A Macroprudential Approach to Financial Regulation*

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Bank capital requirements were the cornerstone of financial regulation up until the global financial crisis. In the wake of the crisis there have been many calls for reform of financial regulation, with a first step having been recently passed in the United States. In this paper, we offer a vision for how a new regulatory regime could be designed. Our prescriptions follow from a specific theory of how modern financial crises unfold, and why both an unregulated financial system, as well as one based primarily on capital rules just for banks, is likely to be fragile.

As a starting point it is useful to distinguish between "microprudential" and "macroprudential" approaches to financial regulation. Many observers have argued that a weakness of the existing framework is that it is largely microprudential (Crockett 2000; Borio, Furfine and Lowe 2001; Borio 2003; Kashyap and Stein 2004; Kashyap, Rajan and Stein 2008; Brunnermeier et al 2009, Bank of England 2009, French et al 2010). A microprudential approach is one in which regulation is partial-equilibrium in its conception, and is aimed at preventing the costly failure of *individual* financial institutions. By contrast, a macroprudential approach recognizes the importance of general-equilibrium effects, and seeks to safeguard *the financial system as a whole*. There seems to be agreement among both academics and policymakers that the overarching orientation of financial regulation needs to move in a macroprudential direction. For example, Bernanke (2008) states:

> "Going forward, a critical question for regulators and supervisors is what their appropriate 'field of vision' should be. Under our current system of safety-and-soundness regulation, supervisors often focus on the financial conditions of individual institutions in isolation. An alternative approach, which has been called systemwide or macroprudential oversight, would broaden the mandate of regulators and supervisors to encompass consideration of potential systemic risks and weaknesses as well."

Moving beyond broad statements of objectives, in order to operationalize the macroprudential approach in a sensible way—i.e., to translate it into a set of specific policy

prescriptions—one must begin with a particular model of what goes wrong in a financial crisis. Moreover, this model must identify the key market failures at work: it must spell out why individual financial firms, acting in their own interests, deviate from what a social planner would have them do. Once the market failures are clear, one can go on to propose various concrete steps to remedy them. This is where we begin.

Theories of Financial Regulation

Microprudential Regulation

At the risk of caricature, traditional microprudential regulation of banks can be said to be based on the following logic. Banks finance themselves with government-insured deposits. While deposit insurance has the valuable effect of preventing bank runs (Diamond and Dybvig 1983), it also creates taxpayer exposure and an accompanying moral hazard problem for bank managers. The goal of capital regulation is to force banks to internalize the losses on their assets, thereby protecting the deposit insurance fund and mitigating moral hazard. Thus if the probability of the deposit insurer bearing losses is reduced to a low enough level, microprudential regulation is by definition doing its job.

To be specific, consider a bank with assets of $100 that is financed with insured deposits and some amount of capital. Suppose that the regulator can check up on the bank at discrete intervals, say once a quarter. Suppose further that the volatility of the bank's assets is such that with probability 99.5%, they do not decline in value by more than 6% in a quarter. Then if the goal of policy is to reduce the probability of bank failure—and the associated losses to the deposit insurance fund—to 0.5%, this can be accomplished by requiring the bank to hold capital equal to 6% of its assets as a cushion against losses. Note that in this setting, the exact form of

the capital cushion is not important—it can be common equity, but it can equally well be preferred stock, or subordinated debt, as long as these instruments are not explicitly or implicitly insured, i.e., as long as they will in fact bear losses in a bad state of the world.[1]

An important element of capital regulation as it is implemented in practice is the principle of prompt corrective action (PCA), which requires that a bank take immediate steps to restore its capital ratio in the wake of losses. Returning to our example, suppose the bank starts out with capital of $6, but then over the next quarter experiences losses of $2, so that its capital falls to $4. If the volatility of its assets remains unchanged, in order for its probability of failure over the subsequent quarter to stay at 0.5%, it would need to bring its capital ratio back up to 6%. It could do so in one of two ways: either by going to the market and raising $2 of fresh capital, or by leaving its capital unchanged and shrinking its asset base to $66.67 (since 4/66.67 = 6%).

Macroprudential Regulation

The basic critique of microprudential regulation can be understood as follows. When a microprudentially-oriented regulator imposes PCA on a troubled bank, and pushes the bank to restore its capital ratio, *he does not care whether the bank adjusts via the numerator or via the denominator—i.e., by raising new capital or by shrinking assets.* Either way, the bank's own probability of failure is brought back to a tolerable level, which is all that a microprudential regulator cares about.

Such indifference to the method of adjustment makes sense if we are considering a single bank that is in trouble for idiosyncratic reasons. If that bank chooses to shrink its assets—e.g., by cutting back on lending—others can pick up the slack. Indeed, asset shrinkage in this case

[1] The current requirement for a bank to be deemed "well capitalized" in a regulatory sense is that it have a ratio of Tier 1 capital to risk-weighted assets of 6%, where Tier 1 capital includes, roughly speaking, not only common equity but also various forms of preferred stock.

can be part of a healthy Darwinian process, whereby market share is transferred from weaker troubled institutions to their stronger peers. However, if a large fraction of the financial system is in difficulty, a simultaneous attempt by many institutions to shrink their assets is likely to be more damaging to the economy. In the simplest terms, one can characterize the macroprudential approach to capital regulation as an *effort to control the social costs associated with excessive balance-sheet shrinkage on the part of multiple financial institutions hit with a common shock.*

It follows that in order to make a compelling case for macroprudential regulation, it is necessary to answer two questions. First, what exactly are the costs imposed on society when many financial firms shrink their assets at the same time? And second, why do individual banks not properly internalize these costs? That is, why do they not choose to raise fresh capital ex post when a bad shock hits, thereby alleviating the need to shrink? Or alternatively, why do they not hold sufficiently large capital buffers ex ante as to make ex post capital raising unnecessary?

There are two primary costs of generalized asset shrinkage: credit-crunch and fire-sale effects. If banks shrink their assets by cutting new lending, operating firms find credit more expensive, and reduce investment and employment, with contractionary consequences for the macroeconomy. If a large number of banks instead shrink their assets by all dumping the same illiquid securities (think of toxic mortgage-backed securities) the prices of these securities can drop sharply, in a fire sale of the sort described by Shleifer and Vishny (this issue).[2] Moreover, the fire-sale and credit-crunch effects are intimately connected, as pointed out by Diamond and Rajan (2009), Shleifer and Vishny (2010) and Stein (2010). If a toxic mortgage security falls in price to the point where it offers a (risk-adjusted) 20% rate of return to a prospective buyer, this

[2] On fire sales, see also Shleifer and Vishny (1992, 1997), Allen and Gale (2005), Brunnermeier and Pedersen (2009), Fostel and Geanakoplos (2008), Geanakoplos (2010), Gromb and Vayanos (2002), Morris and Shin (2004), Caballero and Simsek (2010), and Stein (2009).

will tend to drive the rate on new loans up towards 20% as well—since from the perspective of an intermediary that can choose to either make new loans or buy distressed securities, the rate of return on the two must be equalized. In other words, in market equilibrium, the real costs of fire sales manifest themselves in further deepenings of credit crunches.

Of course, to make a case for regulatory intervention, one has to explain why these 20% rates of return don't naturally draw in enough private capital, either ex post—once a crisis is underway—or ex ante, in the form of a precautionary buffer stock. The ex post answer relies on the debt overhang problem identified by Myers (1977). Once a bank is in serious trouble, and its debt is impaired in value, it is reluctant to raise new equity even to fund investments that are positive-NPV. This is because much of the value that is created is siphoned off by the more senior creditors.[3] Given the debt overhang problem, banks that act in the interests of their shareholders will tend to fix their damaged capital ratios by shrinking assets rather than by raising new capital, even when the latter is more desirable from a social perspective.

