A Risk-based Theory of Exchange Rate Stabilization*

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Abstract

We develop a novel, risk-based theory of the effects of exchange rate stabilization. In our model, the choice of exchange rate regime allows policymakers to make their currency, and by extension, the firms in their country, a safer investment for international investors. Policies that induce a country’s currency to appreciate when the marginal utility of international investors is high lower the required rate of return on the country’s currency and increase the world-market value of domestic firms. Applying this logic to exchange rate stabilizations, we find a small economy stabilizing its bilateral exchange rate relative to a larger economy can increase domestic capital accumulation, domestic wages, and even its share in world wealth. In the absence of policy coordination, small countries optimally choose to stabilize their exchange rates relative to the currency of the largest economy in the world, which endogenously emerges as the world’s “anchor currency.” Larger economies instead optimally choose to float their exchange rates. The model therefore predicts an equilibrium pattern of exchange rate arrangements that is remarkably similar to the one in the data.

JEL classification: E4, E5, F3, F4, G11, G15

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Two thirds of all countries in the world stabilize their currency relative to the US dollar. Such stabilizations take on many different forms, including pegs, moving bands, stabilized arrangements, and managed floats. Their common feature is that they set an upper bound for the volatility of the real or nominal exchange rate, without necessarily manipulating its mean. Why do so many countries stabilize their exchange rates relative to the US dollar?

In this paper, we develop a novel, risk-based theory of the effects of currency manipulation in general, and currency stabilization in particular. In this stylized model, the choice of exchange rate regime affects economic outcomes because it allows policymakers to make their currency, and by extension, the firms based in their country, a safer investment from the perspective of international investors. Policies that induce a country’s currency to retain value or even appreciate when the marginal utility of international investors is high (in “bad times”) lower the required rate of return on the country’s currency and thus also lower domestic interest rates and increase the world-market value of domestic firms. Policies that change the variances and covariances of real exchange rates can thus, via their effect on interest rates and asset returns, affect the allocation of capital across countries.

This approach, linking a country’s exchange rate regime to the value of domestic firms, yields three main insights. First, in canonical models of exchange rate determination, a direct link exists between the stochastic properties of a country’s exchange rate, the expected return on its currency, and the world-market value of its firms (in particular those producing its nontraded goods). The safer a country’s currency is from the perspective of international investors, the safer is the stream of dividends produced by its firms, and the higher domestic investment and wages. Second, the choice of target currency is key to the effects of any exchange rate stabilization. A country that stabilizes its exchange rate relative to a “safe” currency that appreciates when marginal utility is high inherits some or all of the stochastic properties of that target currency. Through its effect on risk premia, a stabilization relative to the safest currency in the world thus offers a maximal boost to the value of domestic firms and to domestic investment and wages. Third, stabilizations are generally cheaper to implement for smaller countries whose actions have little or no effect on the price of traded goods in world markets.

Taken together, these qualitative insights shed new light on otherwise puzzling features of exchange rate arrangements we see in the data today. Since the demise of the Bretton-Woods system of fixed exchange rates in 1975, individual countries have been largely free to choose their own exchange rate regime. Despite this lack of centralized coordination, recent research

\footnote{According to a comprehensive analysis by Ilzetzki, Reinhart, and Rogoff (2019). See Table 1 for a summary.}
by Ilzetzki, Reinhart, and Rogoff (2019) has shown surprising regularity in the choices made by individual countries. Table 1 shows three stylized facts from their data. First, small economies tend to stabilize, whereas only the largest economies in the world float their exchange rate. Second, the smaller the economy, the stricter the stabilizations tend to be — small economies such as Hong Kong, and Iceland tend to maintain hard pegs, while intermediate size economies, such as Mexico or Thailand allow more flexibility in their stabilizations. Third, there is remarkable agreement in the choice of target country: The vast majority of stabilizations target the currency of the largest economy in the world, the US dollar, making it the “anchor” currency of the world monetary system. Almost all exceptions to this rule instead target the currency of the largest market in the world, the euro.

Figure 1 adds to this list a fourth, less well-known, set of stylized facts that will be key to our interpretation below: Small and medium-sized economies that stabilize their exchange rates have lower interest rates, their currencies pay lower returns to international investors, and their firms use relatively more capital than those that do not. Holding constant the size of a country’s economy, a one percentage point decrease in the allowed annual standard deviation of its nominal exchange rate relative to the US dollar is statistically significantly associated with a 0.4 percentage point decrease in its risk-free interest rate (Panel a), 0.4 pp lower average returns the currency pays to international investors (Panel b), and a 1.6% increase in the capital intensity of production in the country (Panel c). In other words, going from a soft stabilization that allows a five percent annual standard deviation to the US dollar (such as Mexico’s managed float), to a much tighter stabilization allowing only variations of two percent (such as Thailand’s moving band) is associated with about a 4.8% increase in the domestic capital-to-output ratio.

We argue this apparent effect of stabilizations on interest rates and capital intensity, and the patterns in countries’ choices of exchange rate regime and anchor currency mentioned above, arise naturally from optimal non-cooperative behavior in a parsimonious model where currency risk premia affect the allocation of capital across countries. In other words, we argue the US dollar may be the anchor of the world monetary system because smaller countries are optimally trying to attract international investment by reducing the risk associated with their currencies.

Our work builds on a growing literature that links highly persistent differences in interest rates, currency returns, and capital intensity across countries to the stochastic properties of their currencies (Lustig and Verdelhan 2007; Lustig, Roussanov, and Verdelhan 2011; Hassan and [2] The data are monthly for 38 countries, 1983-2010. For ease of replicability, we simply merge the replication datasets of Ilzetzki et al. (2019) and Hassan and Mano (2019). Panel (c) uses annual data from the Penn World Table (Feenstra et al. (2015)). See the caption of Figure 1 for details.
This literature has explored various potential drivers of heterogeneity in the stochastic properties of countries’ exchange rates, ranging from differences in country size (Martin, 2012; Hassan, 2013) and financial development (Maggi, 2017) to trade centrality (Richmond, 2019) and differential resilience to disaster risk (Farhi and Gabaix, 2016; Colacito et al., 2018). The common theme across these “risk-based” theories is that whatever makes countries different from each other results in differential sensitivities of their exchange rates to various shocks, so that some currencies (typically the US dollar) tend to appreciate systematically when marginal utility is high.

In this paper, we go one step further and argue the stochastic properties of exchange rates are themselves subject to policy intervention. To formalize this idea, we solve for the effect of currency manipulation on risk premia within an otherwise standard model of exchange rate determination. In our stylized model, households consume a freely traded good and a country-specific nontraded good. The nontraded good is produced by domestic firms, the shares of which are the only assets traded in an international stock market. In equilibrium, the real exchange rate may fluctuate in response to country-specific shocks to productivity or demand.

As a stand-in for the various potential sources of heterogeneity in the stochastic properties of countries’ exchange rates mentioned above, we allow countries to differ in size. That is, we assume all shocks are common within countries, and some countries account for a larger share of world GDP than others. In the absence of policy intervention, this heterogeneity in country size endogenously generates differences in interest rates, because shocks that raise the price of consumption in a larger country spill over more into the world-market price of traded goods. As a result, the currencies of larger countries tend to appreciate when the marginal utility of international investors is high. Larger countries therefore have lower risk-free interest rates, more valuable firms, and higher capital-output ratios in equilibrium.

Within this standard economic environment, we study the effects of policies that lower the variance of one “stabilizing” country’s real exchange rate relative to a “target” country’s currency, while leaving the mean of the exchange rate unaffected. To this end, we assume each country has a central bank that issues and controls the supply of domestic currency, and that the nominal price of the traded good is sticky in that domestic currency, giving the central bank the means to affect allocations and the real exchange rate.

Other papers in this literature have studied heterogeneity in the volatility of shocks affecting the nontraded sector (Tran, 2013), factor endowments (Ready, Roussanov, and Ward, 2017; Powers, 2015), and risk aversion in combination with country size (Govillot, Rey, and Gourinchas, 2010). Also see Gourinchas and Rey (2007), Campbell, Serfaty-De Medeiros, and Viceira (2010), Menkhoff et al. (2012), David, Henriksen, and Simonovska (2016), and Verdelhan (2017). Hassan and Zhang (2021) survey this literature.
Because nontraded goods cannot be shipped internationally, stabilizing the real exchange rate requires driving a wedge between the domestic and world-market prices of traded goods. For example, when the target country appreciates, the stabilizing country must artificially raise the domestic relative price of traded goods to increase the price of the domestic consumption bundle and match the appreciation. We show these stabilizing wedges between the domestic and international prices of traded goods arise naturally from a simple nominal stabilization regime where the central bank exchanges domestic for foreign currency at a predetermined rate. In this sense, a nominal stabilization implements a real stabilization.

We first consider the case in which the stabilizing country is small and thus only affects its own price of consumption. A small country that stabilizes its exchange rate relative to a larger country inherits the stochastic properties of the larger country’s exchange rate, so that the stabilized exchange rate now also tends to appreciate when marginal utility is high (that is, it retains value in “bad times”). A safer currency, in turn, comes with a lower domestic interest rate, a higher world-market value of domestic firms, and increased capital accumulation — the relation shown in Figure 1.

By raising the domestic price of traded goods whenever the target country appreciates, the stabilizing country effectively reduces domestic consumption and thus exports additional traded goods in these states of the world. If the target country is large, these states tend to be those in which the world-market price of traded goods is high, so that the stabilizing country effectively sells traded goods when they are expensive and buys them when they are cheap. Stabilizing relative to a larger target country thus generates an insurance premium in the form of additional seigniorage. (Effectively, a stabilizing country provides more insurance to the target country than it would under freely floating exchange rates, and thus increases the volatility of its own consumption.) If the target country is sufficiently large, this insurance premium may be so large that the stabilization generates a positive net present value of revenues. In this sense, stabilizations relative to a larger country increase, rather than deplete, the central bank’s resources.

However, this revenue-generating effect diminishes when the stabilizing country itself becomes larger, because the stabilization increases the variation in the stabilizing country’s own demand for traded goods and therefore its price impact. When the stabilizing country is large enough to affect the world-market price of traded goods, the stabilization thus induces an unfavorable change in the state-contingent prices of traded goods. The larger the stabilizing country, the more resources are required to maintain a stable exchange rate, making stabilization less attractive for larger countries.
Although the allocation is Pareto efficient if all central banks float their exchange rates, the model nevertheless produces a consistent rationale for currency stabilization. The reason is our assumption that households can transact in an international stock market, but cannot insure against the imposition of currency stabilization ex-ante. Because of this restriction on the asset space, changes in the value of an asset that even a small country has pricing power over (the relative value of its own firms) can translate into shifts in relative wealth across countries. In particular, a small country that announces a stabilization relative to a larger country not only raises the world-market value of its firms, but also increases its households’ share in world wealth. We show this valuation effect can be so large that it more than compensates for all domestic distortions caused by the stabilization.

The model therefore predicts an equilibrium pattern of exchange rate arrangements remarkably similar to that in the data: In the absence of policy coordination, it is optimal for a small country to stabilize its exchange rate; larger countries optimally adopt “softer” stabilizations (due to the rising costs of implementing the stabilization); and the countries with the largest economies find it optimal to float. The optimal target currency for all stabilizations is the currency of the largest country in the world, endogenously rendering this currency the “anchor” currency of the world.

