Cheap but flighty: how global imbalances create financial fragility*

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DRAFT

Abstract

We study how a wealth shift to emerging countries may explain instability in developed countries. Investors subject to political risk seek safety via intermediaries in reserve currency. Less informed foreigners withdraw even in solvent states, forcing inefficient liquidation. Beyond some scale of foreign funding, even informed savers would run excessively, so the socially optimal contract is long-term debt. Yet the intermediary may target only foreign savers to minimize funding costs.

Instability arise once demandable debt becomes optimal because of an absolute safety demand, which is stronger for savers exposed to political risk. Intermediaries issue cheap but unstable demandable debt to foreigners to extract large safety rents, and stable long-term debt to informed investors. As foreign funding becomes abundant and uninformed runs would cause large losses, even domestic funding becomes unstable, causing endogenous risk. Thus, in order for banks to ensure absolute safety to some savers, they must cap their stock of unstable funding.

Keywords: absolute safety, unstable funding, safe haven.

JEL classifications: F3, G2.

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1 Introduction

The recent financial crisis has led to popular macro explanations, such as very low interest rates arising from lax monetary policy, and the accumulation of global imbalances. However, the micro foundations of these channels are not fully understood. At a time of declining saving rates, the credit boom was funded by capital markets, in part fed by capital inflows from emerging and other surplus countries.[1] The re-intermediation of imbalances into reserve currency assets may explain low interest rates in developed countries during the boom.[2] However, it is unclear why foreign funding should lead to greater instability in well developed markets.

Historically, capital moved from developed to emerging countries, though less than neoclassical theory would imply (Lucas (1990)). Developing countries had to borrow in foreign currency because of political risk associated with a weaker institutional framework. Political and exchange rate risk caused frequent "sudden stops", rapid reversals of inflows leading to financial crises. But such reversals were not considered likely for hard currency countries. For decades, foreigners were willing to accumulate claims in reserve currencies, so imbalances were absorbed in their portfolio (Gourinchas and Rey (2007)).

Net flows of capital reversed since 1998, with developing countries on average funding the developed world. Prasad et al. (2007) find that since 1998, capital exports flow from poorer to richer countries. Perhaps as a result of the 1997 Asian crisis, authorities in emerging countries sought to accumulate reserves as a precaution against sudden reversals. In addition, private capital flight, often poorly recorded, created large private holdings of reserve country assets.[3] Assets denominated in dollar and other reserve currencies are a natural safe haven, as it becomes evident at times of distress (Maggiori (2013)).

This paper analyzes the consequences of a wealth shift to developing country residents who invest in countries with a safer environment as a hedge against political and currency risk.[4] We

[1] Bernanke (2005) talks about a "savings glut" abroad to explain US deficits.

[2] Lower rates should not enhance a search for yield unless agents have preferences for absolute target rate of returns (nominal illusion).

[3] Forbes (2010) reports estimates on the scale of capital inflows in the US of 7.8 trillion in the five years through 2007. Despite large official reserves, 81% of U.S. external liabilities were held by the private sector.

[4] "While in emerging markets the concern with capital flows is in their speculative nature [...] capital flows into the U.S. are mostly non-speculative and in search of safety. As a result, the U.S. sells risk-less assets to foreigners, and in so doing, it raises the effective leverage of its financial institutions." (Caballero and Krishnamurthy (2009))

show that even under optimal contracting, and without deposit insurance, a large stock of foreign funding may cause instability. This rationalizes a diffused view, endorsed among others by Shin (2011) and supported by Hahm et al. (2013). The result flows naturally from two key features of foreign funding. First, foreigners accept lower returns since they are in search of a safe haven to avoid political risk.[5] Second, they are also less able to assess new information on local asset risk.[6]

This creates a trade off between funding cost and its stability. Less informed depositors may run even in solvent states, and force more inefficient liquidation relative to informed funding.[7] Therefore, the socially optimal funding contract chosen by domestic intermediaries is long-term debt for all savers (de facto turning intermediaries into mutual funds). However, intermediaries may be tempted to target only cheaper foreign funding, causing underinvestment relative to the social optimum. But even in this case, if assets and liability may be maturity matched, foreign wealth creates no financial instability.

