Bank Incentives, Economic Specialization, and Financial Crises in Emerging Economies

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Abstract

We model the vulnerability of an economy to a financial crisis as arising from the interaction of the degree of economic specialization and bank debt financing. The probability of a financial crisis is shown to increase in the degree of economic specialization. Bank debt financing has the beneficial effect of lowering the degree of economic specialization by increasing access to financing of investment opportunities that would not have been financed due to wealth constraints of entrepreneurs (financial access effect). However, bank debt financing induces risk-shifting incentives (leverage effect). The net effect on the probability of a financial crisis depends on which of these two effects dominates. We show that commonly employed mechanisms in managing financial crises, particularly bailouts, induce an additional agency cost by distorting bank incentives to concentrate loans in specific sectors (bank debt concentration effect). We propose a tax-based *ex ante* solution mechanism that simultaneously induces optimal investment and eliminates the bank debt concentration effect. Implementation issues and empirical/policy implications are also discussed.

JEL Classification: G15; G21; G28; G34; G38; O21

Key Words: Access; Bailouts; Banks; Conflicts of interest, Financial crisis; Incentives; Leverage; Taxes.

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1. Introduction

A significant body of literature has emerged on financial crises in emerging markets. This literature focuses primarily on macro explanations for the onset and propagation of a financial crisis. For example, in a recent paper, Francis, Hasan and Hunter (2002) provide evidence that liberalization of emerging financial markets has resulted in the integration of developing countries' capital markets into global capital markets, thereby resulting in a higher likelihood of financial crises in emerging markets. More recently, Chen and Hasan (2005) and Dwyer and Hasan (2007) show that many financial crises involve bank runs resulting from deteriorating depositor sentiment about the health of the banking industry.[1] While these macro explanations seem plausible, there is an important missing element. Investment distortions (such as, excessive risk-taking, and investments in non-value maximizing pet projects), and the degree of economic specialization, i.e., whether an economy is specialized in a few products/activities, or is sufficiently well-diversified, appear to have had a significant role in contributing to the precipitation and propagation of recent financial crises (see, Corsetti, Pesenti, and Roubini, 1999).

In this paper, we model the vulnerability of an economy to a financial crisis as arising from the interaction of the degree of economic specialization and the mode of financing of the investment opportunities. We define a financial crisis as the joint occurrence of the low payoff state for all firms in an economy.[2] Our main results are as follows: First, we

[1] Other macro explanations include sensitivity to shared macroeconomic factors such as global/regional business cycles and cross market hedging (Kodres and Pritsker, 2002), currency devaluations and financial leverage (Bris and Koskinen, 2002), business cycles and recessions (Allen and Gale, 1998; Kaminsky and Reinhart, 1999), liquidity shocks and linkages among financial intermediaries (Allen and Gale, 2000), and capital flows (Radelet and Sachs, 1998).

[2] Our definition captures the notion of the occurrence of a state in which a large segment of the corporate sector has poor realized cash flows (such as, in a recession), reflecting an inability to pay for continuing operations, such as trade creditors, operating leases, funding pension obligations etc. Our definition is consistent with the empirical evidence on the onset of a crisis, e.g., Kaminsky and Reinhart (1999) document that most crises occur as an economy enters a recession. Moreover, if firms have other financial obligations, such as bank debt, as is typical in many emerging markets, this state is also characterized by the failure of banks due to a preponderance of defaulted loans (see, Diamond, 2004). As we shall see later, the effect of the traditional debt obligations (e.g., bank finance) is to aggravate crisis arising from economic fundamentals. Moreover, in Sections 2.3.1 and 2.3.2, we generalize the notion of financial crisis to capture not only economic specialization (or industrial concentration) but also 'too big to fail' and 'quantity of output' considerations.

show that the probability of a financial crisis increases in the degree of economic specialization. Second, intermediated financing, the most commonly available source of financing in emerging economies, has two countervailing effects on the probability of a financial crisis. On the one hand, bank debt financing decreases the degree of economic specialization by increasing the access to intermediated financing for an increased menu of activities than that would have been financed with only internal financing by entrepreneurs (we refer to this as the financial access effect). On the other hand, the form of bank financing (debt) causes the well-known risk-shifting incentives leading to overinvestment in risky projects (we refer to this as the leverage effect). The net effect on the probability of a financial crisis depends on which of these two effects dominates.

Third, we examine mechanisms commonly employed by governments in managing a financial crisis, with a focus on bailouts (defined as the repayment of bank debt obligations of the corporations in the event of a financial crisis). Although the direct effect of bailouts is to mitigate the negative effect of a financial crisis, the fact that the bailouts occur only in the financial crisis state (characterized by the joint failure of firms), they provide incentives for banks to concentrate their debt financing in specific sectors (we refer to this as the bank debt concentration effect). This additional agency cost of bank financing further offsets the financial access effect above.

Finally, we propose an *ex ante* solution mechanism targeted toward prevention (rather than an *ex post* resolution) of a financial crisis. Our solution mechanism consists of two tax structures, one for the corporate sector, and another for the banking sector. The corporate tax structure is designed to eliminate the leverage effect by concavifying the structure of after-tax payoffs to residual claimants.[3] The bank tax structure is designed to eliminate the bank debt concentration effect by changing the *ex ante* incentives of the bank decision makers. The proposed solution mechanism enhances financial access and mitigates incentive distortions, thereby minimizes the probability of a financial crisis,

[3] The proposed solution mechanism is analogous to a social planner or an external agency holding appropriately designed warrants. As is well-known, debt with warrants or convertible debt (Green, 1984) also can accomplish concavifying the payoff structure to residual claimants. There are precedents for bailouts by the U.S. government in exchange for warrants, e.g., Chrysler in 1990s.

where all the available positive net present value projects are financed. We also discuss the comparative advantages of our solution mechanism relative to others proposed in the literature, such as taxes on short term debt inflows, and deposit insurance.

Our paper differs from other papers on financial crisis in several important ways. Unlike papers that debate the determinants and the *ex post* resolution of a financial crisis, we focus on an *ex ante* solution mechanism aimed at the prevention of a financial crisis. We propose a novel solution of an appropriately designed tax structure that simultaneously addresses the incentive issues in the banking sector and in the corporate sector. Banks play an important role in our model as financiers of projects that otherwise would not have been financed. In addition, in contrast to the literature's focus on excessive debt, currency instability, and depositor behavior resulting in a bank run/banking panic[4], we take a more general view of a financial crisis even in the absence of any of these factors.

In particular, our paper provides the root cause of a financial crisis as arising from the degree of economic specialization, which can be further impacted by the mode of financing of investment opportunities.[5] In our framework, well-publicized causes of a financial crisis, such as currency instability, excessive debt, and banking panics are factors that could aggravate the root cause. For instance, if a country is highly specialized, even a low level of debt financing can result in a financial crisis (characterized as the joint failure of large number of corporations). In fact, as we later show in Section 4, a financial crisis resulting from currency instability arises as a special case of our general characterization, and it hinges on the relationship between currency

[4] See Gorton and Winton (2003) for an excellent survey of the literature on banking panics. They conclude that "In fact, it does not seem to be an exaggeration to say that most of the theoretical work on panics has been motivated by the U.S. experience, which has then been incorrectly generalized." While there is no single definition of a banking panic, see Calomiris and Gorton (1991) who define a banking panic as an event in which bank depositors at all or many banks in the banking system suddenly demand that banks convert their debt claims into cash, to such an extent that banks suspend convertibility. Also see, Allen and Gale (1998) who modify Diamond and Dybvig (1983)'s model so that panics are related to the business cycle, rather than unexplainable events caused by "sunspots."

[5] In a related paper, Gabaix (2005) draws some conclusions similar to ours although the focus of that paper is in explaining real business cycles. He argues that aggregate shocks are initiated by shocks to individual firms, and that when the industrial concentration is high, this effect is magnified. Thus, high industrial concentration leads to high economic volatility in his paper, analogous to our result that a high degree of economic specialization is associated with a larger likelihood of a financial crisis.

instability and the underlying fundamentals (cash flows). In addition, in Section 4 we argue that a deposit insurance scheme, while useful in preventing a bank run and a banking panic, does not remove the root cause of a financial crisis, i.e., the degree of economic specialization. That is, we focus on an alternative view of the financial crisis arising from the asset side of a bank balance sheet whereas the extant literature on bank runs and banking panics has focused mainly on the liability side of bank balance sheets.

Moreover, as we show in Section 4, unresolved agency problems at the micro (i.e., firm or bank) level can not only escalate into a financial crisis, but also serve as a channel for the propagation of macroeconomic shocks, such as a currency shock, resulting in a contagion among countries linked through the common shock, such as those in a currency union (e.g., Euro zone).

While the incentive solutions we propose in this paper are rather unorthodox in the context of broad public policy issues regarding the prevention and management of a financial crisis, we argue that they are implementable and call for "fixing the roof while the sun shines". In this spirit, we also provide a discussion of the implementation issues of the proposed solution mechanism.

The remainder of the paper is organized as follows. Section 2 presents the theoretical model, starting with the optimal investment policy with complete contracting, characterizes the probability of a financial crisis under several alternative definitions of what constitutes a financial crisis, and analyzes the influence of external financing in the form of bank debt financing on the probability of a financial crisis. Section 3 presents our proposed solution mechanism, aimed at eliminating bank incentive effects, while retaining the beneficial effects. Our proposed solution mechanism achieves the minimal probability of a financial crisis given that all the financially viable projects in the economy are implemented at maximal net present value. Section 4 compares the efficacy of the proposed solution mechanism relative to alternative measures proposed in the literature, and discusses whether our results extend to other settings. Finally, Section 5 concludes with empirical and policy implications.

2. The model

To capture the essential ingredients of our basic arguments, we model the following players: (1) local government, which serves as the social planner and the lender of last resort in the local economy, (2) a representative local firm in the corporate sector, and (3) a domestic financial intermediary, such as a representative local bank.[6]

First, we start with a simple description of the agency problems at the corporate level. We have a three-date model. At t=0, the representative local firm in the corporate sector raises capital (either from internal sources or from external sources, where available) for an investment to be made at t=1. At t=1 investment opportunities appear and an investment of an amount I_C (suffix c for corporate sector) is made. For simplicity, we assume that the investment opportunities are of two types: (1) safe investments with zero risk, and (2) a choice from a menu of possible risky investments that are indexed by a parameter q, the probability of receiving the higher payoff from investing in a risky investment whose payoff structure is described below. An amount I_C invested in the risky project at t=1 produces a terminal cash flow at t=2 of H_C with a probability q and L_C with a probability of $(1-q)$, with $H_C > I_C > L_C$[7]. On the other hand, the same investment of I_C in the safe project at t=1 yields a terminal cash flow of I_C at t=2. At t=2, the cash flow from the investment is realized and all claims against the firm are settled, consistent with the tax and legal structure in place. We abstract from discounting in all time periods by assuming a risk-neutral valuation with a zero riskless interest rate.

[6] In interpreting some of our results, it would be useful to bring in as additional players: (1) an external lender who holds hard currency claims (e.g., in U.S. dollars) on the cash flows of the representative local firm, and (2) an external agency, such as the World Bank or the International Monetary Fund (IMF) which could serve as the international lender of last resort should the social planner be unable to play the role of being the lender of last resort in the local economy (for example, due to inadequate financial resources). See Figure 1 for the interactions among the players in such an augmented model.

[7] For expositional ease, the results in this paper are derived using the assumption of there being just two states, the low state and the high state. However, the results are general in nature and do not depend on this assumption. See John and Senbet (1991) for details.

A crucial feature of our model is that there is "incomplete contracting" on the project choices made by the local firms. At t=1, before choosing between the safe and the risky investments, the representative local firm's insiders privately observe the value of the parameter q, the probability of receiving the higher payoff if investing in the risky investment. The value of the parameter q is not observed by the outsiders, such as the external lenders or the external agency. This precludes any contracting that is contingent on the value of the parameter q. However, it is common knowledge that q is distributed uniformly over the interval [0,1]. This modeling device captures the intuition that the local firm's insiders have discretion in their choice of investment risk. The incomplete contracting ability is a commonly used modeling device in the agency literature (see, for example, Grossman and Hart, 1986; Harris and Raviv, 1989), and can give rise to a conflict of interest among claimants (for example, between debt holders and equity holders) regarding investment decisions, which we examine in Section 2.3.

Definition 1:

For a given cut-off value of q^C, $0 \leq q^C \leq 1$, an investment policy $\{q^C\}$ is defined as investing in the risky investment for $q \geq q^C$ and in the safe investment for $q < q^C$.