Because the allocation of resources under freely floating exchange rates is Pareto efficient, any utility gain accruing to a stabilizing country must come at the expense of households in another country. Interestingly, these costs of stabilization do not fall disproportionately on the target country, but on other economies that float their exchange rate and are not the target of the stabilization. The reason is that all countries with floating exchange rates suffer from the valuation effect and some distortion of their consumption plans, whereas only the target country receives something in return: targeted consumption insurance, courtesy of the fact that stabilizing countries export additional traded goods whenever the target country appreciates. In this sense, the model also reflects the general intuition that being at the center of the world monetary system provides a benefit, and that the target country does not wish to retaliate.

To derive these conceptual insights as plainly and clearly as possible, we begin by doing so within a stylized real business cycle model of exchange rate determination. While this canonical framework has a number of well-known shortcomings, none of these are crucial for our main insights, which apply generally. In various extensions, we show the same broad set of conclusions arises regardless of whether variation in exchange rates is driven primarily by supply or demand shocks, regardless of whether the stabilization regime is fully credible, and that the positive
conclusions of our analysis also extend to a model where international financial markets are segmented and assets are priced by financial intermediaries.

We make four main caveats to our interpretation. First, we focus on differences in country size only in the interest of parsimony. Variations of the model where differences in interest rates also result from differences in financial development or some of the other microfoundations mentioned above should yield similar interpretations—with the US dollar and the euro emerging as the safest currencies in the world. Second, although we solve for optimal stabilizations, we do not attempt to answer the broader question of whether other, more complicated, patterns of currency manipulation might produce superior results. Third, as in most models with standard preferences, risk premia are quantitatively small in our framework, so that a quantitative application would need additional ingredients. Finally, in our model, currency manipulation manifests itself as a wedge between the domestic and world-market prices of traded goods. In richer models, currency manipulations could also operate by changing allocations within countries, such as the sectoral allocation of labor or the distribution of wealth across households.

Our paper makes two main contributions to the existing literature: First, we highlight a novel link between exchange rate regimes, currency risk premia, and capital accumulation that can and should operate in a wide range of conventional models of exchange rate determination. Second, we offer a novel rationale for the prevalence of exchange rate stabilizations among small and medium-sized economies and the first formal model that can rationalize the multilateral patterns in exchange rate arrangements that have arisen since the collapse of the Bretton-Woods system.

A large literature studies the effects of nominal stabilizations in two-country New Keynesian models, where they affect the level of production by altering markups (e.g., Kollmann 2002; Devereux and Engel 2003; Fornaro 2015). Another, largely empirical, literature argues that stabilizations may promote bilateral trade or serve to import monetary policy credibility. More closely related to our own work, Fanelli and Straub (2021) and Gabaix and Maggiori (2015) argue real exchange rate interventions can alter the distribution of wealth across agents under segmented markets. Our work complements these other approaches in that the effect of currency stabilization on risk premia may operate in parallel to all of these other mechanisms. To our

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4 One strand of this literature analyzes optimal monetary policy in small open economies with fixed exchange rates (Kollmann 2002; Parrado and Velasco 2002; Gali and Monacelli 2005; Auclert and Roglić 2014), whereas another deals with the choice of the exchange rate regime in the presence of nominal rigidities (Helpman and Razin 1987; Bacchetta and van Wincoop 2000; Corsetti, Dedola, and Leduc 2010; Schmitt-Grohé and Uribe 2012; Bergin and Corsetti 2015), or collateral constraints (Ottonello 2015; Fornaro 2015).  
knowledge, none of these existing approaches have been used to formally model the optimal choice of target currency, nor the emergence of a single anchor currency or any of the other stylized facts outlined above.

In this sense, our work also relates to a recent literature that argues for a special role of the US dollar in world financial markets. Branches of this literature have focused on the emergence of a dominant currency for debt issuance (Chahrour and Valchev 2019, Farhi and Maggiori 2017, He, Krishnamurthy, and Milbradt 2019, Gopinath and Stein 2019) and on the transmission of monetary shocks (Boz et al. 2020, Miranda-Agrippino and Rey 2015, Zhang 2022).

More broadly, our paper also relates to a large literature on capital controls. Similar to Costinot, Lorenzoni, and Werning (2014), who model capital controls as a manipulation of intertemporal prices, we show that currency stabilizations may be thought of as a manipulation of state-contingent prices. The key difference is that capital controls affect allocations through market power and rents, whereas currency stabilization affects allocations through risk premia, even when the country manipulating its exchange rate has no effect on world market prices.

1 Effects of Currency Manipulation in Reduced Form

We begin by deriving the main insights of our analysis in their most general form. Consider a world economy in which international assets are priced by a unique stochastic discount factor that depends only on the realization of a world-wide shock, \( \lambda_T \). Households consume a country-specific final good, the price of which (accounted for in some common unit) depends on this world-wide shock and a country-specific shock, \( x_n \),

\[
p^n = a\lambda_T + bx^n, \tag{1}
\]

where \( \lambda_T \sim N(0, \sigma^2_{\lambda_T}) \) and \( x^n \sim N(0, \sigma^2_x) \) are normally distributed, not necessarily independent, shocks and \( a \) and \( b \) are constants greater than zero. As we show in later sections, this structure arises naturally from a microfounded model where \( x^n \) varies with country-specific shocks to supply or demand; in other words, it is a stand-in for any factor that affects the price of consumption in one country more than in others. The higher \( x^n \), the higher the price of domestic consumption.

The real exchange rate between two countries is the relative price of their respective final

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goods. In logs,
\[ \sigma_{f,h} = p_f - p_h. \]

The risk-based view of differences in currency returns applies some elementary asset pricing to this expression. Using the Euler equation of an international investor, one can show the log expected return to borrowing in country \( h \) and to lending in country \( f \) is
\[ r_f + \Delta \mathbb{E}_{s_f,h} - r_h = \text{cov} \left( \lambda_T, p_h - p_f \right), \]
(2)
where \( r^n \) is the risk-free interest rate in country \( n \) and the log stochastic discount factor is equated to \( \lambda_T \) for simplicity. This statement means a currency that tends to appreciate when \( \lambda_T \) is high pays a lower expected return and, if \( \Delta \mathbb{E}_{s_f,h} = 0 \), also has a lower risk-free interest rate. That is, a currency that appreciates in bad times (when consumption goods are expensive everywhere) provides a hedge against worldwide consumption risk and pays lower returns in equilibrium.

Equations (1) and (2) are the main ingredients of risk-based models of long-lasting differences in interest rates across countries, where different approaches model differences in the stochastic properties of \( p^n \) as the result of heterogeneity in country size, the volatility of shocks, trade centrality, financial development, factor endowments, etc.

We make a simple point relative to this literature: If this risk-based view of currency returns has merit, then policies that alter the covariance between a country’s exchange rate and \( \lambda_T \) can alter interest rates, currency returns, and the allocation of capital across countries. In particular, a country that adopts a policy that systematically increases the price of domestic consumption when \( \lambda_T \) is high can lower its risk-free interest rate relative to all other countries in the world.

As an example, consider a “manipulating” country (indexed by \( m \)) that levies a tax on domestic consumption of traded goods that is proportional to the realization of \( \lambda_T \), such that
\[ p^m = a\lambda_T + bx^m + \pi \lambda_T, \]
where \( \pi \) is some positive constant. The taxation scheme increases the tendency of \( p^m \) to appreciate when \( \lambda_T \) is high and thus, according to (2), lowers its interest rate relative to all other countries in the world by \( \pi \sigma^2_{\lambda_T} \).

If interest rates play a role in allocating capital across countries (as is the case in our fully specified model), manipulations of the stochastic properties of exchange rates can thus divert

\[ \Delta \mathbb{E}_{s_f,h} \] is defined as the logarithm of the ratio of the countries’ expected real price changes. See Appendix B for a formal derivation.
capital investment to the country that conducts the manipulation, and, more broadly, alter the equilibrium allocation of capital across countries. The remainder of this paper fleshes out this argument in the context of a general equilibrium model and applies it to one of the most pervasive policies in international financial markets: currency stabilization.

2 Stabilizing the Real Exchange Rate

We begin by studying the effect of stabilizing the real exchange rate in a highly stylized environment, where money is neutral and the allocation of capital across countries, as well as the stochastic properties of real exchange rates, is determined solely as a function of productivity shocks \cite{BackusSmith1993}. Within this canonical international real business cycle model, one country, labeled the stabilizing country, deviates from the competitive equilibrium by stabilizing its real exchange rate relative to a target country.

Our purpose in beginning our analysis in this parsimonious environment is to lay bare the main mechanisms as clearly and concisely as possible and to contrast them with the existing literature. We emphasize that none of our main insights depend on monetary neutrality or any of the well-known empirical shortcomings of the international real business cycle model. Instead, the intuition from this baseline model continues to apply when we add sticky prices and stabilizations of the nominal exchange rate in section 3, study floating bands and partially credible stabilizations in section 4, and when we study more general economic environments where international financial markets are segmented and exchange rates are driven by preference shocks in section 5.

2.1 Economic Environment

Two discrete time periods exist: \( t = 1, 2 \). There exists a unit measure of households \( i \in [0, 1] \), partitioned into three subsets \( \Theta^n \) of measure \( \theta^n \). Each subset represents the constituent households of a country. We label these countries \( n = \{m, t, o\} \) for the stabilizing (manipulating), target, and outside country, respectively. Households make an investment decision in the first period. All consumption occurs in the second period. All consumption occurs in the second period.

Households derive utility from consuming an index composed of a country-specific nontraded good, \( C_{N,2} \), and a freely traded good, \( C_{T,2} \) in each state \( \omega \), where

\[
C_2(i, \omega) = C_{T,2}(i, \omega)\tau C_{N,2}(i, \omega)^{1-\tau} \tag{3}
\]
and $\tau \in (0, 1)$. Each household exhibits constant relative risk aversion according to

$$U(i) = \frac{1}{1 - \gamma} \mathbb{E} \left[ (C_2(i, \omega))^{1-\gamma} \right],$$

where $\gamma > 0$ is the coefficient of relative risk aversion.

At the start of the first period, each household owns a firm that produces the local, country-specific, nontraded good using a Cobb-Douglas production technology that employs capital and labor. Each household supplies one unit of labor inelastically to its own firm and, in addition, owns one unit of capital, which it can sell to its own firm or to any other firm in the world. Each firm’s output of nontraded goods is

$$Y_{N,2}(i, \omega) = \exp(\eta^n)K(i)^\nu$$

where $0 < \nu < 1$ is the capital share in production, $K(i)$ is the (per capita) stock of capital, and $\eta^n$ is a country-specific productivity shock realized at the start of the second period,

$$\eta^n \sim N \left( -\frac{1}{2} \sigma_N^2, \sigma_N^2 \right).$$

Capital can be freely shipped in the first period, at the end of which it is invested for use in the production of nontraded goods in the second period. In the second period, each household is also endowed with one unit of the traded consumption good.

At the end of the first period, firms trade units of capital and households trade claims to the output of their firms (stocks) in an international stock market. Throughout, we use the traded consumption good as the numéraire, such that all prices and returns are accounted for in the same units. To simplify the derivation, we also assume households receive a country-specific transfer in the first period, $\kappa^n$, that equalizes the marginal utility of wealth across households in the absence of currency stabilization. Finally, because all households and firms within a given country are identical and consumption only occurs in the second period, we henceforth drop the household index $i$ as well as the time subscript $t$ whenever appropriate and write the per-capita capital stock, output, and consumption of traded and nontraded goods in country $n$ as $K^n$, $Y^n_{N,2}$, $C^n_T$, and $C^n_N$, respectively.

