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The Link Between Incomplete Information on the Interbank Network and Counterparty Risk

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Abstract

This paper describes a model in which a network of interbank loans leads to a severe amplification of the previously unanticipated insolvency of one bank. Banks that cannot rule out an indirect hit react by selling assets and hoarding liquidity. While this potentially lowers illiquidity risks, it depresses market liquidity and prices. This leads to a negative externality by which sales to acquire liquidity simultaneously lead to lower global sale proceeds and thus to a greater number of insolvencies inducing deadweight losses. Thus, the distribution of information on the network has a direct impact on welfare by itself.

Der Zusammenhang zwischen unvollständigen Informationen über das Banknetzwerk und Adressenausfallrisiken

Zusammenfassung

In dieser Arbeit wird ein Modell betrachtet, in dem das Netzwerk aus Interbankenkrediten die Folgen der unerwarteten Insolvenz einer einzelnen Bank drastisch verstärkt. Banken, die indirekte Verluste nicht ausschließen können, reagieren mit dem Verkauf von Vermögenswerten und dem Horten von Liquidität. Dies führt zwar potenziell zu einer Senkung der Illiquiditätsrisiken, drückt aber die Marktliquidität und Preise. Es kommt zu einem negativen externen Effekt, da die Verkäufe zur Liquiditätsbeschaffung gleichzeitig zu geringeren Verkaufserlösen und damit zu einer größeren Anzahl von Insolvenzen, die Wohlfahrtsverluste mit sich bringen, führen. Demnach hat die Informationsverteilung im Bankennetzwerk einen direkten Einfluss auf die Wohlfahrt.

Keywords: Banks, Cash-In-The-Market Pricing, Counterparty Risk, Incomplete Information, Liquidity

JEL-Classification: G01, G11, G21, G33

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I. Introduction

The bankruptcy of Lehman Brothers on September 15, 2008 is widely seen as the origin of the great recession of the following years and although the role of the subprime market in the United States is well documented, the propagation of tremors in this relatively small and national market to a global crisis is still debated. The question on researchers' minds was well posed by *Blanchard* (2009): "How could such a relatively limited and localized event […] have effects of such magnitude on the world economy?". This is a question that occupied economic research for a long time. Essentially, it is the question of how shocks to the banking system reinforce themselves and spread from one institution to the next.

Due to their unique position in the economy, banks are subject to specific risks that lie at the heart of this contagion whenever liquidity is scarce. As they engage in liquidity and maturity transformation, the withdrawal of short term financing can severely impair banks when assets cannot be liquidated at fair value and sources of fresh capital dry up. Many different aspects of this scarcity have been analyzed in the past: *Diamond/Dybvig* (1983) demonstrate the existence of purely expectations based bank run equilibria if projects are terminated and present value is lost in the intermediate period. Although their model is geared towards depositors, its insights hold true for many kinds of financial intermediaries, as *Adrian/Shin* (2008) show for financiers whose lending is restrained through risk measures or Morris/Shin (2004) who employ traders' daily loss limits in a similar fashion. *Shleifer/Vishny* (1992) and *Kiyotaki/Moore* (1997) use restrictions on specialized buyers as an explanation as to why assets have to be sold to outsiders who are unwilling or unable to pay their fair value.

An environment of scarce liquidity, however, is a systemic phenomenon and many of these models are not focused on explaining why no other financiers exist that are willing to lend to fundamentally solvent banks or carry on present value generating projects. Thus, recent models focus on the banking system as a whole and the contagious effects that exist therein. *Allen/Gale* (2000) show that interbank loans can serve as insurance against liquidity shocks if aggregate liquidity is plentiful, yet propagate shocks if it is not. This is often referred to as the domino model of shock propagation: if a bank's debtors fail, it itself may become insolvent and in turn impair its creditors and banks fall like dominos. Insightful related models are presented by *Brusco/Castiglionesi* (2007), *Freixas/Parigi/Rochet* (2000) or *Dasgupta* (2004). However, due to the absence of widespread insolvency cases during financial crises, the focus has recently shifted to another link between banks: the similarity of their investments. If banks all hold related asset classes, price distortions affect all banks and result in trades, especially forced sales, which depress prices and worsen distortions. Important research of this channel of contagion through market prices includes *Allen/Babus/*

