# Cheap but flighty: how global imbalances create financial fragility*

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**Abstract**

We analyze how a wealth shift to emerging countries may lead to instability in developed countries. Investors exposed to expropriation risk are willing to pay a safety premium to invest in countries with good property rights. Domestic intermediaries compete for such cheap funding by carving out safe claims, which requires demandable debt. While foreign inflows enable to expand domestic credit, risk-intolerant foreign investors withdraw even under minimal uncertainty. We show that more foreign funding causes larger and more frequent runs. Beyond some scale, even risk-tolerant domestic investors are induced to withdraw to avoid dilution. As excess liquidation causes social losses, a domestic planner may seek prudential measures on the scale of foreign inflows.

**Keywords:** capital flows, unstable funding, safe haven, absolute safety.

**JEL classifications:** F3, G2.

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# 1 Introduction

The scale of the recent crisis has led to a search for global explanations. An influential view is that excess credit was driven by low interest rates, associated with the recycling of large global imbalances into the US financial system (Bernanke (2005), Caballero et al., 2008), which compensated for low US saving rates. Historically, capital has moved from developed to emerging countries to pursue higher returns, though these flows fell short of the amount implied by neoclassical theory (Lucas, 1990). A common explanation is that expropriation risk associated with a weak institutional framework limited inflows and caused sudden reversals leading to crises. In response, emerging market investors have accumulated claims in safe countries (Mendoza et al. (2009), Gourinchas and Rey, 2007).

Net capital flows have in fact reversed since 1998 (Prasad et al., 2007), as many emerging countries invested their trade surpluses in (mostly US) safe assets.[1] The private sector accounts for the largest share of US external liabilities, around 80% at the end of 2007 (Forbes, 2010). As this demand for safety grew faster than US public debt, intermediaries issued more safe private liabilities. This global portfolio reallocation boosted US credit volume and the concentration in risky holdings by US residents and intermediaries. By selling riskless assets to foreign investors, the effective leverage of US financial institutions increased (Caballero and Krishnamurthy, 2009). The literature has so far treated these inflows as inherently stable. Even as many US intermediaries suffered major outflows in 2007-08, the dollar appreciated, so investors shifted to other dollar assets (Maggiori, 2013).

In this paper, we study how a wealth shift that increases safety-seeking inflows may affect the funding and fragility of intermediaries in developed markets. In our model, all investors have some demand for safety to ensure a subsistence level of consumption in all states. Domestic and foreign investors only differ in terms of access to safety, as expropriation may occur in the foreign region. As a result, foreign investors seek to access safe assets via intermediaries from countries with good protection of property rights.

[1] Foreign holdings represent around 20% of US debt securities, and 50% to 60% of the Treasury market.

We show that foreign inflows are beneficial as they support higher domestic lending, but their safety-seeking nature creates fragility and inefficient liquidation. Safety-seeking inflows increase the frequency and scale of runs on domestic intermediaries. In our approach, asset risk does not increase with credit volume, but higher losses arise because of the combination of more lending and less stable funding. Aggregate risk therefore increases in the stock of foreign funding. These results obtain in a simple optimal contracting setup without deposit insurance and bailout, where intermediaries bear all the risk created by their funding and lending choices.

In our model, the privately optimal funding arrangement combines low-yield demandable debt with a more expensive long-term claim, and induces self-selection. Foreign investors accept the lower return of demandable debt in exchange for safety, while domestic investors not exposed to expropriation risk are willing to bear residual risk by investing in the long-term claim.[2] As foreign investors seek absolute safety, they choose to run whenever there is interim residual risk, forcing excess liquidation of investment. The risk intolerance of foreign investors not only concentrates risk on domestic investors in the low state (as in Caballero and Krishnamurthy, 2009), but also increases fragility in the high state.

In equilibrium, foreign funding is cheap but flighty. The private funding choice accepts greater instability in exchange for a higher average return. To prevent inefficient liquidation, long-term funding would be desirable. However, foreign investors would not accept such a claim, as it is not perfectly safe even if it were senior to all other claims. The reason is that intermediaries prefer not to liquidate assets when there is minimal interim uncertainty about asset value, and thus cannot credibly commit to avoiding losses. Thus risk-intolerant foreigners invest only if they have the right to withdraw in uncertain states, provided intermediaries have enough loss-absorbing stable funding to ensure safe withdrawals. We also show that there may be insufficient incentives for domestic arbitrageurs to prevent inefficient liquidation, especially when foreign funding is abundant.

[2] Gourinchas et al. (2010) show that the US provides insurance to the rest of the world, in the form of a lower yield during normal times, and a transfer of wealth to foreign investors in crises.

A key assumption is that foreign investors need an intermediary to access domestic assets, a common assumption in the literature (Caballero and Krishnamurthy, 2009). Domestic intermediation may also be necessary for safe-keeping or anonymity (to avoid taxation or legal and expropriation risk), or if direct holdings need to be protected by costly storage.

We consider the effect of more lending on instability, while holding credit risk constant. Expanding credit involves lending increasingly against assets whose value is more opaque.[3] Greater opacity leads to more interim uncertainty and induces more inefficient runs. Ultimately, both the scale and frequency of runs increase in the scale of safety-seeking foreign inflows.

These results suggest a welfare trade-off associated with foreign inflows. Cheap funding boosts domestic credit, enabling investment in marginal projects with a negative NPV at domestic rates. As these are subsidized by the safety premia earned from foreign investors, the larger scale of lending is efficient, unless excess liquidation associated with runs causes social costs. In this case, the socially optimal balance between stability and aggregate credit differ from the private choice. Our results rationalize macroprudential policies targeting short-term foreign inflows, such as a systemic risk tax on non-core funding (Shin (2011), Hahm et al., 2013), to complement the capital and liquidity requirements proposed in Basel III. In this context, public guarantees would allow banks to attract more unstable funding, shifting both exogenous and endogenous risk to public insurance.

In an extension, we consider the case when some domestic investors also hold demandable debt, for instance because of liquidity needs. As these investors are effectively risk-tolerant, they would not choose to run under modest uncertainty. However, we show that once foreign funding reaches a certain scale, even domestic investors are induced to run. Such additional fragility arises not out of risk avoidance, but in order to avoid a dilution of their claim caused by a foreign run.

[3] A recent example is securitized mortgages pools that are relatively safe but hard to evaluate. Jorda et al. (2014) document the role of housing finance in large credit booms that are followed by crises.

Another extension examines whether "safe intermediaries" may overcome runs and excessive liquidation by issuing long-term funding and investing in domestic safe assets. However, such intermediaries cannot ensure absolute safety for foreign investors if there is an even minimal uncertainty about the monitoring of asset choice. Since leveraged safe intermediaries have an incentive to invest in risky assets, they cannot credibly commit to absolute safe investment. Kacperczyk and Schnabl (2013) document a similar risk-taking behavior of "safe" money market mutual funds during the financial crisis of 2007–10.

Our model offers a simplified portfolio choice, where we focus on safety-seeking capital flows. Foreigners who gained safety via domestic claims invest any residual wealth in their own country, where the expected returns (adjusted for expropriation risk) are higher. For simplicity, we also assume that high expropriation risk discourages domestic speculative outflows, but this is not essential to our result.