In reality, savers largely choose demandable claims, forcing intermediaries to operate as banks. Demandable debt may be optimal because of liquidity demand (Diamond and Dybvig (1983)), asymmetric information (Gorton and Pennacchi (1990)) or agency conflicts (Diamond and Rajan (2001); Calomiris and Kahn (1991)).[8]

Our main results arise when demandable debt arise to satisfy a demand for absolute safety. We model it as a preference for a minimum subsistence level, above which agents are risk neutral. 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)). This approach emphasizes safety over contingent liquidity needs, and has become common since the crisis (Caballero and Farhi (2013); Genniaoli et al. (2013)). While in Diamond and Dybvig (1983) some savers may ex post have a zero return, under absolute safety preferences, agents strive to

[5]Papaioannou (2009) finds that capital flows from developing to developed countries is correlated with differences in the quality of institutions. Pepinsky (2012) finds that these flows are more related to property right protection and political stability than to measures of democracy.

[6]Petersen and Rajan (2002) and Stein (2002) provide a conceptual framework and empirical evidence on the limited capacity by distant lenders to analyse or interpret local information.

[7]Broner et al. (2013) find that global capital flows decrease sharply during crises, with foreign and domestic investors reacting differently to information.

[8]When bankers have an agency conflict, demandable debt may be chosen to avoid excess continuation in the bad state (Ahnert and Perotti (2013)). This comes at the cost of excess liquidation, increasing in the stock of foreign funding. Beyond some threshold, uninformed runs are so large would induce even informed agents to run in some solvent states. The bank is then forced to choose between avoiding excess runs and resolving the agency conflict. Unlike Diamond and Rajan (2001), there are runs in solvent states.

achieve a minimum subsistence in all states.[9]

Foreigners exposed to political risk never choose long-term debt that may be worthless in some state. This maturity preference enables banks to price discriminate across investors. We show that they target cheap demandable debt to foreign savers and long-term debt to domestic savers. The willingness of informed savers not to withdraw early ensures that foreigners have absolute safety even in the bad state. In other words, the optimal funding arrangement has informed investors offer insurance by suffering losses when there is a run, in exchange for a higher long-term return.[10]

As the scale of foreign funding increases, liquidation losses in solvent states increase, reducing the long-term payoff. Beyond some threshold, this arrangement may break down, as domestic investors cannot be compensated for the losses caused by excess runs. To attract safety seeking foreign savers, a minimum stable buffer is needed to offer insurance in all run states. In other words, banks would need to commit to cap the amount of unstable funding raised. If no such commitment is possible, banks would only be able to raise domestic funding. So in the absence of deposit insurance (or its restriction to domestic savers), the bank may choose to secure in advance a minimum amount of long-term claims.[11]

In ongoing work, we extend this framework to allow for multiple banks and endogenize the value of safety rents in a context of heterogeneous access to safe storages of value. We obtain an equilibrium pricing of demandable debt that balances supply and demand. Preliminary results suggest that our insights persist as long as the foreigners have a greater need for absolute safety.

Relation to the literature Our approach to explain unstable funding is distinct from the classic explanations for demandable debt, namely agency and contingent liquidity needs. We review briefly how our approach differs. In the Diamond and Rajan (2011), demandable debt arises as an optimal social contract to address an agency conflict. In our context, the presence of uninformed investors makes the threat of excess runs quite costly. When foreign funding passes a certain threshold, demandable debt produce endogenous risk, as informed agents will also run in some solvent states.

[9] Preferences for absolute safety create instability if investors hold salient beliefs (Genniaoli et al. (2013)).

[10] Gourinchas et al. (2010) show that the US provide 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 during turbulent times.

[11] In the presence of deposit insurance for domestic savers, banks may still be able to attract foreign funding, at the cost of endogenous risk born by public insurance.

In Diamond and Dybvig (1983), savers have extreme time preferences, valuing consumption only at some date. In our approach, savers seek some amount of absolute safety in all states (see also Genniaoli et al. (2013)) to ensure a minimum subsistence level.[12] A much milder version of demand for a safe asset is the classic "money in the utility function", a non-contingent preference for liquidity used in macroeconomic models (Stein (2012)). Money-like claims are cheaper to issue as they offer transaction services, so demandable debt has a lower cost than long-term debt. The private incentive to lower funding costs needs to be balanced against any illiquidity externality, such as fire sales (Perotti and Suarez (2011)).

Our contribution offers a specular counterpart to a rich international finance literature on the "original sin". Most capital inflows in developing countries are short-term loans in foreign currency, believed to be a forced choice driven by political risk (Eichengreen and Hausmann (1999)). Tirole (2003) explain demandable claims as a disciplinary device, reflecting greater agency cost in a context of political risk. We offer here a specular analysis, where inflows into developed markets are driven by political risk elsewhere.