Carletti (2012), in whose model diversification leads to highly similar portfolios and creditors interpreting one bank's difficulties as symptomatic of the whole banking system, as well as *Acharya/Yorulmazer* (2008), *Adrian/Estrella* (2010) or *Wagner* (2010).

This paper builds on the work of *Caballero/Simsek* (2013), who unite both aspects of contagion. In their model, banks that hold one identical asset with superior returns in the final period are linked in a circular network of short term loans, in which each bank has exactly one creditor and one debtor in the banking system. The three period model begins with the realization that one bank is hit by a hitherto unanticipated external liquidity shock that will lead to its insolvency in the intermediate period. As recalling the interbank loan is the cheapest source of capital, the affected bank will then recall its outstanding loan, which causes its debtor bank to recall its loan and so on until all interbank loans are recalled. Thus, the originally affected bank cannot raise additional liquidity in this manner and is forced to sell its asset holdings at a loss. Introducing a binary choice between selling assets or investing all cash reserves, *Cabellero/Simsek* show that, under perfect information, the circular network can deal with the external liquidity shock by transferring cash reserves to the initially affected bank and its creditors by buying their securities at fair value so that the lowest possible number of banks go bankrupt. Their analysis continues by introducing Knightean Uncertainty in the form of a maximin decision rule. This results in panic selling by all banks if they judge their insolvency likely at all.

Our paper also builds on insights of *Förster* (2016) who uses a similar set-up as *Caballero/Simsek* (2013). His work includes a numerical analysis of the introduction of risk neutral banks to demonstrate the existence of a trade-off between selling assets to lower insolvency risk and holding back assets in the hope of a favorable position in the interbank network. Furthermore, he formalizes uncertainty about a bank's structure in the interbank network by introducing a signal separating banks into a group closer to the shock and one further away. As in *Förster* (2016), we focus our analysis on a continuum of banks to facilitate the analysis. However, in this paper, we broaden the model's scope and discuss the consequences of externalities on the results to bring their relevance in a more realistic banking system into sharper focus.

We propose an adaption of the original model in which banks are separated into two distinct groups: The first group of banks can rationally expect to be close to the shock and prepare accordingly for potential contagion, whereas banks in the second group know their minimum distance α from the originally affected bank and can invest their liquid assets profitably. Empirically, there is evidence of a group of central or more interconnected banks as shown by *Liu/Quiet/Roth* (2015) for the British banking system, by *Cocco/Gomes/Martin* (2009) who distinguish big interlinked banks and smaller less connected banks and by *Furfine* (2003) who uses federal reserve transfers between banks to derive overnight lending and thereby demonstrates that many potential connections between banks are left unformed. Similar results were achieved by *Upper/Worms* (2004) who distinguish one tightly interlinked group and another group of banks that are further out in the German banking system and by *Boss* et al. (2004) who identify seven closely linked clusters in the Austrian banking system. We use these results as a basis for discerning two distinguishable types of banks that perceive, justifiably, different levels of exposure to interbank credit risk.

Our model examines how the banking system reacts to a different information structure by changing the relative size of the two groups. This also captures the intuition that panic or a large number of banks that cannot rule out indirect hits are a driving factor behind financial crises without having to resort to Knightean Uncertainty. Specifically, we demonstrate that in our setting and for a given shock, the number of insolvencies rises and welfare decreases when the number of banks that assume to be close to the failing bank increases.