**Literature and empirical evidence.** In our approach, the demand for safety does not come from a subset of investors who are infinitely risk-averse. Rather, all investors suffer a large disutility when wealth falls short of some essential needs. Under Geary-Stone preferences, commonly used in development economics, utility is not defined below a subsistence level.[4] Such preferences are consistent with the recent evidence on the strength and stability of demand for safe assets (Krishnamurthy and Vissing-Jorgensen (2012); Gorton et al., 2012). Recent work has modeled this demand as arising from agents who are or act as infinitely risk-averse (Caballero and Farhi, 2013). In the presence of neglected risk, these preferences can create large-scale instability (Gennaioli et al., 2013).

Our conclusions are consistent with recent empirical evidence. Krishnamurthy and Vissing-Jorgensen (2013) show how changes in the supply of government safe assets affect the safety premium and lead to a response in short-term financial debt. To satisfy the non-financial sector's demand net of public debt, the financial sector issues safe assets and

[4]Campbell and Cochrane (1999) introduced habit formation in asset pricing through a dynamic version of such preferences.

increases long-term investments net of long-term funding. As in our paper, a strong demand for safety is associated with an increase in private credit and in maturity transformation.

Demandable debt is often explained by contingent liquidity demand with extreme time preferences (Diamond and Dybvig (1983), Gorton and Pennacchi, 1990). In our model, demandable debt arises as an optimal contract to satisfy the demand for safety of foreign investors who are exposed to expropriation risk. Demandable debt is also rationalized as an optimal contract to resolve agency conflicts (Diamond and Rajan (2001); Calomiris and Kahn, 1991). In Diamond and Rajan (2001), demandable debt acts as a threat to control agency. The presence of risk-avoiding foreign investors would make this threat quite costly, since runs occur also in solvent states.

The notion of a strict segmentation between savings and investment markets is increasingly common in the literature as a plausible foundation for bank funding preferences (Allen et al., 2015). The traditional view was based on a non-contingent liquidity preference for transaction purposes, the classic "money in the utility function" approach. As money-like claims offer a convenience yield, they are cheaper to issue (Stein, 2012). This private incentive to offer liquid claims needs to be balanced against any illiquidity externality, such as fire sales (Perotti and Suarez (2011); Stein, 2012). In our approach, demandable debt arises from risk intolerance rather than liquidity demand, though a brief extension considers the interaction between these motives.

Our paper complements a large international finance literature on the "original sin". Political risk induces most capital inflows in developing countries to take the form of short-term foreign exchange loans. We take the specular view by studying safety-seeking outflows from developing countries. Mendoza et al. (2009) show how countries with better private contractual enforcement benefit by attracting foreign investment inflows, and can explain their declining net asset holdings. Our approach is complementary. We highlight differences in the protection from public expropriation, and thus describe non-speculative capital flows.

There is abundant evidence of a large demand for safety. Foreign investors seeking safety accept a lower rates of return (Caballero et al., 2008). Forbes (2010) finds that foreigners with less developed domestic bond markets invest comparatively more in the US, and they appear to earn lower returns than US investors earn abroad, even after adjusting for exchange rate movements.

The historical accumulation of US deficits net of official reserves suggests a substantial build-up in the stock of foreign capital, though granular evidence is impaired by a preference for anonymity. Private inflows that seek anonymity are corroborated by the amount channeled via legal entities in offshore financial centers (OFC). Figure 1 shows large net OFC inflows into the US, and how they targeted privately intermediated safe assets, rather than holding assets in their own name. While foreign inflows into the US Treasury market are dominated by official institutions, OFC inflows into US intermediaries, estimated by the FED at 1.9 trillion dollar in 2014, represent over 40% of foreign claims on US banks, dwarfing inflows from international financial centers such as London, Hong Kong and Singapore, or rich economies such as the Eurozone or Japan.

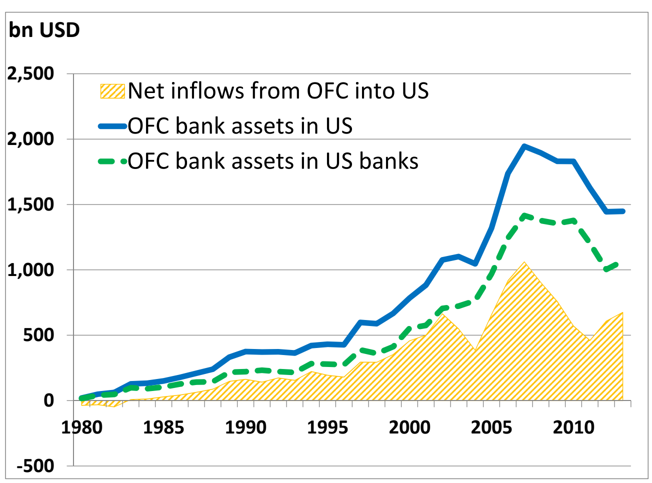


Figure 1: Flows between offshore financial centers (OFC) and the United States (US). Source: BIS locational banking statistics. All values in Billions of USD.

## 2 Model

There are three dates, $t \in \{0, 1, 2\}$, and a domestic and foreign region. Domestic investors of mass 1 and foreign investors of mass $W$ have identical information and endowment $e$ at $t = 0$. All investors have Stone-Geary preferences, which include some demand for absolute safety over a minimum consumption level $S \in (0, 1)$, below which they suffer a huge disutility. Once the subsistence level is secured, investors are risk-neutral with no time preference:

$$U(c_1, c_2) = \begin{cases} c_1 + c_2 & \text{if } c_1 + c_2 \geq S \\ -\infty & \text{if } c_1 + c_2 < S, \end{cases} \tag{1}$$

where $c_t$ denotes consumption at date $t$.

Investors can invest directly in physical storage and local financial assets, which comprise claims on intermediaries and government bonds. In both regions, storage yields a return of $x \in [\frac{S}{e}, 1)$, while short-term and long-term government bonds offer an unit return at $t = 1$ and $T > 1$ at $t = 2$, respectively. Intermediaries invest only in risky real investment projects[5] and are funded by financial claims issued to savers. Investors require an intermediary to invest in assets abroad. We normalize the endowment to $e \equiv 1 + S/T$.

There are differences in political risk across regions. The domestic government never expropriates, while the foreign government may seize all assets in its own region, except storage. Let this chance of expropriation be $\theta_L > 0$ for foreign investors. Hence, foreign investors may satisfy their need for absolute safety only via storage or by investing abroad through domestic intermediaries.[6] For simplicity, we assume that domestic agents investing in foreign assets are less protected than locals, so $\theta_H > \theta_L$, and that the difference in expropriation risk is large enough to discourage speculative capital flows across regions:

[5] We relax this assumption in section 4.5.

[6] Alternatively, foreign investors need to safe-keep any direct holdings of domestic assets by using storage, which returns only a fraction $x$ of payoffs.

$$(1-\theta_H)R_F < T < (1-\theta_L)R_F, \tag{2}$$

where $R_F$ is the expected return on risky foreign investment. The assumption is not necessary, but it enables us to focus on safety-seeking flows.

