



Capital Requirements for Financial Firms

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One of the reforms proposed for preventing financial crises is to require financial institutions to hold more capital. There are a number of unresolved issues related to such a requirement, ranging from the costs of increased capital requirements to the best way to structure them. Some of this research was presented at a recent conference, and we discuss the major findings in this *Commentary*.


The aftermath of the financial crisis has been punctuated by calls for financial reform to ensure that it will never happen again. Among the potpourri of proposed reforms are calls for increasing capital requirements. The Dodd–Frank Act mandates that U.S. regulators increase capital requirements for financial companies deemed to be systemic. The Basel III international capital standards proposed by the Basel Committee on Banking Supervision will require all banks to hold more capital; they also impose a capital surcharge on systemic firms. U.S. and European banking supervisors regularly assess the capital adequacy of their large systemic banking companies through a series of “stress tests.” Overall, the objective of the new emphasis on capital requirements as a regulatory tool is to increase the resiliency of individual financial firms and thereby financial markets.

There is no shortage of research on the issue of bank capital, or of proposals for reform. The issues raised in this literature include the cost of capital, the form of capital, whether capital standards should be procyclical, whether capital standards should be risk-based, and the interaction between capital and liquidity standards. To shed light on these questions, the Federal Reserve Bank of Cleveland held a conference on April 12 and 13 of this year. We discuss the contributions of the papers presented there in this *Commentary*.

How Much Capital Is Enough?

Three of the presenters at the conference address the issue of how much capital is sufficient. Two of them assume that equity is expensive, at least more expensive than debt financing. The third makes the case that bank capital is not expensive, at least from the standpoint of the economy as a whole.

In “Dynamic Prudential Regulation,” Ajay Subramanian and Boazhong Yang calibrate a model of a bank in a continuous time framework where the bank can dynamically shift the risk of its asset portfolio. An unregulated bank in this model has an incentive to issue equity if it becomes insolvent but remains liquid. The capital structure of the unregulated bank balances the expected cost of financial distress against the tax benefits of debt financing. Hence, in this model, equity is costly to issue. Bank regulators have three tools to work with. They set the initial capital requirement. They can intervene to check banks’ risk-taking. Finally, they can seize the bank when it becomes insolvent. If regulators seize the bank, they can inject capital into it and have the option to liquidate the bank when it is no longer optimal to keep it alive.



Banks in the model choose their asset portfolio in response to the initial capital requirement. They dynamically adjust their portfolio risk through time, taking into account regulatory interventions to limit risk, as well as the solvency and liquidity thresholds. Calibration of this continuous-time model suggests that the optimal capital requirement exceeds 20 percent of assets, far above the levels proposed in the most recent draft of the Basel III capital standards. Interestingly, these authors' results support capital levels in the range proposed by Admati et al. (2010), even when capital is costly to issue—an assumption contrary to that in Admati et al.

Capital requirements are found to improve bank lending standards in “Lax Lending Standards and Capital Requirements,” by Pedro Gete and Natalie Tiernan. The authors empirically model the market failure proposed by Hachem (2011), in which banks underallocate resources to loan screening. The lending process in this paper is one in which banks seek a match with opaque firms seeking loans. Banks have a fixed amount of resources to expend on finding a match and screening the borrower. The more of the fixed resources they devote to finding a match, the higher the probability they will be matched with a borrower. The more resources they devote to getting a match, the fewer there are available for screening the borrower. Information collected in screening allows the bank to decide whether to lend to the firm and, if so, how much.

The essential elements in this model are first, that if banks expect the future state of the world to be a good one, they overinvest in matching and underinvest in screening. Second, issuing equity for banks is more costly than issuing debt. If individual banks underinvest in screening, their lending decisions produce an externality because banks do not internalize the effect of their decisions on the borrower pool. This externality creates procyclical volatility in bank lending as banks overreact to the business cycle. Gete and Tierman calibrate this model of bank lending to U.S. banking data. They find that in the absence of capital requirements, banks overlend during booms and underlend during economic downturns. Although bank equity is expensive to issue, a capital requirement mitigates the lending externality and results in better lending standards and less volatility in lending over time. This result holds a relatively low capital requirement, about 4.6 percent of assets.

In the keynote address, Martin Hellwig considered the role of capital regulations in promoting financial stability, which, as a collective good, is not optimally provided by the unregulated marketplace. As a collective good, the social benefits—and costs—diverge from the private benefits and costs; that divergence justifies (potentially) the need for regulation. Lack of capital played a central role in the financial crisis, when a chronically overleveraged system became vulnerable to the shock of the subprime mortgage crisis. Fixing those flaws, however, requires overcoming a conceptual deficit.

