DISCUSSION PAPER SERIES

No. 7819

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FINANCIAL ECONOMICS

Centre for Economic Policy Research

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Available online at: **www.cepr.org/pubs/dps/DP7819.asp**

ISSN 0265-8003

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Discussion Paper No. 7819
May 2010

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CEPR Discussion Paper No. 7819

May 2010

ABSTRACT

Banking-on-the-Average Rules*

In this paper, we introduce a new requirement for bank capital: banking-on-the-average rules. Under these rules a bank's required level of equity capital is monotonically increasing in the realized equity capital of its peers. In a simple model we illustrate the workings of banking-on-the-average rules. We show that in booms these rules can prevent banks from taking excessive risks. Moreover, they alleviate the socially harmful procyclicality of conventional equity-capital rules, which may induce banks to cut back excessively on lending. Finally, we argue that under these rules prudent banks can impose prudency on other banks. In addition, banking-on-the-average rules ensure the build-up of bank equity capital in booms and thus avoid excessive leverage.

JEL Classification: G21 and G28
Keywords: banking crisis, banking on the average, banking system and equity-capital requirements

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* We would like to thank Jürg Blum, Charles Goodhart, Martin Hellwig, Otmar Issing, Harald Nedwed, Hyun Song Shin, Martin Summer, and conference participants at the annual meeting of the German Economic Association in Magdeburg (2009) for many valuable comments and suggestions.

Submitted 23 April 2010

1 Introduction

Designing equity-capital requirements for banks is a thorny issue because such regulations need to fulfill at least three objectives (see Hellwig (2009)). They should curb excessive risk-taking by bank managers; they should guarantee that equity capital can act as a buffer against negative shocks in order to avoid insolvency; and they should allow for supervisory intervention before banks become insolvent.

The risk-sensitive capital requirements of Basel II suffer from a variety of shortcomings with regard to these objectives. For instance, regulatory capital cannot be used as a buffer against adverse shocks because otherwise the bank would violate the regulation. Moreover, the regulatory framework did not prevent the build-up of leverage by many banks starting in the early 1990s, which made the banking system vulnerable to adverse shocks.

Probably the most dramatic drawback is that it reinforces a downward spiral when boom turns into bust. The reason is that when credit risks increase, an individual bank is encouraged or forced to recoil from risk by shedding risky exposures as quickly as possible. Cutting lending to other banks or industrial firms, however, makes the banking system more unstable, and the ensuing credit crunch reinforces the economic downturn.[1] Accordingly, one of the key issues for capital regulation is how banks should adjust their balance sheets when losses reduce equity capital. At the same time, such regulation should prevent or moderate excessive leverage in boom periods.

In this paper we take up a suggestion by Gersbach (2009a) and propose "banking on the average" in order to achieve these objectives. The key idea is that capital requirements for an individual bank could be a monotonically increasing function of average equity capital in the banking sector, i.e. of the realized level of aggregate bank equity in relation to aggregate assets. We formulate such banking-on-the-average rules and explore the properties of, and the rationale for, those rules. We then present a simple model that illustrates two potential advantages of banking-on-the-average rules. First, they

[1] There is extensive literature on the potential procyclicality of bank capital requirements and their macroeconomic implications (see Blum and Hellwig (1995), Gordy and Howells (2006), and Hellwig (2009)). See also Brunnermeier et al. (2009). Heid (2007) demonstrates that the capital buffer that banks hold on top of required minimum levels may mitigate the procyclicality of bank capital requirements.

can reduce the incentives to run excessive risks. In our model, these incentives disappear completely, as banks that gamble may be forced to recapitalize in the next period, which waters down the value of shares for current shareholders. Second, banking-on-the-average rules may reduce the severity of a downward spiral with high social costs if a detrimental systemic shock has occurred. In our model, banking-on-the-average rules eliminate the need for costly liquidation of socially beneficial investments in a crisis. By contrast, conventional rules, where the required level of equity capital a bank must hold is independent of the equity of its peers, are always socially inferior. They either induce banks to gamble or force them to liquidate valuable long-term investments in the event of a harmful systemic shock.

We also discuss additional potential advantages of banking-on-the-average capital requirements. Such rules allow the build-up of bank equity capital in booms, thereby creating buffers for bad times and avoiding excessive leverage. Moreover, such rules are simple and transparent and could easily be integrated into the existing regulatory framework.

