a commitment to a state-contingent monetary policy. Our approach follows Bassetto (2005) and Atkeson, Chari, and Kehoe (2010) in that we allow the central bank to commit to a strategy that depends upon the choices of households.[25]

We consider the following timing within period 0: (i) the central bank announces a commitment to the state-contingent exchange rate policy $e(B_1, B_0)$; [26] (ii) individual households choose their individual level of borrowing b_1; (iii) the central bank sets M_0 to implement the exchange rate $e(B_1, B_0)$ to which it committed; (iv) households choose $\{c^T, c^N\}$ and firms choose h.

The next proposition describes the monetary policy strategy that can avert self-fulfilling

[25] Schmitt-Grohé and Uribe (2016) provide a feedback rule for taxes on capital inflows that can also implement the good equilibrium.

[26] Notice that we do not need to specify policies in response to non-degenerate actions by households, because the household optimum is unique and thus government responses to non-degenerate actions are irrelevant for the game (see Bassetto, 2005 for a discussion).

crises.

Proposition 6 (Unique implementation with sophisticated monetary policy)**.** *There exists an exchange rate rule $e(B_1, B_0)$ that rules out the possibility of self-fulfilling crisis equilibria. Given an initial B_0, the rule is given by*

$$e(B_1, B_0) = \begin{cases} \bar{e} & \text{if } B_0 \leq (1+\kappa)y^T \\ \frac{B_1}{B_0}\bar{e} + \left(1 - \frac{B_1}{B_0}\right) \mathcal{E}\,(B_1, B_0), & \text{if } (1+\kappa)y^T < B_0 < \hat{B}. \end{cases} \tag{29}$$

where $B_1 \leq B_0$, and $\bar{e}$ is given by (16) and $\mathcal{E}$ is given by (27).

When the economy starts with a level of debt, $B_0 \leq (1+\kappa)y^T$, an announcement by the central bank to commit to stabilizing the exchange rate at its natural level $\bar{e}$ is sufficient to guarantee the implementation of the steady-state equilibrium. This result is in line with Proposition 2.

When the initial debt exceeds that amount, a non-state-contingent commitment cannot uniquely implement the good equilibrium. However, the proposition presents a sophisticated policy that can rule out a self-fulfilling crisis. As shown in (29), the exchange rate turns out to be a convex combination of the desired exchange rate level and the exchange rate that the government chooses in the Markov perfect equilibrium for a given B_1, with weights that depend on the deviation of the net foreign asset position relative to the efficient one.

This policy can be interpreted as a *crawling band*. When aggregate borrowing falls below the desirable level, the central bank commits to keeping an exchange rate between the steady-state equilibrium and the free-floating level. The idea is that by keeping the exchange rate appreciated relative to the MPE, this relaxes the individual household's borrowing constraint off the equilibrium path, making $b_1 = B_1$ suboptimal from the individual household's perspective. Notice that this rule implements the first-best allocation $e(B_1, B_0) = \bar{e}$ if aggregate borrowing coincides with the desired level of borrowing $B_1 = B_0$. The policy rule (29) thus ensures the unique implementation of the steady-state equilibrium by making the best response of each household different from the average choice whenever $B_1 < B_0$, and hence discouraging deviations from the desired level of borrowing.

The key takeaway from this section is that the ability to commit to an exchange rate policy is crucial to reducing financial fragility. When the central bank lacks commitment, the lack of a nominal anchor can open the door to a wide set of equilibria with depressed levels of output and capital flows. We interpret this result as a rationale for the prevailed phenomenon of fear of floating.

5 Conclusion

We develop a theory of fear of floating, the ubiquitous policy among central banks of limiting large fluctuations in exchange rates. We show that fixing the exchange rate can safeguard the economy from self-fulfilling financial crises by avoiding a downward spiral between nominal depreciations and the tightening of borrowing constraints. Our findings suggest the need for a reappraisal of current monetary policy frameworks, wherein central banks should allow the exchange rate to float in response to fundamental shocks while maintaining it fixed in response to non-fundamental shocks.

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Appendix

A.1 Proof of Lemma 1

We start by showing that the steady-state equilibrium exists if $B_0 \leq \hat{B}$. At the steady-state equilibrium $B_{t+1} = B_0$ for all t and by (13),

$$c_t^T = y^T - \frac{R-1}{R} B_0 \tag{A.1}$$

The equilibrium exists if the collateral constraint is satisfied. That is, if $B_0 \leq \bar{b}(B_0; B_0)$ defined in (15) where $h \leq \bar{h}$ is the steady-state level of employment. Because $\bar{b}(\hat{B}; \hat{B}) = \hat{B}$ and $\frac{\partial \bar{b}(B_0;B_0)}{\partial B_0} < 0$, it follows that for any $B_0 \leq \hat{B}$ we have $\bar{b}(B_0; B_0) \geq B_0$. Moreover, $\kappa < \frac{R}{R-1}$ ensures that $c_t^T > 0$.

The second part of the proof requires showing that it is optimal for the government to implement a full-employment allocation. Because allocations are constant at the steady-state equilibrium, from (5) we have $\mu = 0$. Thus, the borrowing constraint does not bind and the central bank's problem reduces to solving

$$\max_{e, c^N \leq \bar{h}, W_t \geq W_{t-1}} \sum_{t=0}^{\infty} \beta^t u(y^T - \frac{R-1}{R} B_0, c^N)$$

subject to

$$c^N = \left(\frac{1-\phi}{\phi} \frac{e_t}{W_t} \right)^{\gamma} \left(y^T - \frac{R-1}{R} B_0 \right).$$

Since the objective is strictly increasing in $c^N = h$, it must be that $h \leq \bar{h}$ binds. Replacing $h = \bar{h}$ in the constraint and using $W_t \geq W_{t-1}$, we obtain e_t in Lemma 1.

A.2 Proof of Lemma 2

Unemployment. Assume by contradiction that $h_0 = \bar{h}$. The demand for money (7) in the steady state equilibrium and in period 0 are given by

$$\frac{\chi W_{-1}}{\bar{M}} = \left[1 - \frac{1}{R}\right] u_N \left(y^T - \frac{R-1}{R} B_0, \bar{h} \right) \quad \text{and} \quad \frac{\chi W_0}{\bar{M}} = \left[1 - \frac{1}{\tilde{R}_0}\right] u_N \left(y^T - B_0 + \frac{B_1}{R}, \bar{h} \right)$$

it must be that $\tilde{R}_0 \geq R$. This is because if it were that $\tilde{R}_0 < R$, we would get $W_0 < W_{-1}$, which violates the wage constraint. Given that $\tilde{R}_0 \geq R$ from (8) $e_0 \leq \frac{e_1}{1-\mu_0}$ and by (14)

$$h_0 \leq \left[\frac{1-\phi}{\phi}\frac{e_1}{W_0}\frac{1}{1-\mu_0}\right]^{\gamma} c_0^T \leq \left[\frac{1-\phi}{\phi}\frac{e_1}{W_0}\right]^{\gamma} c_1^T \left(\frac{c_0}{c_1}\right)^{1-\gamma} < \left[\frac{1-\phi}{\phi}\frac{e_1}{W_0}\right]^{\gamma} c_1^T = \bar{h} \tag{A.2}$$

(A.2) contradicts $h = \bar{h}$. Thus, $h_0 < \bar{h}$ in a self-fulfilling crises equilibrium when it exists.