Intermediaries are subject to limited liability and maximize the expected value of equity at $t = 2$. They have a common risky technology at $t = 0$, whose return at $t = 2$ is either $R$ (high state) with probability $\gamma \in (0, 1)$, or zero (low state). Investing $I_i \geq 0$ by intermediary $i \in [0, 1]$ has decreasing returns to scale, where $R'(I_i) < 0$ and $R''(I_i) \leq 0$. Early liquidation at $t = 1$ yields a fraction $\alpha \in (0, 1)$, so it is efficient in the low state.

If storage options were poor, $x \leq \alpha$, the required return of safety-seeking investors would be satisfied even in case of early liquidation. In this case, in equilibrium foreign investors would actually provide insurance to domestic investors. We exclude this extreme case by assuming $\alpha < x$.

At $t = 1$, a precise signal may reveal the final-date return. The chance of revelation of the high state is $\delta \in (0, 1)$, while the chance of revelation of the low state is $1 - \epsilon \in (0, 1)$. If no signal is received, agents update their beliefs but some residual uncertainty remains. A low value of $\epsilon$ implies that the residual chance of a loss is low. Figure 2 summarizes.

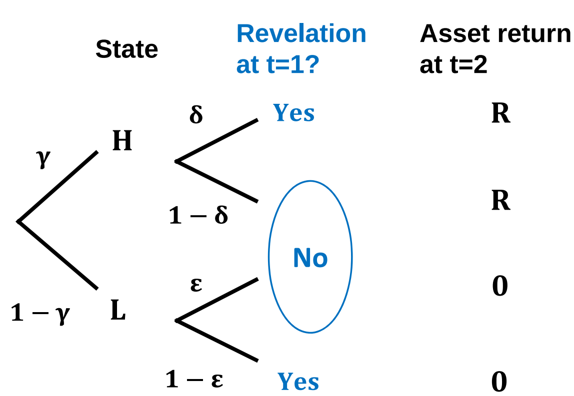


Figure 2: The information structure of domestic risky investment.

When the state is known, it is efficient to continue in the high state (since $R > \alpha$) and to liquidate in the low state (since $\alpha > 0$). When there is residual uncertainty, the chance of the good state is $\frac{\gamma(1-\delta)}{\gamma(1-\delta)+(1-\gamma)\epsilon}$. We assume that $\epsilon$ is sufficiently low that it is optimal to continue the project at $t = 1$:

$$\epsilon < \bar{\epsilon} \equiv \frac{\gamma(1-\delta)}{1-\gamma}\frac{R-\alpha}{\alpha}. \tag{3}$$

This condition holds if the return in the high state $R$ is large relative to the liquidation value $\alpha$, or if the low state is on average revealed earlier than a good state.

At $t = 0$, each intermediary raises domestic funding $d_i \geq 0$ and foreign funding $f_i \geq 0$ in order to invest $I_i$. Each intermediary has local access to one unit of domestic funding, $d_i \leq 1$, and competes freely for foreign funding.[7] The composition of funding at $t = 0$ is contractible. Since neither the signal at $t = 1$ nor the return at $t = 2$ are contractible, we restrict attention to simple debt contracts (Hart and Moore, 1998). Each intermediary offers a menu of contracts:

$$\{(L_1, L_2), (X_1, X_2)\}, \tag{4}$$

where $L_t$ and $X_t$ are the amounts promised upon withdrawal at date $t$. When debt is demandable, we abstract from runs due to pure coordination failure (Allen and Gale, 1998).

As a benchmark, consider the portfolio choice under autarky. Foreign investors use storage to satisfy their absolute safety needs, and invest any residual wealth in risky local assets exposed to expropriation risk. Domestic investors satisfy their absolute safety needs by investing $S/T$ in the long-term bond that dominates storage and the short-term bond. The remaining unit wealth is invested through claims on intermediaries that make risky domestic investment, provided the claim yields at least $T$.

Marginal revenue in the high state decreases in investment, $MR(I_i) \equiv I_i R'(I_i) + R(I_i)$. Since investment continues under uncertainty, the expected marginal revenue of investment

[7] This form of domestic funding would arise in some model of spatial competition among banks.

is $\gamma MR(I) + (1-\gamma)(1-\epsilon)\alpha$. Let risky investment initially dominate the long-term bond, and assume that domestic funding suffices for the efficient level of investment in autarky:

$$\gamma MR(0) + (1-\gamma)(1-\epsilon)\alpha > T > \gamma MR(1) + (1-\gamma)(1-\epsilon)\alpha. \tag{5}$$

Autarky investment $I^{Aut} \in (0,1)$ equalizes the expected marginal revenue of investment with the opportunity cost of funding, $\gamma MR(I^{Aut}) + (1-\gamma)(1-\epsilon)\alpha = T$. As domestic investors are willing to invest in long-term debt, there are never runs at $t = 1$.

# 3 Unstable inflows and endogenous risk

We now study the optimal funding choice by intermediaries when foreign funding is available, taking into account the optimal portfolio choice of investors.

Domestic investors still prefer to satisfy their absolute safety need by investing $S/T$ in the domestic long-term bond. The remaining unit wealth is available to buy a risky claim from intermediaries, provided its expected return equals $T$. Foreign savers satisfy their need for safety by either storing an amount $S/x$, or accept an absolutely safe claim on a domestic intermediary, provided it has a return of at least $x$. Their remaining wealth is channeled to risky foreign investment, where foreign investors face a lower expropriation risk than domestic investors. We can now state a first result.

**Proposition 1** ***Optimal funding contract.*** *Domestic funding $d_i > 0$ is attracted with long-term debt $(0, L)$ at an expected cost of $T$. Safety-seeking foreign funding $f_i \geq 0$ may be attracted with demandable debt $(x, X)$, provided a sufficient amount of loss-absorbing domestic funding is attracted, $d_i \geq \frac{x-\alpha}{\alpha} f_i$.*

**Proof.** See Appendix A. ■

The optimal funding choice is shaped by the demand for absolute safety by foreign investors. Since intermediaries continue investment under residual uncertainty at $t = 1$, this leaves a chance of complete loss in the low state. Thus foreign investors would refuse long-term debt, even if it was senior. Intermediaries must then attract enough loss-absorbing long-term funding in order to be able to attract cheap safety-seeking funding.

**Corollary 1** *If foreign funding is attracted with demandable debt, there is always some liquidation of investment under residual uncertainty. Such liquidation is ex-post inefficient in the high state. This efficiency loss increases in the scale of foreign funding.*

Foreign investors ensure their absolute safety by withdrawing at the interim date, unless the state is revealed to be high. When the state is low, withdrawing protects their priority vis-a-vis long-term debt (no dilution). Under residual uncertainty, a run avoids the chance, however minimal, of a complete loss.

Intermediaries maximize the expected equity value, equal to expected investment return net of funding costs. Domestic funding has an average cost of $T$, while foreign funding costs $X$ in the high state, while reducing returns by $\gamma(1-\delta)\frac{R(I_i)}{\alpha}x$ due to excess liquidation. Intermediaries competing for foreign funding would rather increase the promised amount at the final date $X_2 \equiv X$ over the early withdrawal face value $X_1$, in order to minimize costly liquidation. The promised amount for early withdrawals is thus set as low as possible while being consistent with absolute safety, $X_1^* = x$. If competition for foreign funding is strong, the face value of demandable debt at $t = 2$ may exceed the minimum required return, $X_2^* \geq x$.

