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. Because less informed, foreigners withdraw even in solvent states, forcing early liquidation. Beyond some scale of foreign funding, even informed savers would run too often, so the socially optimal contract is long-term debt. Yet the bank may target only foreign savers to minimize funding costs. Instability arise once demandable debt becomes optimal for either governance or safety needs. When agency costs are large relative to excess liquidation, the bank offers demandable debt to commit to liquidating in the bad state.

In our main model, demandable debt arises 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 long-term debt to informed investors. But when uninformed runs would cause very large losses, it becomes impossible to induce domestic savers to offer long-term funding. 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 classification: 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. The re-intermediation of imbalances into reserve currency assets may explain low interest rates in developed countries during the boom. But why should this combination lead to greater instability? Low rates reduce effective leverage, so they should actually reduce risk-shifting incentives.

Historically, funding moved from developed to emerging countries, though less than neoclassical theory would imply (Lucas (1990)). Developing countries had to borrow in foreign currency, arguably because of policy and political risk associated with a weaker institutional framework. Political and exchange rate risk exposure caused frequent instability via “sudden stop”, rapid reversals of inflows leading to financial crises. But such reversals were not considered likely for hard currency countries. Intuitively, 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 in 2000-2008, with developing countries on average funding the developed world. 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, presumably created large private holdings of reserve country assets. 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. We show

1Bernanke (2005) talks about a “savings glut” abroad to explain US deficits.
2Lower rates should not enhance a search for yield unless agents have preferences for absolute target rate of returns (nominal illusion).
3While 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))

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that even under optimal contracting, and without deposit insurance, a large stock of foreign funding may cause instability, a diffused view endorsed by Shin (2011) and supported by Hahm et al. (2013). The two key assumptions are that foreign funding is cheap, but less informed. It is inexpensive because foreign savers need a safe haven. They are also less able to assess asset risks than domestic savers.

Less informed savers with demandable debt may run even in states when asset values ensure bank solvency. This forces more costly asset liquidation relative to informed funding. Therefore, the optimal funding contract chosen by domestic intermediaries is long-term debt for all savers (de facto turning intermediaries into mutual funds). Intermediaries may be tempted to price this contract so to target only cheaper foreign funding. This causes underinvestment relative to the social optimum. On the other hand, in this basic setup there is no financial instability, since assets and liability are maturity matched.

In reality, savers largely opt for demandable claims, however, forcing intermediaries to operate as banks. Demandable debt may be optimal as a solution to liquidity demand (Diamond and Dybvig (1983)) or agency issues (Diamond and Rajan (2001); Calomiris and Kahn (1991)).

As illustration, we consider briefly the case when bankers have an agency conflict. Demandable debt can serve to avoid excess continuation in the bad state. This comes at the cost of some excess liquidation. Beyond some threshold of foreign funding, the size of uninformed runs 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, because bankers seek to reduce funding costs.

In the main model, the choice of demandable debt is driven by the demand for absolute safety, caused by a minimum subsistence level above which agents are risk neutral. This produces a quite distinct role for demandable debt than contingent liquidity needs as in Diamond and Dybvig (1983), where some savers may ex post have a zero return. Under absolute safety preferences, agents must achieve a minimum subsistence in all states. Such preferences appear consistent with the recent evidence provided by distant lenders to analyse or interpret local information.

A related formulation has extreme risk aversion, such that agents value only the minimum payoff across states. This create instability if investors hold salient beliefs (Gennaioli et al. (2013)).
In this setup, foreigners exposed to political risk have larger safety demand, so they will never hold long-term debt that is worthless in some state. This maturity preference enables banks to price discriminate. We show that they choose to issue cheap demandable debt to foreign savers and higher-return long-term debt to local savers. The willingness of informed savers not to withdraw early ensures that foreigners have absolute safety even in the bad state. De facto, informed investors offer insurance by accepting to suffer losses when there is a run, in exchange for a higher long-term return.

Once again, an increasing share of foreign funding creates endogenous risk, as it increases liquidation losses in solvent states. Beyond some threshold, uninformed investors may reduce the final payoff so that informed investors refuse to accept long-term debt. Thus, at some stage the optimal arrangement excludes foreigners and banks issue expensive long-term debt that attracts only stable local funding, at the cost of much reduced investment.