Exchange depreciation. Using (5) and (8) to substitute for $\tilde{R}_0$ and μ_0, (7) becomes

$$\frac{\chi}{\bar{\bar{M}}} = \left[\frac{1}{e_0}u_T\left(c_0^T, \left(\frac{1-\phi}{\phi}\frac{e_0}{W_{-1}}\right)^{\gamma} c_0^T\right) - \frac{1}{RW_{-1}}u_N(c_1^T, \bar{h})\right] \tag{A.3}$$

where $W_0 = W_{-1}$ by $h_0 < \bar{h}$. Define $\tilde{\phi}_0 \equiv \frac{e_0 c_0^T}{e_0 c_0^T + W_0 c_0^N} \in (0,1)$. Using $c_0^T = y^T - B_0 + \frac{B_1}{R}$ and $c_1^T = y^T + (1-\beta)B_1$, and differentiating (A.3) with respect to B_1, we obtain

$$[\gamma + (1-\gamma)\tilde{\phi}_0]\frac{Rc_0^T}{e_0}\frac{de_0}{dB_1} = -\left[1 + \tilde{\phi}_0\frac{(1-\gamma)(R-1)}{\gamma(1-\mu_0)\tilde{R}_0}\right] < 0 \tag{A.4}$$

Thus, the exchange rate depreciates in a self-fulfilling crisis equilibrium ($B_1 < B_0$). □

A.3 Proof of Lemma 3

The proof is by contradiction. Suppose that $h_0 = \bar{h}$. From (14) and by definition of $\bar{e}$

$$W_0 = \bar{e}\,\frac{1-\phi}{\phi}\left(\frac{y^T - B_0 + \frac{B_1}{R}}{\bar{h}}\right)^{\frac{1}{\gamma}} \quad \text{and} \quad W_{-1} = \bar{e}\,\frac{1-\phi}{\phi}\left(\frac{y^T - \frac{R-1}{R}B_0}{\bar{h}}\right)^{\frac{1}{\gamma}}$$

Because $B_1 < B_0$, this implies that $W_0 < W_{-1}$ which violates downward wage rigidity. Therefore, $h_0 < \bar{h}$ in a self-fulfilling crisis equilibrium. □

A.4 Proof of Proposition 1

Under flexible exchange rates with fixed money supply, the maximum borrowing of an individual household is given by (18) where e_0 is determined by (A.3). Notice that B_1 is part of an equilibrium if (i) $\bar{b}(B_1; B_0) = B_1$, (ii) $B_1 < B_0$, and (iii) $\frac{B_1}{R} > B_0 - y^T$. The first condition states that the constraint holds with equality. Condition (ii) ensures that $\mu > 0$ and condition (iii) ensures that $c_0^T > 0$. Letting $\xi_{B_1} \equiv \frac{Rc_0^T}{e_0}\frac{de_0}{dB_1}$ denote the elasticity of e_0 with respect to B_1 given by (A.4), and noting that $\frac{d\xi_{B_1}}{dB_1} < 0$ we have that

$$\frac{\partial \bar{b}(B_1;B_0)}{dB_1} = \kappa \frac{1-\phi}{\phi}\left(\frac{W_{-1}}{e_0}\right)^{1-\gamma}[1-(1-\gamma)\xi_{B_1}] > 0 \quad \text{and} \quad \frac{\partial^2 \bar{b}(B_1;B_0)}{dB_1^2} > 0$$

Because $\bar{b}(B_1;B_0)$ is increasing and convex in B_1 with $\bar{b}(B_0;B_0) > B_0$, the equation $\bar{b}(B_1;B_0) = B_1$ has at most two solutions with one featuring $\frac{\partial \bar{b}(B_1;\tilde{B}_0)}{dB_1} \geq 1$. Owing to

$$\frac{\partial \bar{b}(B_1;B_0)}{dB_0} = \kappa R \left(\frac{1-\phi}{\phi}\right)^{\gamma}\left(\frac{W_{-1}}{e_0}\right)^{1-\gamma}\left[-1-\frac{1-\gamma}{\gamma+(1-\gamma)\tilde{\phi}_0}\right] < 0$$

at the minimum level of initial debt level, $\underline{B}^m$, for which a crises equilibrium exists, we have $\frac{\partial \bar{b}(B_1;\underline{B}^m)}{dB_1} = 1$. To simplify the algebra, let's define $\psi_0 \equiv 1-(1-\gamma)\xi_{B_1} > 1$. We have

$$\frac{\partial \bar{b}(B_1;\underline{B}^m)}{dB_1} = 1 \Leftrightarrow \psi_0 \kappa \frac{1-\phi}{\phi}\left(\frac{c_0^T}{h_0}\right)^{\frac{1-\gamma}{\gamma}} = 1. \tag{A.5}$$

By (A.4), $\psi_0 > \frac{1}{\gamma}$. Use $\underline{B}^m = y^T + \frac{B_1}{R} - c_0^T$ and plug $B_1 = \bar{b}(B_1;\underline{B}^m)$ in (A.5), to get

$$\underline{B}^m = (1+\kappa)y^T - \frac{\psi_0 - 1}{\psi_0}\left[\psi_0 \kappa \frac{1-\phi}{\phi}\right]^{\frac{-\gamma}{1-\gamma}} h_0 \tag{A.6}$$

Moreover, since $\bar{b}(B_1;B_0)$ is convex in B_1, the equation $\bar{b}(B_1;B_0) = B_1$ has two solutions if and only if $\bar{b}(B_1;B_0) = B_1$ has a solution and at $\tilde{B}_1$ such that $\frac{\partial \bar{b}(B_1;B_0)}{\partial B_1}|_{\tilde{B}_1} = 0$, we have $\bar{b}(\tilde{B}_1;B_0) > B_0$. Because $\frac{\partial \bar{b}(B_1;B_0)}{\partial B_1} = 0$ implies that $c_0^T = 0$, it follows that $\tilde{B}_1$ lowest value in the feasible domain of B_1, i.e. $\tilde{B}_1 = R(B_0 - y^T)$, and we have

$$\bar{b}(R(B_0-y^T);B_0) = (1+\kappa)\kappa y^T > B_0 \;\Leftrightarrow\; B_0 < (1+\kappa)\kappa y^T$$

Therefore, $\bar{b}(B_1;B_0) = B_1$ has two solutions for $B_0 \in \left[\underline{B}^m, (1+\kappa)y^T\right)$ and a unique solution for $B_0 \in \left[(1+\kappa)y^T, \hat{B}\right)$. It remains to show that $[(1+\kappa)y^T, \hat{B})$ is non-empty. Recall that $\bar{b}(\hat{B}, \hat{B}) = \hat{B}$. Using $\hat{c}^T = y^T - \hat{B} + \frac{\hat{B}}{R}$, we get

$$\left[1-\kappa\frac{1-\phi}{\phi}\left(\frac{y^T-(1-\beta)\hat{B}}{\bar{h}}\right)^{\frac{1-\gamma}{\gamma}}\right]\hat{c}^T = (1+\kappa)y^T - \hat{B} \tag{A.7}$$

By Assumption 1, the left-hand side of (A.7) is negative. Thus, $(1+\kappa)y^T < \hat{B}$. □

A.5 Proof of Proposition 2

The maximum borrowing capacity under fixed exchange rates is given by (19). Notice again that B_1 is part of an equilibrium if $\bar{b}(B_1; B_0) = B_1$, $B_1 < B_0$, and $\frac{B_1}{R} > B_0 - y^T$. Because $\bar{b}(B_0; B_0) > B_0$ a sufficient condition for non-existence B_1 that satisfies the first two conditions is $\frac{\partial \bar{b}(B_1;B_0)}{\partial B_1} < 1$. Using (16) to substitute for $\frac{W_{-1}}{\bar{e}}$ in (19) yields

$$\frac{\partial \bar{b}(B_1; B_0)}{\partial B_1} = \kappa \frac{1-\phi}{\phi} \left(\frac{y^T - \frac{R-1}{R} B_0}{\bar{h}} \right)^{\frac{1-\gamma}{\gamma}} > \kappa \frac{1-\phi}{\phi} \left(\frac{y^T - \frac{R-1}{R} \hat{B}}{\bar{h}} \right)^{\frac{1-\gamma}{\gamma}} > 1$$

where the first inequality uses $B_0 < \hat{B}$ and the last inequality uses Assumption 1. Given that $\bar{b}(B_0; B_0) > B_0$ and $\frac{\partial \bar{b}(B_1;B_0)}{\partial B_1} > 1$, it follows by continuity of the function $\bar{b}(B_1; B_0) - B_1$ that there exists $B_1 < B_0$ such that $\bar{b}(B_1; B_0) - B_1 = 0$. Next, we need to check that $c_0^T > 0$ in the crisis equilibrium. Using $\bar{b}(B_1; B_0) = B_1$ and (13), we get $c_0^T = \frac{B_0 - (1+\kappa) y^T}{\delta - 1}$ with $\delta \equiv \kappa \left(\frac{1-\phi}{\phi} \right)^{\gamma} \left(\frac{W_{-1}}{\bar{e}} \right)^{1-\gamma} > 1$. Thus, $c_0^T > 0 \iff B_0 > (1+\kappa) y^T$.