The trade-off associated with safety-seeking foreign funding is thus a lower funding cost (and thus a higher volume of credit) against excess liquidations in the high state. In Appendix B, we show that the intermediary's problem can be stated as:

$$
\begin{aligned}
\max_{f_i \in [0,\infty), d_i \in [0,1]} \pi_i \quad &= \quad I_i \left[\gamma R(I_i) + (1-\gamma)(1-\epsilon)\alpha\right] - d_i T \\
& \quad -f_i \left[\gamma \delta X + x \left(\gamma(1-\delta)\frac{R(I_i)}{\alpha} + (1-\gamma)(1-\epsilon)\right)\right] \qquad (6) \\
\text{s.t.} \quad & \quad x f_i \leq \alpha I_i = \alpha(d_i + f_i)
\end{aligned}
$$

Before solving for the intermediary choice, we assume that the scarcity of domestic funding never limits capital inflows. We assume decreasing returns such that

$$
MR\left(\frac{x}{x-\alpha}\right) < \alpha + \frac{x-\alpha}{x}\frac{T}{\gamma\delta}. \qquad (7)
$$

This condition ensures an interior solution $d_i^* < 1$.

**Lemma 1** ***Demand for funding.*** *The intermediary attracts no foreign funding (autarky) if interim uncertainty is too high, $\delta \leq \underline{\delta} \in (0,1)$. Else, there exists a unique switching threshold $X_S > x$ such that:*

- *If foreign funding is expensive, $X \geq X_S$, autarky is optimal: $f_i^* = 0$ and $d_i^* = I^{Aut}$.*
- *If $X_S > X \geq x$, the safety constraint binds, $d_i^* = \left(\frac{x-\alpha}{\alpha}\right) f_i^*$. Both domestic and foreign funding is attracted. The demand for foreign funding, $f_i^*(X)$, is uniquely given by:*

$$
\gamma\delta MR\left(\frac{x}{\alpha} f_i^*\right) = T + \frac{\alpha}{x}\Big[\gamma\delta X - T\Big]. \qquad (8)
$$

**Proof.** See Appendix B, where the lower bound $\underline{\delta}$ is defined. ■

In what follows, we focus on the interior solution described in the previous Lemma, where the expected return equals the expected marginal cost of both domestic and foreign funding. Aggregation of intermediary demand implies $f \equiv \int_0^1 f_i \, di$. In equilibrium, the amount of foreign wealth determines the amount and cost of demandable debt.

**Proposition 2** ***Unique equilibrium.*** *There exists a unique equilibrium if* $\delta > \underset{\sim}{\delta}$ *and sufficient foreign wealth,* $W > \underline{W}$*. For* $W \leq \overline{W}$*, there exists an interior allocation, with foreign funding* $f_i^* = f^* = \frac{WS}{x}$ *and domestic funding* $d_i^* = d^* = \frac{x-\alpha}{\alpha x} WS \in (0,1)$*. The face value of demandable debt is:*

$$X^* = \frac{x}{\alpha} MR\left(\frac{S}{\alpha}W\right) - \frac{x-\alpha}{\alpha}\frac{T}{\gamma\delta}. \tag{9}$$

**Proof.** See Appendix C, where the bounds on foreign wealth are defined. ■

We can now assess the risk created by safety-seeking capital inflows.

**Proposition 3** ***Excessive liquidation.*** *When foreign funding is attracted,* $W \in (\underline{W}, \overline{W})$*, withdrawals by safety-seeking foreign investors under interim uncertainty lead to inefficient liquidation of investment. The resulting efficiency loss in the high state is* $\frac{SW}{\alpha}\left[R\left(\frac{S}{\alpha}W\right) - \alpha\right]$*.*

**Proof.** See Appendix D. ■

A final result concerns the net present value of domestic investment.

**Proposition 4** ***Negative net present value.*** *For* $W \in (\underline{W}, \overline{W})$*, the level of domestic investment increases in foreign wealth, while its net present value at domestic discount rates decreases in it. If* $\delta > \underset{\sim}{\delta}$*, there exists a unique wealth threshold* $W^* \in \left(\underline{W}, \overline{W}\right)$ *such that the net present value of investment is negative at domestic discount rates for all* $W > W^*$*.*

**Proof.** See Appendix E, where the lower bound $\underset{\sim}{\delta}$ is defined. ■

We now summarize the aggregate effect of capital inflows. If foreign wealth is abundant and thus cheap, investment expands until it earns a negative NPV *at domestic discount rates*. However, in the basic model, this expansion in domestic credit is efficient, since the marginal rate of return required by foreign investors becomes the appropriate discount rate for domestic intermediaries. We will examine social welfare considerations below.

# 4 Extensions

## 4.1 Endogenous uncertainty

In our setup, interim uncertainty about the asset return may lead to runs by risk-intolerant investors, so intermediaries have an incentive to seek transparent assets. In this section, we study the case in which expanding lending implies investing in assets whose value is more uncertain at the interim date.

To keep our focus distinct from traditional risk shifting in banking, we assume that more lending does not involve inherently riskier assets (constant $\gamma$), but interim uncertainty increases in the volume of credit, $\delta = \delta(I_j)$ with $\frac{d\delta}{dI_j} < 0$. We maintain that liquidation is inefficient under uncertainty, and $\delta(0) \equiv \delta$ for comparability with the baseline model.

It is easy to show that higher investment leads to a greater frequency of runs, since a precise signal occurs less often in the high state. As the intermediary bears all cost, the impact of more opaque investment is fully internalized, and it is straightforward to generalize the demand for funding in Lemma 1. If foreign funding is cheap, $X < X_S^{\delta}$, the intermediary still attracts as much foreign funding as possible, constrained by the absolute safety condition, $f_i^* = \frac{\alpha}{x-\alpha} d_i^*$. The new demand for foreign funding $f_i^*(X)$ and the investment level $I_i^*(X) = \frac{x}{\alpha} f_i^*(X)$ are implicitly given by:

$$\gamma\delta(I_i^*)MR(I_i^*) = T + \frac{\alpha}{x}\left[\gamma\delta(I_i^*)X - T \underbrace{-\gamma\delta'(I_i^*)\left(\frac{x}{\alpha}R(I_i^*) - X\right)}_{>0}\right], \tag{10}$$

where the last term is positive and captures the effect of more frequent excess liquidation.

As residual claimant in the high state, the intermediary internalizes all costs of asset opacity, and choosing a lower scale of foreign funding compared to the baseline case.

### 4.2 Social cost of excessive liquidation

Under the optimal contract, intermediaries trade off the cost and stability of foreign funding. Even though it causes some ex-post inefficient liquidation, foreign funding is efficient from an ex-ante perspective. However, a proper welfare analysis must consider the possibility that bank runs have social consequences. A natural case is that excess liquidation imposes social costs associated with early termination, such as spillover losses or social distress. Larger runs may also affect the liquidation price of assets, or undermine confidence in domestic intermediaries, causing a negative externality (Stein, 2012).