In addition, we allow threatened banks to hold back some of their securities in the hope of surviving the intermediate period and collecting its superior returns in the final period. Thereby, our paper is related to a strand of literature, which deals with the liquidity choice of banks. *Acharya* et al. (2011) discern two motives for holding liquidity: protection against liquidity shortages and speculation on falling prices. Their analysis focuses on the latter. *Diamond/Rajan* (2011) demonstrate that limited liability of banks can lead to *insolvency seeking* as the precautionary motive is eliminated. *Gale/Yorulmazer* (2013) consider both motives and show that incomplete markets and liquidation costs can result in inefficient liquidity hoarding. By allowing threatened banks to also hold back their lucrative securities in the hopes of being far from the initial shock and surviving, our model incorporates both motives. This can be interpreted as a form of free riding on precautionary measures by other banks.

This trade-off between limiting insolvency risk through cash hoarding and speculating on survival by buying additional securities is, in our view, a more realistic outcome than a total sale of all assets if there is even the remotest chance of insolvency, which is the result of a maximin decision rule. However, in order to be able to introduce a as the formal group size and keep the analysis tractable, we also draw on a continuum of banks. As infinitesimally small banks have no noticeable effect on global insolvency risk, this eliminates any incentive for precautionary liquidity hoarding. Consequently, we use group-wide optimization in the following analysis, implying enforceable banking cartels as an oversimplification that nonetheless captures the essential motivations discussed above. Thus, our model allows for tractable analysis of the influence of market panic, or size of the core group of banks a, on the system as a whole. The paper is structured as follows: Section 2 describes the model. Section 3 analyzes the market equilibrium. Section 4 discusses the results and presents the conclusion.

II. Model

A continuum of banks with an aggregated equity of 1 unit in a model with a timeline of three periods is considered. The banks are part of an interbank loan network that takes the form of a circle. Particularly, banks borrow funds with a maturity in $t=1$ from one bank and lend these on to the next bank. As in *Caballero/Simsek* (2013), it is assumed that interbank loans cannot be rolled over. The aggregated initial endowment of all banks consists of y units of cash and $(1-y)$ units of a security. The security is completely illiquid in $t=1$ and has a safe pay-off of 1 in $t=2$.

At date 0, the imminent failure of a bank is revealed. In the following this bank or, more appropriately, this point of shock is referred to as b_0. Note that it is not previously clear where b_0 will be. All banks react to this information by trading in the security. It is assumed that no external buyers or sellers exist. At date 1, the banking system has to cover a senior claim of z units of cash to an external investor starting at point b_0. Insolvency spreads around the continuous circle of banks until enough liquidity has been transferred to the outsider and no further defaults on interbank debt occurs. For simplicity, we set the face value of the interbank loans connecting the network as high enough to allow for the complete transfer of the initial shock. Otherwise, the propagation of the shock would be limited to what the face value of the interbank loans allows. By way of illustration, in a discrete world, this can be interpreted as a bank that sits at b_0 being hit by a shock, which requires all its liquidity and causes its insolvency. Consequently, its creditor suffers a loss to the amount of z. If the creditor's resulting liquidity is insufficient to repay its debt in full, she also fails. The insolvencies continue until one bank can repay its debts in full. This requires the aggregated liquidity of failed banks to be equal to the shocks's face value z, which for ease of argumentation, can be set to the interbank loans face value.

The distance to b_0 is denoted by k. The maximal distance is normalized to one. Banks along the continuum do not know their exact distance k. However, they know their relative position to a specific distance a. Thus, the analysis considers two groups of banks. Specifically, one group g_1 knows it is closer than a to the initially failing bank while the other group g_2 knows it is farther away and thus relatively safe. This way of modelling aims to capture the intuition of banks having different levels of confidence in their counterparties' solvency. To this end, we use group-wide optimization in order to capture the idea of each bank having an impact on global insolvency risk, as would be the case in a discrete model.