The paper is organized as follows: In the next section we explain the concept of banking on the average (BoA). A simple model of a banking system is described in Section 3. In Section 4 we use our model to illustrate that capital requirements based on banking on the average may be favorable from a welfare point of view. In Section 5 we address several issues to be considered when banking-on-the-average rules are implemented. We discuss the relationship between BoA rules and alternative reform proposals in Section 6. Section 7 concludes.

2 The Banking-on-the-Average Rule

In this section we outline the regulatory framework of banking on the average (henceforth BoA). In general, a BoA capital requirement specifies that a bank's required level of equity as a fraction of investments is a monotonically increasing function of the average realized equity ratio of other banks. Using e_i to denote bank i's equity ratio and $\overline{e}_{-i}$ to denote the average equity ratio of the other banks, the equity ratio $e_{i,req}$

required for bank i at a particular point in time can be written as

$$e_{i,req} = f(\overline{e}_{-i}), \tag{1}$$

where $f(\cdot)$ is a weakly monotonically increasing function. A possible BoA function is

$$F(\overline{e}_{-i}) = \begin{cases} \overline{e}_{-i} + \kappa(e^* - \overline{e}_{-i}) & \text{for } \overline{e}_{-i} < e^* - \sigma \\ e^* & \text{for } \overline{e}_{-i} \geq e^* - \sigma, \end{cases} \tag{2}$$

where e^*, σ, and κ are parameters with $e^* > 0$, $\sigma \geq 0$, and $0 < \kappa < 1$. Intuitively, if the average level of equity among a bank's competitors, $\overline{e}_{-i}$, is close to or higher than the level e^*, which is the level desirable for times when no adverse shock hits the economy, the required equity ratio will be e^*. If, however, an adverse shock hits the economy and drives down equity ratios for all banks, capital requirements will be relaxed. In particular, each individual bank is required to have an equity ratio that exceeds the average equity ratio of its competitors by $\kappa(e^* - \overline{e}_{-i})$ in this case.[2]

This term is positive and serves two purposes. First, it ensures that equity-capital levels recover gradually after a detrimental systemic shock has reduced the equity of all banks, i.e. when $\overline{e}_{-i}$ is low. Second, it prevents the build-up of excessive leverage in the entire banking system during booms. Without the term $\kappa(e^* - \overline{e}_{-i})$, a downward spiral could result.[3] Banks may decrease their equity capital, which would result in lower capital requirements and thus enable them to reduce their equity capital further. According to (2), banks will be forced to raise their equity after a short period of time if they jointly engage in leverage build-up.

BoA rules have the potential to improve on standard capital requirement rules. Like standard rules, they may reduce banks' incentives to choose excessively risky investment strategies in good times. At the same time they may ensure that banks do not have to liquidate valuable long-term investments or cut back on lending when an adverse shock hits the economy. Hence, equity capital can work as a buffer to cushion harmful systemic shocks. We illustrate the workings of BoA rules with regard to these objectives in the next section.

[2] More sophisticated rules could be considered with different adjustment parameters κ for $\overline{e}_{-i} < e^* - \sigma$ and $\overline{e}_{-i} \geq e^* - \sigma$. Moreover, one could base capital requirements on a particular quantile of banks with the highest realized equity ratios.

[3] Note, however, that (2) stipulates at least a capital requirement of κe^*. This can be verified easily by evaluating $F(\overline{e}_{-i})$ at $\overline{e}_{-i} = 0$.

3 Model

We consider a banking industry with an exogenously given number of banks n. There are two periods. At the beginning of the first period, banks are identical, each of them being endowed with an amount of equity $E^{(1)}$.[4] In a competitive market for deposits, banks finance themselves at the prevailing interest rate r_d. As banks are identical, each bank receives the same amount of deposits, which is denoted by D.[5] Banks use deposits and equity to finance long-term investments I ($I = E^{(1)} + D$).

Banks can choose between two types of investment, prudent investments and risky ones. We assume that each individual bank invests all its resources either in the prudent or in the risky technology. This assumption simplifies the exposition but does not affect our findings.

Prudent investments are only subject to a systemic shock η. This systemic shock has two possible realizations, $\eta = 0$ and $\eta = -B$ ($B > 0$). First, "good times" may occur with probability p^g. Then the realization is $\eta = 0$ and the net rate of return on investments for bank i is $r_i = \overline{r} + \eta = \overline{r}$ with $\overline{r} > 0$. Second, "bad times" ($\eta = -B$) occur with probability $p^b = 1 - p^g$. In this case, the net rate of return on investments is $r_i = \overline{r} + \eta = \overline{r} - B$.