As foreigners have an unsatisfied need for safety, they may accept a lower rates of return. Forbes (2010) finds that foreign investors in the US earn less than US investors earn abroad, even after adjusting for exchange rate movements and rough measures of risk.[13] There is also evidence that foreigners from less developed financial markets invest comparatively more in the US, an effect stronger for countries with less developed bond markets rather than equity markets, suggesting a search for safety. The composition of US net financial assets shows increased holdings of risky assets, while foreigners increasingly invested in safe dollar assets (Mendoza et al. (2009); Caballero and Krishnamurthy (2009)).

On the issue of differential information by foreigners, recent evidence suggests foreign investors tend to withdraw capital rapidly at times of stress, though foreign intermediaries with a more permanent local presence do not. Giannetti and Laeven (2012) show that during the financial crisis, banks redirected lending towards domestic borrowers. Foreign funding may be flighty also

[12] While liquidity demand from sudden consumption needs also explains demandable debt, per period outflows should be modest in a dynamic setting where consumption is smoothed. For this reason, it is hard to explain a large amount of demandable debt, unless driven by fear of runs.

[13] Alternatively, foreigners may supply more capital at any given rate of return. Caballero et al. (2008) argue that tranched securitization of US mortgage was a response to a massive demand for safe dollar assets.

from developed countries in circumstances of major policy uncertainty, as the recent episode of flight of dollar funding from Euro banks suggests. Presumably, foreigners may find particularly difficult to assess the consequences of political uncertainty.

2 A model of cheap but flighty foreign funding

The economy extends over three dates, $t \in \{0, 1, 2\}$, and is populated by a banker B and a unit mass of savers. There is universal risk neutrality and no discounting. Agents wish to consume at either the intermediate date ($t = 1$) or the final date ($t = 2$):

$$u(c_1, c_2) = c_1 + c_2 \tag{1}$$

At the initial date ($t = 0$), savers have a unit endowment of a good used for consumption and investment. The banker has no endowment but exclusive access to a domestic investment technology at the initial date. Investment has constant returns to scale and matures at the final date. Its stochastic gross return $\tilde{R}$ is R in the good state, which occurs with probability $\gamma \in (0, 1)$, and zero in the bad state. Liquidation of investment at the interim date yields $\alpha \in (0, 1)$ per unit. Let $I \geq 0$ denote the investment level and $L \in [0, I]$ the liquidation level. Investment has a positive net present value conditional on liquidation in the bad state:

$$NPV \equiv \gamma R + (1 - \gamma)\alpha - 1 > 0 \tag{2}$$

There are domestic and foreign savers denoted by $k \in \{D, F\}$. The proportion of foreign savers is $W \in [0, 1]$ and measures foreign wealth. The banker attracts funding from savers at the initial date. In line with the literature on the optimality of debt, the investment return is publicly observed but non-verifiable at the final date (Hart and Moore (1998)). Hence, the banker offers a menu of demandable debt contracts $\{(D_1, D_2), (F_1, F_2)\}$, where the banker as residual claimant promises the fixed repayment of D_t or F_t upon withdrawal at date t. The identity of savers is unobserved. The labels D and F indicate the group of savers that the contract is designed for. At the initial date savers decide which contract to accept, if any. If the banker defaults on the contract

at a subsequent date, all assets are handed over to savers who receive a pro-rata share according to their nominal claims. Let $f_D \in [0, 1-W]$ and $f_F \in [0, W]$ denote the amounts of attracted funding.

Domestic and foreign savers differ in terms of available information and their access to a safe store of value. As for the access to a safe store of value, domestic storage yields a unit return and is available to domestic savers. In contrast, foreign storage only yields a return of $1-p$, where $p > 0$ measures the severity of political risk. For instance, political or policy risk may make a foreign currency risky, and foreigners as non-residents may not qualify for deposit insurance. When $\pi_k \equiv \mathrm{E}_k[u(c_1, c_2)]$ is the expected utility of savers, the participation of savers requires:

$$\begin{aligned} \pi_D &\geq 1 \\ \pi_F &\geq 1-p \end{aligned} \tag{3}$$

Participation of the banker requires a positive expected payoff, $\pi_B \geq 0$. Foreign funding is **cheap** since political risk reduces the outside option of foreign savers.

Foreign savers have less precise information about the return on domestic investment at the interim date.[14] In the good state, domestic savers and the banker are perfectly informed about the return. In the bad state, domestic savers and the banker receive an almost perfect signal that indicates the bad state with probability $1-\epsilon$, where $\epsilon > 0$ is tiny. Unless forced by the withdrawal of savers, there is a small probability that the banker does not liquidate in the bad state. In what follows, we treat $\epsilon \to 0$ until it becomes material.