**Links to the conference papers
can be found on our Website at**

<http://clevelandfed.org/research/capital12>

Developing a conceptual foundation is a necessary precondition for reform; it must be established before fighting the political battle needed to secure adequate reform. Two broad questions must be answered: What is the objective of reform? How will this regulation accomplish the objective?

Capital regulation plays three separate roles in promoting financial stability: It is a buffer against losses (for taxpayers, among others); it promotes proper incentives, reducing management's incentive to gamble; and it serves as a basis for supervisory intervention. These different functions call for somewhat different forms of capital regulation, however. For supervisory intervention, the capital requirement needs to reward accountability, so it should be simple, straightforward, and robust to cheating and manipulation. A buffer stock might better depend on the economic situation, in both the industry and the overall economy, and thus would be rather dynamic and complicated.

Hellwig floated the “crazy” suggestion that the bank capital requirements be set at between 20 percent and 30 percent of unweighted assets, bringing them back to levels seen before the introduction of deposit insurance and too big to fail. With higher equity, bank stocks would be safe, and the required return on their equity would fall.

Liquidity Requirements

Another part of the regulatory landscape will be the addition of liquidity requirements, which are mandated for U.S. banks in the Dodd-Frank Act and will be a component of the Basel III capital accords. Two of the papers at the conference examine the efficacy of liquidity requirements in the presence of capital requirements.

In the medical field, drug interactions are a common concern: Adding a second prescription may nullify the effect of the first, or even turn it harmful. Regulators should likewise consider interactions. In “Capital Regulation, Liquidity Requirements, and Taxation in a Dynamic Model of Banking,” Gianni De Nicrolo, Andrea Gamba, and Marcella Lucchetta explore the interactions between two of the most widely discussed banking regulations: minimum levels for capital and liquidity. In a world where banks face both credit and liquidity risk (so such requirements may make sense a priori) they show that moderate capital requirements increase bank lending and social welfare, but liquidity requirements impose sizable costs and nullify the benefits of capital requirements.

Modest levels of capital requirements prove beneficial because the unregulated bank prefers to pay out dividends rather than retain earnings to fund further lending. Imposing a capital requirement moves the bank toward the social optimum. The major effect of liquidity requirements arises because they constrain how banks can adjust to capital requirements. Thus, the bank often cannot meet a capital requirement by increasing equity because it would still not be sufficiently liquid, so often the best choice is to reduce lending. In the model, liquidity risk does not have systemic risk consequences, so it provides little justification for a liquidity requirement, but the model does present the costs of such requirements in a stark perspective.

The interaction of capital and liquidity requirements is also the main theme of “A Theory of Bank Liquidity Requirements,” by Charles Calomiris, Florian Heider, and Marie Hoerova. They point out that in a simple world devoid of frictions, cash and equity represent alternative ways of reducing a bank’s risk—holding riskless cash instead of risky loans makes default less likely, just as issuing equity capital in place of bonds does. This provides a hint that, even in more realistic (or at least more complicated) models, liquidity regulation may have as much to do with protecting a bank’s solvency as with protecting its liquidity.

In more complicated models, where bankers’ efforts are unobservable, banks hold liquidity (cash) to give themselves the right incentives to monitor loans. Holding a lot of cash, which depositors can observe, and can seize if the bank defaults, gives the bank an incentive to monitor loans, preventing both default and the loss of the cash. In effect, holding cash is a bit like posting a bond.

Banks do face liquidity risk, but in this model it is fully diversifiable within the banking system because all spending is routed through banks. However, if liquidity problems matter in financial crises—and the strong demand for liquid assets in panics (gold in the nineteenth century; government currency in the twentieth century; and government securities in the twenty-first century run on the shadow banking system) suggest it does—then Calomiris, Heider, and Hoerova miss an important aspect of the problem. Their model may provide little reason for liquidity regulation as a solution for liquidity problems, but it does raise important issues about the possible costs and unintended consequences of liquidity regulation.

