Working Paper No. 10-29

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Many observers have argued the regulatory framework in place prior to the global financial crisis was deficient because it was largely "microprudential" in nature (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 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*. In the aftermath of the crisis, there seems to be agreement among both academics and policymakers that financial regulation needs to move in a macroprudential direction. According to Federal Reserve Chairman Ben Bernanke (2008):

> 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.

In this paper, we offer a detailed vision for how a macroprudential regime might 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 on capital rules that only apply to traditional banks, is likely to be fragile. We begin by identifying the key market failures at work: why individual financial firms, acting in their own interests, deviate from what a social

planner would have them do. Next, we discuss a number of concrete steps to remedy these market failures. We conclude the paper by comparing our proposals to recent regulatory reforms in the U.S. and to proposed global banking reforms.

Theories of Financial Regulation

Microprudential Regulation

Traditional microprudential regulation of banks is based on the following logic. Banks finance themselves with government-insured deposits. While deposit insurance has the valuable effect of preventing runs (Diamond and Dybvig, 1983; Bryant, 1980), it creates an incentive for bank managers to take excessive risks, knowing that losses will be covered by the taxpayer. The goal of capital regulation is to force banks to internalize losses, 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 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 once a quarter. Suppose further that the volatility of the bank's assets is such that with probability 99.5 percent, the assets do not decline in value by more than 6 percent during a quarter. Then if the goal of policy is to reduce the probability of bank failure (whereby capital is wiped out and there are losses to the deposit insurance fund) to 0.5 percent, this can be accomplished by requiring the bank to have capital equal to 6 percent of its assets as a cushion against losses. Notice 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—that is, as long as they will in fact bear losses in a bad state.

An important element of existing capital regulation is the presumption that a bank will 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 percent, it would need to bring its capital ratio back up to 6 percent. 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 (that is, 4/66.67 = 6 percent).

The basic critique of microprudential regulation can be understood as follows. When a microprudentially-oriented regulator pushes a troubled bank to restore its capital ratio, *the regulator does not care whether the bank adjusts via the numerator or via the denominator—that is, by raising new capital or by shrinking assets.* Either way, the bank's 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—perhaps by cutting back on lending—others can pick up the slack. Indeed, asset shrinkage in this case 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.

Macroprudential Regulation

In the simplest terms, one can characterize the macroprudential approach to financial 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.* Thus to make a compelling case for macroprudential regulation, two questions must be answered. First, what are the costs imposed on society when many financial firms shrink their assets at the same time? Second, why do individual firms not properly internalize these costs? That is, why do they reduce assets rather than raise fresh capital when a bad shock hits? Or alternatively, why do they not build sufficiently large capital buffers ahead of time, so that they can withstand a shock without needing either to raise capital or to reduce assets?

Generalized asset shrinkage has two primary costs: 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 economy. 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 in this issue. Moreover, the fire-sale and credit-crunch effects are intimately connected (Diamond and Rajan, 2009; Shleifer and Vishny, 2010; Stein, 2010a). If a toxic mortgage security falls in price to the point where it offers a (risk-adjusted) 20 percent rate of return to a prospective buyer, this will tend to drive the rate on new loans up towards 20 percent as well—since from the perspective of an intermediary that can choose to either make new loans or buy distressed securities, the expected rate of return on the

two must be equalized. In other words, in market equilibrium, the real costs of fire sales manifest themselves in the further deepening of credit crunches.[1]

Of course, to make a case for regulatory intervention, one has to explain why these 20 percent rates of return inside the financial sector—which are much higher than the outside rates on, say, Treasury securities—don't naturally draw in enough private capital to eliminate the return differentials. One reason why capital is immobile once a crisis is underway is the "debt overhang" problem identified by Myers (1977). Once a bank is in serious trouble and its debt is impaired in value, the bank is reluctant to raise new equity even to fund investments that have a positive net present value. This is because much of the value that is created is siphoned off by the more senior creditors. 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.

If so, why don't banks voluntarily build up adequate buffer stocks of excess capital in good times, when debt overhang is not yet a concern, so they can absorb losses in bad times without having to either shrink assets or raise new capital under duress? After all, such a dry-powder strategy would allow them to exploit profitable opportunities should a crisis arise. This question is addressed in Stein (2010a), who extends the fire-sale model to consider banks' initial choices of capital structure. He shows that if short-term debt is a cheaper form of finance than equity, banks will tend to take on socially excessive levels of debt: while the banks capture the benefits of cheap debt finance, they do not internalize all of its costs.[2] In particular, when Bank

[1] See, e.g. Ivashina and Scharfstein (2010) for evidence on the extent of credit contraction during the recent crisis.

