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Too Many To Fail

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1 Introduction

The recent financial crisis has brought a lot of attention to systemic risk in the banking system. The discussion is often focused on the now widely known too-big-to-fail problem, which describes how a bankruptcy of a large and highly interconnected financial institution would pose a substantial threat to the stability of the entire financial system. However, it is not only sheer size that can cause an individual bank to be of systemic importance. What also matters, possibly even more, is the nature of a bank's business strategy and its correlation with other banks. Many small banks that are exposed to the same risk factors can be systemic together because they could all fail at the same time, which would in aggregation have a large effect on the financial system. This situation is called the too-many-to-fail problem. Accordingly Acharya (2009, p. 225) "unlike most of the extant literature..." defines systemic risk as "joint failure risk arising from the correlation of returns on asset side of bank balance sheets."

Being systemic, these small institutions can expect to be bailed out just like banks that are too-big-to-fail. Acharya and Yorulmazer (2007) formally show the existence of the too-many-to-fail problem and examine its origin. Their model will be presented in detail in chapter 2. Mitchell (2001) indicates that the social cost of liquidating insolvent banks can increase drastically with the number of such banks. Empirical evidence can be found in the actions of regulators in times of crisis: Brown and Dinc (2006) conclude their study of bank failures in major emerging markets during the 1990s stating: "The paper [finds] a Too-Many-To-Fail effect: The government is less likely to take over or close a bank if other banks are also weak." (Brown and Dinc, 2006, p. 13)

The problem has also become visible in the recent crisis. For example, prior to 2007 many relatively small German banks like IKB and several Landesbanken apparently exposed themselves to very similar risk factors in creating off-balance sheet conduits to invest in American mortgage-backed securities. The model of Acharya and Yorulmazer (2007) suggests the presence of incentives for such herding because banks can capture bailout subsidies when they are failing together with many other banks. The crisis has lead to just that: Many countries had to eventually introduce general bailout mechanisms available to all banks as opposed to only saving a few big ones.

The too-many-to-fail problem gives rise to a number of considerations about the regulatory framework that is currently in effect. Specifically it highlights the importance of stronger macro-prudential regulation to better capture systemic risk. Also the large degree of discretionary power that regulators have in deciding how to resolve bank failures is an issue. These policy implication will be discussed in chapter 3. Chapter 4 then concludes the thesis.

2 The model of Acharya and Yorulmazer

In Acharya and Yorulmazer's (2007) model there are two profit-maximizing banks that interact with a welfare-maximizing regulator in discrete time, at dates $t = 0, 1, 2$. Banks finance themselves solely through deposits from risk neutral depositors that have an endowment of one unit each in $t = 0$ and $t = 1$ that they want to invest. The depositors have time additive utility functions $U = \omega_1 + \omega_2$ where ω_t is the expected wealth at time t. In both periods they chose to either deposit their endowment in their bank or to invest in an alternative investment opportunity that gives them a utility of 1 per unit that they invest in it.

Each period banks need one unit of capital to acquire a portfolio of corporate loans to a given industry sector. Depending on random business performance the firms in that corporate sector might not be able to repay the loans. It is assumed that either all of the firms in an industry can repay the loans or all of the firms default. In case of a default the recovery rate is 0. Therefore the random repayment $\widetilde{R}$ on any such loan portfolio can be expressed as

$$\widetilde{R} = \begin{cases} R & \text{with probability } \alpha_t, \\ 0 & \text{with probability } 1 - \alpha_t. \end{cases} \tag{1}$$

Note that the probability of a high return can be different in the two periods; returns are, however, assumed to be independent.