The selling volume density is denoted by x, while p denotes the endogenous price of the security in $t=0$. By assuming that the symmetric banks of each group behave identically, the selling volume densities of each group are given by

(2.1) $$x(k)=\begin{cases}x_1,\ k\leq a\\ x_2,\ k>a\end{cases}.$$

As the security cannot be traded externally the following market clearing condition has to hold:

(2.2) $$\int_0^1 x(k)dk=0\Leftrightarrow ax_1+(1-a)x_2=0\Leftrightarrow x_2=-\frac{ax_1}{1-a}.$$

The resulting limitation of eligible buyers may lead to cash-in-the-market pricing.

It is evident that one group needs to sell $(x_i>0)$ and the other one needs to buy $(x_i<0)$. As the groups of banks are assumed to be risk-neutral they maximize their expected terminal value. The expected terminal value depends on insolvency risk and the amount of securities they hold. Selling securities increases liquidity which, in turn, decreases the risk of insolvency. However, if $p<1$, that is the security price is below its fair value, selling securities incurs costs. Thus, if only the first group g_1 is subject to insolvency risk, it is the selling group and g_2 is the buying group.

The liquidity density is denoted by $\lambda(k)$. It contains the initial cash endowment y and the payments generated by sales $p\cdot x(k)$:

(2.3) $$\lambda(k)=y+p\cdot x(k).$$

The integration of $\lambda(k)$ over a certain interval of k yields the aggregated liquidity of the corresponding subset of banks. The critical distance up to which banks become insolvent is denoted by d. It is defined as the point at which the cumulated liquidity of banks with a distance of $k\in[0;d]$ covers z:

(2.4) $$\int_0^d \lambda(x,p)dk=z.$$

Two cases have to be examined. At first, $d<a$ is considered. This means g_2 is not threatened by insolvency. In this case the critical distance is given by

(2.5) $$d(p,x_1)_{d<a}=\frac{z}{px_1+y}.$$

For $d > a$, a part of the banks in g_2 become insolvent and *(2.4)* can be written as

$$\int_0^a (y + px_1)dk + \int_a^d \left(y - p\frac{ax_1}{1-a}\right)dk = z$$

$$\Leftrightarrow d(p,x_1)_{d>a} = \frac{(1-a)z - pax_1}{(1-a)y - pax_1}. \tag{2.6}$$

Combining *(2.5)* and *(2.6)* yields the critical distance

$$d(p,x_1) = \begin{cases} \dfrac{z}{px_1 + y}, & \dfrac{z}{px_1 + y} \leq a \\ \dfrac{(1-a)z - pax_1}{(1-a)y - pax_1}, & else \end{cases}. \tag{2.7}$$

III. Market Equilibrium

Again, the case $d < a$ is analyzed first. The terminal value of a surviving bank in group 1 is given by $\pi_1(p,x_1) = y + (1-y) - x_1 + x_1 p$. Thus, the aggregated expected terminal value of g_1 amounts to

$$\Pi_1(p,x_1) = \int_d^a [1 - x_1(1-p)]dk. \tag{3.1}$$

With the help of *(3.1)* the assumption of group-wide optimization can be discussed. Note that the assumption of a continuum of banks is necessary to keep the analysis tractable. If banks were to optimize individually, the first-order condition would resolve to $\frac{\partial \pi_1}{\partial x_1} = -1 + p + x_1 \cdot \frac{\partial p}{\partial x_1}$. As in a continuum of banks a single bank's size is marginal, the effect of its trading x_1 on the critical threshold d and in turn the security's price p is zero. However, in reality, the number of banks is discrete and finite. This implies that a bank's actions have an impact on security prices, i.e. that selling will lower the price, $\frac{\partial p}{\partial x_1} < 0$. Consequently, equilibrium prices can deviate from the fair value of $p = 1$. In order to incorporate this effect into our model, we assume that banks optimize group-wide and thus take into account that by selling proactively, the price effect will lead to an increase in the number of insolvencies. This approach internalizes an externality that occurs in the course of optimization: if a bank in the first group increases its selling volume x_1 all banks in g_1 would be affected by the falling price and vice versa. However, as discussed in more detail in Section 4, the qualitative results are unchanged.