[2] The assumption that short-term debt is a cheap form of finance represents a particular deviation from the Modigliani-Miller (1958) capital-structure irrelevance framework. In the context of financial firms, this deviation can arise to the extent that their short-term claims are "money-like" and carry a premium that reflects their usefulness as a transactions medium. We discuss this point in greater detail below.

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.[3]

In sum, a model based on fire sales and credit crunches suggests that financial institutions have overly strong incentives: i) to shrink assets rather than recapitalize once a crisis is underway; and ii) to operate with too-thin capital buffers before a crisis occurs, thereby raising the probability of an eventual crisis and system-wide balance-sheet contraction. Therefore, the macroprudential approach to capital regulation aims 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 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 a rationale for regulation, even absent government deposit insurance. Thus, there is a strong presumption that macroprudential regulation should apply to more than just insured deposit-takers. The broader point (stressed by Tucker, 2010, and Kashyap, Berner and Goodhart, 2010) is that regulators need to pay attention to all the channels through which the actions of financial institutions—both those who are insured and those who are not—can cause damage.

Macroprudential Tools

We now discuss six sets of tools that can be helpful in implementing a macroprudential approach to financial regulation. Our goal here is not to provide a comprehensive laundry list of

[3] A subtlety is that this is a pecuniary externality—i.e., it works through prices. For a pecuniary externality to cause a misallocation of resources, one requires a departure from the standard assumptions that deliver the fundamental welfare theorems (Geanakoplos and Polemarchakis 1986). In Stein (2010a), this departure is in the form of a collateral constraint: banks' ability to raise short-term debt is constrained by the collateral value of their assets.

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.

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 the discussion 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 maintain higher ratios of capital to assets in good times than in bad times. Under such a rule, banks can draw down their buffers when an adverse shock hits, and continue operating with less pressure to shrink assets. 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] In bad times, when bank capital is scarce and credit supply is tight, a planner concerned with both objectives should be willing 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).

One 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 the first quarter of 2010, the four largest U.S. banks had an average ratio of Tier 1 common equity to risk-weighted assets of 8.2 percent, and an average ratio of total Tier 1 capital (including preferred stock, for example) to risk-weighted assets of 10.7 percent. These are both well above the pre-crisis regulatory standard, which required a ratio of total Tier 1 capital to risk-weighted assets of 6 percent for a bank to be deemed "well capitalized." Thus, even as the U.S. economy was emerging from a deep financial crisis in early 2010, the regulatory constraint was non-binding.

This pattern implies that 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 standard for equity-to-assets in bad times is 8 percent, and we want banks to be able to absorb losses of, say, 4 percent of assets without pressure to shrink, then the regulatory minimum for equity-to-assets in good times would have to be at least 12 percent. A loss on the order of 4 percent 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 were on the order of 7 percent of assets. Using this figure, one could argue for a good-times regulatory minimum ratio of equity-to-assets of 15 percent. Either way, these are high values, significantly higher than obtained from a microprudential calculation that asks only how much capital is needed to avert outright failure. (We examine the potential costs of raising capital requirements by this much below, in the penultimate section of the paper.)

[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.

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.

However, in the wake of the financial crisis, many investors and regulators have discussed the "quality" of a bank's capital base, 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. 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 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, one can argue 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.

Corrective Action Targeted At Dollars of Capital, Not Capital Ratios

When regulators are vigilant, banks that fall below a designated capital threshold may be subject to a variety of sanctions (for example, restrictions on dividends) until they repair their capital ratios. The principle of rapid regulatory intervention is undoubtedly a good one, but the 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*, it may well choose to fix the ratio not by raising the numerator (capital) but by reducing the denominator (assets).[6] A better approach is to create incentives for the bank to raise *incremental dollars* of new capital.

One way to implement this policy 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 corrective action is a capital ratio of 6 percent. Now assume that the bank has losses of $4 over year *t+1*, so it ends the year

[6] Hart and Zingales (2009) recommend forcing banks to issue equity whenever their credit risk (as measured by spreads on credit default swaps) goes above a certain level. However this does not address the shrinkage problem, because a bank can also reduce its credit spreads by selling risky assets.

with $4 of capital. Normally regulators would push the bank to get its ratio back to 6 percent, 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 percent. Given that year-*t* assets were $100, and cannot be reduced retroactively, the bank would have to raise $2 of new capital—it could not avoid sanctions by shrinking assets.