The bank may avoid scaling down by committing to secure a minimum amount of long-term debt (or capital). This becomes necessary, as a large amount of unstable funding requires a sufficiently large stable buffer to offer insurance in all run states to safety-seeking foreigners. So the privately optimal contract ensures adequate capitalization by committing to cap the amount of unstable funding. Notice that this result depends critically on the absence of deposit insurance (or its restriction to domestic savers).

Finally, in ongoing work we endogenize the value of safety rents in a context of heterogeneous needs for absolute safety. 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. Intuitively, this arise because political risk implies the possibility of large expropriation.

\[^{6}\text{An alternative motive for less informed savers to hold demandable debt is to avoid adverse selection on reselling information-sensitive assets when facing early liquidity needs (Gorton and Pennacchi (1990)).}\]
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 here 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. In fact, when foreign funding passes a certain threshold, it produces endogenous risk, as also informed agents will also run in some solvent states.

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

Our contribution is to call attention to the role of less informed agents, such as foreign investors seeking safety. It offers a counterpart to a rich international finance literature on the "original sin". The observation that financial crises in developing countries is related to their borrowing too much short term and in foreign currency is related to the notion of political risk (Eichengreen and Hausmann (1999)). Tirole (2003) also offers an optimal contracting approach to explain foreign funding under dual agency. His approach explains demandable debt as a disciplinary device reflecting greater agency cost in a context of political risk. While quite relevant, this interpretation seems less appealing for foreign flows into developed markets.

Our approach makes use of the observation that if some foreigners have an unsatisfied need for safety, they may accept a lower rates of return than domestic investors (or supply more at any given rate). Caballero et al. (2008) argue that tranched securitization of US mortgage was a response to this massive demand for safe dollar assets.

While liquidity demand from sudden consumption needs also explains demandable debt, net outflows should be modest in a dynamic setting where consumption is smoothed. For this reason, it is hard to explain large outflows, unless driven by multiple equilibria.
While the nationality of investors is often not recorded, there is increasing evidence that foreign funding may be unstable also in developed countries (as the recent episode of flight of dollar funding from Euro banks may attest to). Existing evidence on capital inflows into developed countries suggests that foreigners from emerging countries choose safe assets. Indeed, the composition of US net financial assets shows increased holdings of risky assets, while foreigners increasingly invested in safe dollar assets \cite{Mendoza2009, Caballero2009}.

Several recent studies suggest that even in developed markets, foreign investors tend to withdraw their local funding rapidly at times of stress, though foreign intermediaries with a more permanent local presence do not. \cite{empirical review to be completed}. 

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, so agents wish to consume at either intermediate date \((t = 1)\) or the final date \((t = 2)\):

\[
u(c_1, c_2) = c_1 + c_2
\]

where the utility depends on date-\( t \) consumption, \( c_t \).

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 \((t = 0)\). Investment has constant returns to scale and matures at the final date. Its gross return \( \tilde{R} \) is stochastic and yields \( R \) 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:

\[
NPV \equiv \gamma R + (1 - \gamma)\alpha - 1 > 0
\]

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 \((\text{Hart and Moore (1998)})\). 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. First, savers differ in their 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 \( \pi_k \equiv E_k[u(c_1, c_2)] \) is the expected utility of savers, the participation of savers requires:

\[
\begin{align*}
\pi_D & \geq 1 \\
\pi_F & \geq 1 - p
\end{align*}
\] (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.

Second, foreign savers have less precise information about the return on domestic investment at the interim date. Domestic savers and the banker are perfectly informed about the return. By contrast, foreign savers receive a perfectly revealing signal with probability \( \delta \in (0, 1) \) at the interim date if the investment return is high. Domestic savers observe whether foreign savers receive a signal. The information structure is common knowledge. 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:

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

We abstract from runs based on pure coordination failure (Allen and Gale (1998)) when it is common knowledge that the investment return is high at the final date. Let \( u_k \in [0, f_k] \) 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 inefficient liquidation at the interim date.