Since $B_0 < \hat{B}$, it follows that a self-fulfilling crisis equilibrium coexists with the stationary equilibrium under $e_0 = \bar{e}$ for any $B_0 \in ((1+\kappa)y^T, \hat{B})$. Furthermore, as shown in Appendix A.4, the interval $[(1+\kappa)y^T, \hat{B})$ is non-empty under Assumption 1. $\square$

A.6 Proof of Proposition 3

Let us define

$$\underline{e} \equiv W_{-1} \left[\frac{\kappa}{\gamma} \left(\frac{1-\phi}{\phi} \right)^{\gamma} \right]^{\frac{1}{1-\gamma}} \tag{A.8}$$

Combining (14) with (12) and substituting $B_1 = \bar{b}(B_1, B_0)$, we arrive at

$$y_0^N = \left(\frac{1-\phi}{\phi} \frac{e_0}{W_{-1}} \right)^{\gamma} \frac{B_0 - (1+\kappa)\, y^T}{\delta_0 - 1} \quad \text{with} \quad \delta_0 \equiv \kappa \left(\frac{1-\phi}{\phi} \right)^{\gamma} \left(\frac{e_0}{W_{-1}} \right)^{\gamma - 1} \tag{A.9}$$

where it should be noted by (16) that $y_0^N(\bar{e}) < \bar{h}$. Differentiating (A.9), we obtain

$$\frac{dy_0^N}{de_0} = \frac{\delta_0 - \gamma}{\delta_0 - 1} \cdot \frac{y_0^N}{e_0}. \tag{A.10}$$

Consider that $B_0 < (1+\kappa)y^T$. From (A.9) $y_0^N > 0 \Leftrightarrow \delta_0 < 1$ and for any $e_0 \in (\bar{e}, \underline{e})$ we have $\delta_0 > \gamma$. From (A.10), it follows that $\frac{dy_0^N}{de_0} < 0$. Moreover y_0^N is well defined, that is $y_0^N > 0$ if and only if $\delta_0 < 1$, and $\delta_0 < 1 \Leftrightarrow e_0 > \underline{e}\gamma^{\frac{1}{1-\gamma}}$. Finally, if $B_0 > (1+\kappa)y^T$ then, $\frac{dy_0^N}{de_0} > 0$. □

A.7 Proof of Proposition 4

Proof. For any B and any possible B' chosen by households, the central bank solves (22). Let us denote by ϑ the multiplier on (24), $\mu \geq 0$ the non-negative multiplier on (25), and $\eta \geq 0$ the non-negative multiplier on $h \leq \bar{h}$. The optimality condition for h and e are given by

$$\eta = u_N(c^T, h) - \vartheta$$
$$0 = \gamma\vartheta - (1-\gamma)\frac{W}{e}\kappa\mu$$

which lead to $\eta = u_N(c^T, h) - \frac{1-\gamma}{\gamma}\frac{W}{e}\kappa\mu > 0$. Thus, we have $h = \bar{h}$ when the borrowing constraint (25) does not bind. That is, for

$$\bar{h} < \left[y^T - B + \frac{B'}{R}\right]^{\frac{1}{1-\gamma}} \left[\frac{\kappa(1-\phi)}{\phi(\frac{B'}{R} - \kappa y^T)}\right]^{\frac{\gamma}{1-\gamma}} \equiv \tilde{h}\left(B'; S\right) \tag{A.11}$$

where we plug (24) into (25) to obtain (A.11). It follows that when the borrowing constraint binds $h = \widetilde{h}(B'; S)$. Putting them together, we get

$$\mathcal{H}\left(B'; S\right) = \min\{\widetilde{h}\left(B'; S\right), \bar{h}\}$$

which corresponds to (26). To see why the exchange rate policy is given by (27), notice that if $\widetilde{h}(B'; S) < \bar{h}$, then we have $h = \widetilde{h}(B'; S)$ and $W = W_{-1}$. Thus, combining (24) and (A.11), we arrive at

$$\mathcal{E}(B'; S) = W_{-1}\frac{\phi}{1-\phi}\left[\kappa\frac{1-\phi}{\phi}\frac{R(y^T - B) + B'}{B' - R\kappa y^T}\right]^{\frac{1}{1-\gamma}} \tag{A.12}$$

We then use (16) to arrive at (27). If $h = \bar{h}$, i.e. when $\widetilde{h}(B'; S) > \bar{h}$, pick $W = W_{-1}\left(\frac{\widetilde{h}}{\bar{h}}\right)^{\frac{1}{\gamma}} > W_{-1}$ and use (24) to obtain (27).

It remains to show that $\mathcal{E}(B'; S) \geq \bar{e}$. First, note that $\mathcal{E}(B; S) = \bar{e}$. Intuitively, recall that when $B' = B$, the borrowing constraint does not bind for $h = \bar{h}$. Thus, $\bar{h}$ is optimal and we are at the steady-state equilibrium. Moreover, it is straightforward to see from (A.12) that $\frac{\partial\mathcal{E}(B'; S)}{\partial B'} < 0$. Therefore for any $B' \leq B$, we have that $\mathcal{E}(B; S) \geq \bar{e}$.

□

A.8 Proof of Proposition 5

Proof. We first show that the set of equilibria is convex. Note that B_1 is part of a self-fulfilling MPE if $B_1 < B_0$ and satisfies

$$B_1 = \kappa \left[y^T + \frac{1-\phi}{\phi} \left(y^T - B_0 + \frac{B_1}{R} \right)^{\frac{1}{\gamma}} (h_0)^{1-\frac{1}{\gamma}} \right] \tag{A.13}$$

where

$$h_0 = \min \left\{ \left[y^T - B + \frac{B_1}{R} \right]^{\frac{1}{1-\gamma}} \left[\frac{\kappa(1-\phi)}{\phi(\frac{B_1}{R} - \kappa y^T)} \right]^{\frac{\gamma}{1-\gamma}}, \bar{h} \right\} \equiv h(B_1) \tag{A.14}$$

Let B_1^i and B_1^j be part of a self-fulfilling MPE and $h(B_1^i), h(B_1^j)$ the associated levels of employment. Assume without loss of generality that $B_1^i > B_1^j$.
Next, consider $\tilde{B}_1 = \lambda B_1^i + (1-\lambda) B_1^j$ for any $\lambda \in (0,1)$ and let

$$h(\tilde{B}_1) = \left[y^T - B + \frac{\tilde{B}_1}{R} \right]^{\frac{1}{1-\gamma}} \left[\frac{\kappa(1-\phi)}{\phi(\frac{\tilde{B}_1}{R} - \kappa y^T)} \right]^{\frac{\gamma}{1-\gamma}} \tag{A.15}$$

be the associated level of employment. Using (A.15), we have that

$$\kappa \left[y^T + \frac{1-\phi}{\phi} \left(y^T - B_0 + \frac{\tilde{B}_1}{R} \right)^{\frac{1}{\gamma}} h(\tilde{B}_1)^{1-\frac{1}{\gamma}} \right] = \tilde{B}_1 \tag{A.16}$$