A dramatic illustration of this dollars-based corrective action principle comes from the Supervisory Capital Assessment Program (SCAP), the "stress tests" that the major U.S. banks underwent in spring 2009.[7] 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—for example, 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 billion.

Here is a case where a strong regulatory hand appears to have had highly beneficial effects. 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 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 (Myers and Majluf 1984). But if it has no choice, there is no information content, and hence no negative price impact. We hope that this lesson can be

[7] See Hirtle, Schuermann and Stiroh (2009) for a fuller discussion of the lessons learned from the SCAP.

incorporated into regulatory policy going forward. As we note below, it may be especially helpful in thinking about the phase-in of higher capital requirements under Basel III.

Contingent Capital

A dollars-based corrective action policy 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 pre-specified contractual provision is triggered. 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).[8] For example, in November 2009, Lloyds Bank issued £7.5 billion in contingent convertible debt, with conversion to equity to be triggered if Lloyds' Tier 1 capital ratio falls below 5 percent.

A second type of contingent capital is "capital insurance", which involves a bank purchasing an insurance policy that pays off in a bad state of the world (Kashyap, Rajan, and Stein, 2008). To address concerns about the insurer defaulting, the policy would be fully collateralized—that is, the insurer would 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 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

[8] There many 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.

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.

These designs share a common motivation. The premise is that banks view equity capital as an expensive form of finance—in other words, there are one or more violations of the Modigliani-Miller (1958) conditions that make banks reluctant to carry large precautionary buffers of equity. (We discuss the precise nature of these violations in detail below.) In principle, regulation could simply mandate that banks maintain very large equity buffers. However, it may be more efficient 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? One simple answer is that they have to be allowed to count towards regulatory capital requirements. Consider the following approach. The capital requirement for a bank in good times might be set at a relatively high level, say 20 percent. 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.[9] 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 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

[9] As we discuss below, Swiss banking regulators recently announced new rules of exactly this form.

form of stock or options, but would instead be a fixed dollar amount. However, 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

One important lesson from the recent crisis is that the distinction between short-term and long-term debt had been given insufficient attention by regulators. Table 2 presents a snapshot of the aggregate financial structure of the U.S. banking system, including not only traditional commercial banks but also broker-dealer firms. Clearly, the majority of their debt is short-term: either in the form of deposits or "wholesale" funding, which includes commercial paper and repurchase (repo) agreements. While deposits are generally insured and hence not likely to run at the first sign of trouble, the same is not true for wholesale funding. Indeed, wholesale funding runs—a refusal of repo and commercial paper creditors to roll over their loans—played a key 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, 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). It is hard to imagine that Northern Rock, or Bear Stearns, or Lehman would have faced the same problems had they done most of their borrowing on a long-term basis. Second, in the presence of market-wide fire sales, the choice of debt maturity creates an externality. When an individual bank or broker-dealer opts to finance largely with short-term debt, it fails to internalize that in a crisis, 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, 2010a).

Regulating the Shadow Banking System

The fire-sale risk associated with excessive short-term funding comes from not just insured depositories, but rather, any financial intermediary whose combination of asset choice and financing structure may exacerbate a systemic fire-sale problem. A narrow interpretation of this principle would 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 were nevertheless subject to wholesale financing runs. While this specific point is now well-appreciated, the principle has broader application. From the perspective of credit creation and macroeconomic impact, some of the most damaging aspects of the crisis arose not just from the problems of individual large firms, but also from the *collapse of an entire market*—namely the market for asset-backed securities.

Figure 1 illustrates this collapse.[10] The market for "traditional" asset-backed securities, 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.

The investors who buy tranches of asset-backed securities 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 tranches of asset-backed securities and finance them with commercial paper, which typically has a maturity of only days or weeks. Hedge funds and broker-dealer firms may finance their holdings of asset-backed securities with repurchase agreements, a form of overnight collateralized borrowing. Collectively, these various investors who acquire asset-backed securities 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 asset-backed securities market featured the essential elements of a classic bank run—namely an inability of investors in asset-backed securities to roll over short-term financing.

One manifestation of the withdrawal of short-term lending to the asset-backed securities market comes from the behavior of "haircuts" in repurchase agreements. When an investor borrows in the repo market, the investor is required to post a margin, or down payment, known as the "haircut." Haircuts on most highly-rated asset-backed securities were very low prior to the crisis, on the order of 2 percent. Thus, if a hedge fund wanted to buy $1 billion of AAA-rated auto-linked asset-backed securities, it only needed to put up $20 million of its own capital. The

[10] The discussion in the remainder of this section is a much-abridged version of material in Stein (2010b).