Lemma 1:

When q is uniformly distributed over [0,1], an investment policy $\{\tilde{q}\}$ produces the distribution of terminal cash flows as follows: H_C with a probability ½ $[1-\tilde{q}^2]$, I_C with a probability $\tilde{q}$ and L_C with a probability ½$[1-\tilde{q}]^2$.

Proof: See Appendix A.

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Now we discuss the objective function of the social planner that we use in our model. On the one hand, the social planner wants to extract the maximal value possible from the activities in the economy. On the other hand, the social planner wants to do this with minimal expected costs of a financial crisis in the economy. Based on these considerations, the social planner will seek to maximize the sum total of net present value

from all projects financed in an economy net of the expected cost of a financial crisis. We will specify the objective function later after we characterize the details of the technology and the probability of a financial crisis.

2.1. Optimal investment policy benchmark with complete contracting

We begin our analysis by characterizing the optimal investment policy of a firm with complete contracting (i.e., devoid of any agency or information costs). We define failure in the case of a single firm to be the outcome L_C. Hence, based on Lemma 1, an investment policy $\{\tilde{q}\}$ results in a probability of failure assessed at t=0 of $\frac{1}{2}(1-\tilde{q}^2)$. Financial crisis arises from the joint failure of firms in an economy, and could be costly from the standpoint of a social planner depending on the severity of financial crisis. We characterize later the probability of a financial crisis as a function of the extent to which an economy is specialized, and the mode of financing of the investment opportunities.

The optimal investment policy of a firm with complete contracting at t=1 is determined as follows. The representative local firm's insiders observe q and choose to invest in the risky investment if:

$$qH_C + (1-q)L_C \geq I_C. \tag{1}$$

That is, they invest in the risky investment if it yields a higher present value than what they obtain from the riskless investment. The lowest (cut-off) value of q denoted by q^e that satisfies the above equation is:

$$q^e = \frac{I_C - L_C}{H_C - L_C} \tag{2}$$

The investment policy in Eq. (1) is equivalent to investing in the risky investment for all values $q \geq q^e$. Using definition 1, we characterize the optimal investment policy with

incomplete contracting as investment policy $\{q^e\}$ where q^e is as given in Eq. (2). In other words, if q were observable and complete contracting conditional on q were possible (neither of which is possible in our model), the social planner would mandate a cut-off of q^e to the local firm for accepting risky projects. It follows from Lemma 1 that the present value of an investment policy $\{q^e\}$ is given by:

$$V(q^e) = \frac{1}{2}[1-(q^e)^2]H_C + q^e I_C + \frac{1}{2}(1-q^e)^2 L_C. \qquad (3)$$

It should be noted that if an entrepreneur with monopoly access to a project had sufficient internal financing to implement the project, the investment policy that he would undertake is $\{q^e\}$ and the resulting value equals $V(q^e)$ in Eq. (3).

When external financing is required to implement projects, incomplete contracting leads to investment distortions and a reduction in value. These have been referred to as agency costs. We next define in Section 2.2 the degree of specialization for a two-firm economy. We expand the notion of specialization to a multi-firm economy in Section 2.3.

2.2. The degree of specialization of an economy

The investment technologies available in an economy are assumed to have the same structure of cash flows that we described for firm projects in Section 2.1. We define the degree of specialization of a multiple-firm economy, in two steps, by defining: (i) the correlation between any two given technologies, and (ii) the degree of specialization of an economy as the minimal correlation that exists among all technologies that are implemented (financed) in that economy. Let us consider two technologies denoted by a payoff of H_i in the high state and L_i in the low state (we drop the suffix c, i.e., H_i instead of $H_{c,i}$ since it is clear from the context) for a given level of investment, I_i (i = 1,2). As before, we denote as q_i, the probability of receiving the higher payoff (i.e., H_i) for technology i, (i = 1,2). Both q_1 and q_2 are distributed uniformly over the interval

[0,1]. We capture the underlying correlation in a simple fashion in the form of a conditional probability. For any realized values of q_1 and q_2:

$$P(L_2 \mid L_1) = \rho. \tag{4}$$

We specify only one conditional probability in Eq. (4) since the remaining conditional probabilities, such as $P(H_1 \mid H_2)$, $P(H_2 \mid H_1)$, $P(L_1 \mid L_2)$, $P(H_1 \mid L_2)$, $P(H_2 \mid L_1)$, $P(L_1 \mid H_2)$ and $P(L_2 \mid H_1)$ can be expressed in terms of ρ and the firm-level investment policies as shown in Appendix B.

Here ρ is a measure of the correlation between the two technologies 1 and 2.[8] We can also interpret the parameter ρ as an index of economic specialization. Consider an economy which has two technologies indexed 1 and 2. Since ρ is a measure of how closely related the two technologies are, a higher value of ρ, i.e., ρ close to 1, denotes a higher degree of economic specialization, and a lower value of ρ, i.e., ρ close to 0, denotes a lower degree of economic specialization.

Throughout this paper, we assume that ρ is not contractible. That is, ρ-contingent contracts cannot be written. Even though each firm knows its own technology well, its expertise regarding ρ is limited. However, banks have incentives to develop a sufficient degree of expertise on ρ. We also make a plausible assumption that ρ is not verifiable and hence not enforceable in a court of law.[9]

[8] We use the terms correlation and conditional probability interchangeably in the paper. In particular, we view a high value of ρ as a higher conditional probability that both firms have the same payoff (either low or high) as denoted in Eq. (4), and the related equations in Appendix B.

[9] Note the unobservable firm-level investment policies influence ρ, albeit to a limited extent. For example, other conditional probabilities, such as $P(H_1 \mid H_2)$, $P(H_2 \mid H_1)$, $P(L_1 \mid L_2)$, $P(H_1 \mid L_2)$, $P(H_2 \mid L_1)$, $P(L_1 \mid H_2)$ and $P(L_2 \mid H_1)$ can be expressed in terms of ρ and the firm-level investment policies as shown in Appendix B. Since the investment policies of firms are not observable, and hence not contractible, it follows that ρ is also not contractible.

Now we characterize the degree of economic specialization in the context of a multiple-firm economy. For each economy, we denote one of its technologies as its "basic" technology. The basic technology can be thought of as a technology available in the simplest of economies, such as those that rely primarily on natural resources, tourism, or an activity in which the firms in the economy have been historically active. For any other project or technology *i* in the economy, denote as ρ_i the correlation of the technology *i* with the basic technology, defined analogous to Eq. (4).

We define $\rho_{\min}$ as the minimum ρ of all available projects that would be financed if unlimited internal financing were available, i.e., if all positive NPV projects available in the economy could be financed without agency costs. In an economy with a menu of available technologies indexed by ρ from lowest to highest, i.e., $\rho \in [\rho_{\min}, \rho_{\max}]$,[10] $\rho_{\min}$ serves as an index of the degree of economic specialization.

$$\rho_{\min} = \min\{\rho : V_\rho(q^e) \geq I\}, \tag{5}$$

where $V_\rho(q^e)$ is the present value of the cash flows from investing in a project indexed by ρ as per the optimal investment policy $\{q^e\}$ in Eq. (2).

In the context of emerging economies, the minimum ρ available in an economy would be strictly greater than $\rho_{\min}$ because the economy is unable to finance all available projects. Even if sufficient external financing (e.g., external equity or external debt) were available in an economy, since external financing could involve agency costs, some projects which would be financed if internal financing were available (and hence financed with zero agency cost) would not be financed if external financing is required (see Jensen and Meckling, 1976; Myers, 1977). Let ρ_A denote the achieved level of

[10] Since implementing additional projects with the basic technology or expanding a project using the basic technology is a commonly available option in most economies, $\rho_{\max}$ usually equals one. However, to allow for the possibility that the basic technology cannot be repeated due to regulatory constraints or technological obsolescence, we allow $\rho_{\max}$ to be less than one.

specialization, where we define ρ_A as the minimum ρ of all the projects that are financed in an economy. In subsequent analysis, we show that ρ_A is greater than $\rho_{\min}$ due to three factors: (a) limited access to capital, (b) agency costs of debt financing, and (c) distorted incentives in the banking sector to concentrate their loans in specialized sectors. We next characterize how ρ_A is an important factor in determining the probability of a financial crisis in that economy.

2.2.1. Economic specialization and the relative size of industries

In essence, our definition of the degree of economic specialization denoted by ρ in Eq. (4) measures the correlation between industries of an economy. While this is central to the propagation of financial crisis in our framework, it would be useful to generalize it to consider the size distribution of industries within an economy.[11] The limiting nature of our framework can be illustrated as follows. An economy with GDP consisting of 95% steel production and 5% grain production would have the same ρ as an economy with GDP consisting of 50% steel production and 50% grain production, even though the former economy intuitively seems to have a much higher degree of economic specialization. Consequently, *ceteris paribus*, both economies have the same probability of a financial crisis (see Section 2.3).

In Sections 2.3.1 and 2.3.2, we generalize the notion of a financial crisis to consider an interaction between the relative significance of industries and our measure of the degree of economic specialization ρ. Specifically, we examine how our results change if we employ the notion of 'too big to fail' or based on 'quantity of output' considerations in place of our current definition of 'all firms failing' (see Section 2.3 for the current definition of a financial crisis that we use). More specifically, under the notion of 'too big to fail' (See Section 2.3.1. for details), as well as when we define a financial crisis based on the 'quantity of output' considerations (See Section 2.3.2 for details), we show that the economy with 95% steel production and 5% grain production would, in fact, have a higher probability of financial crisis than an economy with 50% steel production and

50% grain production under very plausible assumptions about parameter values of the underlying firm technologies.

2.3. Characterizing financial crisis

In this section, we characterize a direct link between the degree of economic specialization and the probability of a financial crisis. We define a financial crisis as the joint outcome of low payoffs for all the firms (also see, footnote 2). In an economy with multiple firms, the joint failure of companies is a function of the economic specialization and financial structure of the economy. We will demonstrate this in two stages. In the first stage, we analyze the impact of economic specialization, and in the second stage, we demonstrate the impact of financial structure on the joint failure of companies.

In the following proposition, we characterize the probability of financial crisis as a function of economic specialization and firm-level investment policies. Consider an economy with two firms, with technologies 1 and 2. As before, denote as H_i the payoff in the high state and L_i the payoff in the low state for a given level of investment, I_i (i = 1,2). Let the investment policy of the firms be $\{\tilde{q}_i\}$ (i = 1,2).

Proposition 1 (Economic specialization and financial crisis):

The probability of a financial crisis increases in the degree of economic specialization, ρ and in the riskiness of the firm-level investment policies $\{\tilde{q}_1\}$ and $\{\tilde{q}_2\}$.

Proof: We compute the unconditional *ex ante* probability of a financial crisis (at t=0) for firm-level investment policies $\{\tilde{q}_1\}$ and $\{\tilde{q}_2\}$. As stated in Definition 1, an investment policy $\{\tilde{q}_i\}$ implies that insiders of firm *i* (i=1,2) invest in the risky project at t=1 if $q_i \geq \tilde{q}_i$, and implement the safe project otherwise, i.e., if $q_i < \tilde{q}_i$, where q_i is the

[11] We thank an anonymous referee for drawing our attention to this issue.

probability of the high payoff state of the risky project available to firm i. It follows that the probability of a financial crisis is (see Appendix B for details)[12]:

$$P(\textit{Financial Crisis}) = P(L_1 \cap L_2) = P(L_2 \mid L_1)P(L_1) = \frac{1}{2}(1-\tilde{q}_1)^2(1-\tilde{q}_2)\rho. \qquad (6)$$

The probability of firm 1 having the low payoff is $\frac{1}{2}(1-\tilde{q}_1)^2$ (see Lemma 1). However, the likelihood of firm 2 having the safe payoff of I_2 is $\tilde{q}_2$ (see Lemma 1). This holds true even when firm 1 has the low payoff. The next term in Eq. (6), i.e., $(1-\tilde{q}_2)$ excludes such joint outcomes. The final term in Eq. (6) is the conditional probability ρ of firm 2 also having the low payoff when firm 1 has the low payoff.