In the good state, foreign savers, by contrast, receive a perfectly revealing signal with probability $\delta \in (0, 1)$. In the bad state, foreign savers are always uninformed. The information structure is common knowledge and domestic savers observe whether foreign savers receive a signal. If foreign savers receive a signal, the state must be good. If no signal is received, however, Bayesian updating implies that foreign savers assign the following probability to the good state:

$$\rho \equiv \frac{\gamma(1-\delta)}{1-\gamma\delta} \in (0, \gamma) \tag{4}$$

[14] For example, foreign savers are distant and less capable of interpreting news about domestic investment projects (Petersen and Rajan (2002)).

We abstract from runs based on pure coordination failure (Allen and Gale (1998)) when it is common knowledge that the state is good. Let $w_k \in [0, f_k]$ denote the interim-date withdrawals from savers. However, foreign funding is **flighty** when uninformed savers, who did not receive a signal, withdraw in the good state and trigger liquidation of investment at the interim date.

Date 0

- The banker attracts funding by offering a menu of contracts to savers.
- Savers choose a contract or store locally, which may be subject to political risk.

Date 1

- Public information about the return on domestic investment may be available.
- Withdrawal decision of savers. Withdrawing savers consume.

Date 2

- The return on investment is publicly observed but non-verifiable.
- Savers withdraw and consume. The banker consumes.

2.1 First-best

The first-best allocation in this setup is straightforward if the investment return is observed at the interim date. Since the liquidation value lies strictly between the returns on investment, $R > \alpha > 0$, liquidation occurs in the bad state only, $L^{FB} = I^{FB}\,\mathbf{1}\{\tilde{R} = 0\}$. Conditional on efficient liquidation, investment dominates storage, so full investment occurs ex-ante, $I^{FB} = 1$.

Lemma 1 ***First best.*** *Any allocation with full ex-ante investment and ex-post liquidation only in the bad state is first-best:*

$$\begin{aligned} I^{FB} &= 1 \\ L^{FB} &= I^{FB}\mathbf{1}\{\tilde{R} = 0\} \end{aligned} \tag{5}$$

The banker can implement the first-best allocation by offering long-term debt (see Table 1). No withdrawals occur ($w_k = 0$) since $D_1 = 0 = F_1$. This symmetric withdrawal behavior implies that the incentive compatibility constraint of both savers bind, so the banker offers the same contract to both groups of savers, $D_2 = F_2$. Hence, the participation constraint of foreign savers is slack. To maximize its expected profits, the banker sets $D_2^* = \frac{1-(1-\gamma)\alpha}{\gamma} > \alpha$, which implies default in the bad state and a binding participation constraint for domestic savers, $\pi_k^{LT} = 1 > 1-p$. The banker extracts the all value from the project and full investment occurs, $\pi_B^{LT} = NPV > 0$.

signal?	probability	$\tilde{R}$	w_k^{LT}	π_D^s	π_F^s	π_B^s
yes	$\gamma\delta$	R	0	D_2	F_2	$R-(1-W)D_2-WF_2$
no	$\gamma(1-\delta)$	R	0	D_2	F_2	$R-(1-W)D_2-WF_2$
no	$1-\gamma$	0	0	$\frac{\alpha D_2}{(1-W)D_2+WF_2}$	$\frac{\alpha F_2}{(1-W)D_2+WF_2}$	0

Table 1: Withdrawal behavior and payoffs under long-term debt. The first column states whether foreign savers receive a signal. The second column states the ex-ante probability of this case. With slight abuse of notation, π_j^s denotes the realized payoff to agents $j \in \{B, D, F\}$ in circumstance $s \in \{$Good state and signal to F, Good state and no signal, Bad state$\}$.

However, the banker may prefer not to implement the first-best allocation (see Table 2). The intuition for this result is that the banker cannot extract a safety rent from foreign savers when offering long-term debt. (This is implied by the facts that the type of savers is unobserved and the incentive compatibility constraint of foreign savers.) Therefore, the banker may wish to target foreign funding. It is simple to exclude domestic funding in this setup: the bank just offers a contract that informed local savers do not accept, since it violates their participation constraint.

signal?	probability	$\tilde{R}$	w_F^*	π_F^s	π_B^s
yes	$\gamma\delta$	R	0	F_2	$W[R-F_2]$
no	$\gamma(1-\delta)$	R	0	F_2	$W[R-F_2]$
no	$1-\gamma$	0	0	$\min\{F_2, \alpha\}$	$W\max\{0, \alpha-F_2\}$

Table 2: Withdrawal behavior and payoffs if foreign funding is targeted

By excluding domestic funding, the investment size is inefficiently low and the banker loses the net present value in proportion to domestic funding. However, the banker can extract all safety rents from foreign funding. Furthermore, the banker again offers long-term debt in order to avoid costly liquidation associated with flight foreign funding.[15] While foreign savers receive $\pi_F^* = 1-p$