We introduce a social cost of excess liquidation $\xi > 0$ per unit of assets terminated early in the high state in the extended model with endogenous opacity. Recall that in autarky, there are no such costs, since all funding is long-term.

A constrained planner internalizes the social cost of excess liquidation, taking the supply of foreign and domestic funding as well as the absolute safety constraint of foreign investors as given. For sufficiently cheap foreign funding, the social optimum of investment $I_P(X)$, and the demand for foreign funding $f_P(X)$, have an interior solution as before:

$$\begin{aligned} \gamma\delta(I_P)MR(I_P) \quad &= \quad T + \frac{\alpha}{x}\left[\gamma\delta(I_P)X - T - \gamma\delta'(I_P)\left(\frac{x}{\alpha}R(I_P) - X\right)\right] \\ &\quad + \underbrace{\xi\left[\gamma(1-\delta(I_P)) - \gamma\frac{x}{\alpha}\delta'(I_P)f_P\right]}_{>0}. \end{aligned} \tag{11}$$

Relative to the private choice, the constrained planner incorporates the social cost of excessive liquidation. As result, the socially optimal volume of credit is lower, and the degree of stability higher.

A broader implication is that stable funding norms (envisioned under Basel III) should be adjusted to recognize the lower stability associated with safety-seeking foreign inflows.

### 4.3 Induced runs

While more foreign funding can increase both the scale and frequency of runs, so far it has had no effect on the behavior of domestic investors. (Recall that domestic investors are not exposed to expropriation risk.) To consider a direct interaction of foreign and domestic funding, we consider now the plausible case when domestic savers hold demandable debt claims for reasons other than safety, say the ease of payment or timing of liquidity needs.

Specifically, suppose an additional mass $\omega > 0$ of domestic investors chooses a demandable claim, due to exogenous reasons. The demandable debt claim promises a return of $X^*$ at $t = 2$, and is as senior as long-term debt with face value $L^*$ in case of early liquidation. For simplicity, we keep the amount of risk-absorbing domestic funding constant, so the capacity to provide absolute safety is unchanged.

As domestic savers have secured their safety needs, they would not run under (modest) uncertainty, provided the rollover premium is adequate. Indeed, for a low $\epsilon$, all agents share the belief that the chance of the high state is very high. However, even risk-tolerant domestic savers would choose to withdraw under uncertainty whenever:

$$\frac{\gamma(1-\delta)}{\gamma(1-\delta)+(1-\gamma)\epsilon}\min\left\{X^*, \left(R(I^*)I^* - R(I^*)\frac{x}{\alpha}f^*\right)\frac{X^*}{\omega X^* + L^*}\right\} \geq x, \qquad (12)$$

where the first factor is the probability of the high state under uncertainty and the second factor is the value of the demandable debt claim in case of a foreign run.

Interestingly, more foreign wealth has several effects on the risk of a run by domestic investors. First, it leads to a lower equilibrium face value of demandable debt at the final date, $X^*$. Second, it implies larger runs under uncertainty and thus more liquidation, diluting the return of domestic investors who rolls over. Third, more foreign funding leads to more marginal investment returns. All these effects increase the incentives of domestic savers to withdraw at the interim date under residual uncertainty. Thus, an increasing reliance on foreign funding will at some point trigger instability of domestic funding.

The induced run occurs despite the capacity of domestic investors to bear risk and a common belief that the state is very likely to be high. Runs occur to avoid a dilution of the domestic claim caused by a foreign run.

### 4.4 Private arbitrage

In this section, we study whether domestic investors could avoid excess liquidation by becoming arbitrageurs, relying on their superior risk absorption capacity.

This strategy entails transferring some resources to the interim date, which has an opportunity cost of the term premium, $T-1$. Whenever there is uncertainty, arbitrageurs could buy claims from withdrawing foreign investors and then negotiate with the bank to appropriate the gain from avoiding liquidation. Consider the maximum benefit of this strategy, namely when the arbitrageur has all the bargaining power. An arbitrageur with a unit of capital at $t=1$ could then buy $1/x$ units of demandable claims in case of interim uncertainty, and trade them for a long-term claim worth $\frac{R(I)}{\alpha}x$. This strategy generates $\frac{R(I)}{\alpha}$ in the high state, which occurs with an ex-ante probability of $\gamma(1-\delta)$, and a complete loss in the low state. Thus, a sufficient condition to exclude the possibility of domestic arbitrageurs is, for a given amount of investment:

$$T-1 > \gamma(1-\delta)\frac{R(I^*)}{\alpha}. \tag{13}$$

In sum, a private solution to the ex-post inefficiency fails when its opportunity cost, the term premium, exceeds the maximum expected gain. For more general bargaining games, or in the presence of specific costs, the condition will be less stringent.

Note that it is impossible for the arbitrageur to increase its expected profits by leverage. Other domestic investors have the same opportunity cost, while foreign investors would not invest due to the lack of absolute safety.

### 4.5 Safe intermediaries

We have so far restricted domestic intermediaries to invest in risky projects. In this section, intermediaries may also hold bonds. In such a case, could "safe intermediaries" emerge to invest in safe domestic bonds and offer long-term debt to foreign savers? This would enable to capture the safety premium while avoiding inefficient liquidation driven by runs.

Such an arrangement is fragile in the context of absolute safety needs. We continue to assume that the composition of funding is contractible. However, even a tiny chance that the asset choice of such intermediaries cannot be constrained (infinitesimal governance risk) will undermine the credibility of safe intermediaries as sources of absolute safety. We show that safe intermediaries, because of their leverage, will have an incentive to make risky investment. Thus "safe intermediaries" cannot always commit to investing in safe bonds.

Specifically, suppose that an intermediary raises long-term funding at face value $F \geq x$ from foreign investors. If invested in long-term bonds, the intermediary's riskless profit is $T - F$ per unit of funding $f$ raised, so $\pi(safe) = f\,[T - F]$. However, if the intermediary makes risky investment, foreign investors are repaid in the high state but the intermediary defaults in the low state. Therefore, the expected profit to the intermediary is $\pi(risky) = \gamma f\,[R(f) - F]$. Risk-taking incentives are lowest for low funding costs, whereby the intermediary attracts cheap funding $F = x$, and low investment returns due to decreasing returns, whereby $f = W$. As a result, a sufficient condition for leveraged intermediaries to prefer risky investment is:

$$\gamma[R(W) - x] > T - x. \tag{14}$$

Hence, intermediaries cannot commit to offering absolute safety, as would be required to attract foreign funding. Even in the context of the safest class of money market mutual funds, Kacperczyk and Schnabl (2013) document risk-taking behavior during the recent financial crisis.

## 5 Conclusion

This paper has sought a foundation for the widespread view that global imbalances shaped the credit boom and ultimately the financial crisis (Caballero and Krishnamurthy, 2009). We show how the accumulation of wealth in countries with a weak protection of property rights create a demand for absolute safety provided by intermediaries in safe countries. The optimal contractual arrangement shapes the funding structure of domestic intermediaries, creating a clear link between inexpensive funding, credit expansion, and instability.