Clearly, the probability of a financial crisis is increasing in the degree of economic specialization ρ for any firm-level investment policies $\{\tilde{q}_1\}$ and $\{\tilde{q}_2\}$. Similarly, the probability of a financial crisis is increasing in the risk of investment policies which in turn is decreasing in $\tilde{q}_1$ and $\tilde{q}_2$ for a given ρ. Specifically, where both firms are fully financed with internal equity, Eq. (6) can be rewritten as:

$$\phi_e = \frac{1}{2}(1-q_1^e)^2(1-q_2^e)\rho, \qquad (7)$$

where ϕ_e is the probability of financial crisis assessed at t=0 and firms follow investment policies $\{q_1^e\}$ and $\{q_2^e\}$ as defined in Eq. (2) reproduced below[13]:

$$q_i^e = \frac{I_i - L_i}{H_i - L_i}, i = 1,2. \qquad (8)$$

[12] Alternatively, the probability of a financial crisis can be calculated as $P(L_1 \mid L_2)P(L_2)$ which equals the expression in Eq. (6) as shown in Appendix B (see Eq. B-1).

[13] Note that since insiders of firm i (i=1,2) privately observe the probability of the high payoff state of a risky project (q_i), their optimal investment policy $\{\tilde{q}_i\}$ is invariant to ρ.

■

Proposition 1 provides the root cause of a financial crisis as arising from the degree of economic specialization. However, the full-fledged analysis of the empirical predictions of this theory paper is left for future research.

In Section 2.4, we will show that the degree of economic specialization is further impacted by the mode of financing of investment opportunities. In our framework, the well-publicized causes of a financial crisis, such as currency instability, excessive debt, and depositor behavior associated with banking panics are special cases of our more general framework – as factors that could aggravate the root cause, and thereby increase the probability of a financial crisis (See Section 4 for details). Proposition 1 also states that even without finance–related distortions, a financial crisis can arise from economic fundamentals in a country with a high degree of economic specialization. More generally, the mode of financing used can affect the endogenous choice of an investment policy, and thus influence the probability of a financial crisis. From Proposition 1, we know that the probability of a financial crisis is determined by the degree of specialization, ρ and firm level investment policies ($\{\tilde{q}_1\}$ and $\{\tilde{q}_2\}$). In particular, when both firms are financed partly with debt with promised payment of F_i at t=2 (and the remaining with internal equity), they will pursue investment policies $\{q_1^F\}$ and $\{q_2^F\}$ defined as follows (See Appendix A for the derivation):

$$q_i^F = \frac{I_i - F_i}{H_i - F_i}, i = 1,2. \tag{9}$$

Given these investment policies $\{q_1^F\}$ and $\{q_2^F\}$ the probability of a financial crisis, ϕ_F assessed at t=0 is given by:

$$\phi_F = \frac{1}{2}(1 - q_1^F)^2(1 - q_2^F)\rho. \tag{10}$$

The following proposition on the effect of leverage on the probability of a financial crisis is straightforward.

Proposition 2 (Debt and financial crisis):

The probability of a financial crisis is higher when the firms have debt as compared to financing fully with equity, and it is increasing in the debt levels of the firms.

Proof: It is easy to verify from Eqns. (8) and (9) – that $q_i^F < q_i^e$ for firm i (i = 1,2). This implies that the probability of a financial crisis with debt (i.e., Eq. (10)) is larger than that with equity (i.e., Eq. (7)). Further, since q_i^F is decreasing in F, it is easy to verify that the probability of a financial crisis with debt is increasing in F_i.

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Proposition 2 provides a link between the probability of a financial crisis, debt and economic specialization. One can infer from Proposition 2 that just having debt alone is not sufficient to trigger a financial crisis. For example, if an economy were less specialized, as in a developed market, such as the United States, debt induced risk shifting[14] may not lead to a higher likelihood of a financial crisis since the linkage between distorted risk incentives and the probability of a financial crisis is dampened.[15] Interestingly, if an economy were highly specialized, as in an emerging market that specializes in a few products or activities, a relatively small amount of debt can amplify the distorted risk incentives, leading to a higher likelihood of a financial crisis.

In the analysis so far (i.e., Propositions 1 and 2), we implicitly assumed that whether a project is financed with debt or equity does not influence the economic specialization (i.e., ρ was assumed to be independent of the mode of financing). While this may be true in the Miller-Modigliani world, in a world where external financing entails agency costs, the menu of projects financed depend on the availability and the form of external finance. In other words, the form of financing could affect not only the investment

[14] The risk-shifting incentives induced by risky debt have been widely studied in the finance literature, e.g., Jensen and Meckling (1976), Barnea, Haugen, and Senbet (1985), Green (1984), and John (1987).

policies pursued but also the degree of specialization achievable (ρ_A) in an economy. If entrepreneurs in an economy had unlimited internal financing available, all positive net present value projects available in the economy would be financed and ρ_A equals $\rho_{\min}$. However, in many emerging economies the supply of internal financing is lower than the financing required to invest in all the positive net present value projects available in the economy. In Section 2.4, we turn to the availability of external finance in emerging economies.

2.3.1. Financial crisis and 'too big to fail'

In Section 2.2.1, we noted that an economy with 95% steel production and 5% grain production would have the same ρ as an economy with 50% steel production and 50% grain production, even though the former economy intuitively has a higher degree of economic specialization, and *ceteris paribus*, both economies have the same probability of a financial crisis**.**

In this Section, we examine the robustness of our result linking the probability of a financial crisis and the degree of economic specialization ρ to consider the relative importance of industries in the economy. Specifically, we examine how our result changes if we employ the notion of 'too big to fail'[16] or 'too important to fail' as central to the propagation of financial crisis. This notion then supersedes financial crisis that is predicated on all industries failing jointly. In our framework, the failure of a single yet critical industry is necessary but not sufficient for financial crisis. In other words, under

[15] This is analogous to the variance of a portfolio of two assets being a function of the correlation between those two assets: if the correlation is negative, the variance of the portfolio is lower as compared to the case where the correlation is positive.

[16] There is an extensive literature on empirical evidence consistent with a 'too big to fail' phenomenon. For example, O'Hara and Shaw (1990) investigate the effect on bank equity values of the Comptroller of the Currency's announcement that some banks were "too big to fail" and that for those banks total deposit insurance would be provided. Using an event study methodology, the authors find positive wealth effects accruing to too-big-to-fail banks, with corresponding negative effects accruing to non-included banks. They demonstrate that the magnitude of these effects differed with bank solvency and size. In a recent paper, Penas and Unal (2004) present cross-sectional empirical evidence from bank mergers that indicates that the primary determinants of merger-related bondholder gains are diversification gains, gains associated with achieving too-big-to-fail status, and, to a lesser degree, synergy gains. Also see Bhattacharya (2003)

this notion of 'too big to fail', we would expect that an economy with 95% steel production and 5% grain production would have a higher probability of a financial crisis relative to an economy with 50% steel production and 50% grain production since steel production is 'too important to fail' for the former economy.

The notion of 'too big to fail' suggests that in characterizing financial crisis in an economy with 95% steel production and 5% grain production a more reasonable definition of a financial crisis (compared to our current definition of all firms failing) is simply if the steel firm fails (i.e., gets the low payoff).[17] Without any loss of generality, we define the steel firm as firm 1 and redefine Eq. (6) under the 'too big to fail' notion to be simply:

$$P(\textit{Financial Crisis}) = P(L_1) = \frac{1}{2}(1-\tilde{q}_1)^2. \qquad \text{(6-A)}$$

The probability of firm 1 having the low payoff is $\frac{1}{2}(1-\tilde{q}_1)^2$ (see Lemma 1 and Appendix B). Since firm 1 is too important to fail, the probability of financial crisis (under our alternative definition) is neither dependent on firm 2 nor on the correlation between firm 1 and firm 2 technologies as reflected in the degree of economic specialization parameter ρ simply because firm 2 (i.e., grain production firm) is not at all important from the standpoint of a financial crisis.

One could also argue that the notion of 'too big to fail' suggests that in the case of an economy with 50% steel production and 50% grain production, our current definition of a financial crisis of both firms getting the low payoff as shown in Eq. 6 is quite reasonable since firm 2 (i.e., grain production firm) is equally important as firm 1 (i.e., steel production firm) but neither firm is more important than the other.[18]

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for evidence on gigantic ponzi schemes that occurred in history in anticipation of partial bailouts arising from 'too big to fail' gigantic ponzi schemes, such as in France during 1719 and in Great Britain in 1720.

[17] For simplicity, we assume that all steel production is consolidated in a single firm.

[18] Nevertheless, given the spirit of 'too big to fail', since both firms are equally important and each is too big at some level, we could also interpret a financial crisis to be if either firm has a low payoff. In this

In summary, Eq. (6) characterizes the probability of a financial crisis in an economy with 50% steel production and 50% grain production, whereas Eq. (6-A) characterizes the probability of a financial crisis in an economy with 95% steel production and 5% grain production. By comparing the expressions in (6) and (6-A), it is easy to see that the probability of a financial crisis in an economy with 95% steel production is strictly higher than the probability of a financial crisis in an economy with 50% steel production and 50% grain production under the 'too big to fail' notion of a financial crisis.

2.3.2. Financial Crisis and Output Size

From the society's perspective, financial crisis that is predicated on the joint failure of industries in the economy can be viewed as an extreme case of that based on the notion of "too big to fail" or "too important to fail". An alternative perspective, and a variation of joint failure of industries, may be a critically low level of joint output as a basis for financial crisis. Under this alternative perspective both notions of "too big to fail" and "joint failure of industries" may be too restrictive. For instance, in an economy with 50% steel production and 50% grain production, if the total output is sufficiently low, it could be interpreted as a financial crisis despite the fact that none of the firms is more important than the other. In such an economy, we could characterize a financial crisis by a low payoff state of either firm when the other firm does not have a high payoff. These states correspond to the payoffs (L_1,I_2), (L_1,L_2) or (I_1,L_2) for the two firms as shown in Appendix B. The probability of a financial crisis is then obtained by simply summing the probabilities of the respective cells corresponding to (L_1,I_2), (L_1,L_2) or (I_1,L_2) in Appendix B and can be expressed as:

$$P(\textit{Financial Crisis}) = P((L_1 \cap I_2) \cup (L_1 \cap L_2) \cup (I_1 \cap L_2)) = \frac{1}{2}(1-\tilde{q}_1)^2\tilde{q}_2 + \frac{1}{2}(1-\tilde{q}_1)^2(1-\tilde{q}_2)\rho + \frac{1}{2}\tilde{q}_1(1-\tilde{q}_2)^2. \quad \text{(6-B)}$$

---

paper, we strictly viewed 95% steel production and 5% grain production as a clearer case of which firm is more important from a financial crisis standpoint. In Section 2.3.2 we will consider a more general definition of a financial crisis based on the total output of both firms rather than whether both firms have a low payoff or if the more important firm has a low payoff.

However, in an economy with 95% steel production and 5% grain production, financial crisis based on 'too big to fail' or for that matter 'the total output' consideration is likely to yield that the steel firm fail for there to be a financial crisis. The resultant probability of a financial crisis in this economy under both definitions is expressed in Eq. (6-A).

Interestingly, by comparing the expressions in (6-A) and (6-B), the probability of a financial crisis in an economy with 95% steel production is strictly higher than the probability of a financial crisis in an economy with 50% steel production and 50% grain production under both the 'too big to fail' and 'total output' criteria if the degree of economic specialization parameter ρ is sufficiently low as expressed in Eq. (6-C) below. Note from Appendix B that Eq. (6-A) can be expressed as the sum of probabilities in (L_1,H_2), (L_1,I_2) and (L_1,L_2), and Eq. (6-B) as the sum of probabilities in (L_1,I_2), (L_1,L_2) or (I_1,L_2). Consequently, Eq. (6-A) minus Eq. (6-B) can simply be expressed as the probability in (L_1,H_2) minus the probability in (I_1,L_2). Further algebraic manipulation yields the expression in Eq. (6-C):

$$\begin{aligned} &Eq.(6') - Eq.(6'') \geq 0 \Rightarrow \frac{1}{2}(1-\tilde{q}_1)^2(1-\tilde{q}_2)(1-\rho) - \frac{1}{2}q_1(1-\tilde{q}_2)^2 \geq 0 \\ &\Rightarrow \rho <= \rho_{cf} = 1 - \frac{\tilde{q}_1(1-\tilde{q}_2)}{(1-\tilde{q}_2)^2}. \end{aligned} \qquad \text{(6-C)}$$

Intuitively, this makes sense because the probability of a financial crisis under the 'total output' criteria which is most readily applicable for an economy with 50% steel production and 50% grain production is strictly increasing in the degree of economic specialization parameter ρ whereas the probability of a financial crisis under the 'too big to fail' which is most readily applicable for an economy with 95% steel production and 5% grain production is independent of the degree of economic specialization parameter ρ. Consequently, for the latter to be higher, the degree of economic specialization parameter ρ should be sufficiently low. For example, if $\tilde{q}_1$ and $\tilde{q}_2$ are 1/3 each, then ρ needs to be less than ½ as per Eq. (6-C) which seems quite plausible for most economies.