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As mentioned above, even under freely floating exchange rates, differences in country size endogenously generate cross-country differences in firm values and thus in household wealth (Hassan, 2013). The transfer $\kappa^n$ compensates for these pre-existing differences under the freely floating regime, so that any remaining endogenous differences in wealth across households are exclusively attributable to policy intervention.
In sum, the economic environment of our baseline model is identical to that of a standard international real business cycle model. Our only, somewhat subtle, departure from this frictionless benchmark is that we confine households to trading stocks in international markets, and do not allow them to trade a full set of state-contingent claims. We prefer adding this modest restriction on the asset space both for realism and because it gives rise to a model-consistent rationale for stabilization which we discuss in detail in section 2.5.

In the meantime, however, note that because households can trade a unique set of stocks for each country and shock, financial markets are complete within the second period. As a result, the allocation of goods across households (given a distribution of wealth) is efficient in the absence of government interventions and coincides with the solution to the Social Planner’s problem with unit Pareto weights. Consequently, all the positive predictions of our baseline model are invariant to whether or not we impose the aforementioned restriction on the asset space.

**Currency Stabilization** We define a real exchange rate stabilization as any policy that decreases fluctuations of the stabilizing country’s log real exchange rate with the target country by a fraction \( \zeta \in (0, 1] \) relative to the freely floating regime, without distorting the conditional mean of the log real exchange rate. Denoting the real exchange rate that would arise under freely floating exchange rates with an asterisk, a stabilization is thus a policy such that

\[
\text{var}\left( s^{t,m} \right) = (1 - \zeta)^2 \text{var}\left( s^{t,m*} \right) \quad \text{(P1)}
\]

and

\[
\mathbb{E}\left[ s^{t,m} | \{K^n\} \right] = \mathbb{E}\left[ s^{t,m*} | \{K^n\} \right]. \quad \text{(P2)}
\]

We refer to \( \zeta \in (0, 1] \) as a stabilized real exchange rate and \( \zeta = 1 \) as a “hard” peg.

The stabilizing country’s government has two policy instruments available to achieve (P1) and (P2): It has the ability to pay a lump-sum transfer, \( \bar{Z} \), to each household in its country in the first period and to levy a state-contingent tax on the domestic consumption of traded goods in the second period (\( Z(\omega) \)). (In our preferred interpretation, these parts will be taken over by intervention in currency markets and seigniorage. Because showing this correspondence requires

\[9\] In the terminology of Coeurdacier and Rey [2013], financial markets are “first-order complete” in the sense that the payoffs of the available assets span all states of the world in the log-linear solution to the competitive equilibrium.

\[10\] See Appendix C.4 for details.
additional model ingredients, we prefer to first derive results in this more general form.)

The per-capita cost of implementing exchange rate stabilization is thus

$$\Delta \text{Res} = \bar{Z} - \mathbb{E} \left[ \left( \frac{\Lambda_T(\omega)}{\Lambda_{T,1}} \right) (Z(\omega) - 1) C^m_T(\omega) \right],$$

(6)

where $\Lambda_T(\omega)$ represents the (world market) shadow price of one unit of traded consumption in state $\omega$ of the second period and $\Lambda_{T,1} = \mathbb{E}[\Lambda_T(\omega)]$ is the marginal utility of wealth in the first period.

We begin by assuming the government can finance this cost using currency reserves (an independent supply of traded goods) that absorbs any surpluses or deficits generated by the taxation scheme ($\Delta \text{Res}$). We prefer this specification mainly because it simplifies the exposition and also allows us to cleanly separate the effects of stabilizations from the (well-studied) effects of over- or under-valuations of the real exchange rate. However, we stress that none of the positive predictions of the model depend on this assumption. When we analyze the welfare effects of exchange rate stabilization in section 2.5, we set $\Delta \text{Res} = 0$, so that the cost of the stabilization is fully borne by the households in the stabilizing country. In this case, any stabilization also distorts the level of the real exchange rate, and thus violates $\{P2\}$.

Interestingly, we also show below that, under a range of relevant parameters, the cost of currency stabilization is negative, so that many exchange rate stabilizations (achieving both $\{P1\}$ and $\{P2\}$) are implementable even if the government has no access to currency reserves.

The market clearing conditions for traded, nontraded, and capital goods are

$$\int_{i \in [0,1]} C_{T,2}(i, \omega) di = 1 + \theta^m \Delta \text{Res},$$

(7)

$$\int_{i \in \theta^n} C_{N,2}(i, \omega) di = \theta^n Y^n_{N,2}(\omega),$$

(8)

and

$$\sum_n \theta^n K^n = 1,$$

(9)

The economy is in an equilibrium when all households maximize utility taking prices and taxes as given, firms maximize profits, and goods markets clear.
2.2 Solving the Model

Appendix C.1 formally derives the conditions of optimality characterizing the equilibrium allocation. The first-order conditions with respect to $C^T_n$ equate the shadow price of traded consumption across the target and outside countries:

$$\tau (C^m(\omega))^{1-\gamma} (C^T_n(\omega))^{-1} = \Lambda_T(\omega), \quad n = o, t. \tag{10}$$

In the stabilizing country, the state-contingent tax that implements the currency stabilization appears as a wedge on that shadow price

$$\tau (C^m(\omega))^{1-\gamma} (C^m_T(\omega))^{-1} = Z(\omega)\Lambda_T(\omega). \tag{11}$$

In all countries, marginal utilities with respect to $C^m_{N,2}$ define the shadow prices of nontraded goods

$$(1-\tau) (C^n(\omega))^{1-\gamma} (C^m_N(\omega))^{-1} = \Lambda^N_n(\omega). \tag{12}$$

In addition, households’ portfolio problem and the firm’s capital demand function jointly imply

$$K^n = \frac{\nu}{\Lambda_{T,1}Q_K} \mathbb{E} [\Lambda^N_n(\omega)Y^n_N(\omega)], \tag{13}$$

where $Q_K$ denotes the first-period price of a unit of capital. This Euler equation defines the level of capital accumulation in country $n$ as a function of first-period prices and the expected (utility) value of its nontraded goods, $\mathbb{E} [\Lambda^N_n(\omega)Y^n_N(\omega)]$. This latter term will differ across countries and reflect any precautionary motives for capital accumulation, including those that arise as a function of the stochastic properties of the country’s exchange rate.$^{11}$

Finally, the (redundant) first-order conditions with respect to the consumption index $C^m$ pin down the shadow prices of overall consumption in each country:

$$(C^n(\omega))^{-\gamma} = \Lambda^n(\omega), \tag{14}$$

so that $P^n(\omega) = \Lambda^n(\omega)/\Lambda_T(\omega)$ is the price of the consumption bundle country $n$. The real

$^{11}$Because households freely trade stocks and capital across borders, (13) holds in all countries, including in the stabilizing country, even though the government’s intervention drives a wedge between $\Lambda_T$ and the marginal utility of traded consumption in the stabilizing country. See Appendix C.1 for a formal derivation.
exchange rate between two countries \( h \) and \( f \) equals the ratio of these prices,

\[
S^{f,h}(\omega) = \frac{P^f(\omega)}{P^h(\omega)}.
\]

In equilibrium, the resource constraints (7)-(9) and the conditions of optimality (10)-(13) jointly determine the endogenous variables \( \{C^n_N(\omega), C^n_T(\omega), K^n, \Lambda^n_N(\omega)\}_{n \in \{p,t,o\}}, \Lambda_T(\omega), \) and \( Q_K \).

To study the model in closed form, we log-linearize around the deterministic solution — the point at which the variances of shocks are zero (\( \sigma_{N,n} = 0 \)) and all firms have a capital stock fixed at the deterministic steady-state level. To simplify the exposition, we thus ignore the feedback effect of differential capital accumulation on the size of risk premia, studying the incentives to accumulate different levels of capital across countries, while holding the capital stock fixed. Appendix F.3 shows that all propositions in this section continue to hold when we allow for this feedback effect. Throughout, lowercase variables continue to refer to natural logs and we suppress dependence on the state \( \omega \) where appropriate.

### 2.3 The Freely Floating Regime

We begin by showing that, in the absence of currency manipulation, the model predicts that large countries should have lower real interest rates (Hassan, 2013) and accumulate higher capital-output ratios (Hassan et al., 2016). If \( \zeta = 0 \), equilibrium consumption of traded goods is given by

\[
c^n_T = (1 - \tau)(\gamma - 1) + \gamma \tau \left( \bar{y}_N - y^n_N \right),
\]

where \( \bar{y}_N = \sum_n \theta_n y^n_N \) is the average log per-capita output of nontraded goods across countries. The expression shows that households use shipments of traded goods to insure themselves against shocks to the output of nontraded goods. If \( \gamma > 1 \), households receive additional traded goods whenever they have a lower-than-average output of nontraded goods, and vice versa.\(^{12}\)

This risk-sharing behavior generates a shadow price of traded goods of the form,

\[
\lambda^*_T = -(\gamma - 1)(1 - \tau) \sum_n \theta_n y^n_N,
\]

\(^{12}\)The condition \( \gamma > 1 \) (more generally, \( \gamma \) multiplied by the elasticity of substitution between traded and nontraded goods > 1) ensures that the cross-partial of marginal utility from traded consumption with respect to the nontraded good is negative; that is, the relative price of a country’s nontraded good falls when its supply increases. Because most empirical applications of international asset pricing models find a relative risk aversion significantly larger than 1 and an elasticity of substitution around 1, most authors assume this condition holds (see Coeurdacier (2009) for a detailed discussion). We show in section 5 that this condition is not needed if variation in exchange rates is driven predominantly by preference shocks.
where each country’s weight is proportional to its size: shocks to the productivity of larger countries affect a larger measure of households and thus tend to spill over to the rest of the world in the form of higher shadow prices of traded goods. If $\gamma > 1$, the shadow price of traded goods falls with the average output of nontraded goods across countries. Thus, $\lambda_T$ tends to be low in good states of the world when countries, on average, experience positive productivity shocks.

The real exchange rate between two countries $f$ and $h$ is

$$s_{f,h^*} = p_{f^*} - p_{h^*} = \frac{\gamma(1 - \tau)}{(1 - \tau) + \gamma \tau} \left( y_N^h - y_N^f \right),$$

showing that the country with the lower per-capita output of nontraded goods appreciates because its consumption index is relatively more expensive. The literature often criticizes this somewhat counter-intuitive link between low output and appreciation in the real business cycle model. However, none of our conclusions depend on this link. Instead, the crucial ingredient is that whatever shock causes a country’s real exchange rate to appreciate also prompts this country to demand higher imports of traded goods – a feature shared near universally by a broad class of supply- and demand-based models of exchange rate determination, as we show formally in section 5.