Notice by $\tilde{B}_1 \in (B_1^j, B_1^i)$ that $B_1 < B_0$. It follows that the Euler equation (5) is satisfied with $\mu_0 > 0$. The level of consumption $\tilde{c}_0^T$ associated with $\tilde{B}_1$ is positive since $\tilde{c}_0^T \in (c_0^{T,j}, c_0^{T,i})$. By construction of the maximum borrowing capacity (15), equilibrium conditions (3), (12) and (14) are satisfied. It remains to show that $h(\tilde{B}_1) < \bar{h}$. To see this notice that

$$\begin{aligned} \tilde{B}_1 = \lambda B_1^i + (1-\lambda) B_1^j &\geq \kappa y^T + \kappa \frac{1-\phi}{\phi} \left[\lambda \left(y^T - B_0 + \frac{B_1^i}{R} \right)^{\frac{1}{\gamma}} + (1-\lambda) \left(y^T - B_0 + \frac{B_1^j}{R} \right)^{\frac{1}{\gamma}} \right] (\bar{h})^{1-\frac{1}{\gamma}} \\ &> \kappa y^T + \kappa \frac{1-\phi}{\phi} \left(y^T - B_0 + \frac{\lambda B_1^i + (1-\lambda) B_1^j}{R} \right)^{\frac{1}{\gamma}} (\bar{h})^{1-\frac{1}{\gamma}}, \end{aligned} \tag{A.17}$$

where the first inequality uses $h(B_1^i) \leq \bar{h}$ and $h(B_1^j) \leq \bar{h}$. From (A.16), (A.17) and $\gamma < 1$, we have $h(\tilde{B}_1) < 1$. Therefore, it follows from (A.15) and (A.16) that for any $\lambda \in (0,1)$, $\lambda B_1^i + (1-\lambda) B_1^j$ is part of a self-fulfilling MPE. The set of self-fulfilling MPE is thus convex.

We next turn to characterize the boundary of the set of MPE. Under full employment, B_1 is a self-fulfilling MPE if $B_1 < B_0$ satisfies

$$F(B_1, B_0) \equiv \kappa \left[y^T + \frac{1-\phi}{\phi} \left(y^T - B_0 + \frac{B_1}{R} \right)^{\frac{1}{\gamma}} (\bar{h})^{1-\frac{1}{\gamma}} \right] - \frac{B_1}{R} = 0 \tag{A.18}$$

Because (i) F is convex in B_1, i.e. $\frac{\partial^2 F(B_1,B_0)}{\partial B_1^2} > 0$ and (ii) $F(B_0, B_0) > 0$ with $\frac{\partial F(B_1,B_0)}{\partial B_1}|_{B_0} > 0$ for any $B_0 < \hat{B}$ by Assumption 1, we have that equation (A.18) has two solutions $B_1^H < B_0$ and $B_1^L < B_0$. Assuming without loss of generality $B_1^H > B_1^L$, note that (i) and (ii) also imply

$$\frac{\partial F(B_1, B_0)}{\partial B_1}\Big|_{B_1^H} > 0 \quad \text{and} \quad \frac{\partial F(B_1, B_0)}{\partial B_1}\Big|_{B_1^L} < 0.$$

To see that the upper bound must have full employment, suppose by contradiction that there exists $\tilde{B}_1 \equiv B_1^H + \varepsilon > B_1^H$ with associated employment level h_0 that is part of the self-fulfilling MPE (where $\varepsilon > 0$ is arbitrary small). $\tilde{B}_1$ is part of an MPE implies that

$$\kappa \left[y^T + \frac{1-\phi}{\phi} \left(y^T - B_0 + \frac{\tilde{B}_1}{R} \right)^{\frac{1}{\gamma}} (h_0)^{1-\frac{1}{\gamma}} \right] - \frac{\tilde{B}_1}{R} = 0$$

Because $\frac{\partial F(B_1,B_0)}{\partial B_1}|_{B_1^H} > 0$ we have that

$$\kappa \left[y^T + \frac{1-\phi}{\phi} \left(y^T - B_0 + \frac{\tilde{B}_1}{R} \right)^{\frac{1}{\gamma}} (\bar{h})^{1-\frac{1}{\gamma}} \right] - \frac{\tilde{B}_1}{R} > 0 \tag{A.19}$$

That is, starting from the highest level of borrowing under full employment, an increase in borrowing relaxes the borrowing constraint (holding employment at $h_0 = \bar{h}$). Since the borrowing capacity is decreasing in h, for $\tilde{B}_1$ to be a self-fulfilling MPE (that is for (A.19) to hold with equality) it has to be that $h_0 > \bar{h}$ which violates labor market equilibrium condition $h_0 \leq \bar{h}$. Therefore, any $\tilde{B}_1 > B_1^H$ is not part of the set of self-fulfilling MPE.

To see that the lower bound must have full employment, suppose by contradiction that there exists $\tilde{B}_1 \equiv B_1^L - \varepsilon < B_1^L$ with associated employment level h_0 that is part of the self-fulfilling MPE (where $\varepsilon > 0$ is arbitrary small).[27] $\tilde{B}_1$ is part of an MPE implies that

$$\kappa \left[y^T + \frac{1-\phi}{\phi} \left(y^T - B_0 + \frac{\tilde{B}_1}{R} \right)^{\frac{1}{\gamma}} (h_0)^{1-\frac{1}{\gamma}} \right] - \frac{\tilde{B}_1}{R} = 0$$

Because $\frac{\partial F(B_1, B_0)}{\partial B_1}|_{B_1^L} < 0$ we have that

$$\kappa \left[y^T + \frac{1-\phi}{\phi} \left(y^T - B_0 + \frac{\tilde{B}_1}{R} \right)^{\frac{1}{\gamma}} (\bar{h})^{1-\frac{1}{\gamma}} \right] - \frac{\tilde{B}_1}{R} > 0 \tag{A.20}$$

That is, starting from the highest level of borrowing under full employment, a decrease in borrowing relaxes the borrowing constraint (holding employment at $h_0 = \bar{h}$). Since the borrowing capacity is decreasing in h, for $\tilde{B}_1$ to be a self-fulfilling MPE (that is for (A.20) to hold with equality) it has to be that $h_0 > \bar{h}$ which violates labor market equilibrium condition $h_0 \leq \bar{h}$. Therefore, any $\tilde{B}_1 < B_1^L$ is not part of the set of self-fulfilling MPE.

□

A.9 Proof of Proposition 6

First, consider the case where $B_0 < (1+\kappa)y^T$. From Proposition 2, $\bar{e}$ rules out the possibility of self-fulfilling crises. For $B_0 \geq (1+\kappa)y^T$, consider the policy rule

$$e(B_1, B_0) = \bar{e}\frac{B_1}{B_0} + \left(1 - \frac{B_1}{B_0}\right) \mathcal{E}\,(B_1, B_0), \tag{A.21}$$

where $\mathcal{E}\,(B_1, B_0)$ is the exchange rate level in the MPE defined in (27). For $B_1 = B_0$, we have $e(B_1, B_0) = \bar{e}$ and the economy is at the steady state equilibrium. For $B_1 < B_0$, under rule (A.21), an individual household finds it optimal to choose $b_1 \neq B_1$, and thus B_1 cannot be supported as an equilibrium. To see this, suppose by contradiction that the household chooses $b_1 > B_1$ and therefore $\mu_0 > 0$ in (5). Next, notice that under rule (A.21) we have $e(B_1, B_0) < \mathcal{E}\,(B_1, B_0)$ which in turn implies that $h(B_1, B_0) < h_0^{MPE}$ where h_0^{MPE} is

[27] Recall from Proposition B.1 which echoes Proposition 1 that B_1^L is an equilibrium for $B_0 < (1+\kappa)y^T$.

the employment level in the MPE. Thus, we have

$$
\begin{aligned}
b_1 &= \kappa R\left[y^T+\frac{1-\phi}{\phi}\left(y^T-B_0+\frac{B_1}{R}\right)^{\frac{1}{\gamma}}(h(B_1,B_0))^{1-\frac{1}{\gamma}}\right] \\
&> \kappa R\left[y^T+\frac{1-\phi}{\phi}\left(y^T-B_0+\frac{B_1}{R}\right)^{\frac{1}{\gamma}}(h_0^{MPE})^{1-\frac{1}{\gamma}}\right] = B_1
\end{aligned} \tag{A.22}
$$

which contradicts $b_1 = B_1$. Therefore, $B_1 < B_0$ cannot be supported as an equilibrium. □

B Other Monetary Regimes

In this section, we examine the following alternative monetary policy regimes: (i) full-employment policy, (ii) interest rate peg, and (iii) interest rate rule.