In the next section we turn to the availability of external finance in emerging economies, and specifically the role of intermediated financing such as bank finance.

2.4. Role of bank finance

Given the limited availability of internal financing in emerging markets, many technologies would have to rely on external financing. La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1997, 1998) document that countries with poor investor protection (such as, many emerging economies) have smaller and narrower capital markets. External equity is also limited in emerging markets for reasons such as economic fragility (Rajan and Zingales, 1998), concentrated ownership and the associated expropriation of minority shareholders. Even when the local stock markets are developed, these stocks trade much like preferred stock (outsiders get dividends, and do not have any control rights whereas insiders have both cash flow and control rights). It has been argued that in emerging economies debt with stronger creditor rights constitutes a more viable form of external financing, e.g., Hart and Moore (1998). Moreover, since public debt markets are also relatively undeveloped in these economies, it can be argued that bank debt constitutes the primary form of external financing in these economies.[19] In our model, we assume that bank debt financing is the primary form of external financing.

Before we examine the role of bank debt financing on economic specialization, it is useful to benchmark the degree of specialization achievable simply from internal financing by entrepreneurs.

$$\rho_{\text{int}} = \min\{\rho : V_\rho(q^e) \geq I, \text{and } I \leq W_\rho\}, \tag{11}$$

[19] Several papers suggest that bank debt offers many advantages, such as monitoring (see, for example, Ramakrishnan and Thakor, 1984; James, 1987; Billett, Flannery and Garfinkel, 1995), liquidity creation (Gorton and Pennacchi, 1990), resolution of market failures (Petersen, 1999), and information production (Boyd and Prescott, 1986). These advantages, which are likely to be of great value in emerging markets, provide further support to bank debt being the primary form of financing in emerging markets.

where $V_\rho(q^e)$ is the present value of the cash flows from investing in a project indexed by ρ (i.e., correlation with basic technology), I is the level of the required investment, W_ρ is the wealth of the entrepreneur that owns the project and adopts optimal investment policy $\{q^e\}$ in Eq. (2).

Bank finance has been criticized as contributing to financial fragility since it a shorter-term finance. However, we show that bank debt could reduce the probability of a financial crisis (rather than increase it). That is, with the availability of bank financing to supplement the wealth of the entrepreneurs, a larger menu of projects will be financed and lower degree of specialization $\rho_b < \rho_{\text{int}}$ can be achieved (which results in a lower probability of a financial crisis). Formally,

$$\rho_b = \min\{\rho : V_\rho(q^F) \geq I, \text{and } I \leq W_\rho + B^F\}. \tag{12}$$

where $V_\rho(q^F)$ is the present value of the cash flows from investing in a project indexed by ρ as per the optimal investment policy $\{q^F\}$ in Eq. (9), I is the level of the required investment, W_ρ is the available wealth for the entrepreneur that owns the project with the correlation ρ with the basic technology, and B^F is the payment made by the bank to the entrepreneur in return for the promised payment F payable at maturity (t=2).[20] However, the leverage effect from Proposition 2 could offset the beneficial effect of the lowering of the degree of economic specialization. The overall impact of bank debt financing on the probability of financial crisis is summarized in Proposition 3.

Proposition 3 (Financial access effect, leverage effect, and financial crisis)

The effect of bank debt financing on ϕ_b, the probability of a financial crisis is determined by the combined effect of two countervailing factors; namely (1) the financial access effect, i.e., access to external financing for a larger menu of projects lowers ρ to ρ_b

such that $\rho_{\min} < \rho_b < \rho_{\text{int}}$, ($\rho_{\min}$ *is defined in Eq. (5), and* ρ_{int} *is defined in Eq. (11)) that decreases* ϕ_b, *and (2) the leverage effect (given by Proposition 2) that increases* ϕ_b.

Proof: The probability of a financial crisis with bank financing, ϕ_b (obtained by changing subscript *F* in Eq. (10) to *b* to emphasize bank debt financing) is given by:

$$\phi_b = \frac{1}{2}(1 - q_1^F)^2 (1 - q_2^F)\rho_b. \tag{13}$$

Since a larger menu of projects are financed with bank debt financing, the minimal ρ implemented, ρ_b decreases from ρ_{int}, the minimal ρ implemented with only internal financing, where $\rho_b < \rho_{\text{int}}$ (financial access effect).[21] However, as shown in Proposition 2, the debt induced risk-shifting incentives imply $q_1^F < q_1^e$ and $q_2^F < q_2^e$ (leverage effect). The overall effect on ϕ_b reflects these two changes.

■

Now we close the model by specifying the underlying objective of the social planner. On the one hand, the social planner wants to extract the maximal value possible from the activities in the economy. On the other hand, the social planner wants to do this with minimal expected costs of a financial crisis in the economy. To be specific, we define the objective of the social planner as:

$$NPV_{social} = \arg\max_{\phi} \left\{ \sum_{\rho} [V_\rho(\tilde{q}) - I] - \chi\phi \right\}, \tag{14}$$

---

[20] $V_\rho(q^F)$ is obtained by substituting q^F in place of q^e in Eq. (3).

[21] A lowering of ρ due to more profitable projects being financed through bank capital is entirely consistent with the idea of comparative advantage. That is, a country exhausts the profitable projects where it has the most comparative advantage before moving to the next set of profitable projects where it has lesser of a comparative advantage, which should result in a lowering of ρ from the larger number of projects being financed through capital from the bank.

where $V_\rho(\tilde{q})$ is the present value of the cash flows from an investment policy $\{\tilde{q}\}$ of investing I (level of required investment) in a project indexed by the degree of economic specialization ρ, ϕ is the probability of a financial crisis, and χ is the *ex post* cost of a financial crisis, assumed to be independent of the probability of a financial crisis, ϕ.

2.5. The role of bailouts

In this section, we analyze whether the commonly observed practices of social planners managing a financial crisis have the desired effect of reducing the expected cost of a financial crisis (see Eq. (14)). Specifically, we analyze whether bailouts (the most commonly used mechanism) have the desired effect of lowering the probability of a financial crisis by increasing financial access, or by mitigating the incentive problems. We discuss the efficacy of other observed practices, such as deposit insurance, and loan guarantees in Section 4.1.

Our model is general enough to help us formally capture the debate on implicit and explicit bailouts by external agencies, such as the World Bank and the International Monetary Fund (IMF). We view a larger role of both explicit and implicit bailouts, even in the absence of capital structure issues. For example, if a social planner may not have the necessary financial resources to bail out a local firm or a local bank and there may be an implicit understanding that an external agency provides the funds in the form of developmental assistance or explicit bailout packages.[22]

We interpret a bailout as a scenario in which a social planner pays off the debt obligations of the firms to the banks only in state of financial crisis, i.e., where all the corporations jointly fail. Firms which fail individually are not bailed out. The consequence of the joint failure restriction is that it distorts bank incentives to concentrate their loans in

[22] International rescues of countries in financial distress by other external agencies date back to early nineteenth century (see, Table 1 of Bordo and Schwartz, 1999). Even in situations where there have not been explicit bailouts (see Bordo et. al., 2001 for a summary of historical crises), there may have been expectations of implicit bailouts which may have resulted in incentive problems, leading to overinvestment in risky projects, and output reductions due to investment distortions. Finally, any organization (corporation or bank) that is "too big to fail" or enjoys limited liability has similar incentive problems.

specific sectors, whose performance is highly correlated.[23] We refer to this additional incentive effect as the bank debt concentration effect, which increases ρ_b. The leverage effect persists and is potentially magnified at the aggregate level. Proposition 4 characterizes the effect of bailouts on the bank debt concentration.

Proposition 4 (Bank debt concentration):

Bailouts provide incentives for banks to concentrate their loans in the highest ρ sector possible, i.e., $\rho = \rho_{\max}$.

Proof: We argue that banks undertake correlated lending strategies to jointly maximize the net present value of their cash flows as shown in Eq. (15):

$$NPV_{banks} = \underset{\rho \varepsilon [\rho_{\min}, \rho_{\max}]}{\arg\max} \begin{Bmatrix} \pi_{F_1F_2}(F_1 + F_2) + \pi_{F_1L_2}(F_1 + L_2) + \pi_{L_1F_2}(L_1 + F_2) + \\ \pi_{L_1L_2}(L_1 + L_2) + [\pi_{L_1L_2}(F_1 + F_2 - L_1 - L_2)] \\ - B^{F_1} - B^{F_2} - \mu_1 - \mu_2 \end{Bmatrix}, \quad (15)$$

where $\pi_{L_1L_2}$, $\pi_{L_1F_2}$, $\pi_{F_1L_2}$ and $\pi_{F_1F_2}$ denote the probability that banks receive the first subscripted amount from firm 1 and the second subscripted amount from firm 2 in lieu of the promised payment of F_1 and F_2 respectively at t=2. For example, $\pi_{L_1L_2}$ is the probability that a bank receives L_1 from firm 1 and L_2 from firm 2 at t=2 (same as the probability of a financial crisis, ϕ). The terms B^{F_1} and B^{F_2} represent the value of the risky debt absent any bailouts, i.e., loan proceeds received by the firms at t=1 in exchange for their promised payments of F_1 and F_2 at t=2 that do not include the bailout transfers that may occur from the social planner directly to the banks in the event of a financial crisis. Finally, μ_1 and μ_2 represent the *ex ante* price paid (if any) by the banks[24] at t=0 in return for the bail out transfers of $(F_1 - L_1)$ and $(F_2 - L_2)$ in the crisis state at t=2.[25]

[23] In our model, a bank's incentive to specialize its loans to a specific sector arises from its attempt to capitalize on a bailout policy focused on the joint failure of loans. For an alternative argument for specialization of bank loans based on bank's incentives to monitor, see Winton (2000).

[24] In practice, this is equivalent to the banks recovering the price they pay for the bailout from the corporations by lowering the loan proceeds to corporations. On the other hand, if the arrangement were

Based on Eq. (C-6) in Appendix C, Eq. (15) can be simplified to:

$$NPV_{banks} = \underset{\rho\varepsilon[\rho_{\min},\rho_{\max}]}{\arg\max} \left\{ \begin{array}{l} \left[1-\frac{1}{2}\left(1-\tilde{q}_1\right)^2+\left(1-\tilde{q}_2\right)^2\right)\right](F_1+F_2) \\ +\left[\frac{1}{2}(1-\tilde{q}_1)^2\right](L_1+F_2)+\left[\frac{1}{2}(1-\tilde{q}_2)^2\right](F_1+L_2) \\ +(F_1+F_2-L_1-L_2)\pi_{L_1L_2}-B^{F_1}-B^{F_2}-\mu_1-\mu_2 \end{array} \right\}, \quad (16)$$

where $\pi_{L_1L_2}=\frac{1}{2}(1-\tilde{q}_1)^2(1-\tilde{q}_2)\rho$ and $\{\tilde{q}_1\}$ and $\{\tilde{q}_2\}$ denote the firm-level investment policies. We next examine the incentives of banks to concentrate debt.

$$\frac{\partial NPV}{\partial \rho}=[(F_1+F_2-L_1-L_2)]\frac{\partial \pi_{L_1L_2}}{\partial \rho}=\frac{1}{2}(1-q_1)^2(1-q_2)(F_1+F_2-L_1-L_2)>0. \quad (17)$$

Inequality (17) suggests that banks have an incentive to concentrate the debt to the maximum level possible (i.e., $\rho=\rho_{\max}$). This holds true whether or not bailouts are priced fairly since μ_1 and μ_2 are paid at t=0 and the decision of whether to concentrate loans or not is taken by the banks at t=1. In fact even in the case where the bailouts are fairly priced, i.e., rationally determined taking into account that $\rho=\rho_{\max}$, banks do rationally go to $\rho=\rho_{\max}$ since any other ρ would result in a negative NPV as per Eq. (15). That is, banks simply cannot precommit to any ρ other than $\rho=\rho_{\max}$.

■

such that the corporations paid for the bailout, loan proceeds to the corporation would be higher by the price of the bailout. In either case, Eq. (15) represents the objective of the banks.

[25] We specify the most general characterization of μ_1 and μ_2 to include all possible cases, such as free bailouts (both zero), underpriced bailouts (lower than fair value), and rationally anticipated bailouts (that take into account the bank debt concentration). Our results in Proposition 4 are not influenced by whether or not the bailouts are priced fairly.