To incorporate the potential for moral hazard the model assumes bank owners have a choice to invest in a "bad" project instead (acquire a portfolio of lower quality loans), where the return in the high case is only $(R - \overline{\Delta})$ but the owners also get some sort of non-monetary benefit $B < \overline{\Delta}$. This means that to ensure that bank owners chose the (socially desirable) good project, they must have a sufficient share θ of the bank's profits, so that their expected profit from this good project is higher than from the bad alternative. This can be expressed as *incentive-compability constraint:*

$$\alpha_t \theta(R - r) \geq \alpha_t[\theta((R - \overline{\Delta}) - r) + B]. \tag{2}$$

$(R - r)$ and $(R - \overline{\Delta} - r)$ are the bank's profit margins for good and for bad projects. It is assumed here that $r < (R - \overline{\Delta}) < R$, so the bank is always able to pay the promised return of r on deposits in the high return case, irrespective of whether they chose the good or the bad project. At $t = 0$ there is no problem of moral hazard since 100% of bank profits belong to the bank owners.

There is a banking regulator in the model to resolve bank failures. A bank failure occurs when the first-period return of the bank's loan portfolio is low. The regulator tries to employ policies in such a way that the total output of the banking sector is maximized – net of any costs associated with the resolution. It can either let the surviving bank acquire the failed bank (provided the other bank did in fact survive) or it can liquidate the failed bank and sell its assets to outside investors. A third option is keeping the bank open through a bailout. Banks and depositors rationally anticipate what the regulator is going to do in each state. This will be analyzed in detail below.

If banks fail and the regulator chooses to close them, the assets are sold to outside investors. By assumption these outsiders have sufficient funds to buy banking assets but do not have the skills to manage them optimally. Therefore they cannot generate full value from these assets relative to the bank owners, provided the bank owners operate good projects. Explicitly, the return in the high state if outside investors own the assets is set to only $(R - \Delta)$. This is, however, still more than the return from a bad project, so $\overline{\Delta} > \Delta$. Acharya and Yorulmazer (2007, p. 8) point out that the idea of *asset-specificity* that they incorporate here is well known in the corporate-finance literature and that the concept is also supported empirically.[1] The literature suggests that the value of a bank as a going concern is significantly higher than the sum of its assets if liquidated. Therefore the liquidation of a bank causes a loss of social welfare. Still, if bank owners choose bad projects, the misallocation of capital and thus the social welfare loss is even bigger.

Regarding the cost incurred by the regulator to resolve a problem of failing banks, the model focuses on costs of immediately providing emergency funds. The cost function f is taken to be exogenously given and *linear* in the amount of funds x that need to be paid out with immediacy: $f(x) = ax, a > 0$. Acharya and Yorulmazer argue that "[these costs] can be linked to a variety of sources, most notably (i) distortionary effects of tax increases required to fund deposit insurance and bailouts; and (ii) the likely effect of huge government deficits on the country's exchange rate[...]". (Acharya and Yorulmazer, 2007, p. 8)

It is assumed that deposits are fully insured in the first period, so the monetary cost of taking action always includes paying off depositors. In case of a liquidation this is somewhat offset by the proceeds of selling the failed bank's assets, whereas in case of a bailout the regulator gains no such proceeds, so bailouts come with an opportunity cost for the regulator. (This means that the output of the banking sector has to be significantly higher with the bailed out bank still in operation than with its asset's managed by outsiders for the bailout to occur in the first place.) The regulator might also take an equity stake in a bank that it bails out, but that does not change the *immediacy* costs that the analysis concentrates on because bank equity does not immediately generate funds and cannot be sold/ pledged etc. in capital markets. It only influences the longterm fiscal

[1] They point to James (1991), who demonstrates the concept explicitly for banks and financial institutions.

		Same industry		Different industries	
		Bank B's return		Bank B's return	
		High (R)	*Low* (0)	*High* (R)	*Low* (0)
Bank A's return	*High* (R)	α_t	0	α_t^2	$\alpha_t(1-\alpha_t)$
	Low (0)	0	$1-\alpha_t$	$\alpha_t(1-\alpha_t)$	$(1-\alpha_t)^2$

Table 1: Joint distribution of bank returns;
source: Acharya and Yorulmazer (2007), p. 9

cost of a bailout, which will be determined by the eventual value of the regulator's equity stake. Since this longterm perspective represents only a redistribution of wealth there is no welfare effect on the economy and the regulator is indifferent in how much he wants to dilute the bank owners, as long as they keep an equity stake that is sufficiently large so that the incentive-compability constraint (equation 2) is still satisfied and banks do not chose the bad project in the future.