Risky investments yield lower expected returns and are subject to idiosyncratic shocks in addition to the systemic shock. Specifically if bank i undertakes risky investments, the idiosyncratic shock s_i will take the values $-S$ and $+S$ with equal probability. The net rate of return is assumed to be $r_i = \overline{r} + \eta + s_i - \Delta$, where Δ ($\Delta > 0$) measures the difference in expected returns between prudent and risky investments. Despite lower expected returns on risky investments, banks may find it attractive to choose these projects due to limited liability, as will be shown later.

[4]In a more elaborated version of our model, one could endogenize $E^{(1)}$ as the result of previous business decisions and shock realizations. Alternatively, $E^{(1)}$ can be seen as the result of an initial step to set up banks. Then it corresponds to the equity that can be attracted such that equity holders earn the opportunity costs of funds.

[5]For example, this may justified by a large number of depositors, each of them placing savings at all banks with equal probability.

Realized equity in the second period is $E_i^{(2)} = Ir_i - D(1+r_d)$ and the respective equity ratio is $e_i = E_i^{(2)}/I = r_i - (1+r_d)D/I$.[6] It is now convenient to introduce variables for the different realizations of the equity ratio e_i in the second period

$$e^{gg} := (1+\overline{r}+S-\Delta) - (1+r_d)D/I, \tag{3}$$

$$e^{gb} := (1+\overline{r}-S-\Delta) - (1+r_d)D/I, \tag{4}$$

$$e^{g0} := (1+\overline{r}) - (1+r_d)D/I, \tag{5}$$

$$e^{bg} := (1+\overline{r}-B+S-\Delta) - (1+r_d)D/I, \tag{6}$$

$$e^{bb} := (1+\overline{r}-B-S-\Delta) - (1+r_d)D/I, \tag{7}$$

$$e^{b0} := (1+\overline{r}-B) - (1+r_d)D/I. \tag{8}$$

The first superscript stands for the realization of the systemic shock (b or g); the second superscript describes whether a negative idiosyncratic shock (b) or a favorable one (g) has occurred. A superscript of 0 means that the respective bank has engaged in the prudent investment technology, for which no idiosyncratic shock is present.

We make the following assumptions on the parameters of our model: First, $e^{gy} > 0$ $\forall y \in \{b, g, 0\}$, $e^{by} > 0$ $\forall y \in \{g, 0\}$, and $e^{bb} < 0$. Intuitively, a bank will only become insolvent if there is a negative aggregate shock, the bank chooses the risky technology, and a detrimental idiosyncratic shock occurs. Second, we assume $-\frac{1}{2}p^b e^{bb} > \Delta$. We will show later that this assumption guarantees that the risky technology would be chosen by banks in the absence of capital requirements. Intuitively, Δ measures the costs for choosing the risky technology rather than the prudent technology. $-\frac{1}{2}p^b e^{bb}$ is associated with the gains from gambling. It corresponds to the part of the losses from gambling that is not by incurred by the bank due to limited liability. These losses will materialize if there are bad realizations of both the idiosyncratic and the systemic shock. Third, we assume $e^{gb} > e^{b0}$, which is equivalent to $B > S + \Delta$. Roughly speaking, this assumption ensures that the effects of the aggregate shock on bank equity are sufficiently strong compared to the potentially negative impact of gambling.

In the following, we work with a sufficiently large number of banks, which enables a tractable formal analysis due to the law of large numbers. Under this assumption, the

[6] Because only the equity ratios in the second period are relevant in our model, we omit the subscript (2) for equity ratios in the following.

idiosyncratic shocks average out when computing the economy-wide equity ratio. Using λ to denote the fraction of banks choosing risky investment projects, the aggregate equity ratio, $\overline{e}$, takes only two possible values, one for a bad and one for a good realization of the systemic shock

$$\overline{e}^g = e^{g0} - \lambda\Delta, \quad (9)$$

$$\overline{e}^b = e^{b0} - \lambda\Delta. \quad (10)$$

The regulator imposes a minimum capital requirement on banks. For simplicity, we assume that the initial equity level is sufficiently high, so the requirement is non-binding in the first period. In the second period, bank i's minimum equity level as a fraction of I is given by a function $e_{req} = f(\overline{e})$.[7] A specific form for this function will be given later.