Consequently, the probability of a financial crisis with bailouts is higher relative to bank debt financing with no bailouts due to the bank debt concentration effect (Proposition 4). Corollary 1 provides an expression for the probability of a financial crisis with bailouts.

Corollary 1 (Bailout-induced financial crisis):

The probability of financial crisis with bailouts is higher than the probability of financial crisis without bailouts.

Proof: The probability of a financial crisis with bailouts is given by:

$$\phi_b^+ = \frac{1}{2}(1-q_1^F)^2(1-q_2^F)\rho_{\max}, \tag{18}$$

which is clearly greater than ϕ_b in Eq. (13).

■

Our results show that although bailouts play a role in mitigating the negative effect of a financial crisis after it happens, the possibility that there may be a bailout in the financial crisis state provides incentives to banks to concentrate their loans in specific sectors leading to a higher probability of a financial crisis. Taking this into account, we propose a tax structure on bank cash flows that retains the *ex post* benefits of bailouts without the *ex ante* incentive distortions.

Our analysis shows that it is possible to have concentration of bank loans in the absence of other risks, such as currency risks, and unhedged foreign exchange positions, purely from the incentive effects that we model here. However, since currency risk has played a major role in the more recent financial crises, such as the Argentinean, Brazilian, Russian, and the Asian financial crises, we do consider it (in Section 4.2) as a special case of our model. Specifically, we examine whether or not currency risk aggravates the root cause of a financial crisis, namely the degree of economic specialization. We also show that it is possible (based on our arguments) to have a financial crisis in several countries at the same time (financial contagion) when the countries are linked through a common shock, such as those in a currency union (e.g., Euro zone).

3. Solution mechanism

The probability of a financial crisis is increasing in the degree of economic specialization as well as the riskiness of the implemented investment policies. A possible solution could have been for all firms and all banks to be fully financed with equity. However, there are several problems why such a solution is not easy to implement since internal equity is limited (due to entrepreneurial wealth constraints), and external equity and external bond markets are not well developed in many emerging markets due to reasons such as low level of investor protection, high levels of ownership concentrations, and the associated expropriation of minority shareholders (also see Section 2.4). Consequently, bank debt is the primary form of external financing in many emerging markets.

The solution mechanism that we propose aims to reduce the negative effects of bank financing (and debt financing in general) while retaining the positive effects of increased external financing. That is, it eliminates the bank debt concentration effect and the leverage effect, while preserving the financial access effect. With this end in view, we propose a novel tax structure that simultaneously eliminates the bank debt concentration effect and the risk shifting incentives in the managerial investment decision (leverage effect). The specific details of our solution mechanism and the effectiveness are presented below in Proposition 5.

We propose a system of progressive taxation for the corporate sector (to eliminate the leverage effect), and the banking sector (to eliminate the bank debt concentration effect). Our tax structure for the corporate sector can be implemented in a manner very close to the existing scheme of corporate taxation with the following features: (1) tax deductibility of payments to creditors (denoted by F_i), (2) a specified amount of additional deduction, i.e., a tax holiday, similar to non-debt tax shields, such as depreciation (denoted by λ_i), and (3) normal taxation, τ of unshielded profits. The amount of deduction allowed in (2), i.e., λ_i, will be endogenously derived as a function of the promised payment, i.e., F_i, and the firms' investment opportunities. Our proposed tax structure for the banking

sector is a tax rate t on the bank cash flows when the banks receive the full promised payment (i.e., F_i), i=1,2.

Proposition 5 (Incentive alignment in the corporate and banking sectors):

A tax system characterized by a marginal corporate tax rate τ, and a tax deductible amount $F + \lambda_i$ where τ and λ_i are related as follows: $\lambda_i = \frac{(1-\tau)}{\tau}\{F - L_i\}$, leads to value maximizing investment policies $\{q_1^e, q_2^e\}$ with zero agency costs in the corporate sector. A tax system characterized by a tax rate $t \geq t_{bc} = \left(\frac{F_1 + F_2 - L_1 - L_2}{F_1 + F_2}\right)$ paid by the banks only when they receive the full promised payment from the corporate sector induces banks to achieve the minimal degree of economic specialization, i.e., $\rho = \rho_{\min}$.

Proof: We present the proof in two stages.

First stage (corporate sector): Under the specified tax system firms' equity-holders will invest in the risky project for all $q \geq q^F(\tau, \lambda_i)$, where $q^F(\tau, \lambda_i)$ is given by:

$$q^F(\tau,\lambda_i)\{(H_i - F_i) - \tau(H_i - F_i - \lambda_i)\} = \{(I_i - F_i) - \tau(I_i - F_i - \lambda_i)\}.$$

Rearranging the terms gives the following expression for $q^F(\tau, \lambda_i)$,

$$q^F(\tau,\lambda_i) = \frac{(I_i - F_i) - \tau(I_i - F_i - \lambda_i)}{(H_i - F_i) - \tau(H_i - F_i - \lambda_i)}. \tag{19}$$

For the investment policy $q^F(\tau, \lambda_i)$ to be identical to the optimal policy $\{q_i^e\}$, set the right-hand-side of Eq. (19) to the right-hand side of Eq. (2). Simplifying yields the following expression for λ_i.

$$\lambda_i = \frac{(1-\tau)}{\tau}\{F_i - L_i\}. \tag{20}$$

The tax structure (τ, λ_i) implements the pareto optimal investment policy of a firm financed with internal equity, $\{q_i^e\}$. That is, with the proposed tax system, the implemented investment policy $q^F(\tau, \lambda_i) = q_i^e$. This should imply $\rho_b = \rho_{\min}$ if there are no incentive problems in the banking sector.

Second stage (banking sector): We know from Proposition 4 that in the presence of bailouts, banks have an incentive to go to the highest ρ possible no matter what ρ_b is. We eliminate the bank debt concentration effect by making the NPV of banks net of taxes to decrease (rather than increase) in ρ. Given such a tax structure, the banks have no incentive to go to $\rho_{\max}$ so that loans extended satisfy $\rho_b = \rho_{\min}$ as derived in the first stage of this proof. The intuition for this is a high ρ results in lower payoffs in the high state due to the tax structure forcing banks to stay at ρ_b. Formally with the proposed tax structure in place,

$$NPV_{banks} = \underset{\rho \varepsilon [\rho_{\min}, \rho_{\max}]}{\arg\max} \begin{Bmatrix} \pi_{F_1F_2}(1-t)(F_1+F_2) + \pi_{F_1L_2}(F_1+L_2) + \pi_{L_1F_2}(L_1+F_2) + \\ \pi_{L_1L_2}(L_1+L_2) + [\pi_{L_1L_2}(F_1+F_2-L_1-L_2)] \\ -B^{F_1} - B^{F_2} - \mu_1 - \mu_2 \end{Bmatrix}, \qquad (21)$$

where t is the tax rate imposed on the cash flows of the banks in the states of the world where they receives the full promised payment $(F_1 + F_2)$. The other terms are as they were defined earlier in the context of Eq. (15).

Based on Eq. (C-6) in Appendix C, Eq. (21) can be simplified to:

$$NPV_{banks} = \underset{\rho \varepsilon [\rho_{\min}, \rho_{\max}]}{\arg\max} \begin{Bmatrix} \left[1 - \frac{1}{2}\left(1-\tilde{q}_1\right)^2 + (1-\tilde{q}_2)^2\right)\right](F_1 + F_2) \\ + \left[\frac{1}{2}(1-\tilde{q}_1)^2\right](L_1 + F_2) + \left[\frac{1}{2}(1-\tilde{q}_2)^2\right](F_1 + L_2) \\ - B^{F_1} - B^{F_2} - \mu_1 - \mu_2 \\ - t(F_1 + F_2)\pi_{F_1F_2} + (F_1 + F_2 - L_1 - L_2)\pi_{L_1L_2} \end{Bmatrix}, \quad (22)$$

where $\pi_{F_1F_2}$ and $\pi_{L_1L_2}$ are derived in Appendix C [Eqns. (C-1) and (C-4)]. That is,

$$\pi_{L_1L_2} = \frac{1}{2}(1-\tilde{q}_1)^2(1-\tilde{q}_2)\rho;\ \pi_{F_1F_2} = \pi_{L_1L_2} + \left[1 - \frac{1}{2}\left\{(1-\tilde{q}_1)^2 + (1-\tilde{q}_2)^2\right\}\right].$$

Substituting them in Eq. (22) yields:

$$NPV_{banks} = \underset{\rho \varepsilon [\rho_{\min}, \rho_{\max}]}{\arg\max} \begin{Bmatrix} (1-t)\left[1 - \frac{1}{2}\left(1-\tilde{q}_1\right)^2 + (1-\tilde{q}_2)^2\right)\right](F_1 + F_2) \\ + \left[\frac{1}{2}(1-\tilde{q}_1)^2\right](L_1 + F_2) + \left[\frac{1}{2}(1-\tilde{q}_2)^2\right](F_1 + L_2) \\ - B^{F_1} - B^{F_2} - \mu_1 - \mu_2 \end{Bmatrix} \quad (23)$$
$$+ \left\{- t(F_1 + F_2)\pi_{L_1L_2} + (F_1 + F_2 - L_1 - L_2)\pi_{L_1L_2}\right\}.$$

We set the tax rate, t such that NPV in Eq. (23) is decreasing in ρ. Consequently, the lowest tax rate is based on the first-order condition (where $\frac{\partial NPV}{\partial \rho}$ equals zero) is:

$$\frac{\partial NPV}{\partial \rho} = [-t(F_1 + F_2) + (F_1 + F_2 - L_1 - L_2)]\frac{\partial \pi_{L_1L_2}}{\partial \rho} = 0 \Rightarrow t_{bc} = \left(\frac{F_1 + F_2 - L_1 - L_2}{F_1 + F_2}\right)$$

$$t_{bc} = \left(\frac{F_1 + F_2 - L_1 - L_2}{F_1 + F_2}\right) \quad (24)$$

That is a tax-rate t such that $t \geq t_{bc}$ where t_{bc} is defined in Eq. (24) achieves the desired effect of eliminating the debt concentration. This ensures $\rho_b = \rho_{\min}$.

■

Our proposed solution mechanism achieves the minimal probability of a financial crisis given that all the financially viable projects in the economy are implemented at maximal net present value. This probability of a financial crisis is characterized in Corollary 2.

Corollary 2 (Financial crisis with optimal investment):

Under the solution mechanism proposed in Proposition 5, investment is at the optimal level $\{q_i^e\}$ (i=1,2) *and the resulting probability of financial crisis is:*

$$\phi_{\min}^e = \frac{1}{2}(1-q_1^e)^2(1-q_2^e)\rho_{\min}. \tag{25}$$

Proof: Follows from Proposition 5.

■

Given the economic structure and the optimal investment policy that allows for the financing of all positive net present value projects, Eq. (25) represents the minimal probability of financial crisis achievable by investment policies $\{q_i^e\}$ (i=1,2) that maximize the value of the underlying technologies. However, $\phi_{\min}^e$ maximizes the social objective function in Eq. (14) only when χ, the *ex post* cost of a financial crisis is very low. When χ is positive, the social planner may want firms to be more conservative in their investment policies than the value maximizing investment policies $\{q_i^e\}$ (i=1,2). In this case, the social planner may provide the firms incentives, e.g., a more convex tax structure than that in Proposition 5 to induce such conservative investment policies. This conservatism, though, comes at a cost of adopting inferior (albeit, less risky) projects from an allocational standpoint, and hence could sacrifice economic growth. Thus, the severity and cost of financial crisis can hamper economic growth by making a social planner tradeoff between stabilizing economy versus maintaining a higher rate of economic growth. This could explain why some economies grow slower than others, especially those that are more vulnerable to a financial crisis.

4. Discussion of results and implementation issues

In this section we discuss the efficacy of other solution mechanisms suggested in the literature. We also discuss implementation issues relating to our proposed solution.

4.1. Efficacy of other solution mechanisms

We discuss below the mechanisms adopted by social planners and/or mechanisms proposed in the literature for managing a financial crisis. The common feature of these mechanisms is to reduce the expected cost of financial crisis (see Eq. (14)). We focus on three such mechanisms, namely loan guarantees, deposit insurance, and taxes on short-term debt. Specifically, we analyze whether they lower the probability of a financial crisis, ϕ by increasing financial access, or by mitigating the incentive problems.