2.1 Correlation of bank returns

The model features two possible industries that the two banks can invest in, denoted as 1 and 2. Bank A (B) can lend to the firm A_1 (B_1) in industry 1 and A_2 (B_2) in industry 2. If both banks lend to the same industry, their returns are perfectly correlated ($\rho = 1$) because all the firms in that sector default at the same time, as mentioned above. If the banks lend to firms in different industries, correlation is assumed to be zero ($\rho = 0$). Since the return distribution for a portfolio of loans to any industry is alway $\widetilde{R}$, the individual probability of each bank failing is constant at $(1-\alpha_0)$ regardless of what sector they chose. The joint distribution depends on the bank's correlation, of course, and is given in Table 1.

So for the expected profit of a bank the identity of the industry it invests in does not matter, only the inter-bank correlation is important because the regulator's policies depend on it. The way banks react strategically to the regulator's anticipated policies is by choosing the correlation of returns with the other bank that they desire, i.e. choosing whether to invest in the same industry as the other bank or in a different industry. Let $E(\pi(\rho))$ be the expected profit of a bank. Because of the symmetry among banks they invest in the same industry if $E(\pi(1)) > E(\pi(0))$ and otherwise invest in different industries.

2.2 Optimal bank behavior

To find out what is the optimal choice of correlation for banks in $t = 0$ one needs to use backward induction, first calculating the expected profit of banks for the second period starting from each possible state of the world in $t = 1$. The possible states are: both banks survived - denoted by SS, only one bank survived - denoted by SF or FS (these cases are symmetric), or both banks failed - denoted by FF.

Both banks survived (SS): Both banks can operate for a second period. The probability for a high return in $t = 2$ is α_1 for each bank, so the expected second-period profit in this state is

$$E(\pi_2^{ss}) = \alpha_1(R - r_1^{ss}) = \alpha_1 R - 1. \tag{3}$$

The second equality uses the fact that alternative investment opportunities give depositors a utility of 1, so with risk neutrality the market for deposits clears at a promised rate r_1^{ss} so that $\alpha_1 r_1^{ss} = 1$.

Only one bank survived (SF or FS): In this case Acharya and Yorulmazer (2007, p. 11) show that it is profitable for the surviving bank to purchase the failed bank's assets and also that this sale is the optimal strategy for the regulator. The intuition behind this is that because of asset-specificity outsiders can only profitably offer a relatively low price for the failed bank's assets. The surviving bank can therefore acquire these assets at a discount of $\alpha_1\Delta$, which is the excess return it can generate through its more efficient management compared to non-banks. For the regulator, selling the assets to the surviving bank dominates selling to outsiders because the price it can get from a bank will accordingly be at least as high as from outsiders, but without creating a welfare loss: There are no misallocation costs because the assets stay in the banking system.[2] Selling to the surviving bank also dominates a bailout because by bailing out the failed bank instead of selling the assets, the regulator would simply lose the purchase price while not gaining anything in return since a sale already maximizes social welfare.

Both banks failed (FF): The regulator can either liquidate the banks and sell their assets to outsiders or bail the banks out by paying off current depositors and allow banks to operate for a second period. The regulator choses the option that maximizes the value of the expected second-period profit of banks (or banking assets in case of liquidation) – net of fiscal immediacy costs as described above. So the regulator's objective function can be expressed as

$$E(\Pi_2^{ff}) = 2E(\pi_2^{ff}) - f(x), \tag{4}$$

where $E(\pi_2^{ff})$ is the expected second-period profit of each of the two banks and $f(x)$ are the fiscal costs borne by the regulator. There are three options:

1. Both banks are bailed out: Then the total amount of funds required is $2r_0$ and the

[2] Selling to another bank at a discount is simply a transfer of wealth, but selling to outsiders at the same discount causes this wealth to be eaten up by inefficient management.