Contingent Capital

Questions about capital requirements are not always just about the quantity of capital banks must hold, but also about the quality—whether trust-preferred securities should count, and whether anything other than common equity really works as capital. If capital is expensive but debt is cheap, are there forms of capital that banks would find as cheap as debt but that still provide the economic functions of capital? One innovative idea along these lines is contingent convertible capital (or CoCos). This is debt that changes into common equity when one or more

triggers are tripped. Triggers can take several forms, based on accounting data, on regulators’ discretion, or on market values. CoCos should mitigate the debt overhang problem and act as a sort of prepackaged recapitalization. How will such a novel mechanism work? In “An Experimental Analysis of Contingent Capital Triggering Mechanisms,” Douglas Davis, Oleg Korenok, and Edward S. Prescott use the new methods of experimental economics to explore the issues.


A key problem with using a market-based trigger is that the price of the CoCo reflects both market fundamentals and the chance of conversion. Furthermore, whether conversion is good or bad for share prices depends on the conversion ratio—that is, how many shares of stock each CoCo turns into. If CoCo owners get only a few shares, the conversion might be a cheap way to retire debt. If they receive many, the conversion might cause an extensive dilution of equity.

The paper considers three different triggers: a market price trigger, a trigger based on a prediction market, and a trigger pulled by a regulator. One advantage of an experiment is that the underlying fundamentals can be controlled by the researcher: In real life, we can’t know the “true” value of CitiGroup stock, but in an experiment we can. The experiment’s success was judged by the extent to which the underlying price reflected the true fundamentals, the extent to which participants took advantage of beneficial trades, and the number of times the trigger was pulled by mistake.

All three triggers had problems, and the regulators often made conversion errors (how far this translates to an expert regulator is an open question). Adding a prediction market helps considerably—that is, when regulators can observe a market price based on the probability of conversion, results improve, and they make fewer mistakes.

CoCos also come in a more extreme form, known as bail-in debt. The distinction is that CoCos convert when the stock price is above zero, when the equity holders still have some value in the firm, while bail-in debt converts after the value of the equity has hit zero. In “CoCos, Bail-In, and Tail Risk,” Nan Chen, Paul Glasserman, and Bezhad Nouri look at the incentive effects these forms of hybrid capital have on firms’ risk-taking, and on whether the firm has incentives to issue such capital on its own. Calibrating the model to recent data for large banks, replacing straight debt with CoCos makes bankruptcy less likely and substantially reduces the debt-overhang costs (though, to be honest, in most cases it means increasing the debt-overhang benefits).

An important point of the paper by Chen et al. is that it is explicitly dynamic, in that banks need to continually roll their debt over, so that actions today can affect the cost of capital tomorrow, when the debt must be repaid and refunded. Thus, if increasing capital reduces the cost of bankruptcy, it can also reduce the cost of capital. The paper also assumes that bankruptcy is endogenous; that is, the equity holders, who control the firm, put the firm into default when it is in their interest to do so (when the value



of the firm falls below the value of their equity). Replacing straight debt with CoCos lowers the endogenous default barrier because if the value of the firm's assets falls, conversion will be triggered, and this will lower the debt of the firm (because it just converted to equity). With lower debt payments, equity holders have more incentive to stay around, and the value of this more than offsets the reduced tax shield coming from less debt. Substituting CoCos for equity capital may also benefit the value of the bank, which wants to keep the tax shield from unconverted CoCos, and so takes on less risk.

Other Issues in Capital Regulation

The final three papers touch on issues related to the interaction of capital requirements with other regulations, and on measuring and pricing. Two of the papers look at capital requirements when firms respond dialectically to the capital regime in a way that is privately (but not socially) optimal; the final paper looks at the cost of a capital shortfall in the presence of systemic risk externalities.

Capital regulation is not the primary focus of Arnaud Boot and Lev Ratnovski in "Banking and Trading." These authors are interested in activity restrictions akin to those in the Vickers Report and the Dodd-Frank Act's so-called Volcker rule. In their model, banks can engage in two activities: lending and trading. Lending is relationship-based and the returns accrue over time. Lending relationships are a form of implicit capital (also called bank charter value). Lending is not readily scalable, so banks will allocate any extra capital they may have to the other activity, trading. The return on trading activities is short term. Moreover, trading is a scalable business, which means that any capital allocated to trading is used.

The problem with comingling trading with lending is that it can result in a time-inconsistent allocation of capital by banks. When returns on lending are low, banks have an incentive to shift capital from lending to trading, up to the maximum possible scale of the trading operation. Simulating their model under different assumptions about the relative profitability of lending and trading, Boot and Ratnovski find there is an optimal allocation of capital to trading. However, the time-inconsistency of capital allocation between these activities can result in too much trading, reducing the value of relationship banking. The scalability of trading also has the undesired consequence of allowing risk shifting by banks. These results are largely consistent with the activity constraints being pondered and implemented in the U.S. and Great Britain.