Inspecting $\lambda_T^*$ and $s_{f,h^*}$ shows that currencies of larger countries are “safer” in the sense that their consumption bundles tend to appreciate when the shadow price of traded goods is high: Whenever a country suffers a low productivity shock, its real exchange rate appreciates. For a given percentage decline in productivity, this appreciation occurs independently of how large the country is (note $s_{f,h^*}$ is independent of $\theta$). However, a shock to a larger country has a larger impact on the shadow price of traded goods ($\lambda_T$). It then immediately follows from (2) that larger countries have safer currencies and thus a lower risk-free rate:

$$r_{f^*} + \Delta E s_{f,h^*} - r_{h^*} = \text{cov} \left( \lambda_T^*, p_{h^*} - p_{f^*} \right) = \frac{(\gamma - 1)\gamma(1 - \tau)^2}{1 + (\gamma - 1)\tau} (\theta^h - \theta^f) \sigma_N^2.$$  

(18)

To see that these differences in interest rates across countries translate into differential incentives to accumulate capital, we can rearrange the Euler equation for capital accumulation (13) and derive an expression that links differences in capital to differences in interest rates.\(^\text{13}\)

$$k_{f^*} - k_{h^*} = \frac{\gamma}{\tau(\gamma - 1)^2} \left( r_{h^*} - \Delta E s_{f,h^*} - r_{f^*} \right).$$  

(19)

\(^\text{13}\)For a derivation, see Appendix C.5.
Because domestic firms produce (nontraded) goods that are consumed domestically, the value of their goods co-moves with the real exchange rate,

\[ p_N^* + y_N^h = \frac{(1 - \tau)(\gamma - 1)}{1 + (\gamma - 1)\tau} \left( \sum_n \theta^h y_n^N - y_N^h \right). \]

Whenever the home country receives a relatively low output of nontraded goods, the value of their non-traded output increases alongside the increase in the value of the aggregate consumption index. Thus, the same forces that make the currencies of larger countries safer investments from the perspective of international investors also make the firms based in these countries safer investments. The value of dividends of larger firms tend to by high when the shadow price of traded goods is high.

It follows that firms based in larger countries have a lower cost of capital, which increases their value in world markets and prompts them to invest more.

This higher capital accumulation in larger countries is efficient because a larger capital stock in a larger country represents a good hedge against global consumption risk: Households around the world fear states of the world in which the large country receives a bad shock. Although households cannot affect the realization of such shocks, they can partially insure themselves against low output in large countries by accumulating more capital in these countries. This precautionary behavior raises expected output in these countries and dampens the negative effects of a low productivity shock.

### 2.4 Effects of Currency Stabilization

Under freely floating exchange rates, larger (safer) countries thus have lower risk-free rates and higher capital-output ratios. With this result in mind, we now analyze how a country can influence interest rates and the allocation of capital by stabilizing its currency.

Whereas currency stabilization ([P1] and [P2] with \( \zeta < 1 \)) can, in principle, be achieved with a range of different nonlinear policies, such as intervening only in response to shocks smaller or larger than some critical value, we focus our discussion on the unique linear policy that entails a proportional intervention in each state. The advantage of focusing on this case is that it preserves the Gaussian structure of the problem and thus lends itself to closed-form solutions. In section

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\(^{14}\) A series of papers (cited above) have shown that these predictions are indeed borne out in aggregate data. In addition, recent work by Richers (2019) uses detailed firm-level and bond-level data to show that firms in countries with lower risk-free interest rates have lower cost of capital and, correspondingly, higher capital intensity of production.
we discuss issues that arise when the government cannot credibly commit to stabilizing shocks larger than some critical value and show that our main conclusions do not change in that case.

The following lemma characterizes the unique linear form of state-contingent taxes that implements the exchange rate stabilization:

Lemma 1

A tax on the consumption of traded goods in the stabilizing country of the form

\[ z(\omega) = \zeta \gamma \tau + \left(1 - \tau\right) \left(p^*(\omega) - p^{m*}(\omega)\right) \]

implies a real exchange rate stabilization of strength \( \zeta \).

The cost of implementing the stabilization equals the change in the world-market cost of traded goods consumed by households in the stabilizing country,

\[ \Delta Res = \mathbb{E} \left( \left( \frac{\Lambda_T(\omega)}{\Lambda_{T,1}} \right) C^m_T(\omega) \right) - \mathbb{E} \left( \left( \frac{\Lambda^*_T(\omega)}{\Lambda^*_{T,1}} \right) C^{m*}_T(\omega) \right). \]  

(20)

**Proof.** See Appendix C.6. ■

The intuition for both results is simple and quite general: When the target country appreciates (\( p^* \) increases), the stabilizing country must increase its own price level to keep pace. Because the number of nontraded goods in the country is fixed, the only way it can do so is by artificially increasing the relative price of traded goods in the stabilizing country, driving a wedge between the domestic and world-market price of traded goods (\( z(\omega) \)). When the target country appreciates, the stabilizing country thus reduces the domestic consumption of traded goods relative to what it would have been in the freely floating regime and exports additional traded goods to the rest of the world.\(^{15}\)

\[ c^m_T - c^{m*}_T = -\zeta \frac{\left(1 - \theta^m\right)}{\tau \gamma} \left(p^* - p^{m*}\right). \]  

(21)

Conversely, when the target country depreciates, the stabilizing country subsidizes imports of traded goods, resulting in higher imports of traded goods than under the freely floating regime. The cost of implementing the stabilization, therefore, is simply the change in the world-market cost of traded goods consumed by households in the stabilizing country.

\(^{15}\)Note the relative prices of nontraded goods are no longer a sufficient statistic for the real exchange rate, because the state-contingent tax drives a wedge between the domestic and world-market prices of traded goods.
We start by analyzing the effect of this stabilization policy on allocations, prices, and reserves in the stabilizing country. Afterwards, we analyze its impact on the target country.

2.4.1 Internal Effects of Currency Stabilization

The most immediate effect of currency stabilization is that the price level in the stabilizing country becomes more correlated with the price level in the target country:

\[ p^m = p^{m*} + (1 - \theta^m) \zeta (p^{t*} - p^{m*}). \]

Because larger countries tend to appreciate when \( \lambda_T \) is high, a stabilization relative to a larger country (\( \theta^t > \theta^m \)) naturally also makes the stabilizing country appreciate in these states; that is, stabilization increases the covariance between the stabilizing country’s price level, \( p^m \), and the shadow price of traded goods, \( \lambda_T \), similar to the intervention considered in section 1. As a result, a risk-free asset that pays one unit of the stabilizing country’s consumption bundle with certainty becomes a better hedge against consumption risk, increasing its value in the world market, and lowering the stabilizing country’s risk-free interest rate.

Similarly, stabilizing relative to a larger country increases domestic capital accumulation because it raises the world-market value of domestic firms by increasing the covariance of their dividends with the larger country’s price level, and thus with \( \lambda_T \):

\[
p^m_N + y^m_N = (p^{m*}_N + y^{m*}_N) + \zeta \left( \frac{\theta^m + (\gamma - 1) \tau}{\tau \gamma} \right) (p^{t*} - p^{m*}),
\]

where \( p^m_N + y^m_N \) is the dividend the firms in country \( m \) pay to international investors and \( p^m_N = \lambda_N^m - \lambda_T \) is the price of country \( m \)’s non-traded goods.

Whenever the stabilizing government intervenes to appreciate its real exchange rate it also raises the value of this dividend, and vice versa. Any exchange rate stabilization that makes the domestic currency safer from the perspective of international investors also reduces the real exchange rate risk these investors face when investing in domestic firms, and makes them more valuable in world markets. Stabilizations that lower the domestic interest rate thus also lower the cost of capital of domestic firms, increase their value in international markets, and increase the amount of capital they accumulate.\[16\]

\[16\] Another way of gaining intuition for this result is to note that the last term in (22) can be written as \( (\theta^m + (\gamma - 1) \tau)/(1 + (\gamma - 1) \tau) z \). The world-market value of the dividend always moves in the same direction as the wedge between the domestic and world-market price of traded goods. This happens despite the fact that the relative price of non-traded to traded goods within the stabilizing country \( (p^m_N - z) \) moves in the opposite
Proposition 1

If $\gamma > 1$, a country that stabilizes its real exchange rate relative to a target country sufficiently larger than itself lowers its risk-free interest rate and increases the world-market value of domestic firms, domestic capital accumulation, and domestic wages relative to the target country.

Proof. The interest rate differential with respect to the target country is

$$r^m + \Delta E_s^{m,t} - r^t = r^{m*} + \Delta E_s^{m,t*} - r^{t*} - \zeta \frac{\gamma (1 - \tau)^2 ((\theta^t - \theta^m)(\gamma - 1)\tau + 2\theta^m (1 - \zeta))}{\tau (1 + (\gamma - 1)\tau)} \sigma_N^2. \tag{23}$$

See Appendix C.7 for details and the corresponding proof for capital accumulation, which requires that the target country be sufficiently large.

In other words, the model predicts precisely the conditional relationships between the strength of stabilization, interest rates, currency returns, and capital intensity shown in Figure 1. Plugging (18) into (23), and comparing with (19) yields exactly the specification depicted.

Aside from these effects on interest rates and capital accumulation, the stabilization policy also affects the level of currency reserves. From (20), we already know the cost of implementing the stabilization is simply the cost of altering the stabilizing country’s purchases of traded goods in world markets. Moreover, we also know the stabilization induces the stabilizing country to sell additional traded goods in response to an appreciation of the target country, and to buy additional traded goods in response to a depreciation. If the target country is larger than the stabilizing country, this policy amounts to selling traded goods when they are expensive and buying them when they are cheap. In other words, stabilization induces the stabilizing country to provide insurance to the world market against the (larger) target country’s shocks, so that it pockets an insurance premium.

Proposition 2

If $\gamma > 1$ and the stabilizing country is small, $\theta^m = 0$, the cost of stabilization globally decreases with the size of the target country and locally increases with the size of the stabilizing country. Additionally, the cost of stabilization ($\Delta Res$) is negative if and only if

$$\theta^t > \zeta + (\gamma - 1)\tau \frac{1}{(\gamma - 1)^2 \tau^2}.$$ 

Proof. See Appendix C.8.
premium can be so large that the stabilization generates positive net revenues, so that the stabilization increases, rather than decreases, currency reserves. When the stabilizing country itself is large \((\theta^m > 0)\), its purchases and sales of traded goods also affect the equilibrium shadow price of traded goods, \(\lambda_T\). This price impact generally increases the cost of stabilization. The reason is that stabilization effectively induces the stabilizing country to “do more” of what it would have done under freely floating exchange rates: Even under freely floating exchange rates, all countries increase their exports of traded goods when a large country appreciates. Stabilization then induces the stabilizing country to export even more than it ordinarily would have (compare equations (15) and (21)). The larger the stabilizing country is (i.e., the more price impact it has), the more costly it therefore is to maintain the stabilization. This increasing cost of stabilization will be key to our finding below that stabilization relative to the largest country in the world tends to be an optimal policy for small but not large countries.

### 2.4.2 External Effects of Currency Stabilization

If the stabilizing country is large \((\theta^m > 0)\), its actions also have external effects on consumption and prices in the rest of the world. The shadow price of traded goods is

\[
\lambda_T = \lambda_T^* - \frac{(1 + (\gamma - 1)\tau)}{\gamma\tau} \zeta \theta^m (p^t - p^{m*}). \tag{24}
\]

The second term on the right-hand side shows that stabilization by a large country reduces the covariance between the target country’s price level and \(\lambda_T\). By selling insurance against the target country’s shocks, the stabilizing country dampens the effect of these shocks on the world-market price of traded goods. It follows immediately that becoming the target of a stabilization raises the target country’s interest rate and lowers its capital accumulation.

**Proposition 3**

If \(\gamma > 1\), a country that becomes the target of a stabilization of any strength \(\zeta > 0\) imposed by a large country experiences an increase in its risk-free interest rate, a decrease in capital accumulation, and a decrease in average wages relative to all other countries. If the stabilizing country is smaller than the target country \((\theta^m < \theta^t)\), the stabilization also lowers the volatility of consumption in the target country.