Studying inflows into developed countries is specular to the literature on sudden capital outflows in emerging economies. Our contribution is to derive the optimal funding arrangement shaped by an endogenous demand for safety, and to show how it may create endogenous fragility. In our setup, domestic and foreign investors have identical preferences and endowments but regions differ in their exposure to expropriation risk. The optimal funding arrangement comprises loss-absorbing long-term claims issues to domestic investors and demandable debt claims issued to foreign investors. Demandable debt offers safety at the expense of greater fragility, making foreign funding cheap but flighty.

While global imbalances reflect major shifts in wealth away from developed countries, a large fraction has flown back in the form of inexpensive claims on domestic intermediaries, enabling to expand credit at times of declining savings. We show that the safety-seeking nature of foreign flows creates risk. The demand for absolute safety not just redistributes risk among investors, but also increases risk via larger and more frequent runs. This funding shift leads to greater vulnerability even in solvent states, and may induce further runs by risk-tolerant investors who seek to avoid dilution. This result has clear implications and supports a mandate for macroprudential policy to oversee the nature of foreign inflows, as the socially preferred funding structure would involve less credit volume and lower instability than the private choice.

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# A Proof of Proposition 1

We start with the optimal portfolio choice of investors. Let $(X_1, X_2)$ be the claim targeted at foreign investors, and $(L_1, L_2)$ be the claim targeted at domestic investors.

**Claim 1** ***Portfolio choice of domestic investors.*** *If the return on the absolutely safe claim $(X_1, X_2)$ does not exceed $T$, domestic investors satisfy their absolute safety need by investing $S/T$ in the domestic long-term bond. The remaining unit wealth is supplied to a domestic intermediary if the claim $(L_1, L_2)$ has an expected return of at least $T$.*

**Proof.** For the absolute safety component of the portfolio of domestic investors, the domestic long-term bond dominates both storage and the domestic short-term bond. Investment in foreign assets does not yield absolute safety because of expropriation risk. Therefore, domestic investors satisfy their absolute safety needs by investing $S/T$ in long-term domestic bond. While investing in a safe claim issued by a domestic intermediary could also ensure absolute safety, it would yield a lower return. For the speculative component of the portfolio of domestic investors, all foreign assets are dominated because of expropriation risk. Thus, domestic investors either invest in (more of) the domestic long-term bond or in a risky claim issued by a domestic intermediary. ■

**Claim 2** ***Portfolio choice of foreign investors.*** *To satisfy their absolute safety needs, foreign investors accept a claim issued by a domestic intermediary if it is absolutely safe and has a return of at least $x$. Their remaining wealth is channeled to foreign risky investment if the risky claim issued by an intermediary does not reach the expropriation-adjusted expected return of $(1 - \theta_L)R_F$.*

**Proof.** Consider the absolute safety component of the portfolio of foreign investors. Foreign bonds and foreign risky investment do not provide absolute safety due to expropriation risk. As a result, either storage or an absolutely safe claim issued by a domestic intermediary generate the required absolute safety. For foreign savers to accept such the latter claim, it would need to yield a return of at least $x$. For the speculative component of the portfolio of foreign investors, risky foreign investment dominates other foreign and domestic assets. Provided that a claim offered by a domestic intermediary does not offer at least $(1-\theta_L)R_F$, all residual wealth is invested in risky foreign investment. ■

Foreign savers would need to invest $\frac{S}{x}$ in storage to achieve absolute safety. If a demandable debt claim $(x, X)$ is absolutely safe, then it faces an aggregate demand of:

$$f(X) = \begin{cases} \left[0, \frac{WS}{x}\right] & X = x \\ & \text{if} \\ \frac{WS}{x} & X > x \end{cases} \tag{15}$$

Next, we turn to the claims foreign investors who seek absolute safety would accept from a domestic intermediary. We consider long-term debt and demandable debt in turn.

**Claim 3** ***Long-term debt.*** *Foreign investors never accept any long-term debt claim.*

**Proof.** Consider a long-term debt claim $(X_1 = 0, X_2 \geq x)$, where the inequality ensures a return no smaller than that of storage. Under which conditions would this claim be absolutely safe? First, if the state is revealed to be low, absolute safety requires seniority of foreign investors (to avoid the dilution of their claim relative to domestic investors), and a sufficient amount of loss-absorbing domestic funding, $\alpha I_i \geq x f_i$.

Second, consider the case of residual uncertainty at $t = 1$ (when no signal is received). Recall that investment efficiently continues in the high state, $R(I) > \alpha$, and that the continuation of investment is optimal, $\epsilon < \overline{\epsilon} \equiv \frac{\gamma(1-\delta)}{1-\gamma}\frac{R(I)-\alpha}{\alpha}$. As a result, a complete loss occurs if the state is low at $t = 2$. However, this violates a foreign investor's need for absolute safety. Hence, a foreign investor would never accept a long-term debt claim, even it was senior. ■

**Claim 4** ***Absolute safety and demandable debt.*** *Foreign investors accept a demandable debt claim if enough (loss-absorbing) long-term funding is attracted. This requires* $d_i \geq \frac{x-\alpha}{\alpha} f_i$ *when domestic investors hold long-term debt,* $L_1 = 0$*. Foreign investors can ensure absolute safety by withdrawing at* $t = 1$ *under residual uncertainty. To avoid dilution, foreign investors also withdraw when the signal reveals the state to be low if* $L_2 \geq X_2$*.*

**Proof.** Consider now a demandable debt claim ($X_2 \geq X_1 \geq x$), where the first inequality ensures that foreign investors do not withdraw when the state is revealed to be high. To ensure absolute safety under residual uncertainty, foreign investors must withdraw in order to avoid a complete loss at $t = 1$. Absolute safety is ensured under residual uncertainty, provided enough domestic funding is attracted, $\alpha I_i \geq x f_i$, and such funding is loss-absorbing, that is domestic investors do not withdraw at $t = 1$. Long-term debt issued to sufficiently many domestic investors would avoid dilution of a foreign investor's claim at $t = 1$ under residual uncertainty. Moreover, foreign investors withdraw at $t = 1$ when the signal reveals the state to be low in order to avoid dilution at $t = 2$. Their claim at $t = 2$ does not guarantee absolute safety when $X_2 \frac{\alpha I_i}{X_2 f_i + L_2 d_i} < x$, where we used pro-rata in default. Since $\alpha < x$, this condition holds for any positive amount of funding if $L_2 \geq X_2$. ■

We now turn to the funding and portfolio choices of domestic intermediaries.

**Lemma 2** *Domestic intermediaries do not offer a claim that yields more than* $T$ *in expectation and do not make any foreign investments.*

**Proof.** Domestic funding can be attracted locally with a long-term debt claim that yields $T$ in expectation. Because of decreasing returns to scale, and since the efficient level of investment when the expected funding cost is $T$ can be reached by attracting domestic funding only, there is no a reason to attract foreign funding at a higher cost. This applies to both absolutely safe and risky claims.