bank's expected profit is identical to the state SS, so

$$E(\Pi_2^{ff}) = 2(\alpha_1 R - 1) - a(2r_0). \tag{5}$$

2. Both banks are liquidated to outsiders: The amount of funds required is reduced by the proceeds of the sale of $2\underline{p}$ and the banking asset's return in the high case is reduced by Δ because of asset-specificity. The regulator's objective function takes the value

$$E(\Pi_2^{ff}) = 2(\alpha_1(R - \Delta) - 1) - a(2r_0 - 2\underline{p}). \tag{6}$$

3. One bank is bailed out and the other bank is liquidated to outsiders:

$$E(\Pi_2^{ff}) = (\alpha_1 R - 1) + (\alpha_1(R - \Delta) - 1) - a(2r_0 - \underline{p}). \tag{7}$$

Because of the linearity of the fiscal cost function it can only be optimal to either liquidate both banks or bail out both banks. Intuitively the banks are bailed out if the cost of liquidation $\alpha_1\Delta$ (the expected output loss if banking assets are managed by outsiders) is high and/ or the fiscal cost of the bailout $f(x)$ is low. Specifically which action the regulator takes is decided by the comparison of liquidation cost and opportunity cost of a bailout $a\underline{p}$ (resulting from the foregone proceeds of an asset sale). The decision can also be stated as a function of asset-specificity: "The regulator sells banks to outsiders when banks are not "too special" and bails them out otherwise." (Acharya and Yorulmazer, 2007, p. 12) When a bank is bailed out the regulator can also take an equity stake β in the bank in return, along the lines of the earlier discussion.

It follows that the expected second-period profit in the state FF (and only in this state) depends on the value of parameters that dictate the regulator's optimal strategy: asset specificity, immediacy costs of a bailout and the cutoff value of a bank owner's equity stake that ensures investment in the good project. (β can take any value in between 0 and this cutoff.):

$$E(\Pi_2^{ff}) = \begin{cases} 0 & \text{in case of liquidation,} \\ (1-\beta)(\alpha_1 R - 1) & \text{in case of a bailout.} \end{cases} \tag{8}$$

To see now what strategy banks will take in the first period, the total expected second-period profit of a bank can be calculated. (Only the profit in the second period depends on the bank's industry choice.) It is the weighted average of expected values in each of the three states with the weights being the probabilities that these states arise:

$$E(\pi_2(\rho)) = \sum_i Pr(i)E(\pi_2^i(\rho)). \tag{9}$$

This expected value depends on the choice of inter-bank correlation, because the correlation influences the probabilities of each state arising. Therefore it determines both the expected excess profit that a surviving bank can generate from the purchase of the failed bank's assets at a discount in state SF or FS (this state can arise only if both banks invest in different industries, i. e. $\rho = 0$) and the expected subsidy that a bank receives from a bailout in state FF (this state is more likely to arise if the banks invest in the same industry than when they invest in different industries).

It follows from this that banks will chose to invest in different industries if it is optimal for the regulator to liquidate the banks in state FF (i. e. if banking assets are "not too special"). If the regulator instead bails out the banks in state FF, then the optimal strategy for banks depends on the amount of equity dilution they have to endure in return. If dilution is sufficiently small, banks will chose a correlation of $\rho = 1$ because the bailout subsidy is high, otherwise, if dilution gets bigger, the bailout subsidy gets smaller and incentives to chose the low correlation of $\rho = 0$ predominate. However, as noted before, the regulator cannot dilute the owner's equity too much without creating a moral hazard problem in the future.

2.3 Time-inconsistency of regulation

Since the first-period expected profit as well as the second-period expected profit in states SS, SF and FS is independent of bank's choice of correlation, the same is true for the total expected output of the banking sector. (It is simply twice that expected value.) Analogous to the bank's second-period expected profit, the total second-period output of the banking sector also does depend on the value of ρ.