In order to determine g_1's optimal selling volume density, the derivative of Π_1 with respect to x_1 is set to zero:

$$\frac{\partial \Pi_1(p,x_1)}{\partial x_1} = -\frac{a(1-p)(px_1+y)^2-[p(1-y)+y]z}{(px_1+y)^2} = 0. \tag{3.2}$$

This yields[1]

$$x_1^* = \frac{1}{p}\left(\sqrt{\frac{[p(1-y)+y]z}{a(1-p)}} - y\right). \tag{3.3}$$

The aggregated terminal value of g_2 is given by

$$\Pi_2(p,x_2) = \int_a^1 [1-x_2(1-p)]dk = (1-a)[1-x_2(1-p)]. \tag{3.4}$$

It is evident that $\Pi_2(x_2)$ is a linear function. Its derivative with respect to x_2 amounts to

$$\frac{\partial \Pi_2(p,x_2)}{\partial x_2} = -(1-a)(1-p) < 0. \tag{3.5}$$

It follows that, if the security price is below its fair value $(p<1)$ the safe banks of g_2 buy as many securities as possible. Thus, their selling density amounts to their initial liquidity density:

$$x_2^* = -\frac{y}{p}. \tag{3.6}$$

With the market clearing condition *(2.2)* the equilibrium price is given by[2]

$$p_{IV}^* = \frac{y(y-az)}{y^2+a(1-y)z}. \tag{3.7}$$

Thus, the equilibrium x_1 amounts to

$$x_1^* = \frac{(1-a)[y^2+a(1-y)z]}{a(y-az)}. \tag{3.8}$$

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[1] Technically, as the numerator of the first-order condition is a quadratic function, two solutions exist. However, the second $x_1^* = -\frac{1}{p}\left(\sqrt{\frac{[p(1-y)+y]z}{a(1-p)}} + y\right)$ is always negative and does not satisfy the constraint $x_1 > 0$.

[2] The analysis distinguishes between four cases, each of which is denoted by the indices *I*, *II*, *III* and *IV*. These indices are ordered according to increasing values of a.

Note that g_1's aggregated selling volume cannot exceed its initial endowment of the security:

$$\int_0^a x_1^* dk \leq \int_0^a (1-y) dk. \tag{3.9}$$

This condition holds if:

$$a \geq \frac{y^2}{y - z(1-y)} \equiv a_{III}. \tag{3.10}$$

However, for smaller values of a the first group offers all its initial endowment:

$$\int_0^a (1-y) dk = -\int_a^1 x_2^* dk, \tag{3.11}$$

where the left-hand side describes g_1's initial endowment. This results in an equilibrium price of:

$$p_{III}^* = \frac{y(1-a)}{a(1-y)}. \tag{3.12}$$

Additionally, the banks in g_2 only invest all their cash in the security if the return is positive, that is if $p < 1$. For $a = y \equiv a_{II}$, $p_{III}^* = 1$. Consequently, for $a \leq a_{II}$ the buying banks only invest in the security until its equilibrium price equals 1 and retain any surplus liquidity.

The last critical threshold of a is reached when $a = d$. This means all banks in g_1 fail and parts of the shock could spill over to g_2.[3] It is given by $a = z \equiv a_I$. However, $d \geq a$ is not an equilibrium, as the banks of g_2 can increase p^* and thus lower d until $a = d$ is fulfilled and they are completely safe, which increases their expected terminal value. Analytically this can be shown with the partial derivatives of Π_2 with respect to x_2:

$$\left.\frac{\partial \Pi_2}{\partial x_2}\right|_{d>a} = -\frac{[p(1-y)+y](y-z)}{(px_2 - y)^2} < 0. \tag{3.13}$$ [4]

This means that if banks in g_2 bear insolvency risk, they minimize their selling volume density for any positive price, that is they maximize their demand

[3] In particular, this means that all banks in g_2 in the range between a and d fail. This means they have a collective terminal value of zero. Consequently, the aggregated terminal value of g_2 amounts to $\int_d^1 [1 - x_2 (1-p)] dk$.