The conventional wisdom is that bank capital requirements should be countercyclical, that is, tightened at the peaks of credit cycles and relaxed in the troughs. But the conventional wisdom may fail to consider the notion of regulatory arbitrage and the potential unintended consequences of

countercyclical capital requirements. Taejin Kim and Vishal Mangla's "Optimal Capital Regulation with Two Banking Sectors" suggests that, at a minimum, we need to rethink the conventional wisdom. These authors construct a model with two banking sectors: one regulated (commercial banks) and the other unregulated (shadow banks). Banks are allowed to choose which sector to be in. Moreover, banks are strategic and will switch to the unregulated sector if regulation becomes too stringent.

Banks that choose to be in the regulated sector are provided with subsidized (in the model, free) deposit insurance. Regulation is imposed in the form of a risk-based capital requirement. Banks have incentives to increase risk procyclically by expanding the risky asset portfolio. Regulators can dampen commercial banks' risk-taking during this time by tightening capital requirements. However, when there is a shadow banking sector, this has the effect of pushing loan growth from the regulated to the unregulated (shadow) banking sector. In their model, this causes even more risk than if lending growth had remained in the commercial banking sector. Hence, the results of this paper suggest that, in the face of regulatory arbitrage, optimal capital requirements should be procyclical.

The Dodd-Frank Act and the proposed Basel III international capital standards mandate an additional level of capital—a systemic surcharge—for systemically important financial firms. Measuring this surcharge is the objective of Viral Acharya, Robert Engle, and Matthew Richardson in "Capital Shortfall: A New Approach to Ranking and Regulating Systemic Risks."¹ These authors observe that a single systemic bank becoming insolvent is likely to have only minor consequences for the real economy. However, concern arises when aggregate capital in the financial system is low because, in this situation, problems in the financial sector may spill over into the real economy. Viewing capital shortfalls in this context suggests that any systemic surcharge—whether it is a capital requirement or an assessed risk premium—should be based on the firm's contribution to systemic risk.

These authors measure systemic risk as the expected real social costs of a firm's capital shortfall in a financial crisis, multiplied by the probability of a crisis. Using a contingent claims approach, they estimate the capital shortfall of systemically important financial companies. This method resembles the regulatory stress test that was designed to measure how much capital a financial firm needs to weather a severe economic downturn and/or market conditions. However, there are two important differences. First, Acharya et al. use high-frequency public data, which allows them to produce estimates more frequently than the annual stress tests, and for many more time periods. Second, the stress test focuses on capital adequacy from the standpoint of a stand-alone firm. The estimates in Acharya et al. focus on the risk from a more macro-prudential viewpoint, looking at a firm's capital short-



fall in the context of an aggregate capital shortfall. This work could be a useful complement to the regulatory stress test, much as early warning models of financial distress have been used to complement the onsite bank examination process.

Lessons

Do these conference papers hold any applicable lessons for policymakers? While that was by no means the focus of every paper, some conclusions did arise.

Hellwig argued that high capital requirements had large social benefits—reducing the extent and severity of financial crises—and low social costs. Subramanian and Yang, who are unwilling to concede that capital is cheap, still find an optimal capital ratio in the neighborhood of 20 percent, based on the dangers of banks shifting to riskier assets. Chen, Glasserman, and Nouri found major social benefits from replacing 10 percent of debt with contingent capital, above and beyond banks' capital holdings, in the 2004–2011 period. This implies increasing capital from about 6–10 percent to 15–20 percent.

Liquidity requirements received more ambiguous treatment—Calomiris, Heider, and Hoerova find them more effective than capital requirements in promoting bank safety, while De Nicolo, Gamba, and Luchetta view them as costly although—or rather because—they induce banks to voluntarily hold levels of capital in excess of 30 percent.

A final theme that emerges is that the form of regulation matters, whether it be the triggers on CoCos (Davis, Korenok, and Prescott), the interaction between capital and liquidity requirements (De Nicolo, Gamba, and Lucchetta; Calomiris, Heider, and Hoerova), or whether stress tests use current methods or NYU's capital shortfall methods (Acharya, Engle, and Richardson).

Footnote

1. This paper is part of a larger set of ongoing work at New York University's Stern School of Business. See <http://vlab.stern.nyu.edu/>

Works Referenced

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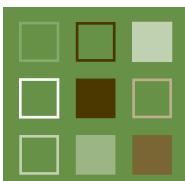


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