This still leaves the ex ante question: why is it that in good times, when debt overhang is not yet a concern, banks don't voluntarily build up adequate buffer stocks of excess capital, so that when bad times come they can absorb the losses without having to either shrink assets or raise new capital under duress? After all, such a dry-powder strategy would allow them to exploit highly profitable opportunities should a crisis arise. This question is addressed in Stein (2010), who extends the basic fire-sale model to consider ex ante capital structure choice. He shows that if short-term debt is a cheaper form of finance than equity, banks will tend to take on more debt than a social planner would like them to: while they capture the benefits of cheap debt

[3] A further complication comes from adverse selection, as in Myers and Majluf (1984): when a bank chooses a new equity issue—instead of the option of shrinking its assets—this may signal that management believes the stock to be overvalued, which in turn leads to a negative stock price response to the issue.

finance, they do not internalize all of its costs. In particular, when Bank A takes on more debt, it does not account for the fact that by doing so, it degrades the collateral value of any assets it holds in common with another Bank B—since in a crisis state of the world, A's fire-selling of its assets lowers the liquidation value that B can realize for these same assets.

In sum, a model based on fire sales and credit crunches suggests that financial institutions have overly strong incentives to both: i) shrink assets rather than recapitalize ex post, once a crisis is underway; and ii) operate with too-thin capital buffers ex ante, thereby raising the probability of an eventual crisis and system-wide balance-sheet contraction. Therefore, one specific vision of the macroprudential approach to capital regulation is that it should aim to counterbalance these two tendencies. With this in mind, we turn next to some of the individual items in the macroprudential toolkit.

Before doing so however, we should emphasize that, in contrast to the traditional view, *nothing in this alternative theory of capital regulation relies on the existence of deposit insurance*. In other words, in a model of crises based on fire sales, there is socially excessive balance-sheet shrinkage, and hence a rationale for regulation, even absent government insurance. Thus there is a strong presumption that macroprudential capital regulation should be applied to more than just insured deposit-taking institutions. The broader point (stressed by Tucker 2010) is that regulators need to pay attention to all the channels through which the actions of financial institutions can cause damage, and must take steps to contain the various channels.

Macroprudential Tools

We now discuss six sets of tools that can be helpful in implementing a macroprudential approach of the sort described above. Our goal here is not to provide a comprehensive laundry

list of current reform proposals, but rather to show how a particular conceptual framework provides a unified way of thinking about what otherwise might seem like a hodgepodge of different fixes. Importantly, the combination of tools we review would safeguard the financial system from the main channels through which credit crunches and fire sales may arise.

As a prelude, note that if the goal of regulation is to prevent financial firms from shrinking their balance sheets excessively in an adverse state of the world, a simple accounting identity imposes a lot of discipline. In particular, when a bank is hit with a shock that depletes its capital, there are only two ways to prevent it from shrinking its assets: i) it can raise new capital to replace that which was lost; or ii) it can let its ratio of capital to assets to decline. Many of the tools that we discuss are just different mechanisms for facilitating adjustment on one of these two margins. We start with capital proposals and then broaden out to other options that have heretofore been outside of the regulatory toolkit.

Time-Varying Capital Requirements

One intuitively appealing response to the problem of balance-sheet shrinkage is to move to a regime of time-varying capital requirements, with banks being asked to hold higher ratios of capital to assets in good times than in bad times. This way, when an adverse shock hits, banks can draw down their buffers, and continue operating with less pressure to shrink. Kashyap and Stein (2004) argue that time-varying capital requirements emerge as an optimal scheme in a model where the social planner maximizes a welfare function that weights both: i) the microprudential objective of protecting the deposit insurance fund; and ii) the macroprudential objective of maintaining credit creation during recessions.[4] The idea is that in bad times, when bank capital is scarce and credit supply is tight, it is optimal for a planner concerned with both objectives to tolerate a higher probability of bank failure than in good times.

[4] The formal model is developed more fully in a 2003 working paper version of Kashyap and Stein (2004).

A challenge in designing such a regime is that in bad times, the regulatory capital requirement is often not the binding constraint on banks. Rather, as the risk of their assets rises, the market may impose a tougher test on banks than do regulators, refusing to fund institutions that are not strongly capitalized.[5] Table 1 shows that, as of 2010Q1, the four largest U.S. banks had an average ratio of total Tier 1 capital to risk-weighted assets (RWA) of 10.7%, and an average ratio of Tier 1 common equity to RWA of 8.2%.[6] These are both well above the regulatory standard, which requires a ratio of total Tier 1 capital to RWA of 6% for a bank to be deemed "well capitalized". Thus even as we emerge from a deep financial crisis, the regulatory constraint is manifestly non-binding.

This implies that in order to achieve meaningful time-variation in capital ratios, *the regulatory minimum in good times must substantially exceed the market-imposed standard in bad times.* Thus if the market-imposed standard for equity-to-assets in bad times is 8%, and we want banks to be able to absorb losses of, say, 4% of assets without pressure to shrink, then the regulatory minimum for equity-to-assets in good times would have to be at least 12%. Moreover, a loss on the order of 4% of assets is actually less severe than the experience of the major banks during the recent crisis; the IMF (2010) estimates that cumulative credit losses at U.S. banks from 2007 to 2010 will be on the order of 7% of assets. Using this figure, one could argue for a good-times regulatory minimum ratio of equity-to-assets of 15%. Either way, these are high values, significantly higher than obtained from a microprudential calculation that asks only how much capital is needed to avert failure.

[5] This tendency may be amplified by the widespread use of "Value at Risk" (VaR) models. As measured volatility and hence VaR go up in bad times, such models mechanically call for banks to hold higher ratios of capital. Thus banks' own internal risk management practices might compel shrinkage even if market funding remains available.

[6] In addition to common equity, total Tier 1 capital includes, e.g., preferred stock.

Missing from the discussion so far is the cost side of the equation: while a good-times capital requirement in the range of 12% to 15% may have substantial benefits from a macroprudential perspective, we have not yet asked what adverse consequences it might have, either in terms of raising the cost of intermediation, or of heightening the incentives for regulatory arbitrage. We return to this important topic in the final section of the paper.

Higher Quality Capital

Traditionally, the capital metric given the most attention by regulators has been the ratio of total Tier 1 capital to risk weighted assets. In addition to common equity, total Tier 1 capital includes, among other items, preferred stock. Thus both equity and preferred have "counted" in the same way towards satisfying capital requirements. From a microprudential perspective, this makes perfect sense. If the only concern is avoiding losses to the deposit insurer in the event of bank failure, so long as both common and preferred holders are strictly junior in priority to the deposit insurer, they will provide the desired loss-absorption cushion.

More recently, however, in the wake of the crisis, there has been much discussion among investors and regulators about how the "quality" of a bank's capital base matters, and how common stock is a "higher-quality" form of capital than preferred. While this distinction is hard to understand from a microprudential loss-absorption perspective, it flows naturally from the macroprudential approach, which focuses less on a static failure scenario, and more on enabling troubled institutions to recapitalize dynamically and remain viable as going concerns. Common equity is more friendly to the recapitalization process than preferred stock, because it is more junior, and hence less problematic in terms of the debt overhang problem described above.

To see this point, consider two banks, A and B. Both begin with total assets of $100, and total capital of $6. But A's capital is composed entirely of equity, while B has $2 of equity and

$4 of preferred. Now suppose both banks lose $3. In an effort to avoid shrinking their assets, they would like to raise new capital. Suppose they do so by trying to issue equity. This will be harder for Bank B, whose entire pre-existing equity layer has been wiped out, and whose preferred stock is as a result now trading at a steep discount to its face value—for any new equity that B brings in will largely serve to bail out the position of its more senior preferred investors.