A bank that violates the capital requirement has to adjust its balance sheet either by raising new equity or by reducing assets I. If the bank decides to raise new equity, the value of old equity will dilute, implying costs for old shareholders.[8] If the bank reduces I, costs may arise because the bank may be forced to sell assets at a price below their fundamental value.[9] Moreover, the bank may be forced to liquidate long-term investments, which is also costly.[10] We will not model this stage of the game explicitly but simply assume that the adjustment costs are proportional to equity.[11] In addition, we assume that the costs are higher in "bad times", where it may be difficult to issue new equity or to sell assets at a fair price.

Accordingly, we assume that balance-sheet adjustment costs as a fraction of investments are given by $C^g := \alpha^g e_i$ in good times ($1 > \alpha^g > 0$). These costs accrue to the individual bank but do not represent aggregate welfare losses. For example, if a bank is forced to sell assets below their fundamental value, then the bank's shareholders will lose, but the investors purchasing these assets will benefit at the same time. In

[7]Due to the large number of banks we do not have to distinguish between the average equity ratio $\overline{e}$ for all banks and the average ratio among all banks expect for bank i.

[8]Such costs are well documented. The classical literature includes Scholes (1972), Asquith and Mullins (1986), and Mikkelson and Partch (1986).

[9]See Brunnermeier et al. (2009) and Hellwig (2009) for explanations why asset values may fall below their fundamental value in a crisis.

[10]This is a standard scenario in the bank-run framework that goes back to Diamond and Dybvig (1983).

[11]This assumption simplifies the analysis but it is immaterial to our findings.

a similar vein, issuing new shares may dilute the value of old shares. However, new shareholders or debt-holders will gain in proportion. Both effects on aggregate welfare balance each other.

In bad times, balance-sheet adjustment costs are higher; they are given by $C^b := \alpha^b e_i$ with $1 > \alpha^b > \alpha^g$. We assume that these costs are not only incurred by shareholders of the respective bank; they also represent social losses because in bad times issuing new equity or selling assets may be very difficult or even impossible. Banks will have to liquidate profitable long-term investment projects instead, which is also costly from a perspective of aggregate welfare.

Finally, we assume that deposits are guaranteed implicitly by the government. The current crisis has highlighted the fact that governments will ultimately step in and protect depositors from bank defaults. Hence, we assume that the insolvency of a bank ($e_i < 0$) creates social costs $k\,|e_i|\,I$ ($k > 0$). These costs arise because the government has to bail out the bank, which means that distortionary taxes have to be raised at some point in time or that expenditures on socially desirable projects have to be cut.

The sequence of events is given as follows:

- 1st Period
  - Each bank is endowed with a fixed level of equity $E^{(1)}$ and obtains deposits D at a competitive rate r_d.
  - It uses these resources to finance either prudent or risky investments $I = E^{(1)} + D$.
- 2nd Period
  - Nature draws shocks s_i and η.
  - Each bank i observes its new equity ratio e_i.
  - Banks with $e_i < 0$ become insolvent and create social costs $k\,|e_i|\,I$.
  - If the equity ratio e_i of a solvent bank i falls short of the minimum capital requirement e_{req}, the bank has to adjust its balance sheet at costs $\alpha^g e_i$ or $\alpha^b e_i$ respectively.
  - Returns on investment accrue, and depositors have to be paid back.

Banks maximize their return on equity by choosing whether to invest invest in the prudent technology or in the risky technology. As $E_i^{(1)}$ and I are given, this amounts to maximizing $\max\{e_i, 0\}$, net of possible balance sheet adjustment costs $\alpha^g e_i$ or $\alpha^b e_i$.

4 Analysis

4.1 Welfare

As a first step, we focus on the social optimum in our model. Our welfare measure is total output at the end of the second period. Suppose a social planner could choose the banks' investment strategies in order to maximize the welfare expected at the beginning of period 1. We immediately obtain

Proposition 1

A social planner would choose prudent investments for all banks. Moreover, he would never liquidate long-term investments. The resulting level of expected welfare would be $W_{opt} = nI\left(1 + \overline{r} - p^b B\right)$

As risky investments yield lower expected returns, it is clear that the social planner will not pursue them. Thus defaults never occur. Moreover, the social planner avoids liquidating long-term investments because this would create costs C^b per bank. We note that total investments are given by nI and the expected rate of return on prudent investments is $1 + \overline{r} - p^b B$. The latter expression can be explained by the observations that good times, which occur with probability $1 - p^b$, involve a rate of return of $1 + \overline{r}$, while bad times, which arise with probability p^b, entail a rate of return of $1 + \overline{r} - B$.