Domestic investors do not invest abroad. Foreign bonds are dominated by domestic bonds because of expropriation risk. Proofing by contradiction, suppose that a domestic intermediary invested in foreign risky investment. Since a domestic intermediary is subject to expropriation risk in the foreign region, such investment yields a zero return with positive probability and cannot support absolute safety offered to foreign investors. Moreover, it yields an expropriation-adjusted return of $(1-\theta_H)R_F < T$, below the required return of domestic investors. ■

As a result, the absolutely safe claim must yield less than the risky claim, $X_2 \leq L_2$. Also, foreign investors, if their funding is attracted, always withdraw when the state is revealed to be low (Claim 4). Moreover, foreign investors never invest in domestic intermediaries for speculative purposes (Claim 2). Taking these results together, we obtain at the optimal funding contract stated.

# B Proof of Lemma 1

We start by showing that the bank's problem simplifies as stated. Table 1 summarizes all payoffs when foreign funding is attracted. We compare the expected equity value when foreign funding is attracted and in autarky at the end.

| state | probability | liquidate? | $\pi_F$ | $\pi_D$ | $\pi_i$ |
|---|---|---|---|---|---|
| $H$ | $\gamma\delta$ | None | $X$ | $L$ | $RI_i - Ld_i - Xf_i$ |
| $H$ | $\gamma(1-\delta)$ | Some | $x$ | $\min\left\{L, R\frac{I_i - \frac{x}{\alpha}f_i}{d_i}\right\}$ | $\max\{0, R(I_i - \frac{x}{\alpha}f_i) - Ld_i\}$ |
| $L$ | $(1-\gamma)\epsilon$ | Some | $x$ | $0$ | $0$ |
| $L$ | $(1-\gamma)(1-\epsilon)$ | Full | $x$ | $\frac{\alpha I_i - xf_i}{d_i}$ | $0$ |

Table 1: Payoffs when foreign capital is attracted. $\pi_D$ and $\pi_F$ are the payoffs to domestic and foreign investors, respectively, while $\pi_i$ is the payoff to intermediary $i$.

The participation constraint of domestic investors is:

$$\mathbb{E}[\pi_D] = \gamma\delta L + \gamma(1-\delta)\min\left\{L, \frac{R(I_i)I_i - \frac{R(I_i)}{\alpha}xf_i}{d_i}\right\} + (1-\gamma)(1-\epsilon)\frac{\alpha I_i - xf_i}{d_i} \geq T. \quad (16)$$

Equity is valueless in the low state, so the expected equity value of intermediary $i$ is:

$$\mathbb{E}[\pi_i] = \gamma\delta\left[R(I_i)I_i - Ld_i - Xf_i\right] + \gamma(1-\delta)\left[\max\left\{R(I_i)I_i - \frac{R(I_i)}{\alpha}xf_i - Ld_i, 0\right\}\right]. \quad (17)$$

Each intermediary $i$ maximizes its expected equity value by choosing its funding profile $(d_i,\ f_i)$ and the face value of long-term debt $L$, taking the face value of demandable debt $X$ as given. These choices are constrained by the participation constraint of domestic investors and the absolute safety constraint. The face value of long-term debt reduces the bank's expected profits but makes the participation constraint of domestic investors less binding (without affecting the absolute safety constraint). Hence, the bank sets $L$ for the participation constraint of domestic investors to bind. Inserting yields the problem stated in the main text.

We now solve this constrained optimization problem. Let $\mathcal{L}_i$ the Lagrangian of the problem and $\lambda_i$ be the Lagrange multiplier associated with the absolute safety constraint of bank $i$. The first-order conditions are:

$$\begin{aligned}
\frac{d\mathcal{L}_i}{dd_i} &= \gamma MR(I_i) + (1-\gamma)(1-\epsilon)\alpha - T - \gamma(1-\delta)\frac{x}{\alpha}R'(I_i)f_i + \lambda_i \\
\frac{d\mathcal{L}_i}{df_i} &= \gamma MR(I_i) + (1-\gamma)(1-\epsilon)(\alpha - x) - \gamma\delta X - \gamma(1-\delta)\frac{x}{\alpha}\left[R'f_i + R\right] - \left(\frac{x}{\alpha} - 1\right)\lambda_i
\end{aligned}$$

and $\lambda_i \geq 0$ and $d_i \geq \frac{x-\alpha}{\alpha}f_i$ with complementary slackness.

**Slack absolute safety constraint** Consider the case in which the constraint to provide absolute safety does not bind ($\lambda_i^* = 0$). There are two subcases: (A) foreign funding is more expensive, (B) foreign funding is cheaper than domestic funding.

**(A) more expensive foreign funding** Suppose that foreign funding is expensive relative to domestic funding, $X \geq \frac{T}{\gamma\delta} - \frac{(1-\gamma)(1-\epsilon)}{\gamma\delta}x - \frac{1-\delta}{\delta}\frac{x}{\alpha}R(I_i^*)$. Then, no foreign funding is attracted, $f_i^* = 0$, and the autarky level of investment occurs, $d_i^* = I^{Aut}$. The profit level is $\pi^{Aut} \equiv I^{Aut}[\gamma R(I^{Aut}) + (1-\gamma)(1-\epsilon)\alpha - T]$.

We need to confirm two suppositions. First, the absolute safety constraint is trivially slack, $\lambda_i^* = 0$. Second, for foreign funding to be (prohibitively) expensive, we require:

$$X \geq \overline{X} \equiv \frac{T}{\gamma\delta} - \frac{(1-\gamma)(1-\epsilon)}{\gamma\delta}x - \frac{1-\delta}{\delta}\frac{x}{\alpha}R(I^{Aut}). \tag{18}$$

Autarky is the unique equilibrium if $\overline{X} \leq x$. However, we impose a lower bound on interim uncertainty in order to allow for an equilibrium in which foreign funding is attracted:

$$\delta > \underline{\delta}_0 \equiv \frac{\gamma R(I^{Aut}) + (1-\gamma)(1-\epsilon)\alpha - \frac{\alpha}{x}T}{\gamma\left[R(I^{Aut}) - \alpha\right]} \in (0,1)\,. \tag{19}$$

**(B) foreign funding is cheaper than domestic funding** If foreign funding is cheap relative to domestic funding, $X < \frac{T}{\gamma\delta} - \frac{(1-\gamma)(1-\epsilon)}{\gamma\delta}x - \frac{1-\delta}{\delta}\frac{x}{\alpha}R(I_i^*)$, then the intermediary would wish to attract only foreign funding, $f_i^* > 0$, and no domestic funding, $d_i^* = 0$. This allocation violates the absolute safety constraint, however. Contradiction.