**Date 0**

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

\[^8\text{For example, foreign savers are distant and less capable of interpreting ps about domestic investment projects (Petersen and Rajan (2002)).}\]
Date 1

- 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, \( L^B = I^B 1\{\tilde{R} = 0\} \). Conditional on efficient liquidation, investment dominates storage, so full investment occurs ex-ante, \( I^B = 1 \).

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

\[
\begin{align*}
I^B &= 1 \\
L^B &= I^B 1\{\tilde{R} = 0\}
\end{align*}
\]

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, \( \pi^L_k = 1 > 1-p \).

The banker extracts the all value from the project and full investment occurs, \( \pi^L_B = NPV > 0 \).

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
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, \( \pi_s^j \) denotes the realized payoff to agents \( j \in \{B, D, F\} \) in circumstance \( s \in \{ \text{Good state and signal to F}, \text{Good state and no signal}, \text{Bad state} \} \).

<table>
<thead>
<tr>
<th>signal?</th>
<th>probability</th>
<th>( \tilde{R} )</th>
<th>( w_{LT}^k )</th>
<th>( \pi_D^s )</th>
<th>( \pi_F^s )</th>
<th>( \pi_B^s )</th>
</tr>
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<td>yes</td>
<td>( \gamma \delta )</td>
<td>( R )</td>
<td>0</td>
<td>( D_2 )</td>
<td>( F_2 )</td>
<td>( R - (1 - W)D_2 - WF_2 )</td>
</tr>
<tr>
<td>no</td>
<td>( \gamma(1 - \delta) )</td>
<td>( R )</td>
<td>0</td>
<td>( D_2 )</td>
<td>( F_2 )</td>
<td>( R - (1 - W)D_2 - WF_2 )</td>
</tr>
<tr>
<td>no</td>
<td>( 1 - \gamma )</td>
<td>0</td>
<td>0</td>
<td>( \alpha D_2 ) ( (1 - W)D_2 + WF_2 )</td>
<td>( \frac{\alpha F_2}{(1 - W)D_2 + WF_2} )</td>
<td>0</td>
</tr>
</tbody>
</table>

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. While foreign savers receive \( \pi_F^s = 1 - p \) in equilibrium, the banker receives \( \pi_B^s = W[p + NPV] \). 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: \( p \frac{W}{1 - p} \geq NPV \). However, the private benefit of the banker of extracting safety rents from foreign funding is purely re-distributional.

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

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 default 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 agency conflict, 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 two 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)). In both cases, a solution would be to supply funds as demandable debt. Next, we expand the framework by introducing a realistic agency conflict, so that long-term investments may be inefficient. In other words, domestic intermediaries must operate as banks as opposed to mutual funds.

In this section, we study the realistic case when bankers enjoy some private benefit from continuing to operate the bank instead of liquidating assets in the bad state. In that case, a second difference arise between the social and private social optimum, as a banker funded with long-term debt will not choose an optimal liquidation policy. This restores a role for demandable debt. If long-term debt is unreliable, savers will choose intermediaries that perform maturity transformation (banks). The main trade-off is the benefit from commitment to liquidating investment in the bad state by offering demandable debt versus the cost of inefficient liquidation triggered by the excessive withdrawals of uninformed foreign funding. To illustrate this trade-off, we focus on a single debt contract offered to all groups of savers. Only in case of positive foreign wealth and demandable debt, we therefore abstract from the incentive compatibility constraints of domestic and foreign
savers at the initial date. Let this contract be denoted by payments \((X_1, X_2)\).

Specifically, we consider an agency conflict between the banker and debt holders that may prevent efficient liquidation. The banker enjoys a non-contractible and non-monetary benefit \(\beta \in (0, \alpha)\) at the interim date if investment continues in the bad state. As a result, the banker does not liquidate the investment in the bad state, so that the resources are lost at the final date unless a run occurs. We start by studying the case of only informed funding \((W = 0)\) and analyse the effect of uninformed funding \((W > 0)\) subsequently.