4.2 Equilibrium without capital requirements

As a benchmark case, we study our model without capital requirements, i.e. $e_{req} = 0$. In the absence of capital requirements, banks have an incentive to choose risky investment projects because due to limited liability they are able to roll off some of the losses incurred for bad realizations of the systemic shock and the idiosyncratic shock to the taxpayers.

Banks maximize their expected value of equity, which is equivalent to maximizing the ratio of equity to investments because the total size of investments is fixed. Hence, choosing risky investments is profitable for a bank if

$$\frac{1}{2}p^g\left(e^{gg}+e^{gb}\right)+\frac{1}{2}p^b e^{bg} > p^g e^{g0}+p^b e^{b0}. \tag{11}$$

This inequality can be easily explained. We note that the left-hand side gives the expected value of the equity ratio for the risky technology, where we have utilized $e^{bb} < 0$, which implies that the bank becomes insolvent for a detrimental aggregate shock and a risky investment with a negative shock realization. The right-hand side describes the expected value of the equity ratio for the prudent technology.

As $\frac{1}{2}\left(e^{gg}+e^{gb}\right)-e^{g0} = -\Delta$ and $\frac{1}{2}\left(e^{bg}+e^{bb}\right)-e^{b0} = -\Delta$, the above inequality is equivalent to $-\frac{1}{2}p^b e^{bb} > \Delta$, which holds by assumption. We immediately obtain

Proposition 2

Without capital requirements, all banks choose risky investment projects. Expected welfare amounts to $W_{NoReq} = W_{opt} - \Delta nI - \frac{1}{2}p^b k\left|e^{bb}\right| nI$.

Compared to the social optimum, welfare is diminished by two factors. First, the expected returns of banks undertaking the risky project are reduced by Δ. Second, if the economy is in the bad state, which happens with probability p^b, half of the banks will become insolvent, which will cause social costs $k\left|e^{bb}\right| I$ per bank.

4.3 Static capital requirement rule

In this section, we consider the standard case with a capital requirement for individual banks that is independent of the aggregate level of equity. To put it differently, all banks have to fulfill a required level of the equity ratio of e_{req} in the second period.

We obtain

Proposition 3

A rule with a static equity-capital requirement never ensures the socially optimal level of welfare.

Proof

If $e_{req} \leq e^{b0}$, the requirement is ineffective. First, in the good state it would never bind, as $e^{gb} > e^{b0}$. In the bad state, the realized value of e_i would either be above e_{req} or, in the case of a risky technology with a bad realization of the shock, the bank would be insolvent and social costs of bailouts would occur. To sum up, for $e_{req} \leq e^{b0}$ social welfare is identical to the case without capital requirements.

For $e_{req} > e^{b0}$, social welfare can never attain its maximum value W_{Opt}. First, if some banks chose risky projects, welfare would be lower due to the lower expected returns on risky projects. Second, if all banks chose prudent investment strategies, they would have to adjust their balance sheets for an adverse aggregate shock, resulting in social losses $\alpha^b e^{b0} I$ per bank. □

4.4 Banking-on-the-average rule

Finally, we examine a banking-on-the-average rule. We assume a special case of the rule defined in (2). In particular, our model comprises only two periods and thus we do not address how equity levels should recover after a detrimental shock has occurred.[12] Using $\overline{e}$ to denote the average equity ratio in the economy, we specify the following simplified BoA rule:

$$e_{req} = f(\overline{e}) = \begin{cases} e^{g0} & \text{for } \overline{e} \geq e^{g0} - \Delta \\ e^{b0} & \text{for } \overline{e} < e^{g0} - \Delta \end{cases} \tag{12}$$

With this rule we obtain

Proposition 4

Suppose that the costs of violating the capital requirement are sufficiently high such that $-\frac{1}{2}p^b e^{bb} < \Delta + \frac{1}{2}p^g \alpha^g e^{gb}$. If the regulator applies (12), a unique equilibrium exists. All banks behave prudently, and no bank will ever incur costs from adjusting its balance sheet. Consequently, the maximum level of welfare is attained.