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.[11]

In the midst of the crisis, haircuts skyrocketed. Even haircuts on consumer asset-backed securities—which were not linked to subprime problems—rose to over 50 percent. From the perspective of the hedge fund holding $1 billion of such securities, all of a sudden it could only borrow $500 million, and instead of having to post a $20 million down payment, had to put up $500 million. If it did not have the cash to do so, it would be forced to liquidate its holdings. These liquidations, and the effect they had on the level and volatility of 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 asset-backed securities market may have been what Brunnermeier and Pedersen (2009) call a "margin spiral."

From a macroprudential perspective, it would be a mistake to focus too narrowly on the largest financial institutions, while paying insufficient attention to potential vulnerabilities in the rest of the system.[12] 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, broker-dealer, hedge fund, or special-purpose vehicle. This task is not easy, but one tool that would help is broad-based regulation of haircuts on asset-backed securities.[13]

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[11] This is not to say that the hedge fund's *overall* leverage would be 50 to 1, as in this example—only that it could borrow aggressively against certain highly-rated assets that were seen as low-risk and hence as very good collateral.

[12] Some have advocated a "narrow banking" model, whereby tightly regulated banks are restricted to core deposit-taking and lending activities, and a substantial chunk of their other business is pushed out to a more lightly-regulated periphery. While such an approach may keep certain functions (such as the payments system) safe, the risk is that the overall process of credit creation may be made more, not less vulnerable to shut-down in the event of a crisis.

[13] A more general version of this observation is that a regulatory toolkit with only a capital ratio and a single liquidity ratio will be inadequate for controlling instability arising from deposit defaults, fire sales and credit crunches (Goodhart, Kashyap, Osorio and Tsomocos (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 asset-backed security whose tranches are distributed to investors. The regulation we have in mind would stipulate that whoever holds a tranche of the asset-backed security 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. For models that suggest a role for haircut regulation, see Geanakoplos (2010) and Stein (2010a).

If these requirements are well-structured, they would have two benefits. First, they could help to harmonize regulation across organizational forms, thereby reducing the incentive for lending activity to migrate into the shadow-banking sector. Second, for those assets that do end up in the shadow-banking system, haircut regulation can dampen the destabilizing dynamics described above. If haircuts start out at 2 percent, and then jump to 50 percent in a crisis, this creates a powerful forced-selling pressure on owners of asset-backed securities. If haircuts are set instead at a higher value before the crisis, this forced-selling mechanism and the vicious spiral it unleashes might be attenuated. Note that central banks, through their discount window and emergency-lending facilities, have already developed significant expertise in determining prudent values of haircuts on various kinds of asset-backed securities.

While we have focused on regulations that address fire-sale externalities, the problems of the asset-backed securities market arguably go beyond fire sales. Hanson and Sunderam (2010) show that the "tranching" process, by which large fractions of underlying collateral pools are

turned into AAA-rated securities, can blunt the incentives of investors to become informed about what they are buying—because AAA-rated securities are ostensibly so low risk that the returns to becoming informed are minimal. A lack of informed investors can in turn make securitization markets more fragile when times turn bad and the need to analyze securitization cashflows rises. This implies that regulators should worry about the structure of securitizations—particularly the amount of AAA-rated securities being manufactured from any given collateral pool.

What Are the Costs of Higher Capital Requirements?

We have argued that a macroprudential approach involves imposing substantially higher capital requirements on financial firms, particularly in good times. But will these higher capital requirements lead to increased costs for borrowers? 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] To preview, our reading of the theory and the relevant empirical evidence suggests that while increased capital requirements might be expected to have some long-run impact on the cost of loans, this impact is likely to be quite small.

A Modigliani-Miller Perspective

Modigliani and Miller (1958) famously showed that under certain conditions, a firm's capital structure is irrelevant for its operating decisions. In the banking context, this would imply that the rate that a firm charges on its loans should be *independent* of its capital ratio. The Modigliani and Miller conditions are stringent, including no taxes, symmetric information,

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

rational risk-based pricing, and cashflows that are independent of financial policy. Thus, they are not meant as an accurate depiction of reality. Rather, the value of the Modigliani and Miller framework 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 Modigliani and Miller 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 Modigliani and Miller conditions hold, this effect is just enough to offset the 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 Modigliani and Miller's idealized conditions that are likely to be relevant in the present context. First, interest payments on corporate 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 effect on the bank's weighted average cost of capital comes from the lost tax shields on the debt. If the coupon on the debt is 7 percent, and given a corporate tax rate of 35 percent, each percentage point of increased equity raises the weighted average cost of capital by .07 x .35 = 2.45 basis points. Thus, even a ten-percentage-point increase in the capital requirement only boosts the weighted average cost of capital—and hence loan rates—by 25 basis points, which is a small effect.