### 3.1 No foreign wealth

We start by analysing the case of exclusive domestic funding, \(W = 0\), and show how the agency conflict alters the optimal contract offered by the banker. Long-term debt is no longer optimal since the banker cannot commit to liquidating in the bad state. The incentive compatibility constraint of savers at the interim date, \(D_2 \geq D_1\), combined with the participation constraint implies \(D_2 \geq 1\). Therefore, the banker as residual claimant receives no payoff in the bad state if long-term debt is offered. As a consequence, the banker would not liquidate in the bad state but enjoy the non-monetary payoff. Savers anticipate this behavior and require a larger compensation in the good state. The optimal long-term debt contract offered by the bank that savers accept is \(D_{LT}^* = 1\). This yields \(\pi_D = 1\) and \(\pi_{LT}^* = NPV - (1 - \gamma)(\alpha - \beta) < NPV\).

Long-term debt does not allow the banker to commit to liquidating investment in the bad state. This problem can be solved with demandable debt if \(D_1 \geq \alpha\). The run on the bank in the bad state triggers efficient liquidation and allows the banker to extract the full surplus of investment. There are several optimal contracts that deliver the efficient allocation (especially, liquidation in the bad state). For example, \(D_1^* = \alpha\) and \(D_2^* = \alpha + \frac{1 - \alpha}{\gamma} > 1\) satisfy the incentive compatibility constraint at the interim date, \(D_2 \geq D_1\), and the participation constraint since \(\pi_D = 1\). The banker receives \(\pi_B^* = NPV\), which is strictly higher than under long-term debt.

**Lemma 3. Efficiency of demandable debt** (Diamond and Rajan (2001)). Absent uninformed foreign wealth, \(W = 0\), demandable debt implements the first-best allocation by triggering efficient liquidation in the bad state.
In sum, offering demandable debt is privately optimal for the banker and implements the first-best allocation despite the agency conflict. The intuition is that informed domestic savers withdraw at the interim date in the bad state and thus force efficient liquidation. Informed investors can monitor the banker. In the next section, we study how this result is affected by the presence of less informed foreign funding.

3.2 Positive foreign wealth

Now suppose that part of the bank’s funding comes from uninformed foreign savers, \( W \in (0, 1) \). Offering demandable debt to foreign savers can lead to runs in solvent states, specifically in the good state when foreign funding may be uninformed. Offering long-term debt overcomes the issue of flighty foreign funding at the expense of the banker’s inability to commit to liquidating in the bad state. As before, \( D_{LT} = F_{LT} = \frac{1}{\gamma} \) is the best long-term debt contract offered by the banker that savers will accept. This yields \( \pi_{LT}^D = 1 = \pi_{LT}^F \) to savers and \( \pi_{LT}^B = NPV - (1 - \gamma)(\alpha - \beta) \) to the banker. Observe that a lower bound on the non-monetary benefit is required to ensure participation of the banker:

\[
\beta \geq \beta_0 = \frac{1 - \gamma R}{1 - \gamma} < \alpha
\]  

(6)

Commitment to liquidation is achieved by offering demandable debt. As we shall see, demandable debt is preferable if the benefit from commitment is larger than the cost of inefficient liquidation in the good state triggered by flighty foreign funding. Only here do we use the single-contract assumption mentioned above. Commitment requires \( X_1 \geq \alpha \). The associated withdrawal behavior and payoffs are stated in Table 3.

<table>
<thead>
<tr>
<th>signal</th>
<th>( \bar{R} )</th>
<th>( w_D )</th>
<th>( w_F )</th>
<th>( \pi_D^s )</th>
<th>( \pi_F^s )</th>
<th>( \pi_B^s )</th>
</tr>
</thead>
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<tr>
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<td>( R )</td>
<td>0</td>
<td>0</td>
<td>( X_2 )</td>
<td>( X_2 )</td>
<td>( R - X_2 )</td>
</tr>
<tr>
<td>no</td>
<td>( R )</td>
<td>0</td>
<td>( W )</td>
<td>( X_2 )</td>
<td>( X_1 )</td>
<td>( R - (1 - W)X_2 - W \frac{R}{\alpha}X_1 )</td>
</tr>
<tr>
<td>no</td>
<td>0</td>
<td>( 1-W )</td>
<td>( W )</td>
<td>( \alpha )</td>
<td>( \alpha )</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 3: Agency conflict: withdrawal behavior and payoffs under demandable debt