So what is the expected value of second-period total banking output net of fiscal immediacy costs over all states, denoted by $E(\Pi_2(\rho))$? With the joint probabilities from table 1 it takes one of the values

$$E(\Pi_2(1)) = \alpha_0 E(\Pi_2^{ss}) + (1-\alpha_0)E(\Pi_2^{ff}), \tag{10}$$

$$E(\pi_2(0)) = \alpha_0^2 E(\Pi_2^{ss}) + 2\alpha_0(1-\alpha_0)E(\Pi_2^{sf}) + (1-\alpha_0)^2 E(\Pi_2^{ff}), \tag{11}$$

depending on the correlation of bank's profits. As described before the value of the regulator's objective function in the state FF is given by equation 5 in case of a bailout or by equation 6 in case of liquidation. Acharya and Yorulmazer (2007, p. 15) show that for both possible values of $E(\Pi_2^{ff})$, the regulator would prefer the banks to chose the low correlation and invest in different industries, that is, it holds: $E(\pi_2(0)) > E(\pi_2(1))$.

This result is mainly driven by the wasteful state FF – a systemic banking crises – which causes large output losses. The regulator would therefore like to minimize the probability of this state being reached by giving banks incentives to invest in different industries. (The probability for both banks to fail is then $(1-\alpha_1)^2$, less than the $(1-\alpha_1)$ probability if they invest in the same industry as can be seen from table 1.) This is were time-inconsistency kicks in, though, because announcing resolution policies designed to set such incentives, like the intention to liquidate both banks in state FF, may not be ex-post optimal and therefore not be credible ex-ante. The banks will then rationally expect a bailout anyways and pay no attention to announcements that say otherwise.

The predicament can be described in this way: "The trade-off is simple: ex-post, the regulator cares only about expected profits in state FF, whereas ex-ante, the regulator is willing to give up some of these profits in order to induce better incentives for banks to be less correlated and reduce the likelihood of ending up in state FF." (Acharya and Yorulmazer, 2007 p. 17)

Alternatively the regulator could announce that it will sufficiently dilute the equity of bank owner's if it bails out a failed bank, to make choosing the high correlation unattractive. If, however, this required dilution is so high that it creates a moral hazard problem in subsequent periods because the incentive compability constraint (equation 2) no longer holds, then the banks know that this policy is also not optimal for the regulator to pursue ex-post, and the same time-inconsistency problem arises.

3 Policy implications

3.1 Micro- vs. macro-prudential financial regulation

The literature on banking regulation distinguishes between two different approaches to regulation. On the one side there are policies that aim at stabilizing individual banks that are called micro-prudential. Crockett (2000) describes the objective of such measures as "limiting the likelihood of failure of individual institutions," or put another way "limiting idiosyncratic risk." (Crockett, 2000, p. 2) Macro-prudential regulation in contrast takes into account the interactions of different market participants and is concerned with directly stabilizing the entire financial system. Brunnermeier et al. (2009, p. xvi) characterize the difference as micro-prudential regulation examining only exogenous risk to a bank while neglecting endogenous risk, meaning those risk factors that only emerge from strategic interactions. Macro-prudential regulation aims to fix this blind spot and shift the objective towards “limiting the costs to the economy from financial distress, including those that arise from any moral hazard induced by the policies pursued.” (Crockett, 2000, p. 2)

The existence of a too-many-to-fail problem as laid out in the model of Acharya and Yorulmazer (2007), as well as other aspects that induce banks to herd,[3] suggest that policy makers should put a stronger emphasis on macro-prudential regulation and look more carefully at inter-bank correlations in business strategies. Instruments to achieve that goal could be worked into the regulatory framework of Basel II, which “took insufficient account of macro-prudential risk.” (Brunnermeier et al., 2009, p. 28) Acharya (2009, p. 225) proposes that ”capital adequacy requirements should be increasing in the correlation of risks across banks as well as in individual risk.” Crockett (2000, p. 5) offers the same idea with hesitation: “A second, no doubt more complicated and controversial, possibility would be to consider extending the calibration [of regulatory arrangements to the institution’s systemic significance] to regulatory capital and other tools as well. Obvious concerns about level playing fields would need to be addressed in the process.” One could argue, however, that this very calibration as suggested by Acharya would be beneficial in truly leveling the playing field, because higher cost of capital would run counter to the implicit bailout subsidies that systemic institutions receive (both because of size and highly correlated strategies) and also have the effect of a Pigouvian tax. Reducing the net value of these subsidies would mitigate the herding incentives, that stem from the too-many-to-fail problem and create excessive systemic risk.