[4] Note that y > z, which means that total liquidity is sufficient to cover the initial shock and not all banks fail.

for the security. Consequently, the security price increases, which, in turn, leads to a decrease of the critical distance d. From *(2.7)* $d(p,x_2)$ for $d > a$ is given by:

$$d(p,x_2)\big|_{d>a} = \frac{px_2 + z}{px_2 + y}. \tag{3.14}$$

Thus,

$$\frac{\partial d(p,x_2)\big|_{d>a}}{\partial x_2} = \frac{p(y-z)}{(px_2 + y)^2} > 0. \tag{3.15}$$

As a result, g_2 increases its demand until the critical distance d falls to a. Note that banks in g_2 are even willing to pay prices above the fair value in order to eliminate insolvency risk.

IV. Results

Figure 1 depicts the equilibrium selling volume density x_1^* for different ranges of a. The numerical example uses the normalized aggregated equity of 1, of which $y = 10\ \%$ is held as cash. The interbank loan amounts to $z = 0.05$, so that aggregated liquidity y is sufficient to cover the initial shock.

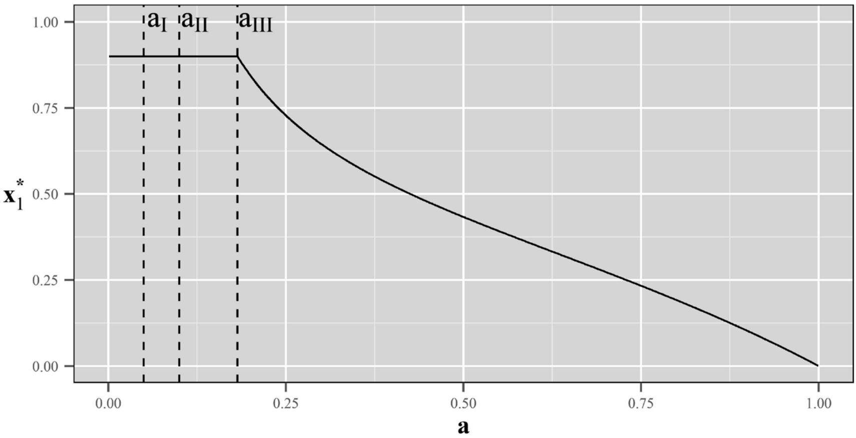

Figure 1: Equilibrium Selling Volume Density

It is evident that banks in g_1 sell all of their security holdings when $a < a_{III}$, that is g_1 is small. However, if $a > a_{III}$ some banks in g_1 survive. Thus, banks speculate on their survival and retain some of their security.

In Figure 2 the equilibrium price p^* is illustrated. A decrease in a leads to a rise in the equilibrium price as the number of buying banks increases while the