The incentive compatibility at the interim date requires \( X_2 \geq X_1 \) in the good state and \( \rho X_1 + (1 - \rho)\alpha \geq \rho X_2 \) for foreign savers to withdraw after not receiving a signal. The participation
constraints are $\gamma X_2 + (1 - \gamma)\alpha \geq 1$ for domestic savers and $\gamma \delta X_2 + \gamma(1 - \delta)X_1 + (1 - \gamma)\alpha \geq 1 - p$ for foreign savers. Feasibility in the good state when foreigners are uninformed requires $R \geq (1 - W)X_2 + W \frac{R}{\alpha}X_1$.

The expected profit of the banker is $\pi_B = \gamma \delta [R - X_2] + \gamma(1 - \delta)[R - (1 - W)X_2 - W \frac{R}{\alpha}X_1]$. Since the cost of raising $X_1$ marginally above $\alpha$ is higher than the benefit in terms of relaxing the participation constraint of foreign savers, we have $X_1^* = \alpha$. If the level of political risk takes an intermediate value, $p \in (p_0, p) \equiv ((1 - \alpha)(1 - \delta), 1 - \alpha)$, then the participation constraint of domestic savers binds, while that of foreign savers is slack. Thus, $X_2^* = \alpha + \frac{1 - \alpha}{\gamma} > 1$, which satisfies the feasibility constraint. The incentive compatibility constraint of foreign savers, who run upon not receiving a signal, requires a lower bound on the probability of receiving a signal in the good state, $\delta \geq \delta_0 \equiv 1 - (1 - \gamma)\frac{\alpha}{1 - \alpha} < 1$. All savers receive $\pi_D^* = 1 = \pi_F^*$, and the banker receives $\pi_B = NPV[1 - (1 - \delta)W] > 0$.

What is the optimal debt contract offered by the banker when attracting both sources of funding? Comparing the expected profit under demandable and long-term debt, the banker offers demandable debt if and only if the benefit from commitment (in terms of avoiding the loss between the liquidation value and the private benefit) is larger than the cost of inefficient liquidation in the good state. The latter increases in the amount of foreign funding and the conditional probability of not receiving a signal, $(1 - \gamma)(\alpha - \beta) \geq W(1 - \delta)NPV$. If the moral hazard friction is sufficiently severe (low $\beta$), then the banker optimally offers demandable debt for all levels of foreign wealth, whenever all sources of funding are attracted:

$$\beta \leq \beta_0 \equiv \alpha - \frac{(1 - \delta)NPV}{1 - \gamma} > \beta_0,$$

where a lower bound on the informativeness of foreign foreign ensures $\beta_0 > 0$:

$$\delta > \delta_1 \equiv \frac{\gamma R - 1}{NPV} < 1.$$

As a result, ex-post inefficient liquidation occurs in equilibrium due to the presence of uninformed foreign funding.

**Lemma 4. Optimal fragility.** Suppose all sources of funding are attracted and the agency conflict is sufficiently severe, $\beta \leq \beta_0$. Then, the optimal contract offered by the banker is demandable debt. For example, if foreign funding is not too uninformed, $\delta \geq \max\{\delta_0, \delta_1\}$, and the level of political risk
takes an intermediate value, \( p < p < \overline{p} \), then the optimal contract specifies the payments \( X_1^* = \alpha \) and \( X_2^* = \alpha + \frac{1-\alpha}{\gamma} \). The expected payoffs received by savers are \( \pi_D^* = 1 = \pi_F^* \), while the banker receives \( \pi_B^* = \text{NPV}[1 - (1 - \delta)W] > 0 \).

**Exclusion of foreign funding**  As foreign funding becomes sufficiently abundant (or cheap), the banker may again be tempted to target it. Excluding domestic funding allows the banker to extract safety rents from foreign funding. Offering long-term debt \( F^{LT}_1 = \frac{1-\alpha}{\gamma} \) yields \( \pi_B^{LT} = W[\gamma R - 1 + p] + (1 - \gamma)\beta \) to the banker, since domestic savers never accept such an offer.