Proof

As a first step, we examine $\overline{e}$ for the two possible realizations of the aggregate shock. Recall from (9) that $\overline{e}^G = e^{g0} - \lambda\Delta$. As λ represents the fraction of banks behaving imprudently, which lies in the interval $[0, 1]$, $\overline{e} \geq e^{g0} - \Delta$ holds in the good state. Thus

[12] Such an analysis necessitates a dynamic model with many periods and is left for future research.

each bank has to achieve an equity ratio of e^{g0} in the good state, irrespective of the behavior of the other banks.

Next we examine $\overline{e}$ for the bad state. According to (10), the aggregate equity ratio amounts to $\overline{e}^b = e^{b0} - \lambda\Delta$ for the bad realization of the systemic shock. We obtain

$$\overline{e}^b \leq e^{b0} < e^{gb} = e^{g0} - \Delta - D < e^{g0} - \Delta,$$

where we have applied our assumption $e^{gb} > e^{b0}$. Thus $\overline{e}$ is always lower than $e^{g0} - \Delta$ for the bad realization of the systemic shock, which implies that the required equity ratio is always e^{b0} in the bad state.

An individual bank chooses the prudent investment strategy for

$$p^g e^{g0} + p^b e^{b0} > p^g \left(\frac{1}{2}e^{gg} + \frac{1}{2}(1-\alpha^g)e^{gb}\right) + p^b \left(\frac{1}{2}e^{bg} + \frac{1}{2} \cdot 0\right). \tag{13}$$

With the help of

$$p^g e^{g0} + p^b e^{b0} = p^g \left(\frac{1}{2}e^{gg} + \frac{1}{2}e^{gb}\right) + p^b \left(\frac{1}{2}e^{bg} + \frac{1}{2}e^{bb}\right) + \Delta,$$

(13) can be rewritten as $-\frac{1}{2}p^b e^{bb} < \Delta + \frac{1}{2}p^g \alpha^g e^{gb}$. □

If the condition in the proposition does not hold, the costs of violating the capital requirement will be too low to deter banks from choosing the risky strategy. If it holds, the banking-on-average rule described in (12) will guarantee the socially optimal solution.

5 Discussion

The current regulatory framework stands accused of being largely powerless during the build-up of leverage in the boom and when the boom has turned into a devastating bust. The present paper offers a proposal that could mitigate some of the deficiencies of the current regulatory system. However, like any other approach to banking regulation it is no panacea, as systemic risks have no perfect remedy. In the following, we discuss some of the most important issues to be considered when BoA rules are implemented.

Rules versus discretion

Although we have framed the BoA principles in a set of rules, it may be useful in practice to allow for some degree of discretion, as in some contingencies mechanical formulas may have detrimental aggregate effects. For this purpose, it may be advantageous to start with some values of the required level of bank equity in normal times, e^*, and the adjustment parameter κ (see Equation (2)). The regulatory authority could be allowed to increase parameter κ, thereby raising the speed of adjustment to higher levels of bank equity after a crisis or in a phase in which banks have built up leverage. Hence, it may be desirable to complement BoA rules with a degree of regulatory discretion.[13] However, discretion on behalf of the regulator entails the risk of regulatory capture. The regulatory agency may be unwilling to use its discretion and ask for higher levels of equity because bankers will argue that this will unduly restrict their ability to finance mortgages or loans to firms.[14] If this problem is severe, the non-discretionary part of the framework will have to be chosen to guarantee sufficiently high levels of bank equity.[15]

Strategic Aspects

There may be concern that banks will jointly pursue a strategy of building up leverage. This development would already be counteracted by the BoA rule, which in this case would imply recapitalization. Moreover, the regulatory authority could further increase the speed of bank-equity recovery in order to make the strategy of increasing leverage even more costly for banks. As a consequence, sufficiently tight BoA rules can deter banks from engaging in such activities in the first place.

[13]In the United Kingdom, regulators have the discretion to select higher target equity ratios for banks taking particular risks (see Ediz et al. (1998)).

[14]Brunnermeier et al. (2009) also put forward the argument that "taking away the punch bowl" may be difficult in a boom.