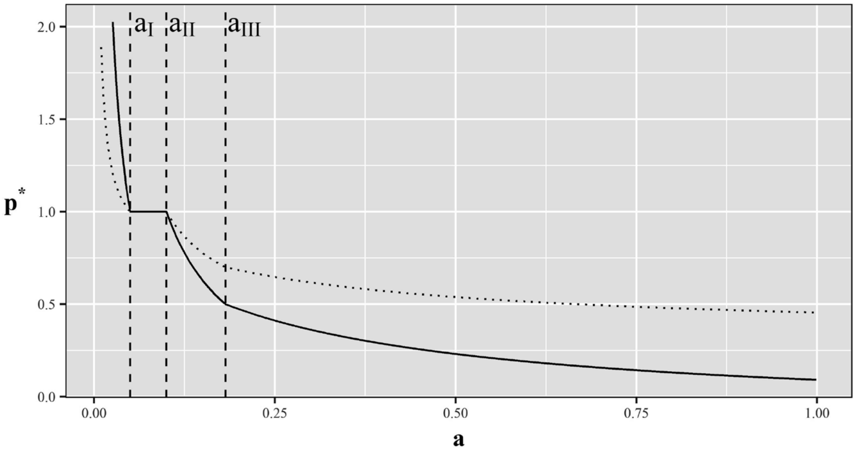

Figure 2: Equilibrium Price

number of sellers declines. For $a > a_{II}$, the banks of g_2 bear no insolvency risk. Therefore, as $p < 1$ they invest all their cash in the security. For $a_I < a < a_{II}$, the price reaches the asset's fair value and banks in g_2 hold back parts of their liquidity. Finally, for $a < a_I$, the banks of g_2 accept a price above the fair value, in order to avoid insolvency risk, which would arise for $p \leq 1$ and constitute a form of bail-out financed by the banking system.

Furthermore, the dotted line illustrates a possible (qualitative) course of the equilibrium price if the externality described in Section 3 is taken into account. In the group-wide optimization, banks consider the consequences of their price-effect for the entire group fully. In reality, banks would not take the effects their trading has on other banks' terminal values into account. As a result, for $a < a_I$ banks in g_2 would be more reluctant to invest in lowering the global insolvency risk. In the same way, for $a > a_{II}$, banks in g_1 would have a stronger incentive to speculate on their survival and accept less direct losses through asset fire sales which also benefits other banks in their group. However, the qualitative results, i. e. the direction, in which the price deviates, are unchanged.

The resulting aggregated terminal value $\Pi^* = \Pi_1^* + \Pi_2^*$ of the banking system, which can be interpreted as welfare[5], is shown in Figure 3. It can be seen that the speculation of banks in g_1 reduces welfare due to the inefficient liquidation of banks holding the security. For $a < a_{III}$ failing banks' portfolios do not contain the security. Thus, no deadweight losses occur.

The dotted line depicts a possible course if the externality is taken into account. As prices deviate less from one, the deadweight losses due to speculation

[5] It is assumed that an insolvent bank's value is zero.

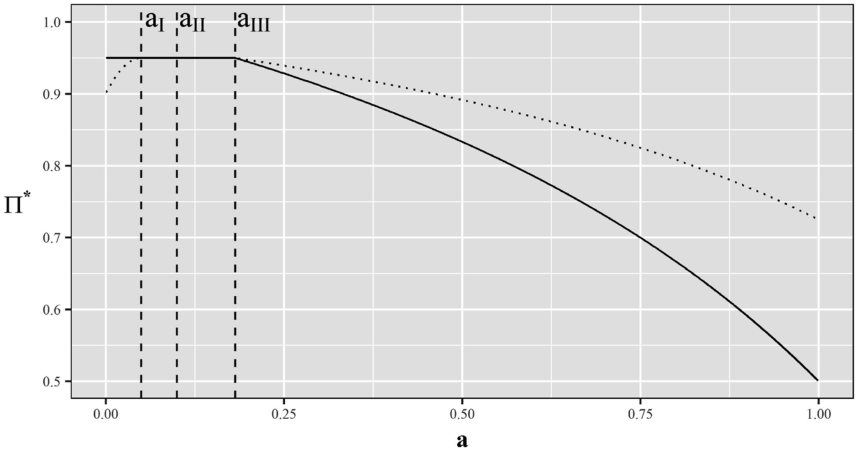

Figure 3: The Banking System's Aggregated Terminal Value

for $a > a_{III}$ decrease but still occur. On the other hand, for $a < a_I$ banks still accept prices higher than the fair value of 1, in order to reduce insolvency risk. However, in contrast to the case of group-optimization, they do not accept prices high enough to guarantee solvency for the entire group g_2. Consequently, deadweight losses occur as some banks in g_2 fail while holding some of the security. This implies that regulators should seek to reduce uncertainty in such a way that $a_I \le a \le a_{III}$. Economically, this means regulators should on the one hand discourage speculation by banks in g_1 leading to inefficient liquidations, i.e. $a > a_{III}$, and on the other hand avoid the shock to spill over to the second group, that is $a < a_I$.