Still, to take correlation of return on assets into account there first have to be the appropriate instruments available to regulators. With the current set of regulatory arrangements it is often just not possible to assess and compare exactly the risk factors that each institution is exposed to because of complicated interrelations that cannot be fully comprehended by each individual regulatory instance: Accounting standards play a role here, but also the need for more international cooperation in sharing information and possibly creating some sort of a central database becomes visible. Furthermore, Hellwig (1995, p. 731) points out that even on a national level there is “fragmentation of financial subsystems reporting to different supervisory authorities.” Brunnermeier et al. (2009, p. 28) make an interesting suggestion regarding international institutions: “[...] [A]ny branch (or foreign-owned) banks designated as ’systemic’ by a host country should automatically be required to change its status to being a separately capitalized subsidiary.” That way a country could treat all banks – domestic and foreign – in the same way regarding e.g. capital adequacy surcharges for exposure to risk factors that are highly correlated with risks that other banks that operate in its markets are exposed to.

Acharya and Yorulmazer abstract from such international considerations, since their

[3] Additional channels of bank herding are presented e.g. in Acharya and Yorulmazer (2005) and Acharya and Yorulmazer (2008).

model features just one unique economy. As was laid out, the regulator in the model does not care about the longterm fiscal outcome of providing emergency funds to bail out banks, materialized in the fact that he is in principle indifferent as to how big an equity stake he receives in return for a bailout (just as long as it is small enough not to induce any moral hazard in the future). The regulator's objective function does not capture this transfer of wealth, because it has no welfare effect in a closed economy. In an international context, though, questions like what exactly the objectives of national regulatory instances are, play an important role. Certainly regulators must be concerned with international redistribution and also probably "are primarily concerned about conditions in their own countries (as has certainly appeared to be the case in practice in the current crisis)." (Brunnermeier et al., 2009, p. 28). To make matters less complicated Brunnermeier et al. (2009, p. 29) advocate transferring regulation to a European institution, "if burden sharing could be agreed upon."

The notion of banks being "systemic as part of a herd" (Brunnermeier et al., 2009, p. 26) also sheds some light on the effectiveness of some proposals aiming to deal with the problem of too-*big*-to-fail, i.e. banks being "individually systemic" for reasons of sheer size and interconnectedness. For example it has been suggested (most notably maybe by Alan Greenspan) that large banks should be broken up into smaller entities under the general motto that "if a bank is too big to fail, it is too big to exist." This appears not to solve the issue because, in the presence of the too-many-to-fail problem and of herding incentives in general, the newly created small banks could collectively pose a similar threat to financial stability as the broken-up large bank. Similarly, when designing a tax on banks and/ or creating a fund to provide the means for crisis resolution like it is currently being discussed, it is crucial that not just the size of a bank but specifically its systemic importance is taken into consideration for determining the premium that each institution has to pay. Acharya et al. (2010) take on the matter of actually quantifying the systemic risk that emerges from individual banks.

3.2 Rules vs. discretion in banking regulation

At the core of the too-many-to-fail problem lies the time-inconsistency of ex-ante optimal regulatory policies: Regulators just cannot credibly commit to liquidate failing banks in a systemic banking crisis because the cost associated with this policy are regularly very high, even though ex-ante this strategy maximizes expected social welfare. (This is because banking crises would be much less likely to occur, were the commitment actually credible.) To raise the credibility of commitments they could be institutionalized in a way that gives regulators fewer discretionary power of suspending ex-ante optimal strategy in situations when this would be desirable.

Hoggart et al. (2005) support the usefulness of previously anchored rules empirically: They find that countries that have a limited deposit insurance scheme are the least likely to experience a systemic crisis, even less likely than countries that have no deposit insurance system at all. Apparently people don't believe that there really will be no support for depositors whatsoever, but assume that instead countries will be forced to introduce a full government guarantee should a crisis hit. A pre-implemented limited scheme, in contrast, appears to be believable and therefore strengthening the banking system by limiting excessive risk taking.