[15]Simply comparing individual bank equity to that of its peers does not work. For example, until 1981 U.S. federal bank regulators attempted to persuade banks with comparably low equity ratios to raise them to the equity ratios of peers with similar characteristics (for an overview, see Gilbert et al. (1985), p. 15). The method used in the United States did not anchor equity ratios effectively. Any equity ratio would have been acceptable for an individual bank, given that its peers had similar equity ratios. By contrast, banking-on-the-average rules involve a long-term target for equity ratios by way of a formal procedure that ensures the build-up of equity capital if it has been low.

Simplicity and ease of implementation

A particular advantage of BoA rules is their simplicity, because in conjunction with the parameters of the rule only individual and aggregate bank equity matter. This facilitates reporting and communication with the public. It is conceivable that such reporting in itself will have a disciplinary effect on banks, as a bank may suffer a loss of reputation if its equity capital is lower than that of its peers.

Additionally, BoA rules are very flexible and could also be integrated into the current Basel II framework. One could compute values for risk-adjusted assets utilizing the sophisticated risk weights introduced under Basel II.[16] Then it would be straightforward to implement BoA rules for correspondingly risk-adjusted equity ratios. An alternative possibility is to adjust capital requirements based on BoA rules upwards or downwards, depending on the riskiness of the bank's assets. In this way, it would be possible to reconcile the microprudential[17] perspective implicit in Basel II and the macroprudential perspective inherent in BoA rules.

Moral hazard in a crisis

Banking-on-the-average rules allow capital requirements to be relaxed in a crisis. One might be concerned that this would induce banks to take excessive risks in such a crisis. First, it is important to stress that BoA rules require banks to pursue gradual increases of equity ratios immediately after adverse shocks, which reduces the incentives for such behavior. Second, it is not necessarily the case that capital requirements under a BoA rule would be lower in a crisis than under current regulation.[18] BoA rules can provide for higher equity ratios in booms and the same level of capital as current regulation in busts. Hence moral-hazard problems can be alleviated by BoA rules.

Extreme events and government interventions

In a severe crisis, bank equity may be reduced so heavily that banks will be unable to obtain new uninsured funds from investors. Then they may be unable to increase their

[16]Blum (2008) shows that regulatory capital requirements dependent on self-reported risk should be augmented by an additional, risk-independent leverage-ratio restriction.

[17]Borio (2003) argues that the macroprudential orientation of the current regulatory framework should be strengthened. Brunnermeier et al. (2009) note that Basel II takes a purely microprudential perspective, i.e. it attempts to ensure the soundness of the system by guaranteeing the soundness of individual institutions.

[18]Note that compared to historical values current regulation allowed for very low equity ratios before the present crisis (see Hellwig (2009)).

capital base rapidly. In such cases, banks may be able to survive with insured debt financing and will gradually improve their financial health. However, if their survival is uncertain, central banks and governments may need to step in to recapitalize or to restructure and liquidate them. Such extreme events can occur under any bank equity regulation, unless bank equity ratios are set prohibitively high.

Social costs of higher equity ratios

One might fear that higher equity ratios in booms could stifle credit supply and thus be socially harmful when banks are unwilling or unable to raise the equity necessary to sustain their supply of loans. However, it is debatable whether such social costs are likely to occur (see Hellwig (2009)). Even if there are some costs from higher equity requirements (see van den Heuvel (2008)), it seems reasonable for the immense costs of financial crises, as highlighted by the current one, to shift the socially desirable balance towards higher equity capital ratios.

6 Relationship to Other Proposals

Several other proposals have been made for the reform of banking regulation. Here we discuss the relationship of these alternatives to our proposal.

Additional macroeconomic indicators

One of the key features of BoA rules is that the minimum capital requirement is higher in booms than in a recession. This is achieved by making a bank's capital requirement an increasing function of the realized capital endowment of its peers. In principle, one could also use other variables for this purpose (see Gordy and Howells (2006)). The Geneva Report on the World Economy (Brunnermeier et al. (2009)) has proposed that the existing Basel II capital requirements be modified by the inclusion of a systemic-risk coefficient which would depend on several indicators for maturity mismatch, credit and asset price expansion (see also Acharya et al. (2009)).[19] BoA rules rely on only one indicator, which makes them particularly transparent and simple. However, macroeconomic indicators may be useful in varying the discretionary part of

[19] Adrian and Brunnermeier (2009) propose "CoVaR" as a measure of systemic risk.

the recapitalization adjustment. This would be closer to the spirit of Brunnermeier et al. (2009).