[15]The equilibrium face value of the long-term debt offered to foreign savers depends on parameter values. If $p \leq 1-\alpha$, then default occurs in the bad state, so $F_2^* = \frac{1-p-(1-\gamma)\alpha}{\gamma}$. By contrast, if $p > 1-\alpha$, then no default occurs in the bad state, so $F_2^* = 1-p$.

in equilibrium, the banker receives $\pi_B^* = W[p + NPV]$. As a result, foreign funding is targeted if it is cheap and relatively abundant in comparison to the foregone net present value extracted from investment funded by domestic savers: $p\frac{W}{1-W} \geq NPV$. However, the private benefit of the banker of extracting safety rents from foreign funding is purely re-distributional.

Lemma 2 ***Inefficient investment.*** *If foreign funding is sufficiently cheap or abundant, $p\frac{W}{1-W} \geq NPV$, then the banker optimally excludes domestic funding. By targeting foreign funding, the banker can extract safety rents from cheap foreign funding. Long-term debt is offered to avoid excessive liquidation associated with potentially flighty foreign funding. The investment level is inefficiently low, $I^* = W$, since domestic savers do not accept a contract with such a low implied long-term interest rate.*

3 Absolute safety

The simple setup explored so far was aimed at capturing two realistic features of foreign savers investing in developed countries, namely their motivation as seeking a safe haven, and their nature as being less informed than local investors. This has allowed to identify a specific source of risk (excess liquidation) as well as its potential reinforcing effect (inducing excess withdrawals also from informed investors). In this context, the privately optimal contract may differ from the social optimum because of the temptation to extract a safety rent from foreigners, but it will not lead to increased instability, as intermediaries will choose to raise long-term funding to avoid creating endogenous risk. Thus, this set-up cannot explain why sustained global imbalances lead to increased instability. A limit of this approach is that it assumes away any social role for early withdrawals, so that it is optimal to attract savings via long-term intermediation such as mutual funds.

This is clearly an oversimplification since, in practice, committing savings for long maturities creates risks, and not only for less informed investors. Consider three simple cases. In the first place, any early liquidity need would force a sale of the long-term asset on unfavorable terms because of adverse selection (Gorton and Pennacchi (1990)). Second, the inability to withdraw early may enable insiders to continue inefficient projects (Diamond and Rajan (2001)). Third, savers may demand absolute safety. In either case, a solution would be to supply funds as demandable debt,

so that domestic intermediaries must operate as banks as opposed to mutual funds.

We now study absolute safety needs that generate a role for demandable debt and financial fragility under the optimal contract.[16] Savers now have preferences for absolute safety, as they must consume at least a subsistence level S_k, beyond which they are risk neutral as studied previously.

$$U_k(c_1, c_2) = \begin{cases} c_1 + c_2 & c_1 + c_2 \geq S_k \\ & \text{if} \\ -\infty & c_1 + c_2 < S_k \end{cases} \tag{6}$$

The main idea is that foreign savers are more exposed to political risk and therefore have a greater demand for absolute safety in equilibrium. Specifically, we assume that domestic savers can satisfy their demand for absolute safety locally, since they have access to domestic storage that is both safe and liquid. Hence, we set $S_D = 0$. By contrast, foreign savers, who only have access to an imperfect store of value, seek absolutely safe assets, $S_F = S$. We endogenize the regional demand for safe assets in a later section.

To generate interesting implications from absolute safety needs, we focus on the parameter values $S \in (\alpha, 1-p)$. The first inequality ensures that flighty foreign funding is costly for informed domestic savers in the good state. In other words, the liquidation proceeds are insufficient to cover the absolute safety needs of flighty foreign funding in the good state, but some additional liquidation is required. The second inequality ensures that the outside option of foreign savers is viable. Foreign savers can use their storage technology to satisfy their demand for absolute safety. If this constraint was violated, foreign savers would be forced to accept any contract offered by the banker.

We start by considering the benchmark cases of no foreign wealth, $W = 0$, and no domestic wealth, $W = 1$. While basic, each case has some insight into the mechanism at work. Subsequently, we study the main case in which both funding sources are potentially available, $W \in (0, 1)$.

[16] Ahnert and Perotti (2013) show that demandable debt may be the socially optimal contract because of an agency conflict. Hence, ex-post financial fragility can occur under the privately optimal contract.