Conversely, offering demandable debt \( F^{DD}_1 = \alpha \) and \( F^{DD}_2 = \alpha + \frac{1-\alpha}{\gamma} - \frac{1-p-\alpha}{\gamma} \), if \( p < 1 - \alpha \), yields \( \pi_B^{DD} = W[\gamma(R - \alpha) + \alpha - 1 + p] \) to the banker. Therefore, demandable debt is optimal if the agency conflict is sufficiently severe:

\[
\beta \leq \overline{\beta}_1 \equiv \frac{\alpha(1 - \gamma) - R\gamma(1 - \delta)}{1 - \gamma},
\]

where a lower bound on the informativeness of foreign foreign ensures \( \overline{\beta}_1 > 0 \):

\[
\delta > \overline{\delta}_2 \equiv \frac{R - \alpha/\gamma}{R - \alpha} < 1.
\]

Exclusion of (more informed) domestic savers in case of demandable debt is tougher and requires \( p > (1 - \alpha)(1 - \delta) \), which is consistent with the previous bound on the level of political risk.

Proposition 1 summarizes the optimal contract offered by the banker in case of an agency conflict (moral hazard).

**Proposition 1.** **Optimal contract under moral hazard features financial fragility.** Suppose that foreign funding is sufficiently informed, \( \delta > \max\{\overline{\delta}_0, \overline{\beta}_1, \overline{\delta}_2\} \), the agency conflict is sufficiently severe, \( \beta \leq \min\{\overline{\beta}_0, \overline{\beta}_1\} \), and the level of political risk takes an intermediate value, \( p < p < \overline{p} \). Then, the optimal contract offered by the banker is demandable debt.

If foreign wealth is small, \( W \leq \underline{W} \), all sources of funding are attracted and little inefficient liquidation occurs. Conversely, if foreign wealth is abundant, \( W > \overline{W} \), then foreign funding is again targeted by the banker. The bound on the level of foreign wealth decreases in the level of political risk: the cheaper foreign funding, the larger the range of foreign wealth for which the banker excludes domestic funding:

\[
\underline{W} = \frac{\text{NPV}}{\text{NPV} + p - (1 - \alpha)(1 - \delta)} \in (0, 1).
\]
If foreign funding is too uninformed, however, the banker offers long-term debt. Committing to liquidating in the bad state is too costly in terms of runs by uninformed foreign funding in solvent states.
4 Absolute safety

Demandable debt arose in the previous section because of an agency conflict. We now abstract from this, $\beta = 0$, in order to study absolute safety needs as an alternative that generates a role for demandable debt and financial fragility under the optimal contract. 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.

$$U_k(c_1, c_2) = \begin{cases} 
  c_1 + c_2 & \text{if } c_1 + c_2 \geq S_k \\
  -\infty & \text{if } c_1 + c_2 < S_k 
\end{cases} \tag{12}$$

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, $S_F > 0$. We endogenize the regional demand for safe assets in section 5.

To generate interesting implications from absolute safety needs, we focus on the parameter values $S_F \in (\alpha, 1-p)$. 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. While simple, each case has some insight into the mechanisms at work. Subsequently, we study the main case in which both funding sources are potentially available to the banker, $W \in (0,1)$. 
4.1 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 4 depicts the withdrawal behavior and payoffs if there is no foreign funding (\( W = 0 \)).

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, \( \pi_B \geq 0 \).

<table>
<thead>
<tr>
<th>( \tilde{R} )</th>
<th>( w_D )</th>
<th>( \pi_D^* )</th>
<th>( \pi_B^* )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( R )</td>
<td>0</td>
<td>( D_2 )</td>
<td>( R - D_2 )</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>( \min {\alpha, D_1} )</td>
<td>( \max {0, \alpha - D_1} )</td>
</tr>
</tbody>
</table>

Table 4: 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.) 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.