\(^{17}\)That is, the portfolio of stocks that pays exactly the cost of the stabilization policy in each state of the world has negative cost in the first period. See Appendix C.6 for details on the form of this portfolio.
Proof. The interest rate differential between the target and outside country is

\[ r_t + \Delta E s_t^{t,o} - r^o = (r^{t*} + \Delta E s_t^{t,o*} - r^{o*}) + \frac{\theta^m (1 - \tau)^2 \gamma}{\tau (1 + (\gamma - 1)\tau)} \sigma_N^2. \]

See Appendix C.9 for details and the remainder of the proof.

Currency stabilization can thus divert capital from the target country to the stabilizing country even though it has no effect on the level of the real exchange rate. This finding is particularly interesting because it sheds new light on recent public controversies, for example, between Chinese and US officials (Levy, 2011), which usually focus on the idea that an undervaluation of the Chinese real exchange rate favors Chinese workers at the expense of U.S. workers. By contrast, our model suggests that even a currency stabilization that manipulates the variance but not the level of the real exchange rate can have this effect.

On the flip side, currency stabilization by a large country decreases the volatility of consumption in the target country, because it effectively prompts the stabilizing country to provide consumption insurance to the target country. We show below that this positive effect of insurance provision can dominate, so that stabilization is associated with utility gains in both the stabilizing and the target country, at the expense of the outside country.

2.5 Welfare and the Rationale for Stabilization

Having characterized the positive effects of currency stabilization, we next study why a country might find it optimal to stabilize its currency. The existing literature has shown currency stabilization can be a second-best policy response in the presence of monetary and other frictions. We show that even in the absence of such frictions, stabilization relative to a larger country may increase welfare in the stabilizing country through a valuation effect that increases its share in world wealth. As we shall see, this valuation effect results from an appreciation of the equity value of the stabilizing country’s domestic firms upon announcement of the stabilization policy.

So far, we have defined a currency stabilization as reducing the variance of the log real exchange rate (P) while not distorting its level (P). Achieving both objectives simultaneously requires that the government has the ability to add and subtract resources from the economy by accumulating or depleting currency reserves. For the purposes of assessing the welfare effects of currency stabilization, we no longer allow the government to add or subtract resources from the economy. Instead, the government rebates the cost of stabilizing the exchange rate back to

\[ \text{For a recent example see Fanelli and Straub (2021).} \]
households using the lump-sum transfer, so that $\Delta Res = 0$ and (7) becomes $\int_{i \in [0,1]} C_{T,2}(i, \omega) di = 1$. That is, households in the stabilizing country directly bear the financial cost or benefit of stabilizing the exchange rate, which shifts the level of their traded consumption in all states of the world. As a result, the stabilization policy now directly impacts the level of the exchange rate, and we drop objective (P2). Nevertheless, closing the model in this way does not interfere with the intuition of the positive results derived above but increases the complexity of the solution, so that we relegate the mathematical details to Appendix D.

Within this closed model, solving for the effect of an exchange rate stabilization on the utility of a household in a small stabilizing country ($\theta = 0$) yields:

$$\Delta u^m = \left( -\zeta^2 + \frac{\zeta \Theta^t (\gamma - 1) \tau}{\tau (1 + (\gamma - 1) \tau)^2} \sigma_N^2 \right) - \frac{\left( \zeta \Theta^t + \zeta^2 \right) (\gamma - 1) (1 - \tau)^2}{(1 + (\gamma - 1) \tau)^2} \sigma_N^2 \Delta K,\text{Revenues}$$

$$+ \frac{(\zeta \Theta^t + \zeta^2) (\gamma - 1)^2 (1 - \tau)^2}{(1 + (\gamma - 1) \tau)^2} \sigma_N^2 \Delta \text{Var}[c^m] \text{ Valuation Effect}$$

where $\Delta u^m$ is measured as the percentage increase of the household’s certainty-equivalent consumption attributable to the stabilization, and $\Theta^t = \theta^t (\gamma - 1) \tau - 1$ is positive and monotonically increasing in $\theta^t$ whenever the target country is sufficiently large and the households sufficiently risk averse. Equation (25) shows how we can decompose the overall change in household utility into three intuitive terms.

The first term on the right-hand side reflects changes in the expected level of consumption that result from changes in the level of domestic capital accumulation and the cost of implementing the stabilization. We have already seen that a stabilization relative to a larger country can increase capital accumulation and generate positive revenue, so that this term is positive if $\theta^t$ is sufficiently large. However, stabilization also increases the variance of consumption because

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19When the central bank rebates the cost of stabilization back to households, the expected log real exchange rate can be expressed as:

$$E \left[ s^{m,t} \right] = \zeta \left( \frac{(1 - \tau)^3 (-\zeta - (\gamma - 1)(1 - (1 - 2\theta^m)\zeta) \tau + (\theta^t - \theta^m)(\gamma - 1)^2 \tau^2)}{\tau^2 (1 + (\gamma - 1) \tau)} \right) \sigma_N^2,$$

which captures the ratio of the expected marginal utilities of consumption when the cost of stabilization is rebated back to households.

20In keeping with the solution method outlined above, we solve for the equilibrium valuation change in households’ portfolios using a second-order approximation around the point at which the marginal utility of wealth of households in all countries is equalized.

21Specifically, if $\gamma > 1 + 1/\tau$, then there exists a $\bar{\theta} \in [0,1]$ such that $\Theta^t > 0$ whenever $\theta^t > \bar{\theta}$. 

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the stabilizing country effectively provides insurance to the world market against shocks that affect the target country. This increase in the volatility of consumption strictly reduces expected utility, as shown in the second term.

One can show that the second term is always larger than the first term so that stabilizing would never be welfare increasing if not for the third term: the effect of the stabilization on the stabilizing country’s share in world wealth. This term reflects the fact, already shown above, that stabilizations relative to a larger country increase the world-market value of firms in the stabilizing country. Households in the stabilizing country are the monopoly suppliers of domestic firms so that, even if the country is small and a price-taker in international markets, it is always large enough to affect the world-market price of its own firms relative to the world-market price of foreign firms. Because we have assumed households and governments can only trade stocks in these firms in international markets, but cannot write insurance contracts contingent on the imposition of a stabilization itself, this valuation effect effectively enables the stabilizing government to shift wealth from the rest of the world to its own country by announcing a stabilization relative to a larger country.

Proposition 4

If \( \gamma > 1 \) and all households own the portfolio of stocks that decentralizes the Pareto-efficient allocation of consumption under freely floating exchange rates at the time of the announcement of the stabilization, then there exists a \( \theta > 0 \) such that a small stabilizing country (\( \theta^m = 0 \)) strictly increases the welfare of its households by stabilizing relative to a target country with \( \theta^t > \theta \).

Proof. See Appendix D.

In other words, the positive effect of the stabilization on the valuation of domestic firms can be large enough to make stabilization relative to a larger country a welfare-increasing policy for the stabilizing country.

Panel (a) of Figure 2 illustrates this result graphically by plotting the three terms of (25) over the size of the target country for a typical numerical example where \( \theta^m = 0, \zeta = 1, \tau = 1/3 \).

\[ ^{22} \text{See Appendix D for a formal proof of this statement.} \]

\[ ^{23} \text{For a similar result, where small countries benefit from deviating from policy coordination, see Chari and Kehoe (1990).} \]

\[ ^{24} \text{One can show the same result holds if instead households are confined to trading international bonds, because, again, stabilizing relative to a larger country increases the world-market value of the stabilizing country’s bonds. See Appendix D.1 for details.} \]

\[ ^{25} \text{In this static model the number of domestic firms is fixed, so that the valuation gain appears as a one-off effect from the announcement of the stabilization. However, in reality, countries continuously create new firms and are the “monopoly producers” of domestic firms. We may thus think of the valuation effect more broadly as increasing the value of domestic entrepreneurship and generating a persistent flow of rents to the stabilization country.} \]
and $\gamma = 7$. If the target country is small, all three terms are negative, but as the size of the target increases, both the first and the third term monotonically increase and become positive. The sum across the three lines represents the total change in the stabilizing country’s welfare. This net effect is positive for all $\theta^t > \bar{\theta} = (\zeta + (1 - \zeta)\tau^2(\gamma - 1))/((\tau^3(\gamma - 1)^2)$. If it is optimal for a small country to stabilize relative to any target country, that country is thus always the largest country in the world.

This increase in welfare through stabilization is, for a given set of parameters, easier to achieve for a small country than for a large country. As we have already seen above, a stabilization implemented by a large stabilizing country manipulates state-prices of traded goods in an unfavorable direction, which increases the cost of implementing the stabilization. The welfare benefits of stabilization thus tend to decrease with the size of the stabilizing country. Panel (b) of Figure 2 shows the utility gain from stabilization is smaller for larger stabilizing countries. The figure also shows the optimal stabilization need not be a hard peg: In the example shown, the largest stabilizing country ($\theta^m = 0.2$) maximizes its utility gains with a soft peg ($\zeta \approx 0.2$).

Taken together, these findings provide a rich set of predictions for a stabilizing country’s optimal choice of exchange rate regime ($\zeta \in (0, 1)$) as a function of its own size ($\theta^m$) and the size of the target country ($\theta^t$). Panel (a) of Figure 3 shows a graphical representation of this optimal choice for the same numerical example as above. If the largest country in the world is sufficiently large ($\theta^t > \bar{\theta}$), a small stabilizing country finds it optimal to impose a hard peg relative to that country, which endogenously emerges as the anchor currency of all stabilizations.

As the size of the stabilizing country increases (moving from left to right in the figure), the optimal stabilization is still relative to that anchor currency, but becomes looser, allowing more fluctuations in the real exchange rate ($\zeta \in (0, 1)$). Finally, stabilizing countries above a certain size, and the anchor country itself, find it optimal to float their exchange rates ($\zeta = 0$).

Because the allocation under freely floating exchange rates is Pareto efficient, any utility gains from exchange rate stabilization accruing to households in a stabilizing country with positive mass ($\theta^m > 0$) must be causing losses to households somewhere else in the world. Interestingly, this collateral damage typically does not fall on the target country, but rather on the outside country (which, on the surface, has no relation to the stabilization). The reason is that although both the

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26Because the consumption index has a unit elasticity of substitution between traded and nontraded goods, the portfolio of stocks that decentralizes the Pareto-efficient allocation of consumption under freely floating exchange rates is naturally home biased, in the sense that a given country’s households own a relatively larger share of their own country’s firms. As a result, an increase in the relative valuation of the stabilizing country’s firms shifts wealth from foreign to domestic agents. Appendix D gives analytical solutions.

27In this sense, the target country also has no incentive to “retaliate” by imposing its own stabilization.
target and outside countries suffer from distortions to the state prices of traded goods, and from
the relatively higher prices of firms in the stabilizing country, the target country also receives a
benefit: The stabilizing country provides tailor-made insurance against shocks that are specific
to the target country.

Panel (b) of Figure 3 shows the same triangular region as in Panel (a) (the area where
stabilization is welfare improving for the stabilizing country), but now highlights the area where
the target country also receives a net utility gain (the lower shaded area). In this subset of
the parameter space, stabilization is thus welfare increasing for residents of both the stabilizing
and the target country, and goes exclusively to the detriment of residents in the outside country
(which always loses when it is optimal for the stabilizing country to stabilize). 28

In the upper-left triangular region, the target country would also prefer the stabilizing country
to float its exchange rate and not stabilize. However, given a stabilization, the welfare loss in the
target country is less than the welfare loss of the outside country ($\Delta u^t > \Delta u^o$). In this sense, the
model generates the intuitive result that for a large country that cannot gain from stabilizing
itself, being the target country of choice can be beneficial: *Given that other countries stabilize, being the target of that stabilization is preferable to being the outside country.* (See Appendix
D.2 for a formal proof.)