This logic suggests that an emphasis on quality of capital is well-placed. Given the goal of promoting rapid recapitalization by going-concern banks that run into trouble, it is entirely reasonable for regulators to require that most of the capital requirement be satisfied with common equity. Indeed, we are inclined to the view that essentially *all* of what is now the Tier 1 requirement should be in terms of equity, or instruments that are contractually guaranteed to convert into equity in a bad state (see below for a discussion), while more senior securities like preferred stock should for the most part not count.

Prompt Corrective Action Targeted At Dollars of Capital, Not Capital Ratios

As mentioned above, an important element of the capital-regulation process is the notion of prompt corrective action (PCA). According to PCA, banks that fall below a designated capital threshold are subject to a variety of potential sanctions (e.g., restrictions on dividends) until they repair their capital ratios. The principle of rapid regulatory intervention in the face of problems is no doubt a good one. However, the precise form of the intervention matters a great deal. If a bank is put in the penalty box until it manages to fix its capital *ratio*, there is the shrinkage concern: it may well choose to fix the ratio not by raising the numerator (capital) but by reducing

the denominator (assets).[7] A better approach is to create direct incentives for the bank to raise *incremental dollars* of new capital, rather than just boosting its capital ratio.

One way to implement this would be with a capital-ratio requirement that refers to the *maximum* of current and lagged assets. Imagine a bank that starts with assets of $100 and capital of $8 at the end of year *t*, and suppose that the threshold for PCA intervention is a capital ratio of 6%. Now assume that the bank has losses of $4 over year *t+1*, so that it ends the year with $4 of capital. As normally applied, PCA would push the bank to get its ratio back up to 6%, which it might do by shrinking its assets to $66.67. Under our alternative, the bank would only get out of the penalty box when its ratio of capital to the *maximum of year-t and year-t+1 assets* exceeded 6%. Given that year-*t* assets were $100, and cannot be reduced retroactively, the bank would have to raise $2 of new capital, i.e., it could not avoid PCA sanctions by shrinking assets.

A dramatic illustration of this dollars-based corrective action principle comes from the Supervisory Capital Assessment Program (SCAP), the so-called "stress tests" that the major U.S. banks were subject to in the spring of 2009. The output of the SCAP was, for each bank being tested, a *dollar* target for new equity capital that had to be raised, via equity issues or asset sales. For some of the banks involved, the numbers were very large—e.g., Bank of America was required to raise $33.5 billion. The penalty box in this case was that any bank failing to raise the capital from the private markets would be required to accept an equity injection from the Treasury, which would have involved strict limits on executive compensation. Remarkably, in the few weeks following the release of the SCAP results, the banks involved were able to raise nearly $60 billion in new common equity; by the end of 2009 this figure had risen to over $125

[7] Hart and Zingales (2009) recommend forcing banks to issue equity whenever their credit risk (as measured by the spreads on their credit default swaps) goes above a certain level. While this can be thought of as a form of PCA, it does not address the shrinkage problem, since a bank can also reduce its credit spreads by selling risky assets.

billion. Here is a case where a strong regulatory hand appears to have had highly beneficial effects.[8] Hopefully, this basic lesson can be incorporated into regulatory policy going forward.

Contingent Capital

The dollars-based PCA policy described above amounts to an attempt to force banks to recapitalize on the fly when they get into trouble. A closely related idea is to "pre-wire" the recapitalization with a contingent instrument that automatically increases a bank's equity position when some prespecified contractual trigger is breached. Two broad types of contingent capital instruments have been proposed. The first, sometimes called "reverse convertibles" or "contingent convertibles" involves a bank issuing a debt security that automatically converts into equity if a measure of either the bank's regulatory capital or stock-market value falls below a fixed threshold (Flannery 2005, French et al 2010).[9] A prominent case of something along these lines was a £7.5 billion issue by Lloyds Bank in November of 2009, with the conversion from debt to equity to be triggered if Lloyds' Tier 1 capital ratio falls below 5%.

A second type of contingent capital is "capital insurance" (Kashyap, Rajan and Stein 2008). As the name suggests, this involves a bank purchasing an insurance policy that pays off in a bad state of the world, again as captured by some prespecified trigger. In order to address concerns about the insurer defaulting, the policy would be fully collateralized ahead of time—that is, the insurer would be required to put the full amount of the policy into a lock box up front. For example, a bank might contract with a pension fund to buy a capital insurance policy that

[8] Indeed, by being tough and giving banks no choice, regulators probably made it easier for banks to do the capital raising. This is because absent discretion, the adverse-selection problem normally associated with equity issues disappears. If a bank has a choice of whether or not to issue equity, its decision to do so may signal that management believes it to be overvalued, and hence may knock down the stock price. But if it has no choice, there is no information content, and hence no negative price impact.

[9] There are a number of important design issues associated with the specification of the trigger in a contingent convertible security, with both pros and cons to using a trigger based on stock prices as opposed to regulatory accounting numbers. See McDonald (2010) for a detailed discussion of these issues.

pays $20 billion in the event that an economy-wide index of bank stock prices falls below some designated value any time in the next five years. At initiation, the pension fund would turn the $20 billion over to a custodian; if the bad state is not realized within five years, the $20 billion reverts back to the pension fund, and if it is realized, the funds are transferred to the bank.

Both of these designs share a common motivation. The premise is that banks view equity capital as an expensive form of finance—i.e., there are one or more violations of the Modigliani-Miller (1958) conditions that make banks reluctant to carry large precautionary buffers of equity. In principle, regulation could confront the problem with brute force, simply mandating that banks hold very large equity buffers. However, it may be more efficient to economize on the unconditional use of equity in most states of the world, and instead to develop a financing arrangement that delivers more equity only in those bad states where it is most valuable.

If these forms of contingent capital are such a good idea, why haven't we seen more of them to date? A simple answer is that they require regulatory blessing—they have to be allowed to count towards regulatory capital requirements—in order to be more attractive to a prospective bank issuer than straight debt. Consider the following approach. The capital requirement for a bank in good times might be set at a relatively high level, say 20%. Banks would then be given a choice: they could satisfy the entire requirement with equity, or they could satisfy up to say 10 percentage points of it with a reverse convertible, so long as it was contractually guaranteed to turn into equity in a well-defined bad state. The reverse convertible might be seen as more costly than straight debt—which is why banks would not use it if it did not count as regulatory capital—but as long as it was cheaper than equity, there would be an efficiency gain.

Finally, it is worth noting the close connection between contingent capital and certain proposals to reform executive compensation by imposing bonus holdbacks on key employees of

financial firms. For example, French et al (2010) suggest withholding a significant share of each senior manager's total compensation for several years. The withheld compensation would not take the form of stock or options, but would instead be a fixed dollar amount. Moreover, managers would forfeit their holdbacks if the firm were to fail or to receive extraordinary government assistance.

Structurally, this holdback proposal is similar to the capital insurance scheme of Kashyap, Rajan and Stein (2008), with the key difference being that it requires firm managers—rather than, say, a pension fund—to be the insurance provider. The merit of this approach is that not only does the held-back compensation create an extra contingent capital buffer, it also helps to improve incentives within the firm. In particular, by making insiders bear downside risk, without any additional upside potential, it aligns their fortunes with those of taxpayers and other creditors—and in so doing, leans against the heads-I-win, tails-you-lose risk-taking incentives created by more conventional forms of stock and profit-linked compensation.

Regulation of Debt Maturity and Asset Liquidity

In our discussion thus far, we have framed the capital-regulation question as being about how much debt banks should be allowed to have in their capital structures, without discriminating between short-term and long-term debt. One important lesson from the recent financial crisis is that this distinction is a crucial one, and that it has been given insufficient attention in the existing regulatory framework.