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

4.2 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. 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 \( \alpha \), which is insufficient to cover the foreign savers’ demands for absolute safety, \( \alpha < S_F \). As

\[\text{If the banker had also access to the domestic storage technology, the banker makes no investment but keeps the safety rent of } \pi_B^* = p \text{ in case of no domestic wealth.} \]
we will see in the main part, 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.

4.3 Attracting both domestic and foreign funding

Consider the case of both domestic and foreign wealth, \( W \in (0, 1) \), both attracted by the banker.

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 next section 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 \( F_1 \geq S_F \). Table 5 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 \((L)\).

<table>
<thead>
<tr>
<th>contingency</th>
<th>signal</th>
<th>( \hat{R} )</th>
<th>( w_D )</th>
<th>( w_F )</th>
<th>( \pi_D^a )</th>
<th>( \pi_F^a )</th>
<th>( \pi_B^a )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( H )</td>
<td>yes</td>
<td>( R )</td>
<td>0</td>
<td>0</td>
<td>( D_2 )</td>
<td>( F_2 )</td>
<td>( R - (1 - W)D_2 - WF_2 )</td>
</tr>
<tr>
<td>( M )</td>
<td>no</td>
<td>( R )</td>
<td>0</td>
<td>( W )</td>
<td>( D_2 )</td>
<td>( F_1 )</td>
<td>( R - (1 - W)D_2 - WF_1 )</td>
</tr>
<tr>
<td>( L )</td>
<td>no</td>
<td>0</td>
<td>0</td>
<td>( W )</td>
<td>( \frac{W}{1-W}F_1 )</td>
<td>( F_1 )</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 5: 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:

\[ W \leq \underbar{W} \equiv \frac{-1 + \alpha \left[ 1 + \gamma \left( \frac{R}{\alpha} - 1 \right) \right]}{-1 + S_F \left[ 1 + \gamma \left( \frac{R}{\alpha} - 1 \right) \right]} \in (0, 1) \]  

where the boundaries of \( \underbar{W} \) is implied by the assumption on the level of absolute safety, \( \alpha < S_F \).

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:

\[ p > \overline{p} \equiv (1 - \delta)(1 - S_F) \in (0, 1) \]  

**Proposition 2.** Suppose foreign funding is sufficiently scarce, \( W \leq \underbar{W} \), and cheap, \( p > \overline{p} \). 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:

\[ D^*_1 = 0 < 1 - \frac{1 - \gamma}{\gamma} \frac{1 - \gamma}{\gamma} \frac{\alpha - WS_F}{1 - W} = D^*_2, \quad F^*_1 = S_F < S_F + \frac{1 - p - S_F}{\gamma \delta} = F^*_2 \]  

Both types of savers receive their outside option, \( \pi^*_D = 1 - p = \pi^*_F \), 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:

\[ \pi^*_B = NPV + Wp - W\gamma(1 - \delta) \left( \frac{R}{\alpha} - 1 \right) S_F \]  

**Proof 1.** To be typed.

### 4.4 Targeting domestic funding

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 \( D_2 = \frac{1 - \gamma}{\gamma} \frac{\alpha}{\gamma} \). 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 \( 1 - W \):

\[ \pi^*_B = (1 - W)NPV \]
Why do foreign savers not participate? First, if they accepted the contract, they could never withdraw at the interim date, $w^*_{IF} = 0$. Hence, foreign savers receive a pro rata share of the final-date proceeds in the bad state, which is $\alpha < S_F$. 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:

$$\gamma(1 - \delta)S_F \left(\frac{R}{\alpha} - 1\right) \geq NPV + p \quad (19)$$

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 $\delta$). 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 $\pi^*_B$ is only valid for a sufficiently small proportion of foreign funding.

**Lemma 5.** Suppose that foreign funding is sufficiently costly in terms of inequality (19). Then, the banker optimally attracts only stable domestic funding, $I^* = 1 - W$, offering long-term debt.

5 Market equilibrium of absolutely safe assets

This section is work-in-progress. We are currently solving the generalized problem with an industry structure of competitive banks and the optimal portfolio choice of savers. All savers have absolute safety preferences but foreign savers are subject to political or expropriation risk, which impedes their access to a safe store of value.
References