B.1 Full-employment policy

We consider a regime in which the central bank adjusts monetary policy to implement full employment. We first show that this is indeed feasible for the central bank.

Lemma B.1. *Consider an equilibrium under flexible wages. Then, for any W_{-1}, there exists an exchange rate policy under sticky wages that implements the equilibrium under flexible wages.*

Proof. Suppose the economy starts with $B_0 \leq \hat{B}$ and let B_1 represent the aggregate level of borrowing. Then, any exchange rate policy e_0 such that

$$
e_0 > \left(\frac{y^T-B_0+\frac{B_1}{R}}{y^T-\frac{R-1}{R}B_0}\right)^{\frac{1}{\gamma}} \tag{B.1}
$$

implements the flexible wage allocation. To see this, suppose by contradiction that the economy is not at full employment $h_0 < \bar{h}$. Then, by (3) and (9) we have

$$
W_0 = \frac{1-\phi}{\phi}\left(\frac{y^T-\frac{R-1}{R}B_0}{h_0}\right)^{\frac{1}{\gamma}} > \frac{1-\phi}{\phi}\left(\frac{y^T-\frac{R-1}{R}B_0}{\bar{h}}\right)^{\frac{1}{\gamma}} = W_{-1} \tag{B.2}
$$

which by (6) contradicts $h_0 < \bar{h}$. □

Echoing the results of Proposition 1 , we show that there exists multiple self-fulfilling crises equilibria under full-employment policy.

Proposition B.1 (Crises Under Full-Employment Policy)**.** *Suppose Assumption 1 holds and* $\gamma < 1$*. Then, under flexible wages,*

i. if $B_0 \in ((1+\kappa)y^T, \hat{B})$*, the steady-state equilibrium coexists with one and only one self-fulfilling crisis equilibrium. Moreover, we have that* $\hat{B} > (1+\kappa)y^T$*, and thus the interval is non-empty;*

ii. if $B_0 \in [\underline{B}, (1+\kappa)y^T)$*, there exist two self-fulfilling crisis equilibria that coexist with the steady-state equilibrium, where* $\underline{B}$ *is given by*

$$\underline{B} \equiv (1+\kappa)y^T - (1-\gamma)\left[\frac{1}{\gamma}\frac{\kappa(1-\phi)}{\phi}\right]^{\frac{\gamma}{\gamma-1}} \bar{h} < \underline{B}^m;$$

iii. if $B_0 < \underline{B}$*, we have one and only one equilibrium (which corresponds to the steady-state equilibrium).*

Proof. Under full employment policy, the maximum borrowing of an household is

$$\bar{b}(B_1; B_0) = \kappa R \left[y^T + \frac{1-\phi}{\phi}\left(y^T - B_0 + \frac{B_1}{R}\right)^{\frac{1}{\gamma}} (\bar{h})^{\frac{\gamma-1}{\gamma}} \right]$$

Notice again that B_1 is part of a self-fulfilling crises equilibrium if the following conditions are satisfied: $\bar{b}(B_1; B_0) \geq 0$, $B_1 \leq B_0$, and $\frac{B_1}{R} > B_0 - y^T$. Because $\bar{b}(B_1; B_0)$ is increasing and convex in B_1 with $\bar{b}(B_0; B_0) > B_0$, the equation $\bar{b}(B_1; B_0) = B_1$ has at most two solutions with one solution featuring $\frac{\partial \bar{b}(B_1; \hat{B}_0)}{dB_1} \geq 1$. Moreover, owing to

$$\frac{\partial \bar{b}(B_1; B_0)}{dB_0} = -\kappa R \frac{1-\phi}{\phi\gamma}\left(y^T - B_0 + \frac{B_1}{R}\right)^{\frac{1}{\gamma}} < 0$$

at the minimum level of initial debt level, $\underline{B}$, for which a self-fulfilling crises equilibrium exists, we have

$$\frac{\partial \bar{b}(B_1; \underline{B})}{\partial B_1} = 1 \Leftrightarrow \frac{\kappa}{\gamma}\frac{1-\phi}{\phi}\left(\frac{c_0^T}{\bar{h}}\right)^{\frac{1-\gamma}{\gamma}} = 1 \tag{B.3}$$

Using $\underline{B} = y^T + \frac{B_1}{R} - c_0^T$ and plugging in $\bar{b}(B_1; \underline{B}) = B_1$ to substitute for B_1 yields

$$\underline{B} = (1+\kappa)y^T - (1-\gamma)\left[\frac{\kappa(1-\phi)}{\gamma\phi}\right]^{\frac{\gamma}{\gamma-1}} \bar{h} < \underline{B}^m \tag{B.4}$$

with $\underline{B}^m$ is given by (A.6) and where the inequality uses $\psi_0 > 1/\gamma$. Thus, at least one self-fulfilling crises equilibrium coexists with the steady state equilibrium for $B_0 \in (\underline{B}, \hat{B})$ where $\underline{B}$ is given by (B.4) and we use $B_0 < \hat{B}$ by Lemma 1.

Moreover, since $\bar{b}(B_1; B_0)$ is convex in its first argument, the equation $\bar{b}(B_1; B_0) = B_1$ has two solutions if and only if $\bar{b}(B_1; B_0) = B_1$ has a solution and at $\tilde{B}_1$ where $\frac{\partial \bar{b}(B_1;B_0)}{\partial B_1}|_{\tilde{B}_1} = 0$ we have $\bar{b}(\tilde{B}_1; B_0) > B_0$. Because $\partial \bar{b}(B_1; B_0)/\partial B_1 = 0$ implies that $c_0^T = 0$, it follows that $\tilde{B}_1$ lowest value in the feasible domain of B_1, i.e. $\tilde{B}_1 = R(B_0 - y^T)$, and we have

$$\bar{b}(R(B_0 - y^T); B_0) = (1+\kappa)\kappa y^T - B_0 > 0 \;\Leftrightarrow\; B_0 < (1+\kappa)\kappa y^T$$

Therefore, $\bar{b}(B_1; B_0) = 0$ has two solutions for $B_0 \in \left[\underline{B}, (1+\kappa)y^T\right)$ and a unique solution for $B_0 \in \left[(1+\kappa)y^T, \hat{B}\right)$. Furthermore, as shown above the interval $[(1+\kappa)y^T, \hat{B})$ is non-empty under Assumption 1. By (B.4), we have $\underline{B} < \underline{B}^m$. □

Comparing Proposition 1 and B.1, we can see that the crisis region under full employment is larger than under fixed money supply (and therefore also larger than under fixed exchange rate).

B.2 Interest Rate Peg

We consider in this section a floating exchange rate regime where the central bank fixes the nominal rate, instead of the money supply. Assuming that the exchange rate tomorrow is given by $\bar{e}$ and the central bank today sets the nominal rate at $\tilde{R} = R$, we have that the current exchange is then determined by

$$e_0 = \frac{\bar{e}}{1-\mu_0} \tag{C.5}$$

We have the following lemma:

Lemma B.2 (Unemployment under an interest rate peg)**.** *In a self-fulfilling crisis, the exchange rate depreciates at $t = 0$ and there is unemployment.*

Proof. To see this why $h_0 < \bar{h}$, combine market clearing $h_0 = y_0^N = c_0^N$ with the demand for non-tradables (14) to obtain

$$h_0 = \left[\frac{1-\phi}{\phi}\frac{e_1}{W_0}\frac{1}{1-\mu_0}\right]^{\gamma} c_0^T$$

Using (5) and $c_0^T < c_1^T$ we arrive at

$$h_0 < \left[\frac{1-\phi}{\phi}\frac{e_1}{W_0}\right]^{\gamma} c_1^T = \bar{h} \tag{C.6}$$

Therefore, if a self-fulfilling crisis exists under $\tilde{R}_0 = R$ it has to be that $h_0 < \bar{h}$. □