Table 2 presents a snapshot of the aggregate financial structure of the U.S. banking system, including not only commercial banks but also broker-dealer firms. As can be seen, the large majority of their debt is short-term: either deposits or "short-term wholesale funding", which includes e.g., commercial paper and repurchase (repo) agreements. While deposits are

generally insured and hence not likely to be withdrawn at the first sign of trouble, the same is not true for short-term wholesale funding. Indeed, a number of observers have pointed out that wholesale funding runs—a refusal of repo and commercial paper creditors to roll over their loans—played a central role in the demise of Northern Rock, Bear Stearns and Lehman Brothers, among other high-profile failures (Shin 2009; Gorton and Metrick 2010; Duffie 2010).

The case for regulating the use of short-term debt by financial firms—above and beyond regulating total leverage—rests on two observations. First, as is well understood, the ability of short-term lenders to run leads to more fragility than with an equivalent amount of long-term debt (Diamond and Dybvig 1983). Holding fixed their overall leverage ratios, it is hard to imagine that Northern Rock, or Bear Stearns, or Lehman would have faced the same kinds of problems had they done most of their borrowing on a long-term basis. Second, in the presence of market-wide fire sales, there is an externality in the choice of debt maturity. An individual bank or broker-dealer may opt to finance largely with short-term debt if this option is cheaper; what it fails to fully internalize is that in a crisis scenario, an inability to roll over short-term debt will force it to liquidate assets, thereby imposing a fire-sale cost on others who hold the same assets, and who see the value of their own collateral diminished. The result is a level of short-term financing that is socially excessive—hence the role for regulation (Stein 2010).

A corollary to this diagnosis is that some of the fire-sale risk can be managed partially by adjusting the requirements for asset composition. To the extent that financial institutions have assets which are not prone to fire-sales discounts (e.g., Treasury securities), some of these assets can be sold as pressure develops without adversely impacting other institutions.

In the wake of the crisis, the regulatory community has responded by significantly increasing its emphasis on debt-maturity and asset-liquidity considerations as part of the overall

regulatory regime. The Basel Committee on Banking Supervision (2009) has put forth a set of proposals that include a "net stable funding ratio" test—effectively, a requirement that financial firms' capital structures have a certain amount of long-term funding, which would encompass both equity and debt with a maturity of greater than one year.[10] While the details of this and other aspects of liquidity regulation are delicate and remain to be fleshed out, the broad thrust of this effort is a step in the right direction.

Regulating the Shadow Banking System

As argued above, if one takes a macroprudential/fire-sales view of the world, the key market failure is not that associated with deposit insurance. Rather, it is the fact that highly-leveraged financial firms, especially those that rely primarily on short-term debt, are forced to dump assets simultaneously when hit with a common shock, and that these firms do not properly take into account the problems that this fire-selling creates when picking their initial capital structures. It follows that financial regulation must cover not just insured depositories, but rather, any kind of financial intermediary whose combination of asset choice and financing structure has the potential to exacerbate a systemic fire-sale problem.

A narrow interpretation of this principle would be to say that regulation should cover large, systemically significant non-bank institutions such as Bear Stearns and Lehman Brothers, who did not finance themselves with insured deposits, but who, as just noted, were nevertheless subject to wholesale financing runs. This specific point is now well-appreciated; however, the principle is actually much broader in its implications. It is true that many of the most dramatic moments of the recent crisis involved the failures of some of the nation's biggest non-bank

[10] The amount of net stable funding required would be a function of the assets that the firm holds, in much the same way that risk-based capital requirements work. But determining this linkage will be difficult. For example, sovereign debt might be considered to have maximum liquidity, but as recent events in Europe have shown, this assumption may not hold true for all countries.

financial firms. Yet from the perspective of credit creation and impact on the broader economy, one of the most damaging aspects of the crisis was not just the problems of these big firms, but also the *collapse of an entire market*, namely the market for asset-backed securities, or ABS.

This collapse is illustrated in Figure 1.[11] The market for "traditional" ABS, those based on credit-card, auto, and student loans, averaged between $50 and $70 billion of new issues per quarter in the years prior to the crisis (total issuance for 2007 was $238 billion). However, in the last quarter of 2008, following the demise of Lehman, issues in this category fell to just over $2 billion. The disappearance of this market represented a major contraction in the supply of credit to consumers, and may well have played a central role in the steep drop in aggregate consumption that occurred at this time.

The investors who buy ABS tranches frequently do so by relying on short-term borrowing. Entities known as "structured investment vehicles" or "conduits", which in the past tended to be affiliated with sponsoring commercial banks, hold ABS tranches and finance them with commercial paper, which typically has a maturity of only days or weeks. Hedge funds and broker-dealer firms often finance their holdings of ABS with repurchase agreements, a form of overnight collateralized borrowing. Collectively, these various investors who acquire ABS and finance them with short-term debt are often referred to as the *shadow banking system*. Moreover, as emphasized by Gorton (2010), Gorton and Metrick (2010), and Covitz, Liang and Suarez (2009), the collapse of the ABS market featured the essential elements of a classic bank run, namely an inability of ABS investors to roll over short-term financing.

One manifestation of the withdrawal of short-term lending to the ABS market comes from the behavior of "haircuts" in repurchase agreements. When an investor borrows in the repo market, he is required to post a margin, or downpayment. This is known as the haircut. Haircuts

[11] The discussion in the remainder of this section is a much-abridged version of material in Stein (2011).

on most highly-rated ABS were very low prior to the crisis, on the order of 2%. What this means is that if a hedge fund wanted to buy $1 billion of AAA-rated auto-linked ABS, it only needed to put up $20 million of its own capital. The other $980 million could be borrowed on an overnight basis in the repo market; in many cases the ultimate lenders were money-market mutual funds.

In the midst of the crisis, haircuts skyrocketed. Even haircuts on consumer ABS—those not linked to subprime problems—rose to over 50%. From the perspective of the hedge fund holding $1 billion of auto-linked ABS, all of a sudden it could only borrow $500 million, and instead of having to post a $20 million downpayment, had to put up $500 million. If it did not have the cash to do so, it would have been forced to liquidate its holdings. These liquidations, and the impact they had on the level and volatility of ABS prices, in turn justified the increased skittishness of the lenders in the repo market, since their protection depends on the collateral value of the assets they lend against. In other words, the disruption to the ABS market may have been the result of what Brunnermeier and Pedersen (2009) call a "margin spiral".

This discussion suggests that, from a macroprudential perspective, it would be a mistake to focus too narrowly on insulating our largest financial institutions, while paying insufficient attention to potential vulnerabilities in the rest of the financial system. Rather, the goal should be a balanced approach that addresses all elements of the system in an integrated fashion. What concrete steps might be taken in this regard? A useful first principle is that an effort should be made to impose similar capital standards on a given type of credit exposure, irrespective of who winds up ultimately holding the exposure—be it a bank, a broker-dealer firm, a hedge fund, or a special-purpose vehicle. This is not an easy task, but one tool that would help is broad-based regulation of haircuts (i.e., minimum margin requirements) on asset-backed securities.[12]

[12] For models that suggest a role for haircut regulation, see Geanakoplos (2010), and Stein (2010).

Consider the case where the exposure is a consumer loan. If this loan is made by a bank, it will be subject to a capital requirement. Now suppose instead that the loan is securitized by the bank, and becomes part of a consumer ABS whose tranches are distributed to various types of investors. The regulation we have in mind would stipulate that whoever holds a tranche of the ABS would be required to post and maintain a minimum haircut against that tranche—with the value of the haircut depending on the seniority of the tranche, the quality of the underlying collateral, and so forth. Such a requirement is nothing conceptually new, and should not be difficult to enforce; indeed it is closely analogous to the initial and maintenance margin requirements that are currently applicable to investors in common stocks.