4.1.1. Loan guarantees

When a government guarantees bank loans, i.e., if a corporation defaults on its loans to a bank, the government makes up for the shortfall, this could improve the financial access for the corporate sector since banks will be more willing to lend. This holds true irrespective of whether or not the loan guarantees are fairly priced. The resulting effect is one of potentially lowering ρ_b due to an increase in the supply of capital to the corporate sector. In addition, since loan guarantees are not predicated on joint failure as in bailouts (see Section 2.5), they should not create any incentives for banks to concentrate their debt. However, the leverage effect outlined in Proposition 2 remains intact, although it can be addressed in a manner similar to the tax solution in Proposition 5.

4.1.2. Deposit insurance

When a government (or an agency of the government) insures bank deposits, i.e., if a bank defaults on its deposits, the government makes up for the shortfall, the depositors receive the face value of the promised payment. The primary motivation of such a deposit insurance scheme is to avoid bank runs (see, Diamond and Dybvig, 1983). Such

a mechanism might be useful in preventing a banking crisis that further aggravates the financial crisis modeled here. However, it should be clear that a deposit insurance scheme, such as the Federal Deposit Insurance Corporation (FDIC) does not remove the root cause of a financial crisis, i.e., the degree of economic specialization.

In our framework, we have so far abstracted away from bank capital structure issues. However, if banks financed their assets (loans) with deposits, and that deposit insurance is already in place, this could potentially improve financial access for the corporate sector. This is because deposit insurance enables depositors to lend to banks with more confidence and hence increases the supply of funds available for banks to lend to the corporate sector. This can occur whether or not the deposit insurance is fairly priced. The increase in the supply of capital to the corporate sector can potentially lower ρ_b. Given the high leverage of banks, and their investment strategy, the risk of the loans that the banks make would be subject to the risk-shifting incentives at the bank level, and also the concentration of their loans in specific sectors. These distortions can be addressed through a tax solution as outlined in Proposition 5 (See, John, John, and Senbet, 1991; John, Saunders, and Senbet, 2000).

4.1.3. Taxation of short-term debt

The rationale for taxing short-term debt inflows is that it will force corporations to borrow more on the medium and long-term end of the maturity structure which are less vulnerable to an impending crisis.[26] Intuitively, proportional taxes play a role analogous to that of regulating capital. However, while capital regulation may reduce the debt induced risk-shifting incentives, it has limited effectiveness in eliminating these incentives since the payoff structure to the equity holders under proportional taxes is still a convex function of the underlying firm value, albeit has a lower slope. See, John, John, and Senbet (1991), and John, Saunders, and Senbet (2000) for formal proofs.

[26] Diamond and Rajan (2001) make an alternative argument that short-term debt is not the culprit for a financial crisis but it is the increasing illiquidity of the investment being financed (or the deteriorating credit quality of borrowers) that necessitates short-term financing. They further argue that a ban on short-term financing may precipitate a more severe crisis.

4.2. Foreign currency debt and financial contagion

In our framework, the root cause of a financial crisis is the degree of economic specialization achievable (i.e., ρ_A), and financial crisis resulting from currency instability arises as a special case of our general characterization, and it hinges on the relationship between currency instability and the underlying fundamentals (cash flows). We next show in Corollary 3 that if the currency risk is positively correlated with project risk, firms with foreign currency borrowings will have increased incentives to risk shift leading to a higher probability of a financial crisis, i.e., currency risk could exacerbate the incentive effects leading to a higher probability of a financial crisis.

Corollary 3 (Foreign currency debt and financial crisis):

The probability of a financial crisis is higher with foreign currency debt (as compared to local currency debt) when project risk and currency risk are positively correlated.

Proof: See Appendix D.

■

A direct implication of Corollary 3 is that unresolved agency problems at the micro (firm or bank) level can not only escalate into a financial crisis, but also serve as a channel for the propagation of macroeconomic shocks (such as a currency shock) among several countries resulting in a financial contagion, especially among countries linked through the common shock, such as those in a currency union (e.g., Euro zone). That is, our framework provides for a phenomenon of financial contagion characterized by: (a) an exogenous shock, such as a significant depreciation of the local currency[27], leading to a revision in priors about exchange rate dynamics, (b) an endogenous risk-taking due to

[27] In independent work, Bris and Koskinen (2002) recognize the incentive effects of a currency devaluation in a pegged-exchange rate environment. A currency devaluation is a policy implemented by the central government in their paper, likely to be induced by high leverage. Our model is fairly general and does not impose conditions such as pegged exchange rates, requirement of a high leverage or a potential currency devaluation being a strategic choice variable for a social planner. In our paper, exchange rate changes could well be reflective of the comparative advantage of the local economy versus other economies in manufacture of exporting goods as perceived by the participants of the foreign exchange market. In fact, in our model, it is possible to have a financial crisis without a currency crisis since the vulnerability of a local economy to a financial crisis is driven by the economic specialization, and debt induced risk shifting incentives, and is not predicated on the currency risk.

higher risk-shifting incentives induced by the exogenous shock, and (c) a high degree of economic specialization that can make an economy more vulnerable to a financial crisis.

4.3. Implementation issues

There are several interesting issues in implementing our somewhat unconventional solution mechanism. In our proposal, the taxes collected primarily alter the structure of the payoffs to the insiders of the corporations or banks, and thus eliminate the distortions due to debt induced risk-shifting incentives and bank debt concentration. In a system with multiple corporations or multiple banks, the proposed tax solution can be implemented on a corporation-specific and bank-specific basis rather than a "one-size fits all". Our solution is analogous to the implementation of the investment tax credit rules on an industry-specific basis, in conjunction with economy-wide corporate taxation for firms and banks as in the United States.

In practice, bailouts may be targeted towards loans of firms that are too big to fail and banks that play a key role in an economy.[28] One way to implement a bailout policy is to collect the price of the bailout *ex ante* from corporations and banks much like an insurance premium. The social planner may also consider some of the taxes collected towards defraying the cost of a bailout scheme. However, it is important to credibly communicate that the bank or the firm that chose not to participate in the bailout insurance scheme will not be bailed out *ex post* should there be a financial crisis. Thus, the tradeoff is a commitment of less financial resources by the social planner versus higher administrative costs in determining firms that are too big to fail and banks that play a key role in an economy in the targeted case vis-à-vis insuring all firms and banks.

5. Conclusions

We provide a model of incentive effects where we argue that the vulnerability of an economy to a financial crisis (defined as the joint occurrence of the low payoff state for

[28] The Long-Term Capital Management (LTCM) bailout is one such example of a recent targeted bailout. See Kho, Lee, and Stulz (2000) for evidence on the stock price effects of the LTCM crisis on U.S. banks.

all firms in an economy) arises from the interaction of the degree of economic specialization and the mode of financing of the investment opportunities. The probability of a financial crisis increases in the degree of economic specialization under several alternative definitions of what constitutes a financial crisis in our model. We show that bank debt financing (the common source of financing in emerging economies) has the beneficial effect of lowering the degree of economic specialization by increasing access to financing of investment opportunities that would not have been financed due to wealth constraints of entrepreneurs (financial access effect). However, bank debt financing introduces the well-known debt induced risk-shifting resulting in overinvestment in risky projects by corporations (leverage effect).

We analyze mechanisms commonly employed by governments in managing financial crises, with a focus on bailouts (defined as the repayment of bank debt obligations of the corporations in the event of a financial crisis). Although the direct effect of bailouts is to mitigate the negative effect of a financial crisis, the fact that bailouts are targeted towards the financial crisis state, they provide incentives for banks to concentrate their debt financing in specific sectors (bank debt concentration effect). This additional agency cost of bank financing further offsets the financial access effect above.

Our solution mechanism consists of two tax structures, one for the banking sector, and another for the corporate sector, designed to eliminate the bank debt concentration effect, and to change the *ex ante* incentives of the residual claimants in the corporate sector in the right direction by altering the structure of the after-tax cash flows. Moreover, our solution mechanism is versatile enough to handle departures from the optimal investment policy, such as a conservative investment policy that further reduces the probability of a financial crisis, albeit at the cost of sacrificing future economic growth.

The results of our paper provide several empirical and policy implications. *First*, the lower the degree of specialization of an economy, the less susceptible it is to a financial crisis. *Second*, the higher the availability of external finance, lower is the likelihood of a financial crisis provided the risk shifting incentives are contained by solution mechanism

such as the one we proposed. *Third*, higher the extent of government safety nets (e.g., explicit and implicit subsidies or bailouts), higher the debt concentration of bank loans and higher the likelihood of a financial crisis. *Finally*, our analysis shows that government safety nets should be accompanied by commensurate improvements in the incentive structure.[29]

A general implication of our analysis is to highlight the importance of appropriate regulatory and supervisory infrastructure to accompany financial liberalization. This is especially in emerging economies with a high degree of specialization because rapid economic growth and the associated international capital flows can mask their vulnerability to a financial crisis. Further, incentive problems tend to worsen during a financial crisis, but countries with sound financial systems in place can withstand financial crises[30] and financial contagion more effectively (see, Caprio 1998).

Acknowledgements

We thank the editor James Lothian, an anonymous referee, Rajesh Aggrawal, Franklin Allen, Andres Almazan, Sugato Bhattacharya, Rajesh Chakrabarti, Douglas Diamond, R. Gaston Gelos, Robert Hauswald, David Lesmond, and Raghuram Rajan for helpful comments. An earlier version of the paper entitled "The Role of Incentives in the Prevention of Financial Crises in Emerging Economies" was presented at the Western Finance Association (WFA) meetings in Vancouver, Canada, the American Finance Association (AFA) meetings in Atlanta, Georgia, the Fortis-Georgia Tech Conference on International Finance in Atlanta, Georgia, the Financial Management Association (FMA) meetings in Denver, Colorado, the McGill University Conference on Challenges and Opportunities in Global Asset Management, in Montreal, Canada, the Indiana

[29] See Johnson et al (2000) for evidence that in countries with weak corporate governance, worse economic prospects result in more expropriation by managers and a larger fall in asset prices. Also see Mitton (2002), Johnson and Mitton (2003), and Baek et al (2004) for other studies that examine the linkage between corporate governance and firm value.

[30] This is consistent with the available evidence. In particular, Cull, Senbet and Sorge (2005) provide evidence on the impact of deposit insurance on financial stability and the results hinge on the quality of regulation and rule of law. In lax regulatory and legal environments, the introduction of deposit insurance is counterproductive and destabilizing. However, in well-regulated environments, deposit insurance has the desired outcome of impacting positively on financial stability and growth.

University's Symposium on "Crisis Events in Financial Intermediation and Securities Markets", Bloomington, Indiana, the Conference on "Financial Market Development in Emerging and Transition Economics", in Hyderabad, India, the IIM/ICICI "Conference on Incentives and Emerging Markets" in Mumbai, India, Rutgers University, University of Kansas, University of Oklahoma, University of South Carolina, Securities and Exchange Commission (SEC), and Tulane University.

Appendix A (Proofs)

Proof of Lemma 1

Straightforward computation yields the probabilities associated with the outcomes H_C, I_C, and L_C as shown below.

$$P(H_C) = \int_{\tilde{q}}^{1} q dq = \frac{1}{2}(1 - \tilde{q}^2).$$

$$P(I_C) = \int_{0}^{\tilde{q}} dq = \tilde{q}.$$

$$P(L_C) = \int_{\tilde{q}}^{1} (1 - q) dq = \frac{1}{2}(1 - \tilde{q})^2.$$

Investment policy of a firm financed partly with debt

The equity holders of the representative local firm observe q at t=1 privately, and choose to invest in the risky investment if:

Appendix B (Relationship between conditional and unconditional probabilities)

This Appendix shows the relationship between conditional and unconditional probabilities for two technologies indexed 1, and 2. The unconditional probabilities $P(H_1), P(L_1), P(I_1), P(H_2), P(L_2), P(I_2)$ are based on Lemma 1. We start with defining a single conditional probability as per Eq. (4) reproduced below:

$$P(L_2 \mid L_1) = \rho.$$

We next show that the remaining conditional probabilities can be derived from ρ and the firm-level investment policies.

$$P(H_2 \mid H_1) = \rho_H ; P(L_2 \mid H_1) = (1 - \rho_H);$$
$$P(L_2 \mid L_1) = \rho; P(H_2 \mid L_1) = 1 - \rho.$$