3.1 Benchmark: no foreign wealth

Suppose that all wealth comes from informed domestic savers, $W = 0$. This generates a trivial constrained optimization problems in which both the objective function and the constraints are linear. Table 3 depicts the withdrawal behavior and payoffs if there is no foreign funding ($W = 0$), where we maintain $\epsilon \to 0$ for now. In the good state, savers do not withdraw since $D_2 \geq D_1$ and receive D_2. Runs purely based on coordination failure are absent if the return is commonly known to be high. The banker keeps the remainder, $R - D_2 \geq 0$, which ensures his participation, $\pi_B \geq 0$.

$\tilde{R}$	w_D	π_D^s	π_B^s
R	0	D_2	$R - D_2$
0	1	$\min\{\alpha, D_1\}$	$\max\{0, \alpha - D_1\}$

Table 3: Withdrawal behavior and payoffs if there is only domestic funding ($W = 0$)

In the bad state, informed domestic savers optimally withdraw. Coordination on not withdrawing is impossible when the return is low. It is also inefficient provided $D_1 > 0$. Thus, savers receive a pro-rata share of $\min\{\alpha, D_1\}$ at the interim date. In turn, the banker receives zero if all assets are liquidated and keeps the remainder if there is only partial liquidation, $\max\{0, \alpha - D_1\}$.

Thus, the banker chooses $(D_1,\, D_2)$ to maximize $\gamma[R - D_2] + (1 - \gamma)\max\{0, \alpha - D_1\}$ subject to $D_2 \geq D_1$ and the participation constraint that reads: $\gamma D_2 + (1 - \gamma)\min\{\alpha, D_1\} \geq 1$. The participation constraint binds in equilibrium. There is a continuum of optimal contracts.[17]

$$D_1^* = [0, 1],\ D_2^* = \frac{1 - (1 - \gamma)D_1^*}{\gamma},\ \pi_D^* = 1,\ \pi_B^* = NPV > 0 \tag{7}$$

3.2 Benchmark: no domestic wealth

The second benchmark of no domestic wealth, $W = 1$, offers more insights. As assumed so far, the banker can only make risky investment.[18] As a result, the banker cannot attract foreign funding in the absence of domestic wealth. The reason is that the available resources in the bad state are only α, which is insufficient to cover the foreign savers' demands for absolute safety, $\alpha < S$. As we

[17] This implicitly assumes that $\frac{1}{\gamma} \leq R$, so the resource constraint in the good state is not violated. If this condition does not hold, $\gamma R < 1$, then the set of optimal contracts shrinks to $D_1^* \in [\frac{1-\gamma R}{1-\gamma}, 1]$ and $D_2^* = \frac{1-(1-\gamma)D_1^*}{\gamma} \in [1, R]$.

[18] If the banker had also access to the domestic storage technology, the banker makes no investment but keeps the safety rent of $\pi_B^* = p$ in case of no domestic wealth.

will see below, if domestic and foreign savers are attracted, there will be a transfer of wealth from domestic savers to foreign savers in the bad state that ensures the participation of foreign savers.

3.3 Attracting both domestic and foreign funding

Consider the case of both domestic and foreign wealth, $W \in (0,1)$, and the banker attracts all sources of funding.

Risk-neutral informed domestic savers accept long-term debt. The banker optimally offers exactly this to domestic savers for two reasons. First, long-term debt will never be accepted by foreign savers because of their demand for absolute safety (see below for the formal argument). Thus, the incentive compatibility of foreign savers never binds, which allows the banker to push foreign savers down to their participation constraint, extracting all safety rents arising from political risk. Second, offering long-term debt to domestic savers avoids the issue of endogenous risk. If domestic savers had demandable debt, they might run in the good state states even if they know that the return on investment is high. Such a behavior may arise when foreign wealth becomes abundant and triggers a substantial amount of inefficient liquidation in the good state. Offering demandable debt to domestic savers, however, avoids endogenous risk.

The demand for absolute safety also ensures that foreign savers require demandable debt with an interim withdrawal option of at least $F_1 \geq S$. Table 4 depicts the withdrawal behavior and payoffs. There are three contingencies: the good state and foreign savers receive a signal (H), the good state and foreign savers receive no signal (M), and the bad state, in which foreign savers never receive a signal (L).

contingency	signal	$\tilde{R}$	w_D	w_F	π_D^s	π_F^s	π_B^s
H	yes	R	0	0	D_2	F_2	$R-(1-W)D_2-WF_2$
M	no	R	0	W	D_2	F_1	$R-(1-W)D_2-W\frac{R}{\alpha}F_1$
L	no	0	0	W	$\frac{\alpha-WF_1}{1-W}$	F_1	0

Table 4: Absolute safety: withdrawal behavior and payoffs if all funding is attracted

Specifically, the case is analyzed in which the banker does not default in contingency M,

which places an upper bound on the proportion of foreign funding under the optimal contract:

$$W \leq \overline{W} \equiv \frac{-1+\alpha\left[1+\gamma\left(\frac{R}{\alpha}-1\right)\right]}{-1+S\left[1+\gamma\left(\frac{R}{\alpha}-1\right)\right]} \in (0,1) \tag{8}$$

where the boundaries of $\overline{W}$ is implied by the assumption on the level of absolute safety, $\alpha < S$.