Figure 4 depicts the critical threshold d. For $a > a_{II}$, a decrease in a leads to a decrease in d as the equilibrium price and the selling density x_1 increase. In the interval $a_I < a < a_{II}$ the price is constant at the fair value and the selling density is maximal. This results in a constant liquidity density. Consequently, the number of failing banks remains unchanged. For smaller values of a, all banks in g_1 fail while all banks in g_2 survive, that is $d = a$.

The dotted line represents a possible course of d if the externality is taken into account. Due to the attenuated price decrease for $a > a_{II}$ compared to the group-wide optimization, fewer banks in g_1 become insolvent. However, for $a < a_I$ the banks in g_2 do not accept prices that are high enough to guarantee solvency. Consequently, some of the banks in g_2 fail and $d > a$.

In summary, if a relatively high number of banks can rule out being hit by the shock, i.e. a is small, the high demand for the security leads to a high equilibrium price. The resulting low returns coupled with the high insolvency risk of

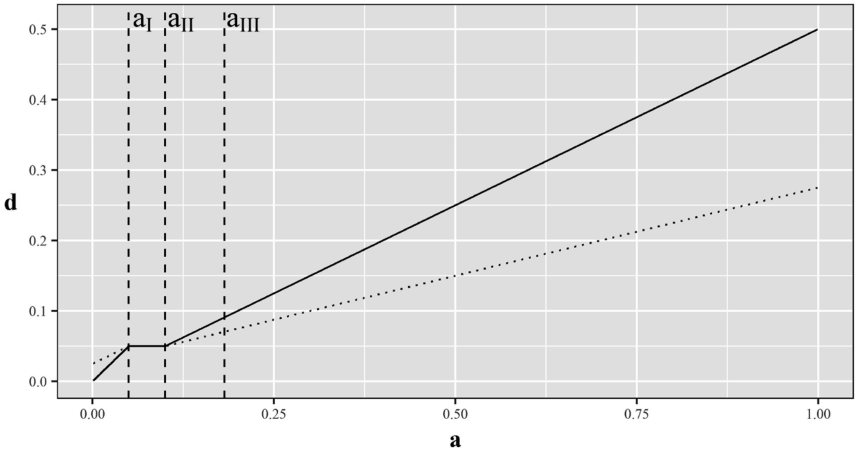

Figure 4: Critical Threshold

banks in group 1 lead to those banks not retaining any of their security holdings for speculative reasons. This can be interpreted as the benign equilibrium of *Caballero/Simsek* (2013) in which the system allocates liquidity to affected banks effectively, avoiding welfare losses and minimizing the number of insolvencies. However, due to the indistinct nature of the parameter a, this does not translate into a minimal number of insolvencies in our model.

Conversely, if many banks bear insolvency risk, the price is low, making insolvency protection expensive while a chance of survival still exists. Consequently, the large number of banks in group 1 speculates on survival and does not sell all security holdings. Thus, inefficient liquidations occur in the final period, which, in turn, lead to deadweight losses and a higher number of failing banks. Our model is able to demonstrate that a change in the information structure alone is able to exacerbate these effects.

It can be argued that the case, in which there is no certainty about future insolvency, is most relevant to today's banking system. This corresponds to $a > a_{III}$ in which the first group of banks remains partially solvent. Thus, the analysis indicates that increasing uncertainty about indirect hits in the interbank market amplifies shocks by itself. Regulators should therefore seek to reduce this uncertainty. One option would be to require banks to disclose their interbank credit relationships and to provide relevant information to the institutions concerned. This would add another focus to the reporting to central banks and regulatory bodies currently required by banks.

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