We turn to showing that the exchange rate depreciates. From (C.5), we have

$$e_0 = W_{-1}\frac{u_T(y^T - B_0 + \frac{B_1}{R}, h_0)}{u_N(y^T - \frac{R-1}{R}B_1, \bar{h})}, \quad \text{with } h_0 = \left(\frac{1-\phi}{\phi}\frac{e_0}{W_{-1}}\right)^{\gamma}\left(y^T - B_0 + \frac{B_1}{R}\right) \tag{C.7}$$

Totally differentiating (C.7) yields

$$[\gamma + (1-\gamma)\tilde{\phi}_0]\frac{Rc_0^T}{e_0}\frac{de_0}{dB_1} = -\left[1 + (R-1)\frac{-u_{TT}(c_1^T, \bar{h})}{u_N(c_1^T, \bar{h})}\right] \tag{C.8}$$

where $u_{TT}(c^T, h) \equiv \frac{\partial u(c^T, h)^2}{\partial (c^T)^2} < 0$. The exchange rate depreciates in a crisis equilibrium. □

The next proposition characterizes when an economy under an interest rate peg features multiple equilibria:

Proposition B.2 (Crises under an interest rate peg)**.** *Suppose Assumption 1 holds and $\gamma < 1$. Under a flexible exchange rate with a target interest rate,*

i. if $B_0 \in ((1+\kappa)y^T, \hat{B}) \neq \emptyset$, the steady-state equilibrium coexists with one and only one self-fulfilling crisis equilibrium.

ii. if $B_0 \in [\underline{B}^r, (1+\kappa)y^T)$, there exists two self-fulfilling crisis equilibria that coexist with the steady-state equilibrium, with $\underline{B}^r > \underline{B}$.

iii. if $B_0 < \underline{B}^r$, we have one and only one equilibrium (which corresponds to the steady state equilibrium).

Proof. Note that the maximum borrowing capacity is given by (18) where e_0 is determined by (C.5). Differentiating (18), we obtain

$$\frac{\partial \bar{b}(B_1;B_0)}{dB_1} = \kappa\frac{1-\phi}{\phi}\left(\frac{W_{-1}}{e_0}\right)^{1-\gamma}[1-(1-\gamma)\xi_{B_1}]$$
$$\frac{\partial^2 \bar{b}(B_1;B_0)}{dB_1^2} = (1-\gamma)\left[-\frac{\partial \bar{b}(B_1;B_0)}{dB_1}\xi_{B_1}-\kappa\frac{1-\phi}{\phi}\left(\frac{W_{-1}}{e_0}\right)^{1-\gamma}\frac{d\xi_{B_1}}{dB_1}\right]$$

where $\xi_{B_1} \equiv \frac{Rc_0^T}{e_0}\frac{de_0}{dB_1} < 0$ is the elasticity of the exchange rate with respect to B_1 in (A.4). Differentiating (C.8), we obtain

$$\frac{d\xi_{B_1}}{dB_1} = -\frac{(1-\gamma)^2(1-\tilde{\phi}_0)^2}{1-(1-\gamma)(1-\tilde{\phi}_0)}\frac{1}{Rc_0^T}\xi_{B_1}^2-(1-\gamma)\frac{(1-\beta)\tilde{\phi}_1}{\gamma\tilde{R}_0c_1^T}\left[\frac{2+(R-1)\,c_0^T/c_1^T}{1-(1-\gamma)(1-\tilde{\phi}_0)}-\xi_{B_1}\right] < 0 \quad \text{(C.9)}$$

It follows from (C.8) and $\xi_{B_1} < 0$ that $\frac{\partial^2\bar{b}(B_1;B_0)}{dB_1^2} > 0$. Next, following the same steps as in the proof of Proposition 1, we arrive at

$$\underline{B}^r = (1+\kappa)y^T-\frac{\psi_0-1}{\psi_0}\left[\psi_0\kappa\frac{1-\phi}{\phi}\right]^{\frac{-\gamma}{1-\gamma}}h_0 \quad \text{(C.10)}$$

Thus, at least one self-fulfilling crises equilibrium coexists with the steady state equilibrium for $B_0 \in (\underline{B}^R, \hat{B})$ where $\underline{B}^R$ is given by (C.10) and we use $B_0 < \hat{B}$ by Lemma 1. Using $\frac{1}{\psi_0} < \gamma$ and $h_0 < \bar{h}$, we have follows from (C.10) that

$$\underline{B}^r > (1+\kappa)y^T-(1-\gamma)\left[\frac{1}{\gamma}\kappa\frac{1-\phi}{\phi}\right]^{\frac{-\gamma}{1-\gamma}}\bar{h} \quad \text{(C.11)}$$

Moreover, since $\bar{b}(B_1;B_0)$ is convex in its first argument, the equation $\bar{b}(B_1;B_0) = B_1$ has two solutions if and only if $\bar{b}(B_1;B_0) = B_1$ has a solution and at $\tilde{B}_1$ such that $\frac{\partial\bar{b}(B_1;B_0)}{\partial B_1}|_{\tilde{B}_1} = 0$ we have $\bar{b}(\tilde{B}_1;B_0) > B_0$. Because $\partial\bar{b}(B_1;B_0)/\partial B_1 = 0$ implies that $c_0^T = 0$, it follows that $\tilde{B}_1$ is lowest value in the feasible domain of B_1, i.e. $\tilde{B}_1 = R(B_0-y^T)$, and we have

$$\bar{b}(R(B_0-y^T);B_0) = (1+\kappa)\kappa y^T > B_0 \;\Leftrightarrow\; B_0 < (1+\kappa)\kappa y^T$$

Therefore, $\bar{b}(B_1;B_0) = B_1$ has two solutions for $B_0 \in \left[\underline{B}^r, (1+\kappa)y^T\right)$ and a unique solution for $B_0 \in \left[(1+\kappa)y^T, \hat{B}\right)$ which is non-empty under Assumption 1. □

It follows from Proposition B.2 and Proposition 2 that the crisis region under interest rate peg is larger than under fixed exchange rate.

B.3 Interest Rate Rule

In this section, we consider an interest rate rule that depends on the output gap:

$$\tilde{R}_0 = R\left(\frac{h_0}{\bar{h}}\right)^{\phi_h}, \tag{C.12}$$

where $\phi_h \geq 0$ is a non-negative coefficient that describes the strength of the interest rate response to deviations of output from its efficient level. For $\phi_h \to \infty$, the rule (C.12) corresponds to the full employment policy where monetary policy ensures $h_0 = \bar{h}$ and for $\phi_h = 0$ the rule (C.12) reduces to $\tilde{R}_0 = R$, i.e. the interest rate target policy. Using (8) and substituting for μ_0 using (5) we get

$$\tilde{R}_0 e_0 = e_1 \frac{u_T(y^T - B_0 + \frac{B_1}{R}, h_0)}{u_T(y^T - \frac{R-1}{R}B_1, \bar{h})} \tag{C.13}$$

In the proposition below, we characterize the crisis region under interest rate rules.

Proposition B.3 (Crises under an interest rate rule)**.** *Suppose Assumption 1 holds and $\gamma < 1$. Under a flexible exchange rate where the nominal interest rate is set according to* (C.12)*,*

i. if $B_0 \in ((1+\kappa)y^T, \hat{B}) \neq \emptyset$, the steady-state equilibrium coexists with one and only one self-fulfilling crisis equilibrium.

ii. if $B_0 \in [\underline{B}^I, (1+\kappa)y^T)$, there exist two self-fulfilling crisis equilibria that coexist with the steady-state equilibrium, with $\underline{B}^I > \underline{B}$.

iii. if $B_0 < \underline{B}^I$, we have one and only one equilibrium (which corresponds to the steady state equilibrium).