If these haircut requirements are well-structured, they would have two benefits. First, they could help to harmonize the effective extent of regulation across organizational forms, thereby reducing the incentive for consumer loans to migrate off bank balance sheets and into the shadow-banking sector. As discussed below, this is especially important as we move towards significant increases in the capital requirements imposed on banks. The goals of these higher bank-capital requirements are likely to be partially frustrated if they drive significant amounts of activity outside of the banking system.

Second, for that portion of credit-creation activity that does end up in the shadow-banking sector, haircut regulation can dampen the bank-run-like dynamics described above. The problem is that if haircuts start out at 2% before a crisis, and then jump to 50%, this creates a powerful forced-selling pressure on ABS owners. If instead haircuts are set at a more prudent value before the crisis, so that investors put up more of their own cash at the outset, this forced-selling mechanism, and the vicious spiral it unleashes, might be substantially attenuated.

What Are the Costs of Higher Capital Requirements?[13]

We have argued that a macroprudential approach involves imposing substantially higher capital requirements on financial firms, particularly in good times. But what are the costs of doing so? In what follows, we focus on the long-run steady-state consequences of higher capital requirements, setting aside the transitional issues associated with phase-in of a new regime.[14]

A Modigliani-Miller Perspective

Modigliani and Miller (1958) (henceforth M-M) show that under certain conditions, a firm's capital structure is irrelevant for its operating decisions. In the banking context, this would imply, e.g., that the rate that a firm charges on its loans should be *independent* of its capital ratio. The M-M conditions are stringent—they include no taxes, symmetric information, rational risk-based pricing, and investment decisions and cash flows that are independent of financial policy. Thus they are not meant to be an accurate depiction of reality. Rather, the value of M-M is that it forces one to be precise about which of the conditions is violated, which allows for a more disciplined analysis of the effects associated with changes in capital structure.

In particular, the M-M paradigm exposes the flaw in the following reasoning: "Equity is more expensive than debt because it is riskier. Thus if a bank is forced to rely more on equity, its overall cost of finance will go up, and it will have to charge more for its loans." The fallacy here is that the risk of equity, and hence its required return, is not a constant, but rather declines as leverage falls.[15] Indeed, when all the M-M conditions hold, this effect is just enough to offset the

[13] This section draws on material from our unpublished working paper, Kashyap, Stein and Hanson (2010).

[14] Transitional costs reflect the fact that, because of adverse-selection problems (Myers and Majluf (1984)) and other frictions, it is more costly for banks to *raise* new equity from external sources than it is for them to *maintain* equity on their balance sheet once they have accumulated it from, say retained earnings.

[15] In Kashyap, Stein and Hanson (2010), we show that this proposition holds empirically in the banking sector: in a panel of large banks, those with less leverage have significantly lower values of both beta and stock-return volatility.

increased weight of the more-expensive equity in the capital structure, so that the overall cost of capital *stays fixed* as bank leverage varies.

With this caveat in mind, we discuss two deviations from M-M's idealized conditions that are likely to be important. The first has to do with corporate taxes—the fact that interest payments on debt are tax-deductible, while dividend payments on equity are not. This effect lends itself to easy measurement. Suppose that new equity capital displaces *long-term* debt in a bank's capital structure, and that the only impact on the bank's weighted average cost of capital (WACC) comes from the lost tax shields on the debt. If the coupon on the debt is 7%, and given a corporate tax rate of 35%, each percentage point of increased equity raises the WACC by .07*.35 = 2.45 basis points. Thus even a ten-percentage-point increase in the capital requirement only boosts the WACC—and hence loan rates—by 25 basis points; this is a small effect.

To generate a higher figure, consider a case where equity displaces *short-term* debt; this can be interpreted as capturing the joint effects of an increase in both capital and liquidity requirements, along the lines described above. Moreover, following Gorton (2010), Gorton and Metrick (2010), and Stein (2010), assume that—in violation of the M-M conditions—there is a non-risk-based "money" premium on wholesale short-term bank debt that reflects its usefulness as a transactions medium. (Commercial paper and repo is often held by money-market mutual funds, who in turn issue checkable deposits.) A generous upper-bound estimate of this money premium might be on the order of 100 basis points.[16] So now, a ten-percentage-point increase in capital requirements raises the WACC by an added 10 basis points relative to the previous taxes-only case, and we are up to 35 basis points in total. This is still a quite modest number.

[16] As a benchmark, Krishnamurthy and Vissing-Jorgensen (2010) estimate that Treasury securities impound a money-like convenience premium of approximately 72 basis points, on top of what would be expected in a standard risk-vs.-return asset-pricing setting.

Time Variation in Bank Capital Ratios and Lending Rates

A different way of learning about the impact of higher capital ratios is to examine the historical record. Figure 2, which is adapted from Berger, Herring, and Szego (1995), plots the ratio of book equity to book assets for U.S. commercial banks from 1840 to 2009. Capital ratios exceeded 50% in the 1840s and fell steadily for the next 100 years, reaching 6% by the 1940s. Have these large fluctuations in capital ratios translated into big differences in the cost of bank credit? To address this question, we examine three proxies for the markup that banks charge on loans: i) the net interest margin (net interest income over earning assets); ii) the yield on loans (interest income on loans over gross loans) minus the rate paid on deposits (interest expense on deposits over deposits); and iii) the prime rate minus the rate on short-term Treasury bills.[17] Our net interest margin and prime-rate spread series are available from 1920-2009, while the loan yield minus deposit rate series is only available beginning in 1927.[18]

In Table 3, we regress each of these measures on the ratio of equity-to-assets. In univariate regressions, there is no discernible relationship between equity-assets and any of our three markup measures. In fact, the relationship is actually negative for the net interest margin and the loan yield minus the deposit rate. Thus, consistent with the small effects from our M-M-based calibration, the simplest historical analysis reveals no tendency for higher capital ratios to be associated with higher loan spreads.

Table 3 also displays multivariate regressions in which we control for other plausible determinants of markups. While these controls greatly enhance the fit of the regressions—the R^2

[17] None of these measures is without problems. For instance, net interest margins are affected by changes in the mix of loans versus securities held by banks over time. Furthermore, the prime rate has become a less meaningful indicator of the cost of customer loans over the last 15 to 20 years.

[18] Data from 1919-1933 is for Federal Reserve member banks and is from Banking and Monetary Statistics, 1919-1941. Data from 1934-2010 is for all insured commercial banks and is taken from the FDIC's Historical Statistics on Banking at http://www2.fdic.gov/hsob/. Interest income on loans is not available until 1927.

now ranges from 0.77 to 0.93—the coefficients on the key equity-to-assets variable remain small and statistically insignificant in the first two specifications, those involving the net interest margin and the loan yield minus the deposit rate. By contrast, in the third specification, that involving the spread between the prime rate and T-bills, the coefficient on the equity-to-assets variable is large and statistically significant. The point estimate of 28.31 implies that a one-percentage point increase in the ratio of equity-to-assets is associated with a 28 basis point increase in the cost of loans. The magnitude of this effect is approximately *ten times* that emerging from our M-M calibrations, and is too big to make economic sense—loosely speaking, it implies that the cost of equity exceeds the cost of debt by 28 percentage points.

Overall, our reading of the historical evidence is that it is too noisy, and our proxies for loan spreads too crude, for us to draw any confident conclusions about whether a correlation between equity ratios and loan rates *even exists*. Certainly this data does not allow us to reject the M-M-based premise, namely that any effect is likely to be economically small in magnitude.

But Then Why Are Banks So Determined to Operate With High Leverage?

The above conclusions may appear surprising, even paradoxical. If significant increases in capital ratios have only small consequences for the rates that banks charge their customers, why do banks generally feel compelled to operate in such a highly-leveraged fashion, in spite of the obvious risks this poses? And why do they deploy armies of lobbyists to fight against increases in their capital requirements? By way of contrast, it should be noted that non-financial firms tend to operate with much less leverage than financial firms, and indeed often appear willing to forego the tax (or other) benefits of debt finance altogether.