	$P(H_2) = \frac{1}{2}(1-\tilde{q}_2^2)$	$P(I_2) = \tilde{q}_2$	$P(L_2) = \frac{1}{2}(1-\tilde{q}_2)^2$
$P(H_1) = \frac{1}{2}(1-\tilde{q}_1^2)$	$P(H_2 \mid H_1)P(H_1)$ $= \frac{1}{2}(1-\tilde{q}_1^2)(1-\tilde{q}_2)\rho_H$	$P(I_2 \mid H_1)P(H_1)$ $= P(I_2)P(H_1)$ $= \frac{1}{2}(1-\tilde{q}_1^2)\tilde{q}_2$	$P(L_2 \mid H_1)P(H_1)$ $= \frac{1}{2}(1-\tilde{q}_1^2)(1-\tilde{q}_2)(1-\rho_H)$
$P(I_1) = \tilde{q}_1$	$P(H_2 \mid I_1)P(I_1)$ $= P(H_2)P(I_1)$ $= \frac{1}{2}\tilde{q}_1(1-\tilde{q}_2^2)$	$P(I_2 \mid I_1)P(I_1)$ $= P(I_2)P(I_1)$ $= \tilde{q}_1\tilde{q}_2$	$P(L_2 \mid I_1)P(I_1)$ $= P(L_2)P(I_1)$ $= \frac{1}{2}\tilde{q}_1(1-\tilde{q}_2)^2$
$P(L_1) = \frac{1}{2}(1-\tilde{q}_1)^2$	$P(H_2 \mid L_1)P(L_1)$ $= \frac{1}{2}(1-\tilde{q}_1)^2(1-\tilde{q}_2)(1-\rho)$	$P(I_2 \mid L_1)P(L_1)$ $= P(I_2)P(L_1)$ $= \frac{1}{2}(1-\tilde{q}_1)^2\tilde{q}_2$	$P(L_2 \mid L_1)P(L_1)$ $= \frac{1}{2}(1-\tilde{q}_1)^2(1-\tilde{q}_2)\rho$

$$P(H_1 \mid H_2) = \eta_H ; P(H_1 \mid L_2) = (1 - \eta_H);$$
$$P(L_1 \mid L_2) = \eta; P(L_1 \mid H_2) = 1 - \eta.$$

	$P(H_2) = \frac{1}{2}(1-\tilde{q}_2^2)$	$P(I_2) = \tilde{q}_2$	$P(L_2) = \frac{1}{2}(1-\tilde{q}_2)^2$
$P(H_1) = \frac{1}{2}(1-\tilde{q}_1^2)$	$P(H_1 \mid H_2)P(H_2)$ $= \frac{1}{2}(1-\tilde{q}_1)(1-\tilde{q}_2^2)\eta_H$	Same as above	$P(H_1 \mid L_2)P(L_2)$ $= \frac{1}{2}(1-\tilde{q}_1)(1-\tilde{q}_2)^2(1-\eta)$
$P(I_1) = \tilde{q}_1$	Same as above	Same as above	Same as above

$P(L_1)=\frac{1}{2}(1-\tilde{q}_1)^2$	$P(L_1 \mid H_2)P(H_2)$ $=\frac{1}{2}(1-\tilde{q}_1)(1-\tilde{q}_2^2)(1-\eta_H)$	Same as above	$P(L_1 \mid L_2)P(L_2)$ $=\frac{1}{2}(1-\tilde{q}_1)(1-\tilde{q}_2)^2\eta$

We next show that ρ_H, η, η_H can each be expressed in terms of ρ. This facilitates inferences based on a single parameter ρ, which we refer to as the index of economic specialization. We obtain this by solving the following four equations which result from equivalence of the joint probabilities (based on Bayes Rule):

$$\frac{1}{2}(1-\tilde{q}_1^2)(1-\tilde{q}_2)\rho_H = \frac{1}{2}(1-\tilde{q}_1)(1-\tilde{q}_2^2)\eta_H \quad \text{(B-1)}$$

$$\frac{1}{2}(1-\tilde{q}_1^2)(1-\tilde{q}_2)(1-\rho_H) = \frac{1}{2}(1-\tilde{q}_1)(1-\tilde{q}_2)^2(1-\eta) \quad \text{(B-2)}$$

$$\frac{1}{2}(1-\tilde{q}_1)^2(1-\tilde{q}_2)(1-\rho) = \frac{1}{2}(1-\tilde{q}_1)(1-\tilde{q}_2^2)(1-\eta_H) \quad \text{(B-3)}$$

$$\frac{1}{2}(1-\tilde{q}_1)^2(1-\tilde{q}_2)\rho = \frac{1}{2}(1-\tilde{q}_1)(1-\tilde{q}_2)^2\eta \quad \text{(B-4)}$$

We simplify the above equations to be:

$$(1+\tilde{q}_1)\rho_H = (1+\tilde{q}_2)\eta_H \quad \text{(B-1S)}$$

$$(1+\tilde{q}_1)(1-\rho_H) = (1-\tilde{q}_2)(1-\eta) \quad \text{(B-2S)}$$

$$(1-\tilde{q}_1)(1-\rho) = (1+\tilde{q}_2)(1-\eta_H) \quad \text{(B-3S)}$$

$$(1-\tilde{q}_1)\rho = (1-\tilde{q}_2)\eta \quad \text{(B-4S)}$$

Adding (B-2S) and (B-4S) and rearranging terms, we get:

$$(1+\tilde{q}_1)(1-\rho_H)+(1-\tilde{q}_1)\rho=(1-\tilde{q}_2)\Rightarrow\rho_H=\frac{1}{(1+\tilde{q}_1)}\left[(1-\tilde{q}_1)\rho+(\tilde{q}_1+\tilde{q}_2)\right] \quad \text{(B-5)}$$

Clearly, ρ_H is increasing in ρ. Since $0\le\rho\le1$, it follows that:

$$\rho_H\in\left[\left(\frac{\tilde{q}_1+\tilde{q}_2}{1+\tilde{q}_1}\right),\left(\frac{1+\tilde{q}_2}{1+\tilde{q}_1}\right)\right]. \quad \text{(B-6)}$$

Without loss of generality, we assume that

$$q_2\le q_1 \quad \text{(B-1A)}$$

such that ρ in (B-6) satisfies $0\le\rho_H\le1$.

Next, rearranging (B-1S) and substituting (B-5) yields:

$$(1+\tilde{q}_1)\rho_H=(1+\tilde{q}_2)\eta_H\Rightarrow\eta_H=\left(\frac{1+\tilde{q}_1}{1+\tilde{q}_2}\right)\rho_H=\frac{1}{(1+\tilde{q}_2)}[(1-\tilde{q}_1)\rho+(\tilde{q}_1+\tilde{q}_2)]. \quad \text{(B-7)}$$

Again, η is increasing in ρ. Since $0\le\rho\le1$, it follows that:

$$\eta_H\in\left[\left(\frac{\tilde{q}_1+\tilde{q}_2}{1+\tilde{q}_1}\right),1\right]. \quad \text{(B-8)}$$

Based on (B1-A), it follows that $0\le\eta_H\le1$.

Finally, based on (B-4S), we obtain:

$$(1-\tilde{q}_2)\eta=(1-\tilde{q}_1)\rho\Rightarrow\eta=\frac{(1-\tilde{q}_1)}{(1-\tilde{q}_2)}\rho. \quad \text{(B-9)}$$

Once again, η is increasing in ρ. Since $0 \le \rho \le 1$, it follows that:

$$\eta \in \left[0, \left(\frac{1-\tilde{q}_1}{1-\tilde{q}_2}\right)\right]. \tag{B-10}$$

and it follows from (B1-A) that $0 \le \eta \le 1$.

Appendix C (Unconditional probabilities of bank payoffs)

We define $\pi_{L_1L_2}$, $\pi_{L_1F_2}$, $\pi_{F_1L_2}$ and $\pi_{F_1F_2}$ as the probability that a bank receives the first subscripted amount from firm 1 and the second subscripted amount from firm 2 in lieu of the promised payment of F_1 and F_2 respectively at t=2. For example, $\pi_{L_1L_2}$ is the probability that a bank receives L_1 from firm 1 and L_2 from firm 2 at t=2.

From Appendix B, it should be clear that:

$$\pi_{L_1L_2} = \frac{1}{2}(1-\tilde{q}_1)^2(1-\tilde{q}_2)\rho \tag{C-1}$$

$$\begin{aligned}\pi_{L_1F_2} &= \frac{1}{2}(1-\tilde{q}_1)^2(1-\tilde{q}_2)(1-\rho) + \frac{1}{2}(1-\tilde{q}_1)^2\tilde{q}_2 \\ &= \frac{1}{2}(1-\tilde{q}_1)^2 - \pi_{L_1L_2}\end{aligned} \tag{C-2}$$

Substituting $(1-\rho_H)$ from Eq. (B-5) in Appendix B, and rearranging terms yields:

$$
\begin{aligned}
\pi_{F_1L_2} &= \frac{1}{2}(1-\tilde{q}_1^2)(1-\tilde{q}_2)(1-\rho_H) + \frac{1}{2}\tilde{q}_1(1-\tilde{q}_2)^2 \\
&= \frac{1}{2}(1-\tilde{q}_1^2)(1-\tilde{q}_2)\left(\frac{(1-\tilde{q}_2)-(1-\tilde{q}_1)\rho}{(1+\tilde{q}_1)}\right) + \frac{1}{2}\tilde{q}_1(1-\tilde{q}_2)^2 \\
&= \frac{1}{2}(1-\tilde{q}_1)(1-\tilde{q}_2)^2 + \frac{1}{2}\tilde{q}_1(1-\tilde{q}_2)^2 - \pi_{L_1L_2} \\
&= \frac{1}{2}(1-\tilde{q}_2)^2 - \pi_{L_1L_2}.
\end{aligned}
\tag{C-3}
$$

Substituting ρ_H from Eq. (B-7) in Appendix B, and rearranging terms yields:

$$
\begin{aligned}
\pi_{F_1F_2} &= \frac{1}{2}(1-\tilde{q}_1^2)(1-\tilde{q}_2)\rho_H + \frac{1}{2}(1-\tilde{q}_1^2)\tilde{q}_2 + \frac{1}{2}\tilde{q}_1(1-\tilde{q}_2^2) + \tilde{q}_1\tilde{q}_2 \\
&= \frac{1}{2}(1-\tilde{q}_1)(1-\tilde{q}_2)\left[(1-\tilde{q}_1)\rho + (\tilde{q}_1+\tilde{q}_2)\right] + \frac{1}{2}(1-\tilde{q}_1^2)\tilde{q}_2 + \frac{1}{2}\tilde{q}_1(1-\tilde{q}_2^2) + \tilde{q}_1\tilde{q}_2 \\
&= \frac{1}{2}(1-\tilde{q}_1)^2(1-\tilde{q}_2)\rho + \frac{1}{2}(1-\tilde{q}_1)(1-\tilde{q}_2)(\tilde{q}_1+\tilde{q}_2) + \frac{1}{2}(1-\tilde{q}_1^2)\tilde{q}_2 + \frac{1}{2}\tilde{q}_1(1-\tilde{q}_2^2) + \tilde{q}_1\tilde{q}_2 \\
&= \pi_{L_1L_2} + \frac{1}{2}\left\{2q_1 + 2q_2 - q_1^2 - q_2^2\right\} \\
&= \pi_{L_1L_2} + \frac{1}{2}\left\{2-(1-\tilde{q}_1)^2 - (1-\tilde{q}_2)^2\right\} \\
&= \pi_{L_1L_2} + \left[1 - \frac{1}{2}\left\{(1-\tilde{q}_1)^2 + (1-\tilde{q}_2)^2\right\}\right].
\end{aligned}
\tag{C-4}
$$

It is easy to see that the four probabilities in (C-1) thru (C-4) add up to one. That is,

$$
\pi_{L_1L_2} + \pi_{L_1F_2} + \pi_{F_1L_2} + \pi_{F_1F_2} = 1. \tag{C-5}
$$

It is to be noted that absent any external effects, such as bailouts and taxes, the present value to the bank (which we refer to as base-case) is independent of ρ. That is,

$$
\begin{aligned}
PV_{base-case} &= \left\{ \begin{array}{l} \pi_{F_1F_2}(F_1+F_2)+\pi_{F_1L_2}(F_1+L_2)+\pi_{L_1F_2}(L_1+F_2)+ \\ \pi_{L_1L_2}(L_1+L_2) \end{array} \right\} \\
&= \left\{ \begin{array}{l} \pi_{L_1L_2}\left[(F_1+F_2)-(F_1+L_2)-(L_1+F_2)+(L_1+L_2)\right] \\ +\left[1-\frac{1}{2}\left(1-\tilde{q}_1\right)^2+(1-\tilde{q}_2)^2\right)\right](F_1+F_2) \\ +\left[\frac{1}{2}(1-\tilde{q}_1)^2\right](L_1+F_2)+\left[\frac{1}{2}(1-\tilde{q}_2)^2\right](F_1+L_2) \end{array} \right\} \qquad \text{(C-6)} \\
&= \left\{ \begin{array}{l} \left[1-\frac{1}{2}\left(1-\tilde{q}_1\right)^2+(1-\tilde{q}_2)^2\right)\right](F_1+F_2) \\ +\left[\frac{1}{2}(1-\tilde{q}_1)^2\right](L_1+F_2)+\left[\frac{1}{2}(1-\tilde{q}_2)^2\right](F_1+L_2) \end{array} \right\}.
\end{aligned}
$$