Repullo et al. (2009) advocate capital requirements that are a function of current GDP growth in relation to the respective long-term growth rate. Compared to GDP growth, the use of the equity capital of a bank's peers has a number of advantages. First, our variable is more closely related to the soundness of the banking system. Second, a banking crisis may only result in lower GDP growth after some time, so conditioning capital requirements on GDP growth may delay the adjustment of capital requirements.[20] By contrast, capital requirements under BoA rules are eased as soon as an adverse shock has eaten into bank balance sheets. Third, the future trend growth rate of GDP may be difficult to identify. For example, growth in Japan slowed considerably in the 1990s. A persistent slowdown in the growth rate may result in long periods of lax capital requirements if current growth is used as an indicator in relation to its historical average.

Reverse Convertible Debentures

In an interesting article, Flannery (2005) proposes that banks be required to issue "reverse convertible debentures" (RCDs). These are bonds that automatically convert into common stock once the market's evaluation of a bank's equity ratio drops below a certain threshold.

One problematic aspect of his proposal is that it may create strategic incentives to short-sell the bank's shares. If short-selling can drive the bank's market value below its fundamental value, investors holding RCDs will be able to obtain common stock at the distorted market price (see Flannery (2005) for a discussion). In a similar vein, self-fulfilling downward spirals may occur (see Kashyap et al. (2008)). If stock prices decline, investors will assume a conversion of the RCDs to be more likely. Consequently, they will expect a dilution of current shares, thus driving down share prices even further.

In effect, the RCD proposal implies that banks hold additional "contingent capital." If a crisis unfolds, this "contingent capital" can be used as a buffer and does not have to be replenished immediately. Compared to such state-contingent capital requirements,

[20]It is also important to note that real-time GDP data are often imprecise and subject to major revisions.

BoA rules have the advantage of providing a formal process for the recapitalization of banks after a crisis.

As RCDs and BoA rules are not mutually exclusive, one could apply BoA rules to the required amount of contingent capital, i.e. the volume of RCDs issued by banks.

Private insurance against systemic risk

Gersbach (2004) and Kashyap et al. (2008) have proposed that banks buy private insurance against systemic risk.[21] In a crisis, the insurer is obliged to inject additional funds without obtaining shareholder's rights. One potential disadvantage is that, like the implicit insurance granted by governments, private insurance creates moral hazard. In particular, Kashyap et al. (2008) note that their proposal may reduce banks' incentives to hedge against the crisis. This potential disadvantage of private insurance against systemic risks can be mitigated by requiring that bank managers themselves act as insurers for banks (see Gersbach (2009b)). BoA rules demand that banks hold higher levels of capital in booms, which alleviates moral-hazard problems stemming from limited liability.

Taxing systemic externalities

The presence of externalities in the banking sector suggests the introduction of a Pigovian tax. Acharya et al. (2009) and Adrian and Brunnermeier (2009) argue along this line of reasoning and propose that banks be taxed based on their systemic risk contribution. However, this would necessitate a robust assessment of an individual bank's impact on systemic risk in real time, which would be difficult for regulatory authorities.

Liquidity controls

BoA rules focus on the equity endowment of banks. Additional measures focusing on liquidity may could be used to supplement our proposal (see, e.g., Brunnermeier et al. (2009)). BoA could be applied to the determination of liquidity. Then the liquidity requirement of an individual institution would depend on the proportion of liquid assets to total assets among its peers. Moreover, BoA rules could easily be extended to include additional capital requirements for banks taking high liquidity risks.

[21] Perotti and Suarez (2009) propose a mandatory liquidity insurance for systemic crises.

7 Conclusions

In this paper we have introduced a new regulatory framework where the equity capital that a bank is required to hold is monotonically increasing in the equity capital of its peers. Such a rule may alleviate one of the main problems of current risk-sensitive capital requirements, which stipulate the same required equity ratios in a downturn as in boom periods. Consequently, banks have to cut back on lending in a downturn, which may exacerbate a downward spiral.

In our simple model of a banking system, we illustrate that conventional capital requirements cannot simultaneously achieve the goals of preventing excessive risk-taking by banks and costly liquidation of long-term investment projects in a crisis. A framework based on the principle of banking on the average will perform well in achieving both targets at the same time, thereby leading to a socially optimal level of welfare.

Moreover, BoA rules may prevent the build-up of leverage in booms. It is also possible to integrate them into the current Basel II framework. Incorporating BoA principles could be a fruitful way of integrating macroprudential elements into the Basel II framework.

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