In Kashyap, Stein and Hanson (2010) we argue that the resolution of this puzzle has to do with the unique nature of competition in financial services. Unlike in many other industries, the

most important (and in some cases, essentially the only) competitive advantage that banks bring to bear for many types of transactions is the ability to fund themselves cheaply. Thus if Bank A is forced to adopt a capital structure that raises its cost of funding relative to other intermediaries by only 20 basis points, it may lose most of its business. Contrast this with, say the auto industry, where cheap financing is only one of many possible sources of advantage: a strong brand, quality engineering and customer service, and control over labor and other input costs may all be vastly more important than a 20 basis-point difference in the cost of capital.

One suggestive piece of evidence for this competition hypothesis comes from the distribution of capital ratios by bank size, as illustrated in Figure 3, which covers the period 1976-2009. As can be seen in the figure, there is a strong inverse relationship between bank size and capital ratios, with the smallest banks (those with assets under $100 million) having Tier 1 risk-based capital ratios more than double those of the largest banks (those with assets over $100 billion) for most of the sample period. Whatever their root cause, these large differences in capital ratios hint at a couple of important points. First, consistent our M-M-based calibration exercise, they suggest that even several additional percentage points of capital need not imply prohibitively large effects on lending rates—for if they did, it would be hard to understand how the smaller community banks have managed to stay in business without being evolved away.

Second, however, it is likely that the ability of small banks to survive at higher capital levels reflects something about the softer degree of competition in their core line of business. A large literature argues that small banks tend to focus on informationally-intensive "relationship lending", and that the embedded soft information in these relationships creates a degree of lock-in between firms and their small-bank lenders (Rajan (1992), Petersen and Rajan (1994, 1995), Berger et al (2005)). Thus while a small bank probably cannot afford to be at a 100-basis point

funding disadvantage, it may not lose a longstanding relationship borrower over, say, a 20-basis-point pricing gap. By contrast, to the extent that larger banks deal with larger customers where competition from other providers of finance is more intense, even small cost-of-capital disadvantages are likely to prove unsustainable.

Testing the Competition Hypothesis

To further investigate the competition hypothesis, we examine the effects of changes in state branching regulations. We test two basic predictions. First, we expect that a regulatory shock that increases the degree of competition in a state should lead the *average* capital ratio of banks in that state to decline. Second, we expect a *compression effect*: the decline in capital ratios should be largest for those banks in the state that, prior to the shock, were operating with the highest capital ratios. Or said differently, we expect the regulatory shock to reduce the cross-sectional dispersion of capital ratios of banks in the given state.

To implement our tests, we take data on the year that various state banking regulations were relaxed from Stiroh and Strahan (2003). We examine two types of deregulation: the easing of intrastate branching restrictions and the advent of interstate banking. Prior to 1970, two-thirds of states had restrictions on intrastate branching which were relaxed from 1975 to 1992. In most states, intrastate branching was first permitted via mergers and later was permitted without restriction. Following the literature, we focus on the date where branching was permitted via mergers. Turning to interstate banking restrictions, the Bank Holding Company Act of 1956 prevented BHCs from acquiring out-of-state banks unless the target state explicitly permitted this. Since no states did so, interstate banking was *de facto* prohibited. Between 1982 and 1993, 48 states entered into regional or national agreements whereby out-of-state BHCs could own banks in the permitting state. Since the Reigle-Neil Act of 1994 allowed BHCs to acquire banks

in other states after 1995 ("interstate banking") and permitted mergers between *banks* in different states after 1997 (effectively permitting interstate branching), we conclude our analysis in 1994.

We use annual Call Report data from 1976 to 1994. Since our source of variation is at the state-year level, we work with state-year aggregates. In particular, we estimate reduced-form regressions of the state-level equity-to-asset ratio on dummies ($DEREG_{s,t}$) that switch on in the year that a state relaxes its regulations, along with state and year fixed effects. The identification strategy uses differences in the timing of deregulation across states. We have two deregulatory dummies. $DEREG_{s,t} = INTRASTATE_{s,t}$ is based on the year that state *s* allows intrastate branching by mergers, and $DEREG_{s,t} = INTERSTATE_{s,t}$ is based on the year the state enters a regional or national interstate banking agreement.

Table 4 shows the results of these regressions where the dependent variable is alternately, the mean equity-to-asset ratio in state *s* in year *t*, the cross-sectional standard deviation of equity-to-assets, and cross-sectional quantiles of the equity-asset ratio. The results in column (1) show that equity-to-assets falls by about 30 bps following intrastate branching and another 20 bps following interstate banking. Thus, equity-to-assets falls by roughly 50 bps for the average state relaxing both restrictions. This decline can be compared to the typical cross-sectional standard deviation of 108 bps and is economically meaningful considering that the average equity-to-assets ratio is our sample just over 7%.

The remaining columns in Table 4 report regressions of annual state-level measures of either the dispersion or the distribution of capital ratios on the deregulatory dummies. Consistent with the notion of a compression effect, the results suggest that the dispersion of capital ratios within a state falls following deregulation, and that capital ratios fall the most for those banks that were previously in the upper tail of the distribution. This appears to have been particularly

true following the advent of intrastate banking: the capital ratios of banks in the 75th and 90th percentiles of the distribution fall by 60 bps and 70 bps, respectively, versus only a 10 bps change at the 10th and 25th percentiles.

The results in Table 4 are also robust to adding several obvious state-level controls. For example, the coefficients are similar if we control for the average size of banking organizations in each state-year. This indicates that our results are not a mechanical consequence of post-deregulation consolidation in combination with the fact that bigger banks hold less capital.

In sum, the data provide clear support for the competition hypothesis: when faced with more intense competition, banks tend to be driven towards both higher and more uniform levels of leverage. On the one hand, such competitive effects—combined with our earlier M-M-based calibration results—suggest one reason why generally tougher capital regulation of financial firms is appealing. More stringent capital regulation would seem to hold the promise of reducing competition on a dimension that creates negative externalities and systemic risk, while at the same time not raising loan rates by much. However, the complication is that these same competitive pressures also create powerful incentives to evade either the letter or the spirit of the rules. Thus the most worrisome long-run byproduct of higher capital requirements is likely to be not its impact on the cost of credit to borrowers, but the pressure it creates for activity to migrate outside of the regulated banking sector.

Summary: The Importance of a Systemic Approach

If one takes a macroprudential view, the overarching goal of financial regulation goes beyond just protecting insured depositories, and even beyond dealing with the problems created by "too-big-to-fail" non-bank intermediaries. Instead, the task is to mitigate the fire-sales and

credit-crunch effects that can arise as a consequence of excessive leverage *anywhere in the financial system*. Containing these effects with just capital rules, or even with capital rules and liquidity regulation, will be difficult.

In particular, while higher capital and liquidity requirements on banks will no doubt help to insulate the banks themselves from the consequences of large shocks, the danger is that, given the intensity of competition in financial services, they will also drive a larger share of intermediation into the shadow-banking realm. For example, perhaps an increasing fraction of corporate and consumer loans will be securitized, and in their securitized form will end up being held by a variety of highly-leveraged investors (say hedge funds) who are not subject to the usual bank-oriented capital regulation. If so, the individual regulated banks may be left safer than they were before, but the overall system of credit creation may not.

We absolutely do not mean to suggest that capital and liquidity requirements should not be strengthened for large banking firms. Rather, our point is that in doing so, careful attention must be paid to not tilting the playing field in a way that generates a variety of damaging unintended consequences. As we have argued, this is likely to involve increased regulation of the shadow banking sector as a complement to the measures undertaken for banks and other large financial firms. In particular, we reiterate that it would be a good idea to establish regulatory minimum haircut requirements on asset-backed securities, so that any investor who takes a long position in credit assets, irrespective of their identity, cannot do so with an arbitrarily high degree of leverage.