Furthermore, the domestic savers must not be enticed to take the contract designed for foreign savers. In equilibrium, this requires the political risk to be high relative to the probability of contingency M conditional on the good state:

$$p > \underline{p} \equiv (1-\delta)(1-S) \in (0,1) \tag{9}$$

Lemma 3 *Suppose foreign funding is sufficiently scarce, $W \leq \overline{W}$, and cheap, $p > \underline{p}$. If the banker attracts both sources of funding, then the optimal set of contracts is long-term debt for domestic savers and demandable debt for foreign savers:*

$$D_1^* = 0 < \frac{1}{\gamma} - \frac{1-\gamma}{\gamma}\frac{\alpha - WS}{1-W} = D_2^*, \;\; F_1^* = S < S + \frac{1-p-S}{\gamma\delta} = F_2^* \tag{10}$$

Both types of savers receive their outside option, $\pi_D^* = 1 > 1-p = \pi_F^*$, while the expected profit of the banker has three components: the net present value of investment, the extraction of safety rents from cheap foreign funding, and the cost of flighty foreign funding:

$$\pi_B^* = NPV + Wp - W\gamma(1-\delta)\left(\frac{R}{\alpha}-1\right)S \tag{11}$$

Proof (Skipped.)

As discussed before, the banker cannot exclude domestic savers. However, foreign savers may be excluded if they cause too much damage when running in the good state. So, when does the banker exclude foreign savers? Suppose the banker offers long term debt only, $D_1 = 0$ and $D_2 = \frac{1-(1-\gamma)\alpha}{\gamma}$. This satisfies the participation constraint of domestic savers, $\pi_D = 1$, and extracts the full net present value of investment, which is now at the reduced volume $1-W$:

$$\pi_B^{**} = (1-W)NPV \tag{12}$$

Why do foreign savers not participate? First, if they accepted the contract, they could never withdraw at the interim date, $w_F^* = 0$. Hence, foreign savers receive a pro rata share of the final-date proceeds in the bad state, which is $\alpha < S$. But this violates their demand for absolute safety, so foreign savers would never accept the long term debt contract stated above. This allows the banker to target stable (aka informed) funding by offering long-term debt.

When is it optimal to exclude flighty foreign funding? Comparing the expected profit of the banker in case of excluding foreign funding to the expected profit from attracting both sources of funding, $\pi_B^{**} \geq \pi_B^*$, yields the following inequality that implicitly defines $p \leq \overline{p}$, where $\overline{p} > \underline{p}$.

$$\gamma(1-\delta)S\left(\frac{R}{\alpha}-1\right) \geq NPV + p \tag{13}$$

The left-hand side is the cost of flighty funding in terms of costly liquidation at the interim date in the good state. This cost is the higher, the larger the demand for absolute safety, which drives the minimum payment to foreign savers, and the more likely runs in the good state are (lower δ). The right-hand side is the benefit from cheap foreign funding in terms of extracted safety rent due to political risk. The net present value also enters the right-hand, as more funding allows for a larger investment volume. The inequality above is independent of W, but the expected profit π_B^* is only valid for a sufficiently small proportion of foreign funding.

Lemma 4 *Suppose that foreign funding is sufficiently costly in terms of inequality (13). Then, the banker optimally attracts only stable domestic funding, $I^* = 1 - W$, by offering long-term debt.*

Is there any alternative to scaling down the volume of intermediation when foreign wealth is too large? Any arrangement that attracts foreign funding prescribes a transfer of resources from domestic savers in the bad state. Could this be attained with senior debt? If the bank were to always liquidate in the bad state, the payoff at time 2 would also ensure absolute safety needs are satisfied. However, since the information received by domestic agents is incorrect with a small probability $\epsilon > 0$ when there is no signal, there will be a chance of excess continuation of investment in the bad state. In this case, there will be no resources to distribute at the final date, so the absolute safety needs of foreign savers is violated. Thus, foreign savers will only accept demandable debt, and will always triggers liquidation when there is not a positive signal.

Taking this insight and the previous two lemmas together, we can state our main result.