In sum, our simple, near frictionless, model can simultaneously rationalize all four of the
stylized facts about international exchange rate arrangements outlined in the introduction as the
outcome of a non-cooperative equilibrium where each country chooses the exchange rate regime
that maximises its own welfare. In equilibrium, (i) small economies find it optimal to stabilize
their exchange rates, whereas only the largest economies in the world float their exchange rate,
(ii) larger countries choose looser stabilizations, (iii) all stabilizations are relative to the largest
economy in the world, which endogenously emerges at the world’s anchor currency, and (iv) other
things equal, countries that maintain stronger stabilizations to the anchor currency have lower
interest rates, pay lower currency returns, and have higher capita-to-output ratios in equilibrium.

The former three insights on the optimal choice of exchange rate regime ((i)-(iii)) rely cru-
cially on the interaction of two forces. The first is the fact that exchange rate stabilization
makes domestic firms safer investments from the perspective of international investors, and thus
increases their world-market value. The second is our assumption that households cannot write
insurance contracts contingent on the imposition of a currency stabilization, but instead transact

\[\text{28 We believe these statements hold quite generally. However we were unable to prove them formally as the}
\text{analytical expressions are quite complex. See Appendix D.2.}\]
only in an international stock market. Because of this (we believe realistic) restriction on the asset space, changes in the value of an asset that even small countries have pricing power over (the relative value of their own firms) translate into shifts in relative wealth across countries.\footnote{Maybe as relevant in practice as these welfare considerations, our model also lends itself to a political economy rationalization for the same patterns: A large literature argues that policymakers trying to win elections have an interest in raising wages (e.g., if the median voter is a worker, Persson and Tabellini (2002)), and often prefer generating revenue through central bank operations to direct taxation (Cukierman et al., 1992; Bates, 2005). Currency stabilizations relative to the largest economy in the world may thus also be politically attractive.}

Having studied the positive and normative implications of exchange rate stabilization in this canonical environment, we now show how the insights from this analysis continue to hold in more general settings.

\section{Nominal Stabilization and Monetary Policy}

In practice, most countries stabilize their exchange rates not by levying state-contingent taxes, but instead by buying and selling currency in foreign exchange markets. An extreme example is Hong Kong, which simply exchanges US for Hong Kong dollars at a pre-determined nominal rate. Other countries buy and sell foreign currency in open-market operations when the real or nominal exchange rate deviates too far from a reference level (Sarno and Taylor, 2001). This section formally introduces currencies and nominal frictions into our model and shows that our insights carry over directly to the kinds of currency-based stabilizations we see in the data.

In the main text, we focus our attention on perhaps the empirically most relevant case – a standard “new open economy” framework in which the prices of traded goods are sticky. A large body of empirical work shows that price stickiness in traded goods is pervasive in the data. As a result, the pass-through of changes in exchange rates into the prices of traded goods is limited, real and nominal exchange rates are highly correlated, and the law of one price regularly fails (Mussa, 1986; Engel, 1999; Cavallo et al., 2014).\footnote{For example, Burstein and Gopinath (2014) estimate that the pass-through of the nominal exchange rate into the consumer prices of traded goods at the quarterly frequency is close to zero all for many industrialized countries.} We show that within this framework with sticky prices, stabilizing wedges of the same form as those shown in section 2 arise naturally from a simple nominal stabilization regime, where the central bank buys and sells currency to stabilize the nominal or real exchange rate relative to a target country.\footnote{Appendix E shows similar results for variants of the model with other, widely used, frictions allowing for the transmission of monetary policy to the real economy.}

To formally introduce currencies, we extend the setup of our model in section 2.1 by assuming...
each country has a central bank that issues and controls the supply of domestic currency through open market operations. In each country $n$, the nominal price of the traded good is fixed at $\tilde{P}_n^T$ units of domestic currency. Households face a cash-in-advance constraint — that is, they must use their domestic currency when buying stocks in period 1 and when buying consumption goods in period 2. Each central bank controls its own money supply. Let $\Delta M_n^1$ and $\Delta M_n^2(\omega)$ denote the growth of money supply in the first and second period, respectively. A given household’s second-period budget constraint then reads:

$$\tilde{P}_n^T C_n^m(\omega) + \tilde{P}_n^N(\omega) C_n^N(\omega) \leq \tilde{P}_T^m \left( \sum_l A_n^l P_n^l(\omega) Y_n^l(\omega) + Y_n^m \right) + \Delta \tilde{M}_n(n),$$

(26)

where $\tilde{P}_n^N$ denotes the equilibrium price of the domestic non-traded good in terms of country $n$’s currency and $A_n^l$ is the number of shares a household in country $n$ bought in firms in country $l$ in the first period.$^{32}$

Having introduced money into the model, we can write the log nominal exchange rate as:

$$\tilde{s}^{f,h} = p_f - p^h + \tilde{p}_T^f - \tilde{p}_T^h.$$

(27)

In keeping with our convention above, we define a stabilization of the nominal exchange rate of strength $\tilde{\zeta}$ as a set of policies that decreases the variance of this log nominal exchange rate between the stabilizing and target countries, $\text{var}(\tilde{s}^{t,m}) = (1 - \tilde{\zeta})^2 \text{var}(\tilde{s}^{t,m})$, while keeping the conditional mean of the log nominal exchange rate unchanged, $\mathbb{E}[\tilde{s}^{t,m}|\{K^n\}] = \mathbb{E}[\tilde{s}^{t,m}|\{K^n\}]$.

We assume the central banks in the target and outside countries use their control of their money supply to recover the efficient allocation of resources, taking as given the actions of the stabilizing country’s central bank. By contrast, the central bank in the stabilizing country uses its control of monetary policy to stabilize the nominal exchange rate.

Although the actors and policymakers have different names in this extended version of the model, the equilibrium allocation is identical to the one already discussed above. To see this result, note first that the term $\tilde{p}_T^f - \tilde{p}_T^h$ in (27) is fixed so that the real exchange rate is simply proportional to the nominal exchange rate. In this model, nominal and real stabilizations are isomorphic: A central bank that stabilizes the nominal exchange rate relative to some target currency automatically stabilizes the real exchange rate relative to that same target country and to the same degree ($\zeta = \tilde{\zeta}$).

$^{32}$Appendix E.1 gives formal details and additional notation.
This tight link between nominal and real stabilization holds quite generally in this class of models. As long as the price of traded goods is at least partially sticky in terms of the domestic currency, any stabilization of the nominal exchange rate also implies some stabilization of the real exchange rate and vice versa. Therefore, in practice, it may not matter much if policymakers target the real or the nominal exchange rate. Even if we allowed $\hat{P}_T^{m}$ to partially adjust, any nominal stabilization would simply amount to a looser real stabilization with $\zeta < \hat{\zeta}$.

Second, through its control of money supply, the stabilizing country’s central bank effectively has the same ability to drive a state-contingent wedge between $\lambda_T$ and the domestic price of traded goods in the second period (and pay a lump-sum transfer in the first period) as the stabilizing government in section 2. Instead of policy instruments $\bar{Z}$ and $Z(\omega)$ it has $\Delta M_1$ and $\Delta M(\omega)$ at its disposal.

Solving the extended model (formal details are in Appendix E.1) shows these monetary policy tools are just as effective. Because the nominal price of the traded good cannot adjust, expansions and contractions of the money supply artificially make traded goods relatively more and less expensive, and thus again drive a wedge between the domestic and world-market price of traded goods. In order to maintain stabilization, the stabilizing central bank must contract the domestic money supply whenever the target country appreciates:

$$m^m(\omega) - m^{m*}(\omega) = -\frac{\zeta (1 - \theta^m)}{\gamma_T} (p_t^*(\omega) - p_m^*(\omega)),$$

where $m^m(\omega)$ is the log size of the monetary base in period 2.

Moreover, comparing this expression with the one in Lemma 1 shows that there is a one-to-one mapping between these monetary policy actions by the stabilizing central bank and the stabilizing wedges in Lemma 1: $m^m(\omega) - m^{m*}(\omega) = -\frac{1 - \theta^m}{1 + (\gamma - 1)\tau} z(\omega)$. As a result, the equilibrium allocation, as well as our our positive and normative analyses of the internal and external effects of stabilizations, are identical to the ones the previous section.

The only real difference to our baseline model is that this policy is now much easier to map to the real-world nominal exchange rate stabilization policies that central banks typically follow: When the target country appreciates, the central bank in the stabilizing country decreases the domestic money supply by buying domestic currency and selling foreign currency, matching the

33In practice, monetary authorities often sterilize the effects of their interventions in currency markets on interest rates by additionally changing the money supply. Modeling the difference between these two types of interventions would require introducing additional frictions. However, there is mixed evidence on whether sterilized exchange rate interventions are effective (see for example Obstfeld (1982), Chamon et al. (2017), and Fratscher et al. (2019)).
nominal appreciation. Because the price of traded goods is sticky in domestic currency, this reduction in domestic money supply increases the real price of traded goods in the stabilizing country, prompting domestic households to consume fewer traded goods whenever the target country appreciates. A conventional nominal stabilization thus automatically replicates the effect of stabilizing state-contingent taxes: The stabilizing country exports additional traded goods whenever the target country appreciates, and vice versa.

**Proposition 5**

If the price of the traded good is rigid in terms of the stabilizing country’s currency,

1. a nominal stabilization implements a real stabilization of equal strength \( \zeta = \tilde{\zeta}, \) and

2. the seigniorage from stabilization is equal to \(-\Delta \text{Res}, \)

\[
\text{seigniorage} = \mathbb{E}\left[ \frac{\Lambda_T^*(\omega)}{\Lambda_{T,1}} C_T^{m*}(\omega) \right] - \mathbb{E}\left[ \frac{\Lambda_T(\omega)}{\Lambda_{T,1}} C_T^m(\omega) \right] = -\Delta \text{Res}.
\]

**Proof.** See Appendix E.1. ■

If households need domestic currency to buy consumption goods and prices are sufficiently sticky to give the central bank some leverage over real allocations, we thus conclude that stabilizations of the real exchange rate can be implemented with a simple and intuitive rule that commits the central bank to contract the domestic money supply whenever the target country appreciates. The role played by the country’s reserves in the previous section is now taken over, one-for-one, by seigniorage accruing to the central bank. Aside from this relabeling, all the remaining insights from the our baseline model remain unchanged and continue to apply.

Appendix E shows these same insights continue to hold in variations of the model that employ other, widely used, nominal frictions. Appendix E.2 shows an extension where, instead of the price of traded goods, the price of the entire domestic consumption bundle is sticky. Appendix E.3 studies an economy where prices are fully flexible and monetary policy instead affects real allocations because some households within each country hold only nominal bonds (Alvarez et al., 2002). In each case, the stabilizing central bank must contract the domestic money supply whenever the target country appreciates to maintain the stabilization; and all positive results from our baseline model continue to apply. The normative analysis again remains unchanged in the former variant (Appendix E.2), but is naturally harder to interpret when there are different types of households within each country (Appendix E.3).
4 Partially Credible Stabilizations and Floating Bands

A major issue in the study of policies that manipulate the first moment of exchange rates (under- or over-valuations), is the depletion of reserves and the credibility of such manipulations in the face of potential speculative attacks (Krugman, 1979; Garber and Svensson, 1995). By contrast, we have already shown that stabilizations of the real exchange rate relative to a large target country may generate, rather than deplete, reserves, assuaging some potential concerns about the policy’s credibility. (The portfolio of stocks that finances the stabilization policy in each state has a negative cost in period 1.)