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Table 1
Capital Ratios for Top Four U.S. Banks, 2010Q1

	Bank of America	Citigroup	J.P. Morgan Chase	Wells Fargo	**Weighted Average**
Total Risk- Weighted Assets ($millions)	1,519	1,023	1, 147	988	
Tier 1 Common Equity to Risk-Weighted Assets (%)	7.6	9.1	9.1	7.1	**8.2**
Tier 1 Capital to Risk-Weighted Assets (%)	10.2	11.2	11.5	10.0	**10.7**

Source: Individual banks' websites.

Table 2
Liability Structure of U.S. Bank Holding Companies, 2009

	$ Trillion	% of Assets
Assets	**15.927**	**100.0%**
Liabilities		
Deposits	**7.502**	**47.1%**
Short-term Wholesale Funding		
Repurchase Agreements and Federal Funds Purchased	1.658	10.4%
Other Short-term Wholesale Funding	0.880	5.5%
Trading Liabilities	0.736	4.6%
Total	**3.274**	**20.6%**
Long-term Funding		
Long-term Wholesale Funding	1.718	10.8%
Subordinated Debt and Trust Preferred	0.416	2.6%
Total	**2.134**	**13.4%**
Other Liabilities	**1.570**	**9.9%**
Total Liabilities	**14.480**	**90.9%**
Equity		
Common Stock	**1.309**	**8.2%**
Preferred Stock	**0.137**	**0.9%**
Total Equity	**1.446**	**9.1%**

Notes: This table summarizes the liability structure of U.S. Bank Holding Companies as of December 31, 2009**.** The table is based on data from the FR Y-9C reports that Bank Holding Companies are required to file with the Federal Reserve.

Table 3
Relationship Between Loan Spreads and Bank Equity-to-Assets Ratio, 1920-2009

	Net interest margin		Loan yield – deposit rate		Prime rate – T-bill yield	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Equity/Assets	-2.91	2.05	-12.72	-1.07	2.62	28.31
	[0.59]	[0.72]	[2.66]	[0.20]	[0.40]	[4.90]
T-bill yield		15.61		17.40		0.25
		[2.23]		[1.73]		[0.02]
(T-bill yield)2		-0.71		-0.21		1.96
		[1.67]		[0.38]		[2.06]
Term spread		14.35		9.06		20.39
		[2.79]		[1.20]		[3.13]
Trend		0.52		1.03		3.42
		[1.46]		[1.32]		[5.95]
Recession		0.49		4.44		20.21
		[0.09]		[0.41]		[1.98]
Loans/Assets		2.87		0.15		-3.50
		[4.23]		[0.10]		[2.10]
Constant	297.13	23.40	548.27	319.13	201.57	-78.94
	[5.56]	[1.09]	[10.49]	[6.65]	[3.39]	[2.23]
Observations	90	90	83	83	90	90
R-squared	0.01	0.93	0.18	0.77	0.01	0.79

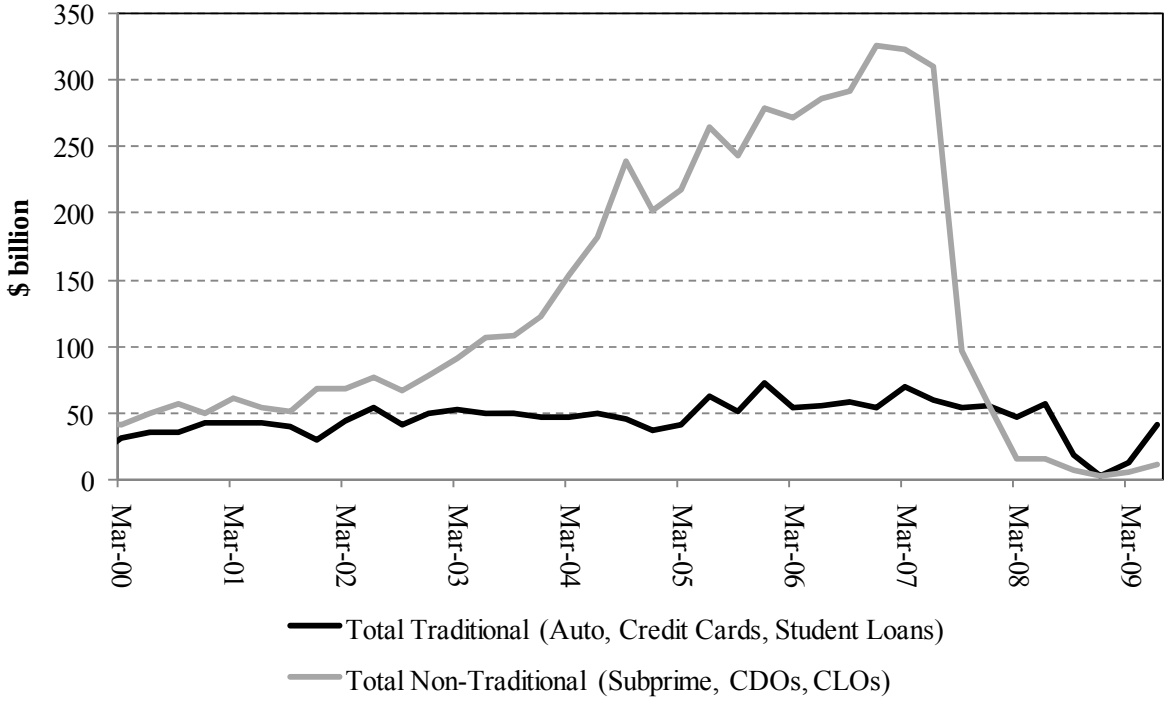
Notes: This table shows regressions of the markup charged by banks over their cost of funds on the ratio of equity capital to assets, controlling for the T-bill yield, the squared T-bill yield, the term spread (yield on long-term Treasuries minus the T-bill yield), a time trend, a recession dummy based on NBER business cycle dates, and the ratio of loans to earning assets. The dependent variable is alternately: i) the net interest margin (net interest income over earning assets); ii) the yield on loans minus the rate paid on deposits (interest income on loans over gross loans minus interest expense on deposits over deposits); and iii) the prime rate minus the rate on short-term Treasury bills. Equity-to-assets is the ratio of book equity capital to book assets for U.S. commercial banks. The long-term Treasury yield and T-bill yield are constructed as in Krishnamurthy and Vissing-Jorgensen (2010). *t*-statistics, in brackets, are based on Newey-West (1987) standard errors allowing for five years of lags.