Proposition 1 ***Financial fragility under the privately optimal contract.*** *Suppose foreign funding is sufficiently scarce, $W \leq \overline{W}$, and cheap, $\overline{p} > p > \underline{p}$. Then, the banker optimally attracts both sources of funding by offering (stable) long-term debt to domestic savers and (unstable) demandable debt to foreign savers:*

$$D_1^* = 0 < \frac{1}{\gamma} - \frac{1-\gamma}{\gamma}\frac{\alpha - WS}{1-W} = D_2^*, \quad F_1^* = S < S + \frac{1-p-S}{\gamma\delta} = F_2^* \tag{14}$$

There is financial fragility under the optimal contract, as foreign savers withdraw in the good state whenever no signal is received.

Breakdown of intermediation We showed that when the volume of foreign funding is too large, it is impossible to offer reliable absolute safety to all foreigners, and intermediation would drop to the scale of domestic funding.

To avoid such an inefficient outcome, the intermediaries need to commit to cap the amount of unstable funding. In our setting, this may be achieved only by raising a sufficient amount of committed capital (that is, enough long term funding) from domestic savers, and then cap the volume of demandable debt issued. However, there may be a credibility issue in a context of simultaneous contracting, so a credible regulator enforcing the cap (which may be expressed as a minimum capital ratio) would be necessary to ensure full intermediation.

An alternative would be deposit insurance, if this were not restricted to domestic savers. However, in general this would not necessarily be a socially optimal arrangement when private investors would not be willing to provide the insurance, as it would subsidise a larger volume of credit and thus larger excess liquidation.

Endogenous safety rents This section is work-in-progress. We are currently solving the generalized problem of pricing demandable debt in a competitive banking market. When all savers have absolute safety preferences, aggregate demand for absolutely safe claims arises from a continuum of investors with heterogeneous access to self-storage. The equilibrium pricing of safety rents equates bank aggregate demand to the supply schedule obtained by the optimal portfolio choice by savers.

Foreign savers subject to greater expropriation risk will be the marginal investors in demandable debt, as they need to compensate for their reduced capacity for self-storage. Once foreigners have achieved their subsistence level, they will also hold some amount of long term claims. Finally, when banks hold similar assets, the amount of demandable debt will determine the aggregate volume of withdrawals in solvent states, and thus the equilibrium value of liquidation losses.

Ultimately, in this general solution the trade off for bank funding (liquidation losses vs. safety rents) becomes fully endogenous. It will still be the case that a shift in the allocation of wealth away from savers with better access to self-storage makes demandable debt cheaper and less stable.

4 Conclusions

This paper offers some foundations for the widespread view that global imbalances contributed to the credit boom and ultimately to the financial crisis (Caballero and Krishnamurthy (2009)). In our simple setup, changes in the composition of wealth shape the optimal funding structure chosen by intermediaries, and contribute to the risk of sudden financial crises in hard currency countries.

Our results derive from two established features of foreign capital flows into reserve countries. First, these are driven by a search for safety, often because of political risk at home. We model such preferences for absolute safety in the spirit of Caballero and Farhi (2013) and Genniaoli et al. (2013). Second, more distant investors are less able to assess local economic news and thus the risk of assets held by local intermediaries (Brennan and Cao (1997); Petersen and Rajan (2002)).

We show that the privately optimal contract targets cheap demandable debt for foreign savers, even when this is socially suboptimal as it creates endogenous risk. As foreign wealth increases, their uninformed runs cause losses in solvent states, and at some point may induce even informed savers to run. Informed investors must then be issued costly long-term claims to ensure insurance for savers seeking safety. Ultimately, once the stock of foreign wealth passes a certain threshold, financial intermediation without deposit insurance breaks down. To avoid a collapse in credit volumes, intermediaries need to commit to cap unstable funding. In practice, it may be hard to commit to this goal, unless the bank raises in advance long-term capital and regulators enforce a strict capital requirement.

Our approach offers a specular perspective from the literature on sudden stops in emerging economies, where capital inflows are unstable because of political risk. We show that endogenous risk may build up also in financially developed countries that enjoy an advantage in offering greater safety, in terms of exchange rate risk and property right protection. In fact, the scale of financial instability in these countries may be much larger, as local intermediaries can attract capital inflows more easily. These inflows enable domestic intermediaries to expand credit volume even as domestic savings decline, relying increasingly on more unstable non-core funding.

In future work, we plan to investigate the effect of foreign funding on credit volume and on domestic risk taking incentives. In particular, we will consider how intermediaries may adapt when an increasing fraction of savers seeking safety is unable to assess asset risk. Changes in funding composition may also reshape optimal corporate governance for financial intermediaries.

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