Proof. The proof follows the same steps as the proof of Proposition B.2 with $\xi_{B_1} \equiv \frac{Rc_0^T}{e_0}\frac{de_0}{dB_1}$ now given by

$$[(1+\phi_h)\gamma + (1-\gamma)\tilde{\phi}_0]\frac{Rc_0^T}{e_0}\frac{de_0}{dB_1} = -\left[1 + \phi_h + (R-1)\frac{-u_{TT}(c_1^T, \bar{h})}{u_N(c_1^T, \bar{h})}\right] \tag{C.14}$$

where (C.14) follows directly from totally differentiating (C.13). □

C An Extension with Domestic Currency Debt

In the baseline model, we assume that only borrowing in units of foreign currency is subject to the collateral constraint and that domestic currency debt is in zero net supply. These simplifying assumptions are not only motivated by empirical observation that emerging markets often rely heavily on external borrowing denominated in foreign currency (original sin), but most importantly, allows us to isolate the mechanism through which non-fundamental financial crisis can emerge under different exchange rate regimes. In this section, we show that the mechanism underlying our theory is qualitatively robust to relaxing these assumptions.

We relax these assumptions by assuming that there is a positive net supply of domestic currency bonds and that the collateral constraint (2) now takes the form

$$\frac{e_t b_{t+1}}{R} + \frac{\tilde{b}_{t+1}}{\tilde{R}_t} \leq \kappa \left(P_t^T y^T + W_t h_t \right) \tag{C.15}$$

Note that the inter-temporal Euler equations for domestic bonds (4) becomes

$$(1-\mu_t) u_T(c_t^T, c_t^N) = \beta \tilde{R}_t \frac{e_t}{e_{t+1}} u_T(c_{t+1}^T, c_{t+1}^N) \tag{C.16}$$

and the implied interest parity condition which relates the nominal returns on domestic and foreign currency bonds to the expected currency depreciation is

$$R = \tilde{R}_t \frac{e_t}{e_{t+1}} \tag{C.17}$$

The definition of equilibrium 1 is now modified with (C.16) and (C.15), in terms of households' optimality, and market clearing now for domestic currency bonds is

$$\tilde{b}_{t+1} = \bar{D} e_{t+1}. \tag{C.18}$$

Combining the budget constraints of households, firms, and the central bank, as well as market clearing condition (12) and (C.17), we arrive at the resource constraint for tradables:

$$c_t^T - y^T = \frac{1}{R} \left(b_{t+1} + \frac{\tilde{b}_{t+1}}{e_{t+1}} \right) - \left(b_t + \frac{\tilde{b}_t}{e_t} \right). \tag{C.19}$$

Note that the individual borrowing limit in period t can be expressed as

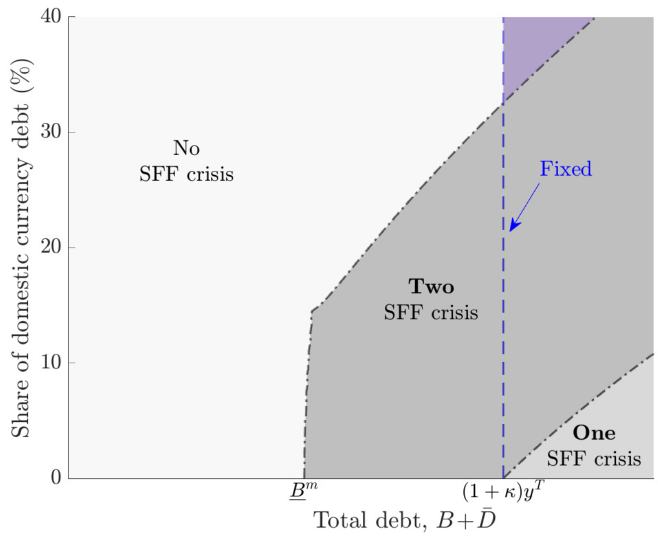
$$\bar{b}(B_{t+1};B_t)+\bar{D} = \kappa R \left\{ y^T + \frac{1-\phi}{\phi} \left[y^T - \left(B_t + \frac{\tilde{b}_t}{e_t} \right) + \frac{B_{t+1}+\bar{D}}{R} \right]^{\frac{1}{\gamma}} (h_t)^{1-\frac{1}{\gamma}} \right\} \tag{C.20}$$

We solve the model numerically for different values of $\bar{D}$. Figure C.1 plots the crisis region under flexible exchange rates. (Under a fixed exchange rate regime, the crisis region remains unaffected.)

Figure C.1 shows that as the share of local-currency debt increases, the range of debt levels over which the economy admits multiple equilibria shrinks. In particular, for shares above 35%, there exists a region of initial debt in which a fixed-exchange-rate regime is vulnerable to self-fulfilling crises, while a floating regime is not; in that region, fixing is dominated by floating. This region is denoted in purple. This result is consistent with Mendoza and Rojas (2018). In a flexible-price environment, they show that crisis vulnerability falls when debt is indexed to the price of aggregate consumption. The mechanism is analogous: in their model, a bad equilibrium features a *real* exchange-rate depreciation that reduces the real value of liabilities; in ours, a bad equilibrium features a *nominal* depreciation that likewise reduces the real burden of nominal debt.

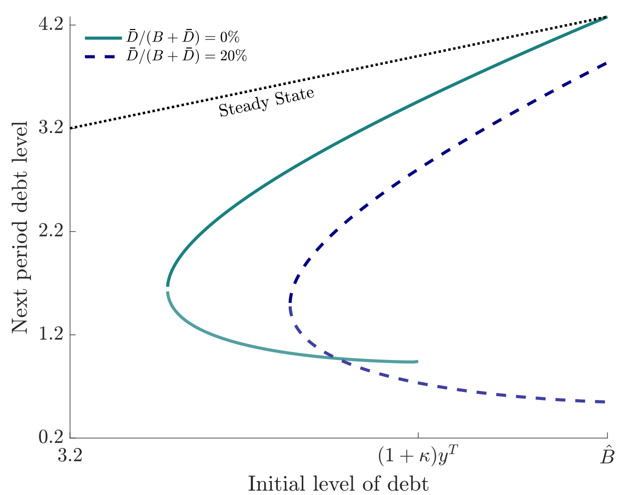
Interestingly, however, intermediate local-currency shares may backfire. As shown in Figure C.2, for total debt below $(1+\kappa)\, y^T$, the economy may exhibit two self-fulfilling crisis equilibria (whereas with no local-currency debt there is only one). Because the worst of these two crisis equilibria yields outcomes inferior to the unique crisis equilibrium without local-currency debt, overall vulnerability is higher.

Figure C.1: Domestic currency debt and the crisis region



Note: The crisis region under fixed exchange rate is located to the right of the vertical dashed-blue line.

Figure C.2: Borrowing in period 0



Note: The figure shows the possible equilibrium levels of borrowing for two values of initial local currency debt.

D Empirical Analysis

Exchange rate flexibility and labor market rigidity. To study this empirical prediction in the data, we use a measure of effective downward nominal wage rigidity (DNWR) following Schmitt-Grohé and Uribe (2016) where the effective DNWR is implicitly defined based on the following DNWR constraint $W_t \geq \rho_w W_{t-1}$. In particular, as in Matschke (2024), the measure is constructed by computing the decline in wages conditional on episodes with an observed increase in the unemployment rate (i.e., it provides an implied measure of ρ_w).

Table C.1: Wage rigidity and exchange rate regime in 2019

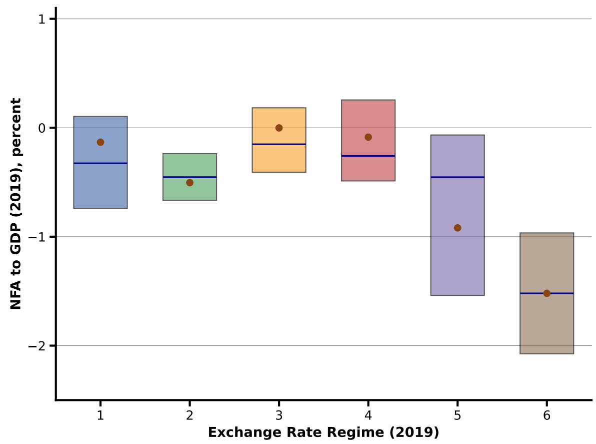
Exchange Rate Regime	Countries	Implied ρ_w Mean
1	Cambodia, Mauritius, Panama, Bolivia, Armenia, Costa Rica, Bosnia and Herzegovina, El Salvador	1.048
2	Honduras, Peru, Vietnam, Sri Lanka, Philippines, Hungary, Pakistan, Indonesia, Dominican Republic, Guatemala	1.043
3	Chile, Thailand, Malaysia, Poland, Uruguay, Paraguay, Brazil, Colombia	1.035
4	Mexico, South Africa	1.000

Notes: #1 corresponds to *Fixed*; #2 corresponds to *Crawling Peg*; #3 corresponds to *Crawling band/managed floating*; and #4 corresponds to *Floating*.