Table 4
Impact of Deregulation on Distribution of Equity-to-Assets Within States

	Dependent Variable						
	Mean	**Standard Deviation**	**10th %tile**	**25th %tile**	**50th %tile**	**75th %tile**	**90th %tile**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Regression 1:							
INTRASTATE	-0.288	-0.274	-0.099	-0.106	-0.193	-0.626	-0.682
	[-2.10]	[-2.75]	[-0.70]	[-0.81]	[-1.49]	[-2.47]	[-2.40]
Regression 2:							
INTERSTATE	-0.217	-0.133	0.037	-0.182	-0.278	-0.290	-0.349
	[-2.25]	[-0.68]	[0.31]	[-1.46]	[-2.68]	[-1.96]	[-1.73]
Regression 3:							
INTRASTATE	-0.281	-0.270	-0.100	-0.100	-0.183	-0.617	-0.671
	[-2.05]	[-2.68]	[-0.71]	[-0.78]	[-1.41]	[-2.44]	[-2.33]
INTERSTATE	-0.203	-0.120	0.042	-0.177	-0.269	-0.261	-0.317
	[-2.05]	[-0.62]	[0.34]	[-1.43]	[-2.62]	[-1.69]	[-1.47]

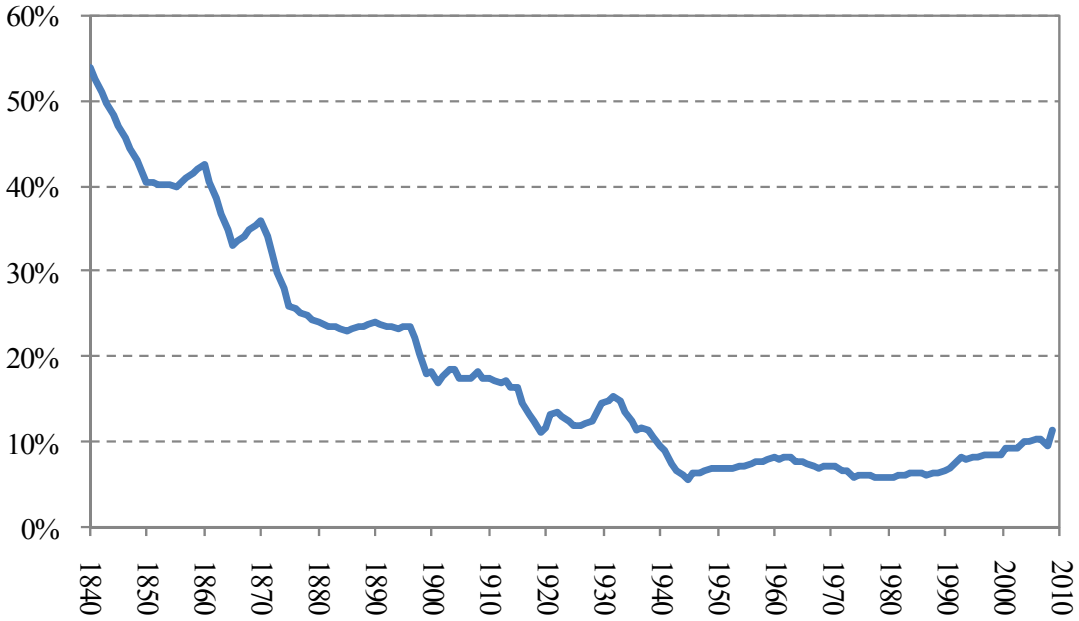
Notes: The table shows regressions of equity-to-assets on dummies for deregulation using an annual state-level panel from 1976-1994. The deregulation dummies are based on the data in Table 1 of Stiroh and Strahan (2003). The *INTRASTATE* dummies switch on beginning in the year when the state first permitted intrastate branching via mergers. The *INTERSTATE* dummies switch on beginning in the year when the state entered a regional or national interstate banking agreement. The dependent variables are alternately the asset-weighted average, standard deviation, and quantiles of the equity-to-assets ratio within each state-year. The table reports coefficients from 21 separate regressions (7 dependent variables each with 3 specifications). All regressions include a full set of state and year effects and have 969 observations (= 51 states x 19 years). *t*-statistics, in brackets, are based on standard errors that are robust to clustering (i.e. serial correlation of residuals) at the state level.

Figure 1
Quarterly Issuance of Asset-Backed Securities, 2000-2009,



Notes: The data underlying this figure come from Thompson SDC. While the non-traditional category includes securitizations backed by subprime mortgage loans, it does not include securitizations based on prime mortgage loans, such as mortgage-backed securities guaranteed by Fannie Mae or Freddie Mac.

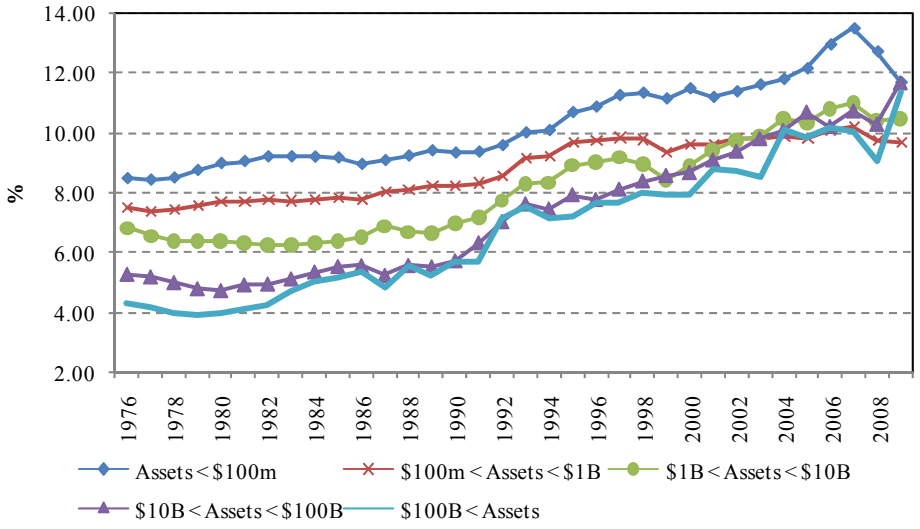
Figure 2
Book Equity to Book Assets for U.S. Commercial Banks, 1840-2009



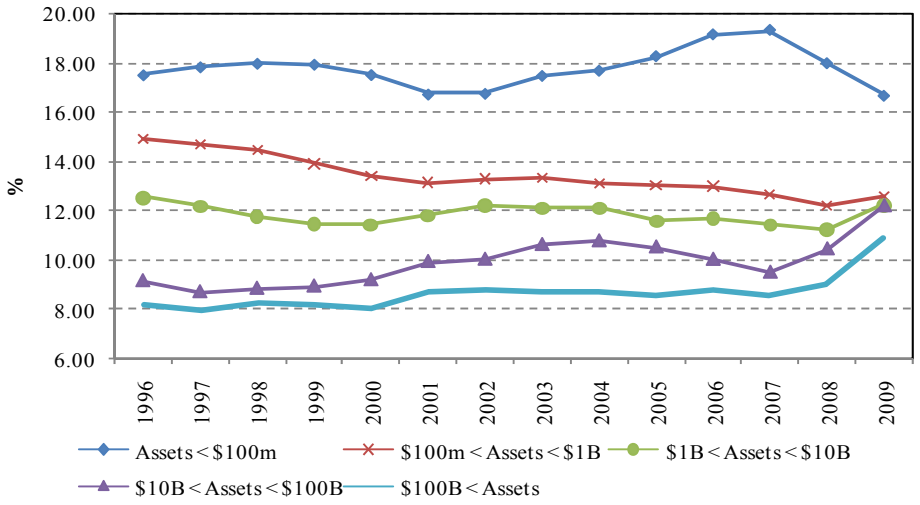
Source: Data from 1840-1896 is based on Berger, Herring, and Szego (1995) who use data from the Statistical Abstracts of the United States from the U.S. Census. Data from 1896-1919 is based on data for All Banks and is taken from the Federal Reserve's All Bank Statistics, 1896-1955. Data from 1919-1933 is based on Federal Reserve member banks and is taken from Banking and Monetary Statistics, 1919-1941. Data from 1934-2010 is for all insured commercial banks and is taken from the FDIC's Historical Statistics on Banking at http://www2.fdic.gov/hsob/.

Figure 3
U.S. Bank Capital Ratios by Bank Size, 1976-2009

Panel A: Book Equity to Book Assets



Panel B: Tier 1 Risk-Based Capital Ratios



Notes: This figure plots capital ratios by bank size from 1976-2009. Banks are placed into size groups based on assets in 2008Q4 dollars. Panel A plots book equity to book assets. Panel B plots Tier 1 capital ratios (Tier 1 regulatory capital over risk-weighted assets). All banks owned by a given bank holding company are combined into a single organization for the purposes of this size classification.