**Binding absolute safety constraint** Consider now the case in which the constraint to provide absolute safety binds ($\lambda_i^* > 0$). Hence, $d_i^* = \left(\frac{x}{\alpha} - 1\right) f_i^*$ and $I_i^* = \frac{x}{\alpha} f_i^*$. Optimality requires $f_i^* > 0$, so we have $\frac{d\mathcal{L}_i}{df_i} = 0$. Solving for the Lagrange multiplier yields:

$$\lambda_i = \frac{\alpha}{x-\alpha}\gamma MR\left(I_i^*\right) - (1-\gamma)(1-\epsilon)\alpha - \frac{\alpha\gamma\delta}{x-\alpha}X - \gamma(1-\delta)\frac{x}{x-\alpha}[R(I_i^*) + R'(I_i^*)f_i^*]. \tag{20}$$

Inserting the multiplier in $\frac{d\mathcal{L}_i}{dd_i}$ yields:

$$\frac{d\mathcal{L}_i}{dd_i} = \gamma\delta\frac{x}{x-\alpha}MR\left(\frac{x}{\alpha}f_i^*\right) - T - \gamma\delta\frac{\alpha}{x-\alpha}X. \tag{21}$$

First, if $d_i^* \in (0,1)$, then $\frac{d\mathcal{L}_i}{dd_i} = 0$, so the optimal amount of foreign (and domestic) funding is implicitly defined by:

$$MR\left(\frac{x}{\alpha}f_i^*\right) = \frac{x-\alpha}{x}\frac{T}{\gamma\delta} + \frac{\alpha}{x}X. \tag{22}$$

The left-hand side strictly decreases in the amount of foreign funding since $MR'(\cdot) < 0$. The right-hand side is a positive constant. Note that the left-hand side at zero strictly exceeds the right-hand side for all $X \leq \overline{X}$. Therefore, there exists a unique interior solution $f_i^*(X) > 0$ for all $X < \overline{X}$.[8] The demand for foreign funding in downward-sloping, $\frac{df_i^*(X)}{dX} < 0$, since the right-hand side increases in the price of foreign funding.

To ensure an interior solution, $d_i^* < 1$, and thus $I_i^* < \frac{x}{x-\alpha}$, we require sufficiently strong decreasing return when foreign funding is as cheap as possible ($X = x$):

$$MR\left(\frac{x}{x-\alpha}\right) < \frac{x-\alpha}{x}\frac{T}{\gamma\delta} + \alpha. \tag{23}$$

Finally, one can show that $\lambda_i^* > 0$ always holds, which confirms our initial supposition.

**When is autarky optimal?** Next, we compare the expected equity value under autarky to the case in which foreign funding is attracted. This allows us to determine the intermediary's globally optimal amount of foreign funding.

The expected equity value of the intermediary that chooses autarky is:

$$\pi^{Aut} \equiv I^{Aut}[\gamma R(I^{Aut}) + (1-\gamma)(1-\epsilon)\alpha - T]. \tag{24}$$

For $X \in [x, \infty)$, a bank's expected equity if choosing to attract foreign funding is:

$$\pi_i^*(X) = \frac{x}{\alpha} f_i^*(X)\left[\gamma\delta R\left(\frac{x}{\alpha} f_i^*(X)\right) - \gamma\delta\frac{\alpha}{x}X - T\frac{x-\alpha}{x}\right], \tag{25}$$

where $f_i^*(X) \in (0, \frac{\alpha}{x-\alpha})$ and $I_i^*(X) = \frac{x}{\alpha} f_i^*(X)$. By the envelope theorem, the expected profit strictly decreases in the face value of foreign funding, $\frac{d\pi_i^*}{dX} < 0$.

Thus, for any foreign funding to be attracted in equilibrium, we require $\pi^{Aut} < \pi_i^*(x)$,

[8] That is, $R(0) \geq \frac{x-\alpha}{x}\frac{T}{\gamma\delta} + \frac{\alpha}{x}X$ for all $X \leq \overline{X}$ because of the first boundary condition and the definition of the autarky investment level.

which places a lower bound on interim uncertainty:

$$\delta > \underline{\delta}_1 \equiv \frac{-(I^{Aut})^2 R'(I^{Aut})}{-I_i^*(x)^2 R'(I_i^*(x))}. \tag{26}$$

Then, the effective lower bound is $\underline{\delta} \equiv \max\{\underline{\delta}_0, \underline{\delta}_1\}$.

Under this boundary condition, there exists a unique switching threshold $X_S > x$ such that foreign funding is attracted if and only if it is sufficiently cheap, $X < X_S$. This threshold is implicitly determined by $\pi^{Aut} \equiv \pi_i^*(X_S)$.

# C Proof of Proposition 2

This proofs builds on the supply of foreign funding in (15) and Lemma 1. To ensure existence of equilibrium with foreign capital intermediation, we require a lower bound on foreign wealth. This lower bound $\underline{W}$ is given by the interaction between the supply of foreign funding, $f = \frac{WS}{x}$, and the demand for foreign funding as implied by the solution to the intermediary's problem stated in Lemma 1. Thus, the lower bound on the level of foreign wealth is given by:

$$\gamma\delta MR\left(\frac{S}{\alpha}\underline{W}\right) = \frac{\alpha}{x}\gamma\delta X_S + \frac{x-\alpha}{x}T. \tag{27}$$

Finally, the upper bound on the level of foreign wealth ensures that all foreign wealth is absorbed by domestic intermediaries:

$$\gamma\delta MR\left(\frac{S}{\alpha}\overline{W}\right) = \frac{x-\alpha}{x}T + \alpha\gamma\delta. \tag{28}$$

# D Proof of Proposition 3

This proof builds on the supply of foreign funding in (15), Lemma 1, and Proposition 2. Foreign funding is attracted whenever foreign wealth is sufficiently abundant, where

$W \in \left(\underline{W}, \overline{W}\right)$. In this equilibrium, the absolute safety constraint binds, $\alpha I_i^* = x f_i^*$ for each intermediary $i$. Hence, there are no resources left after foreign investors withdraw at the interim date under uncertainty, and bank equity value is zero in this contingency. Then, the total efficiency loss is $\left(\frac{R(I^*)}{\alpha} - 1\right) x f^*$. For $W \in (\underline{W}, \overline{W})$, we have that $I^* = \frac{S}{\alpha} W$ and $f^* = \frac{S}{x} W$. Thus, the efficiency loss of $(R\left(\frac{S}{\alpha} W\right) - \alpha)\frac{S}{\alpha} W$.

# E Proof of Proposition 4

The net present value of investment at domestic discount rates for a level of foreign wealth $W \in \left(\underline{W}, \overline{W}\right)$ is:

$$NPV = \frac{\gamma R\left(\frac{WS}{\alpha}\right) + (1-\gamma)(1-\epsilon)\alpha}{T} - 1. \tag{29}$$

Hence, the net present values decreases in foreign wealth, $\frac{dNPV}{dW} = \frac{\gamma R'\left(\frac{WS}{\alpha}\right)\frac{S}{\alpha}}{T} < 0$. By continuity and monotonicity, it suffices to show that the net present value at domestic discount rates, when evaluated at the maximum level of foreign wealth $\overline{W}$, is negative. This condition can be written as $\gamma R\left(\frac{WS}{\alpha}\right) + (1-\gamma)(1-\epsilon)\alpha < T$. Using the definition of $\overline{W}$ and rewriting yields a lower bound as sufficient condition:

$$\delta > \underset{\sim}{\delta} \equiv \frac{\alpha}{x-\alpha} \frac{T - \alpha[1-(1-\gamma)\epsilon] + \gamma\left(\frac{\overline{W}S}{\alpha}\right) R'(\frac{\overline{W}S}{\alpha})}{T}. \tag{30}$$