This measure of wage rigidity is constructed for 30 emerging countries spanning the four classes of exchange rate regime according to Ilzetzki, Reinhart, and Rogoff (2019)'s classification. The table suggests that, on average, countries with a higher degree of exchange rate flexibility tend to have a lower degree of wage rigidity, as captured by a lower estimated value for the wage rigidity parameter ρ_w.

Exchange rate flexibility and debt levels. To study empirically relationship between exchange rate flexibility and debt, we combine Ilzetzki, Reinhart, and Rogoff (2019)'s exchange rate regime dataset with the updated dataset on the ratio of net foreign assets (NFA) to GDP from the External Wealth of Nations Database by Lane and Milesi-Ferretti (2018). Figure D.1 presents the distribution of NFA-to-GDP ratio by exchange rate regime in 2019. Consistent with our theoretical finding, Figure D.1 shows that countries with high level of debt tends to be floaters while those with intermediate/low debt level tends to experience a fear of floating.

Figure D.1: Distribution of NFA-to-GDP ratio by Exchange Rate Regime (2019)



Notes: The sample includes 179 countries that are present in both datasets. The distribution of countries across exchange rate regimes is as follows: regime #1 comprises 97 countries, regime #2 includes 42 countries, regime #3 covers 21 countries, regime #4 consists of 7 countries, regime #5 contains 8 countries, and regime #6 contains for 4 countries.

Exchange rate flexibility and debt levels. We now estimate the differential response of consumption and GDP at different horizons to a "regime-induced" exchange rate depreciation using panel local projections (see Jordà, 2005). In particular, we follow Fukui, Nakamura, and Steinsson (2023) and run the regression below:

$$y_{i,t+h} - y_{i,t-1} = \alpha_{i,h} + \alpha_{r(i),t,h} + \beta_h \, \text{Peg}_{i,t} \times \Delta e_{USD,t} + \varrho_h \, \text{Peg}_{i,t} \times \Delta e_{USD,t} \times NFA_{i,t} + \Gamma_h' \boldsymbol{X}_{i,t-1} + \gamma_h \text{Peg}_{i,t} + \epsilon_{i,t,h} \quad \text{(C.1)}$$

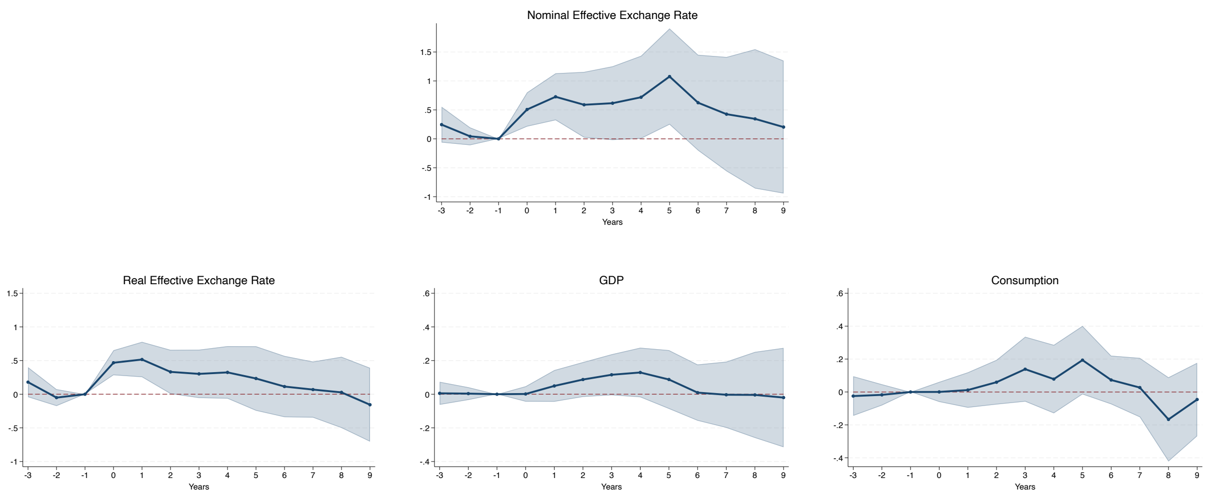
where $y_{i,t+h}$ is the outcome variable in country i at time $t+h$ (i.e. either consumption, GDP, nominal exchange rate and real exchange rate), $NFA_{i,t}$ is the NFA-to-GDP ratio of country i at time t, $\text{Peg}_{i,t}$ is an indicator of whether country i is a peg at time t, $\Delta e_{USD,t}$ is the log change in the US dollar nominal effective exchange rate between time $t-1$ and time t, $\alpha_{i,h}$ is a country fixed effect, $\alpha_{r(i),t,h}$ is a region-by-time fixed effect, $\boldsymbol{X}_{i,t-1}$ denotes additional control variables, and $\epsilon_{i,t,h}$ denotes unmodelled influences on the outcome variable. The coefficient of interest is ϱ_h. We run this regression on annual data for different horizons h. Figure C.2 presents the impulse responses.

Consistent with Fukui, Nakamura, and Steinsson (2023), we find that in response to a 1% depreciation of the US dollar, the trade-weighted nominal effective exchange rate of pegs depreciates on average by 0.5% relative to floats (top panel) which in turn leads to persistent real depreciation, and a persistent increase in both GDP and consumption (middle panels).

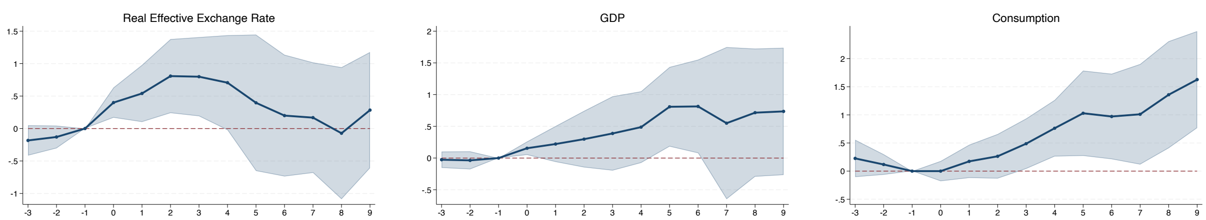
Most importantly, we find these "regime-induced" exchange rate depreciations are less expansionary in more indebted countries (bottom panels). Specifically, we find that GDP rises by about 0.15% more in countries with higher NFA-to-GDP-ratio in the first year and reaches a peak of 0.8% after 5 years. Consumption also expands more in countries with higher NFA-to-GDP-ratio (or equivalently, expands less in countries with more debt).

Figure C.2: Response of Pegs vs. Floats for Exchange Rate, Output, and Consumption

Direct effect (β_h)



Interaction with NFA (ϱ_h)



Note: This figure plots the response of the nominal effective exchange rate, real effective exchange rate, real GDP, and consumption for pegs versus floats in response to a change in the US dollar exchange rate. Following Fukui, Nakamura, and Steinsson (2023), for the exchange rates, the dependent variable is the change in the logarithm of the variable. For GDP, the dependent variable is the percentage change, while for consumption it is $(C_{i,t+h} - C_{i,t-1})/Y_{i,t-1}$. These are our estimates of β_h and κ_h in equation (C.1) for different horizons h when these variables are the outcome variables. The shaded areas are 95% confidence intervals.