In addition, Taylor (2010), using the example of the recent crisis in the fall of 2008, argues that the uncertainty that discretionary power brings with it causes crises to be even more severe because it amplifies panic in the markets. He therefore proposes a special bankruptcy process for financial institutions to create a credible alternative to bailouts. Implementing such elements to constitute a more pronounced rule-based regulatory framework could mitigate the time-inconsistency and the too-many-to-fail problem.

In contrast to this stands the concept of "constructive ambiguity", by which a bailout policy is not explicitly announced ex-ante in the hope "that free riding will be limited. (Freixas et al., 2002, p. 18) The term is used mostly in connection with central banks acting as lender of last resort, where central bankers usually argue that a certain amount of discretionary power is efficient. Freixas (1999) presents a cost benefit analysis of such bailouts by central banks and finds that a mixed strategy is optimal, which he "interpret[s] as the confirmation of the 'creative ambiguity' principle." (Freixas, 1999, p. 1) Goodhart and Huang (1999) back up this claim in a model where only banks above a threshold size are rescued. It is then favorable not to communicate what exactly that threshold size is, to keep banks from adjusting their risk choices knowing their position. The focus of their model is on too-big-to-fail, though, and appears not to incorporate the more complicated bailout decisions regulators have to take in presence of the too-many-to-fail problem. In particular, "constructive ambiguity" does not help in limiting the expectation of bailouts when it is clear that ex-post optimal strategy dictates them.

In a more general context such a problem of time-inconsistency can be solved in a repeated game by building up reputation. If regulators were widely seen to be exerting little forbearance and regularly taking swift action according to ex-ante optimal policies, i.e. closing and liquidating failing institutions, banks could eventually no longer expect to be bailed out during a systemic crisis, and incentives to chose correlated strategies – at least those stemming from the too-many-to-fail channel – would disappear. In practice, though, all policy makers have strong incentives to rescue failing banks and regularly do so. Even stricter rules might not help as long as they could potentially be suspended again in extreme cases by declaring an emergency. In the light of the recent crisis, it remains questionable if expectations of living up to those rules could actually be generated.

4 Conclusion

The too-many-to-fail problem constitutes an important aspect of what makes financial institutions systemic. Acharya and Yorulmazer's model presents the time-inconsistency of ex-ante optimal regulatory policies as a channel of bank herding. Because policy makers often find themselves forced to extend bailouts ex-post in the wake of a banking crisis, banks have incentives to chose correlated strategies, i.e. invest in assets that have correlated returns. This leads to excessive risk taking concerning specific risk factors, creates negative externalities and poses a threat to the stability of the financial system. In a sense, by choosing these similar risk exposures banks can create herds that are too-big-to-fail in aggregation. They then capture the same implicit bailout subsidies as large banks.

To address the problem of time-inconsistency, an increased rule-based banking regulation could be on option. Herding incentives through the too-many-to-fail channel could be eliminated if the commitment of regulators to ex-ante optimal policy were to be credible. To achieve this credibility and limit expectations of future bailouts, regulators need a viable alternative which might lay in new bankruptcy laws that would enable the orderly liquidation of banks. The case for more pronounced rules, however, stands in opposition to the concept of "constructive ambiguity" that gives decision makers a high degree of discretionary power in hopes of creating uncertainty and dampening bailout expectations that way.

The need for more macro-prudential financial regulation is less controversial. Tackling the apparent herding incentives directly, the extension of the regulatory framework to inter-bank correlations could make sure that endogenous risk factors are less neglected than under Basel II. Banks would then have to hold more equity the higher their systemic significance, while the degree in which a bank's returns is correlated with those of other banks should play a role in determining this significance. This would for once ensure fair competition between institutions that profit from an implicit guarantee and those that do not, but more importantly it would reduce incentives to herd. Alternatively, a similar effect could be reached by directly introducing a Pigouvian tax. To actually implement such regulation, it must be ensured that all regulatory instances have access to the relevant data. Therefore more emphasis should be put on international cooperation.

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