Nevertheless, it is worthwhile to consider the effects of only partially credible stabilizations. Suppose the government, either by choice or necessity, abandons the stabilization in a subset of states $\Omega_{-s} \subset \Omega$ (where $\Omega$ is the set of all possible states). Assuming the government continues to stabilize state-by-state within $\Omega_s = \Omega \setminus \Omega_{-s}$, and that this limited stabilization continues to leave the mean of the real exchange rate undistorted (e.g., the partition of $\Omega$ into $\Omega_s$ and $\Omega_{-s}$ is symmetric around the mean), we can show that

$$\text{var}(s^{m,t}) = (\text{Prob} [\omega \in \Omega_s] (1 - \zeta)^2 + \text{Prob} [\omega \in \Omega_{-s}]) \text{var} [s^{m,t} | \Omega_{-s}] < \text{var}(s^{m,t*})$$

and

$$r^m + \Delta E[s^{m,t}] - r^t = - (\text{Prob} [\omega \in \Omega_s] (1 - \zeta) - \text{Prob} [\omega \in \Omega_{-s}]) \text{cov} [\lambda_T, s^{m,t*} | \Omega_s].$$

In contrast to partially credible manipulations of the level of the real exchange rate, partially credible manipulations of its variance are thus still effective: They reduce the variance of the real exchange rate and affect interest rates and other outcomes in the same way as characterized above — only less so than a fully credible stabilization. In this sense, we may simply think of partially credible stabilizations as “weaker” credible stabilizations.

Additionally, the equations above also describe the effects of a variety of nonlinear stabilization policies, such as floating bands, that allow freely floating exchange rates within some range and intervene state by state only when the real exchange rate departs this band.

34 See Appendix F.1 for a formal derivation.
35 Appendix F.2 shows that our analysis also extends directly to stabilizations relative to a basket of currencies, where stabilizing relative to a basket of currencies has effects akin to a stabilization relative to a (hypothetical) country with a weighted average size of the basket’s constituents.
5 Financial Intermediation and Preference Shocks

So far, we have based our analysis of currency stabilization on a conventional real business cycle model where productivity shocks are the only drivers of variation in real exchange rates (Backus and Smith, 1993). Although an important benchmark, this framework has a number of well-known empirical shortcomings. First, it predicts a perfectly negative correlation between appreciations of the real exchange rate and aggregate consumption growth — a currency appreciates when the country’s aggregate consumption decreases. Second, the model predicts consumption should be more correlated across countries than output, whereas the opposite is true in the data (Backus et al., 1994). Third, real exchange rates and terms of trade seem much too volatile to be rationalized by productivity shocks alone (Chari et al., 2002).

In this section, we argue the conclusions from our analysis of exchange rate stabilizations do not rely on any of these counterfactual features of the international real business cycle model. Instead, they depend solely on two, more general, features of conventional approaches to modeling variation in exchange rates: First, whatever shock causes a country’s real exchange rate to appreciate also prompts this country to demand higher imports of traded goods. Second, shocks that raise the price of consumption in a larger country spill over more into the world-market price of traded goods. Both of these forces are common features of a broad class of models where real exchange rates may also fluctuate in response to shocks to preferences or money supply.

To provide one such example, we augment our nominal model from section 3 to allow for a typical demand-based source of variation in real exchange rates (Pavlova and Rigobon, 2007) and for imperfect financial intermediation (Gabaix and Maggiori, 2015; Fanelli and Straub, 2021).

First, we allow households in each country to experience preference shocks as suggested by Pavlova and Rigobon (2007):

\[ U(i) = \frac{1}{1 - \gamma} \mathbb{E} \left[ \left( \exp \left( \chi^n C_2(i) \right) \right)^{1 - \gamma} \right], \]

where \( \chi^n \) is a common shock to households’ preferences for consumption goods in country \( n \)

\[ \chi^n \sim N \left( -\frac{1}{2} \sigma_\chi^2, \sigma_\chi^2 \right). \]

Second, we assume that within each country, a fraction \( 1 - \psi \) of households lack access to financial markets except for risk-free savings. These households are labeled “consumers” and own only a risk-free bond that is issued by a domestic financial intermediary. This risk-free bond
is indexed to the country’s consumer price index and pays off exactly the $P^n(\omega)$ traded goods needed to purchase one unit of utility for households in country $n$ in state $\omega$. The remainder of the country’s assets (all shares in domestic firms, the first-period endowments of traded goods, and the first-period country-specific transfer) are held by a domestic financial intermediary, which is owned and managed by the remaining mass $\psi$ households ("financiers").

In the first period, the intermediary trades stocks and risk-free bonds in international markets with its foreign intermediary counterparts. In the second period, the intermediary receives its portfolio payoff, pays off the domestic risk-free bond held by domestic consumers, and returns all remaining assets and intermediation profits to the financiers.

Both consumers and financiers use their second period wealth to purchase consumption goods following utility function (5). As before, the stabilizing country’s central bank stabilizes its exchange rate with the target country using its control of the domestic money supply.

Solving the model (details are in Appendix G) yields

$$s^{m,t*} = \Gamma_s \left[ \frac{\gamma(1 - \tau)}{1 + (\gamma - 1)\tau} (1 - \tau)(y^N_t - y^m_N) + \frac{\gamma}{1 + (\gamma - 1)\tau} (\chi^t - \chi^m) \right]$$

and

$$\lambda^*_t = \Gamma_\lambda \left[ -(\gamma - 1)(1 - \tau) \sum_n \theta^n y^N_t - (\gamma - 1) \sum_n \theta^n \chi^m \right],$$

where $\Gamma_s = (\gamma \tau + (1 - \tau))/(\gamma \tau + (1 - \tau)\psi) \geq 1$ and $\Gamma_\lambda = (\gamma - \psi)/(\psi(\gamma - 1)) \geq 1$ are multipliers greater or equal one that are inversely related to the financial intermediary’s risk-bearing capacity: As the mass of financiers decreases, fewer households absorb the trading profits and losses of the financial intermediary, risk-sharing decreases, and both multipliers rise. As a result, the effect of all shocks are amplified, the demand for risky assets is more sharply downward sloping, and exchange rates and the marginal utility of traded consumption are more sensitive to all types.

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36 For the workings of our model it is immaterial whether consumers hold nominal or risk-free (real) bonds. We chose to model a risk-free bond mainly to contrast our findings with Fanelli and Straub (2021), see below.

37 As we add a second type of shock for each country we require two assets per country (stocks and risk-free bonds), so that the payoffs of the available assets continue to span all states of the world in the log-linear solution to the competitive equilibrium.

38 An alternative formulation is to allow the central bank to intervene in bond markets rather than currency markets. In this case, central banks use reserves to increase and decrease the supply of domestic bonds (rather than currency) and thus manipulate currency risk premia directly, effectively by going long and short the carry trade to stabilize the exchange rate in the short-term. While this alternative kind of intervention is fully consistent with our argument, it also confounds the policy instrument with our main object of interest – currency risk premia – requiring a careful distinction between the impact of state-by-state policy interventions and their overall effect on covariances. For this reason we prefer to maintain the assumption of sticky prices, even though interventions could make use of segmented financial markets, instead.
of shocks when intermediation capacity falls.\(^{39}\) By contrast, both multipliers are one when there are no constraints on intermediation \((\psi = 1)\).

Other than the presence of these multipliers, note that the first term in the square brackets of each of the two equations is identical to \((16)\) and \((17)\), respectively, so that the co-movement between exchange rates and \(\lambda^*_T\) induced by productivity shocks is already familiar: Countries import more traded goods when they appreciate, and shocks to the price of consumption in a larger country spill over more to \(\lambda^*_T\), so that larger countries tend to appreciate when \(\lambda^*_T\) is high.

The second terms in both brackets show that preference shocks induce exactly the same co-movements between exchange rates and \(\lambda^*_T\): A low \(\chi\) in a given country increases the marginal utility of its households, prompting them to want to consume more of all goods in that state. As a result, the country’s real exchange rate appreciates and it imports more traded goods. If the country is large, these higher imports also raise \(\lambda^*_T\), so that a larger country’s preference shocks spill over more to the rest of the world.

To summarize, demand shocks give rise to the same co-movements between appreciations, imports, and the shadow price of traded goods as the productivity shocks studied in previous sections. The presence of financial frictions amplifies the impact of both kinds of shocks on exchange rates and their international spillovers to \(\lambda^*_T\). Using the expressions above, one can show

\[
\gamma \lambda^* + \gamma^m - \tau^* = \Gamma \lambda \left( \gamma^m - \gamma^s_{m,t} - \tau^* \right),
\]

where lines over variables represent interest rates and exchange rates in the limiting case where all households have access to international financial markets, \((\psi = 1)\). Limited intermediation capacity thus increases the size of risk premia and deviations from Uncovered Interest Parity, as in \([\text{Gabaix and Maggiori} 2015]\), but leaves the qualitative insights from our earlier analysis unchanged. Under freely floating exchange rates, larger countries thus continue to have safer currencies, lower interest rates, and more valuable firms.

The punchline is that the effects of exchange rate stabilization in this richer model also follow the same logic as in earlier sections: A smaller country stabilizing its real exchange rate relative

---

\(^{39}\)Appendix G.2 solves for the number of bonds demanded by each country’s intermediary within our general equilibrium setup. It shows the number of country \(j\) bonds the country \(n\) intermediary demands, \(B^n_j\), is proportional to the country \(j\) interest rate, \(r^j\), but decreasing in \(\Gamma \lambda\). That is, similar to earlier models of financial intermediation, decreases in intermediation capacity reduce the elasticity of demand for risky assets:

\[
B^n_j = \frac{1}{(1 + (\gamma - 1)\Gamma \lambda)} \left( r^j + G^n_j \right).
\]
to a larger country increases the covariance between its exchange rate and $\lambda_T$. By making its currency safer, the stabilizing country increases domestic capital accumulation and its households’ share in world wealth. The stabilizing central bank implements the stabilization by contracting its money supply, and thus artificially increasing its exports of traded goods, whenever the target country appreciates:

$$[\psi c_T^m + (1 - \psi)\hat{c}_T^m] - [\psi c_T^m* + (1 - \psi)\hat{c}_T^m*] = -\zeta \left( \frac{1 - \theta^m}{\tau(1 + (\gamma - 1)\Gamma_\lambda(1 + (\gamma - 1)\Gamma_\lambda))} \right) (p^*_t - p^*_m),$$

where $c_T$ now denotes financiers’ consumption of traded goods while $\hat{c}_T$ indicates consumers’ consumption, so that the two expressions in square brackets represent aggregate consumption of traded goods under stabilized and floating exchange rates, respectively.

Moreover, by effectively insuring the world against the target country’s shocks, the stabilizing country dampens the effect of the target country’s shocks on the world-market price of traded goods:

$$\lambda_T = \lambda_T^* - \zeta \left( \frac{\theta^m (1 + (\gamma - 1)\Gamma_\lambda)}{\tau(1 + (\gamma - 1)\Gamma_\lambda)} \right) (p^*_t - p^*_m).$$

It follows directly that all of our positive predictions about the effects of currency stabilizations carry over to this richer model.

**Proposition 6**

In the model with limited financial intermediation and preference shocks with $\gamma > 1$, the following hold:

1. A country that stabilizes its real exchange rate relative to a target country sufficiently larger than itself lowers its risk-free interest rate and increases the world-market value of domestic firms, the level of domestic capital accumulation, and the level of domestic wages relative to the target country.