Appendix D (Proof of Corollary 3)

We extend our model in Section 2 in two ways: (1) The face value of the debt, $F_i^{\$}$ is denominated in foreign currency (say, in U.S. dollars), (2) We assume the following simple dynamics for the exchange rate process. The current exchange rate e_0 can go up to e_L or go down to e_H where $e_H < e_0 < e_L$.[31] e_H denotes an appreciation of the local currency and e_L denotes a depreciation of the local currency. Also assume P(e_H) = π and P(e_L) = 1- π. Depending on the nature of the projects of the firms and their exposure to foreign exchange risk, the success state (i.e., higher payoff state) of the firm technology will be correlated to some degree with a favorable movement in the exchange rate. For simplicity in modeling we assume P($e_H \mid H_i$) = P($e_L \mid L_i$) = ρ_x and P($e_H \mid L_i$) = P($e_L \mid H_i$) = 1- ρ_x for i = 1,2. When $\rho_x \in [\pi,1]$, the project outcomes and the exchange rate outcomes are positively correlated. The experiences from recent financial crises suggest that the project outcomes and the exchange rate outcomes are positively correlated. Further, given our assumption of a zero riskless interest rate and the current

[31] The exchange rate is specified in units of the local currency that are required to buy one U.S. dollar. We normalize the current exchange rate e_0 to be 1.

exchange rate, it follows that the promised payment in the local currency, F_i and in the foreign currency, $F_i^{\$}$ are related in the following manner:

$$F_i = F_i^{\$} e_0.$$

Now the equity holders of firm i take into account the dynamics of the exchange rate (and hence the expected promise payment on their debt) in determining their investment policy. Given that the debt is denominated in U.S. dollars, the promised payment on the debt in equivalent local currency in the high payoff state will be different from that in the low payoff state. The conditional expected value of the promised payment in the high payoff state will be

$$F_i^H = F_i^{\$}[\rho_x e_H + (1-\rho_x)e_L]$$

and in the low payoff state will be

$$F_i^L = F_i^{\$}[(1-\rho_x)e_H + \rho_x e_L].$$

The equity holders of representative local firm i observe q_i at t=1 privately, and choose to invest in the risky investment if:

$$q_i[H_i - F_i^H] \geq [I_i - F_i^{\$}] \Rightarrow q_i \geq q_i^{F\$} = \frac{I_i - F_i^{\$}}{H_i - F_i^H}. \qquad \text{(D-1)}$$

$\{q_i^{F\$}\}$ characterizes the investment policy of firm i with foreign currency debt.

Where both firms are financed partly with debt denominated in foreign currency, e.g., U.S. dollars, and the remaining with equity, the probability of a financial crisis is:

$$P(\textit{Financial Crisis}; \textit{Fcy Debt}) = \frac{1}{2}(1-q_1^{F\$})^2(1-q_2^{F\$})\rho. \qquad \text{(D-2)}$$

where $\{q_1^{F\$}\}$ and $\{q_2^{F\$}\}$, the investment policies of firms 1 and 2 are defined as follows (see D-1 above):

$$q_1^{F\$} = \frac{I_1 - F_i^{\$} e_0}{H_1 - F_i^{\$}[\rho_x e_H + (1-\rho_x)e_L]}; \quad q_2^{F\$} = \frac{I_2 - F_i^{\$} e_0}{H_2 - F_i^{\$}[\rho_x e_H + (1-\rho_x)e_L]}. \qquad \text{(D-3)}$$

where the face value of the debt, $F_i^{\$}$ is debt of firm i denominated in a foreign currency (say, in U.S. dollars), the current exchange rate e_0 (in units of local currency per U.S. dollar) can go up to e_L or go down to e_H where $e_H < e_0 < e_L$ as shown below:

$$\pi e_H + (1-\pi)e_L = e_0. \qquad \text{(D-4)}$$

where $P(e_H) = \pi$ and $P(e_L) = 1-\pi$, $P(e_H \mid H_i) = P(e_L \mid L_i) = \rho_x$ and $P(e_H \mid L_i) = P(e_L \mid H_i) = 1-\rho_x$ for i = 1,2.

Using Eqns. (D-3) and (D-4), $\rho_x > \pi \Rightarrow \rho_x e_H + (1-\rho_x)e_L < e_0 \Rightarrow q_i^{F\$} < q_i^F$. This implies that the probability of a financial crisis with foreign currency (i.e., Eq. (D-2)) is higher than the probability of a financial crisis with local currency debt (i.e., Eq. (10).

References:

Allen, F., Gale, D., 1998. Optimal financial crises. Journal of Finance 53(4), 1245-1284.

Allen, F., Gale, D., 2000. Financial contagion. Journal of Political Economy 108(1), 1-33.

Barnea, A., Haugen, R. A., Senbet, L. W., 1985. Agency problems and financial contracting. Prentice-Hall, Englewood Cliffs, NJ.

Baek, J. S., Kang, J. K., Park, K. S., 2004. Corporate governance and firm value: evidence from the Korean financial crisis. Journal of Financial Economics 71(2), 265-313.

Bhattacharya, U., 2003. Optimal design of ponzi schemes in finite economies. Journal of Financial Intermediation 12(1), 2-24.

Billett, M., Flannery, M., Garfinkel, J., 1995. The effect of lender identity on a borrowing firm's equity return. Journal of Finance 50(2), 699-718.

Bordo, M. D., Eichengreen, B., Klingebiel, D., Martinez-Peria, M. S., 2001. Is the crisis problem growing more severe? Economic Policy 16(32), 51-82.

Bordo, M. D., Schwartz, A. J., 1999. Under what circumstances, past and present, have international rescues of countries in financial distress been successful? Journal of International Money and Finance 18(4), 683-708.

Boyd, J., Prescott, E., 1986. Financial intermediary coalitions. Journal of Economic Theory 38(2), 211-32.

Bris, A., Koskinen, Y., 2002. Corporate leverage and currency crises. Journal of Financial Economics 63(2), 275-310.

Calomiris, C., Gorton, G., 1991. The origins of banking panics: models, facts, and bank regulation. In: Hubbard, G. (Ed.), Financial Markets and Financial Crises. University of Chicago Press, Chicago, IL.

Caprio, G., Jr., 1998. Banking on crisis: expensive lessons from recent financial crises.In: Kaufman, G. (Ed.), Bank Crises: Causes, Analysis and Prevention, Jai Press, London, United Kingdom.

Chen, Y., Hasan, I., 2005. Why do bank runs look like panic? a new explanation. Unpublished Working Paper, Rensselaer Polytechnic Institute, Troy, NY.

Corsetti, G., Pesenti, P., Roubini, N., 1999. What caused the Asian currency and financial crisis? Japan and the World Economy 11(3), 305-373.

Cull, R., Senbet L. W., Sorge, M., 2005. Deposit insurance and financial development. Journal of Money, Credit and Banking 37(1), 43-82.

Diamond, D. W., 2004. Committing to commit: short-term debt when enforcement is costly. Journal of Finance 59(4), 1447-1479.

Diamond, D.W., Dybvig, P. H., 1983. Bank runs, deposit insurance, and liquidity. Journal of Political Economy 91(3), 401-419.

Diamond, D.W., Rajan, R. G., 2001. Banks, short term debt and financial crises: theory, policy implications and applications. Carnegie Rochester Conference Series on Public Policy 54(1), 37-71.

Dwyer, G.P., Hasan, I., 2007. Suspension of payments, bank failures, and the non-bank public's losses. Journal of Monetary Economics 54(2), 565-580.

Francis, B.B., Hasan, I., Hunter, D.M., 2002. Emerging market liberalization and the impact on uncovered interest rate parity. Journal of International Money and Finance, 21(6), 931-956.

Gabaix, X., 2005. The granular origins of aggregate fluctuations. Unpublished Working Paper, Massachusetts Institute of Technology, Cambridge, MA.

Gorton, G., Pennacchi, G., 1990. Financial intermediaries and liquidity creation. Journal of Finance, 45(1), 49-71.

Gorton, G., Winton, A., 2003. Financial intermediation. In: Constantinides, G. M., Harris, M., Stulz, R.(Eds.), Handbook of the Economics of Finance Vol 1A. Elsevier, North Holland, Amsterdam, The Netherlands.

Green, R., 1984. Investment incentives, debt, and warrants. Journal of Financial Economics 13(1), 115-136.

Grossman, S. J., Hart, O. D.,1986. The costs and benefits of ownership: a theory of vertical and lateral integration. Journal of Political Economy 94(4), 691-719.

Harris, M., Raviv, A., 1989. The design of securities. Journal of Financial Economics 24(2), 255-287.

Hart, O., Moore, J., 1998. Default and renegotiation: a dynamic model of debt. Quarterly Journal of Economics 113(1), 1-41.

James, C. M., 1987. Some evidence on the uniqueness of bank loans. Journal of Financial Economics 19(2), 217-235.

Jensen, M., Meckling, W., 1976. Theory of the firm: managerial behavior, agency costs and ownership structure. Journal of Financial Economics 3(4), 305-360.

John, K., 1987. Risk-shifting incentives and signalling through corporate capital structures. Journal of Finance 42(3), 623-641.

John, K., John, T. A., Senbet, L. W., 1991. Risk-Shifting incentives of depository institutions: a new perspective on federal deposit insurance reform. Journal of Banking and Finance 15(4-5), 895-915.

John, K., Saunders, A., Senbet, L. W., 2000. A theory of bank regulation and management compensation. Review of Financial Studies 13(1), 95-125.

John, K. and L. W. Senbet, 1991, Limited liability, tax liability of corporate debt, and public policy. Unpublished Working Paper, New York University, New York, NY.

Johnson, S., Mitton, T., 2003. Cronyism and capital controls: evidence from Malaysia. Journal of Financial Economics 67(2), 351-382.

Johnson, S., Boone, P., Breach, A., Friedman, E., 2000. Corporate governance in the Asian financial crisis. Journal of Financial Economics 58(1-2), 141-186.

Kaminsky, G. L., Reinhart, C. M., 1999. The twin crises: the causes of banking and balance-of-payments problems. American Economic Review 89(3), 473-500.

Kho, B. C., Lee, D., Stulz, R. M, 2000. U.S. banks, crises, and bailouts: from Mexico to LTCM. American Economic Review 90(2), 28-31.

Kodres, L. E., Pritsker, M., 2002. A rational expectations model of financial contagion. Journal of Finance 57(2), 769-799.

La Porta, Lopez-De-Silanes, R. F., Shleifer, A., Vishny, R. W., 1998. Law and finance. Journal of Political Economy 106(6), 1113-1155.

La Porta, Lopez-De-Silanes, R. F., Shleifer, A., Vishny, R. W., 1997. Legal determinants of external finance. Journal of Finance 52(3), 1131-1150.

Myers, S., 1977. Determinants of corporate borrowing. Journal of Financial Economics 5(2), 147-175.

O'Hara, M., Shaw, W., 1990. Deposit insurance and wealth effects: the value of being "too big to fail". Journal of Finance 45(5), 1587-1600.

Penas,M. F., Unal, H., 2004. Gains in bank mergers: evidence from the bond markets. Journal of Financial Economics 74(1), 149-179.

Petersen, M., 1999. Banks and the role of lending relationships: Evidence from the U.S. experience. Rassegna Economica 63(1), 37-61.

Radelet, S., Sachs, J., 1998. The onset of the East Asian financial crisis. NBER Working Paper no. 6680, Cambridge, MA.

Ramakrishnan, R., Thakor, A., 1984. Information reliability and a theory of financial intermediation. Review of Economic Studies 51(3), 415-432.

Rajan, R., Zingales, L., 1998. Debt, folklore, and cross-country differences in financial structure. Journal of Applied Corporate Finance 10(4), 102-107.

Mitton, T., 2002. A Cross-Firm analysis of the impact of corporate governance on the East Asian financial crisis. Journal of Financial Economics 64(2), 215-241.

Winton, A., 2000. Don't put all your eggs in one basket? Diversification and specialization in lending. Unpublished Working Paper, University of Minnesota, Minneapolis, MN.

Figure 1

Interactions between the main players in the model