2. If the stabilizing country is small ($\theta^m = 0$), the cost of stabilization globally decreases with the size of the target country.

3. A country that becomes the target of a stabilization of any strength $\zeta > 0$ imposed by a larger country experiences an increase in its risk-free interest rate, a decrease in capital accumulation, and a decrease in average wages relative to all other countries.

**Proof.** See Appendix G.1. ■
In addition to reinforcing the main insights from earlier sections, this richer framework addresses the three major empirical shortcomings of the international real business cycle model outline above: The combination of financial market segmentation and preferences shocks loosens the negative correlation between appreciations of the real exchange rate and aggregate consumption growth, lowers the correlation of aggregate consumption across countries, and increases the volatility of real and nominal exchange rates (Alvarez et al., 2002; Pavlova and Rigobon, 2007; Kollmann, 2012).

Beyond this particular model, we believe the results stated in Proposition 6 are quite general and hold in a wide range of models where currency manipulation transmits itself through a wedge on the price of traded goods. As noted in the introduction, more general models could also allow governments to stabilize exchange rates by manipulating additional wedges on allocations within countries, such as the sectoral allocation of labor or the distribution of wealth across households. Within this broader class of models, it is possible to construct examples where stabilization of the real exchange rate is achieved by reducing rather than increasing exports in response to an appreciation by the target country. In those examples, stabilizations relative to larger countries continue to lower domestic interest rates and increase capital accumulation, but some of the other implications highlighted above may not generalize. In this sense, the first statement in Proposition 6 is the most general, whereas the second and third statements rely on the – we believe plausible – assumption that interventions in currency markets affect allocations primarily through their effect on trade and the prices of traded goods.

Finally, it is useful to contrast our findings with those of Fanelli and Straub (2021) who study optimal exchange rate stabilization in the presence of segmented international financial markets. In their framework, stabilization becomes optimal due to a pecuniary externality that makes the consumption of poor households excessively sensitive to fluctuations in the real exchange rate. Stabilization can then help protect these households from excessive consumption risk. This channel is dormant within our framework as we have assumed consumers hold risk-free bonds, and are thus perfectly protected from such risk. Instead, within our model, exchange rate stabilization can be an optimal because it alters the riskiness of the domestic currency and thus allows governments to attract additional investment and a larger share of world wealth. A more

Throughout this paper, we assume that currency stabilization is implemented by a monetary or fiscal authority. In principle, the private sector could also affect stabilizations. For example, a monopolistic firm might attempt to stabilize the real exchange rate by reducing the production of non-traded goods whenever the target country appreciates. Doing so would match the appreciation, but instead of increasing exports of traded goods when the target country appreciates (as is the case when the wedge is between the domestic and world market prices of traded goods), such an alternative stabilization would decrease exports in those states of the world.
general model could nest both channels, adding an additional motive for stabilization.

**Conclusion**

The majority of countries in the world stabilize their real or nominal exchange rate relative to the US dollar. Although exchange rate stabilizations are possibly the most pervasive form of currency market interventions, existing theories give relatively little guidance on the effects of such stabilizations, on what might be special about the US dollar as a target currency, and on how these stabilizations might affect the target country.

Building on a growing literature that views risk premia as the main driving force behind large and persistent differences in interest rates across developed economies, we propose a novel, risk-based theory of the effects of currency manipulation: Policies that reduce the riskiness of a country’s currency from the perspective of international investors reduce its risk premium in international markets, lower the country’s risk-free interest rate, and increase domestic capital accumulation, domestic wages, and the world market value of domestic firms.

In particular, we show that stabilizing a country’s real exchange rate relative to a larger (and safer) target economy is precisely such a policy that enables small countries to increase the world-market value of their capital stock, bonds, and firms.

In equilibrium, the effect of exchange rate stabilizations on risk premia gives rise to a pattern of optimal stabilizations that is remarkably similar to the one we see in the data: In the absence of coordination, small countries find it optimal to stabilize their exchange rates relative to the currency of the largest economy in the world, which endogenously emerges as the world’s “anchor” currency. By contrast, larger countries optimally choose looser stabilizations or float their exchange rates. In other words, our model suggests that the dollar-centric pattern of exchange rate regimes that has arisen since the collapse of the Bretton-Woods system can be understood as an attempt to manage risk and attract investment. This interpretation is further bolstered by our empirical finding showing small and medium-sized economies that stabilize their exchange rates have lower interest rates, their currencies pay lower returns to international investors, and their firms use relatively more capital than those that do not.

Interestingly, our model also suggests that this (non-cooperative) equilibrium pattern of stabilization tends to benefit not only the stabilizers, but also the target (anchor) country, while other countries that are too large to stabilize their own exchange rates are always worse off relative to a world-wide freely-floating regime.
In sum, we believe our paper provides a novel way of thinking about the effects of currency stabilization. Along with highlighting a model-consistent rationale for stabilizing, we also give an account of the costs and benefits of important choices for the stabilization regime, such as the choice of target country, the effects of hard pegs versus floating bands, and stabilizations relative to a single country versus a basket of currencies.

**Data Availability Statement**  The replication package underlying this article is available in the Zenodo repository and can be accessed via the following URL: https://doi.org/10.5281/zenodo.6371745.
References


Figure 1: Interest Rate Differentials, Capital Intensity, and Exchange Rate Regimes

(a) Interest Rate Differential (Resid.)

```
FX Allowed Deviation (Resid.)
coef = 0.41, s.e. = 0.13
```

(b) Currency Excess Returns (Resid.)

```
FX Allowed Deviation (Resid.)
coef = 0.35, s.e. = 0.15
```

(c) Capital Intensity (Resid.)

```
FX Allowed Deviation (Resid.)
coef = −1.56, s.e. = 0.74
```

Notes: This figure shows binned scatterplots of the conditional relationship between each currency’s maximum allowable annual exchange rate deviation relative to its target currency according to Ilzetzki et al. (2019) and (a) its “risk-free” interest rate differential against the US dollar, (b) the excess returns on the currency (that is, the returns measured in US dollars obtained when borrowing in dollars and lending in the currency in question), and (c) the capital intensity of production in the country issuing the currency (measured by its log capital to output ratio). For each panel, we regress both the dependent variable of interest and allowed exchange rate deviation on the share the country issuing the currency contributes to world GDP (“country size”) and show binned scatter plots of the residuals. The slopes shown are estimates of $\beta$ from the corresponding panel regression:

$$y_{it} = \alpha + \beta FX\ Allowed\ Deviation_{it} + \gamma GDP\ Share_{it} + \epsilon_{it},$$

where standard errors are clustered by currency. To derive this specification from our model, plug (18) into (23) and note that there is a one-for-one correspondence between FX Allowed Deviation and $\zeta$. Table 2 in the Online Appendix shows the full regression output for reference, including estimates of $\gamma$ and additional specifications that instead use $\zeta$ as a regressor. The sample consists of the intersection of the replication datasets of Hassan and Mano (2019) and Ilzetzki et al. (2019), covering data for 39 currencies from 1983-2010. Panel (a) and (b) use monthly data; panel (c) collapses to the annual frequency. We assign allowed exchange rate deviations according to the fine exchange rate arrangement classification from Ilzetzki et al. (2019): Codes 1, 2 and 4 are assigned 0% allowed deviation; codes 5 and 7 are assigned 1%; codes 3, 6, 8 and 11 are assigned 2%; codes 9, 10 and 12 are assigned 5% and code 13 is assigned 10% – assuming that a freely floating exchange rate implies an allowable annual standard deviation of the exchange rate to the US dollar (or the euro) of 10%). We treat the few currencies that do not target the dollar or the euro as also allowing 10% (though doing so has no effect on our results). We drop the Taiwanese dollar (TWD), because it is not in the Ilzetzki et al. (2019) dataset, and we exclude the European currency unit (ECU) to avoid double counting Euro-area countries prior to 1999. Interest rate differentials in Hassan and Mano (2019) are measured using forward and spot exchange rates to isolate differences in “risk-free” interest rates that are unaffected by country default risk. Data on log capital to output ratios and GDP are from the Penn World Tables. GDP share is constructed as in Hassan (2013) as the share of the issuing country’s GDP in the total GDP of all countries in the sample: $GDP_{it}^j / \sum_{n=1}^{N} GDP_{it}^n$. 

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Table 1: 2010 Exchange Rate Arrangements According to Ilzetzki, Reinhart, and Rogoff (2019)

<table>
<thead>
<tr>
<th>Panel A</th>
<th>Exchange rate arrangement</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP Decile</td>
<td>1 – 5</td>
</tr>
<tr>
<td>(smallest)</td>
<td>(largest)</td>
</tr>
<tr>
<td>Floating</td>
<td>0%</td>
</tr>
<tr>
<td>Stabilized</td>
<td>100%</td>
</tr>
<tr>
<td>soft peg</td>
<td>40%</td>
</tr>
<tr>
<td>hard peg</td>
<td>60%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel B</th>
<th>Target currency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Countries</td>
<td>Dollar</td>
</tr>
<tr>
<td></td>
<td>123</td>
</tr>
</tbody>
</table>

Notes: Countries are divided into deciles by GDP in 2010 using data from World Bank (2020). Deciles 1-9 each contain 18 countries, the tenth 17 countries. The “floating” category refers to exchange rates classified as “freely floating” in Ilzetzki, Reinhart, and Rogoff (2019) (fine classification code 13), the “soft peg” category includes currencies with any form of crawling peg, crawling band, or managed float. The “hard peg” category includes currency unions, pre-announced pegs, and de facto pegs (codes 1, 2, and 4). A list of Euro area countries
Figure 2: Effect of Stabilization on Utility in the Stabilizing Country

(a) Drivers of utility gains/losses over the size of the target country

(b) Utility gains of stabilization over strength of stabilization for stabilizing countries of different sizes

Notes: Both plots show the percentage increase in the certainty-equivalent consumption of a representative household in the stabilizing country attributable to the stabilization ($\Delta u^m$) for a numerical example where $\tau = 1/3$, and $\gamma = 7$. Panel (a) shows the three components of $\Delta u^m$ shown on the right hand side of (25) for a small stabilizing country ($\theta^m = 0$) and a hard peg ($\zeta = 1$). The net utility gain is the sum of the three lines. It is positive for all $\theta^t > \bar{\theta}$. Panel (b) shows the net utility gain as a function of $\zeta$ for stabilizing countries of different sizes. See Appendix D for the generalization of (25) that allows for $\theta^m > 0$. 

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Figure 3: Optimal Stabilizations

(a) Optimal Choice of Exchange Rate Regime

- Hard Peg ($\zeta=1$)
- Soft Peg ($\zeta \in (0,1)$)
- Freely Floating ($\zeta=0$)

(b) Externalities on Target and Outside Countries

Notes: The triangular region shown in both figures marks the subset of the parameter space where a stabilization is strictly welfare-increasing for the stabilizing country ($\Delta u^m > 0$) for a numerical example where $\tau = 1/3$, and $\gamma = 7$. Outside of triangular region the stabilizing country maximizes its own utility by floating ($\zeta = 0$). Panel (a) marks regions where the stabilizing country’s optimal choice is to impose a hard peg ($\zeta = 1$, marked in red) versus a “softer” stabilization ($\zeta \in (0, 1)$, marked in purple). Panel (b) illustrates the (pecuniary) externalities of these optimal stabilizations on the target and outside countries.