[15] In Kashyap, Stein and Hanson (2010), we show that this 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.

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. Moreover, following Gorton (2010), Gorton and Metrick (2010), and Stein (2010a), assume that—in violation of the Modigliani and Miller 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 are often held by money-market mutual funds, who in turn issue checkable deposits.) An upper-bound estimate of this money premium might be on the order of 100 basis points.[16] Now, a ten-percentage-point increase in capital requirements raises the weighted average cost of capital by an added 10 basis points relative to the previous taxes-only case, and we are up to 35 basis points. This number is still quite modest.

Time Variation in Bank Capital Ratios and Lending Rates

Our calibrations based on the Modigliani-Miller paradigm suggest that the long-run effects of higher capital requirements on loan rates should be small. A complementary approach is to examine the historical record. Panel A of Figure 2, which is adapted from Berger, Herring, and Szego (1995), shows the ratio of book equity to book assets for U.S. commercial banks from 1840 to 2009. Capital ratios exceeded 50 percent in the 1840s and fell steadily for the next 100 years, reaching 6 percent 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 have examined the behavior of various proxies for the markup that banks charge on loans. In a variety of regression specifications (not shown here), we found no reliable time-series correlation between these markup variables and bank capital ratios. The historical data is simply too noisy, and our proxies

[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.

for loan spreads too crude, for us to draw any confident conclusions about whether a correlation between equity ratios and loan rates *even exists*.

To illustrate the loose ties between loan costs and capital ratios, Panel B of Figure 2 plots capital ratios for the period 1920-2009 against two markup proxies: 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). As can be seen, there is no apparent correlation between capital ratios and either measure of markups.

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

These 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 risks this poses? And why do they deploy armies of lobbyists to fight increases in their capital requirements? After all, non-financial firms tend to operate with much less leverage, and indeed appear willing in many cases 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 nature of competition in financial services. The most important competitive edge 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 20 basis points, it may lose most of its business, (or become much less profitable, since the return on assets in banking is on the order of 125 basis points). 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 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. There is a strong inverse relationship between bank size and capital ratios, with the smallest banks (with assets under $100 million) having Tier 1 risk-based capital ratios more than double those of the largest banks (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, they suggest that several percentage points of additional 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. Second, the ability of small banks to survive at higher capital levels probably 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 specificity between firms and their lenders (Rajan, 1992; Petersen and Rajan, 1994, 1995; Berger et al., 2005). 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. Between 1982 and 1993, 48 states entered into regional or national agreements permitting interstate banking—i.e., allowing out-of-state bank holding companies to own banks in their state. Given the timing of deregulation, we focus on bank data (from the Call Reports) over the period from 1976 to 1994. Since our source of variation is at the state-year level, we work with state-year aggregates. We estimate reduced-form regressions of the state-level equity-to-asset ratio on dummies that switch on in the year that a state relaxes its regulations, along with state and year fixed effects. We have two deregulatory dummies: *INTRASTATE* is based on the year that a state allows intrastate branching by mergers, while *INTERSTATE* is based on the year that a state enters a regional or national interstate banking agreement.

Table 3 displays the results of these regressions where the dependent variable in the first column is the mean equity-to-asset ratio in state s in year t; in the second column is the cross-sectional standard deviation of equity-to-assets; and in the remaining columns are the cross-sectional quantiles of the equity-asset ratio. The results in the first column imply that equity-to-assets falls by about 30 basis points following intrastate branching and another 20 basis points following interstate banking. Thus, equity-to-assets falls by roughly 50 basis points for the

average state relaxing both restrictions. This decline can be compared to the typical cross-sectional standard deviation of 108 basis points and is economically meaningful considering that the average equity-to-assets ratio is our sample just over 7 percent.

The remaining columns in Table 3 show that, consistent with the notion of a compression effect, the dispersion of capital ratios within a state falls following deregulation, and 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 and 70 basis points, respectively, versus only a 10 basis point change at the 10th and 25th percentiles.

In sum, the data support the hypothesis that when banks are faced with more intense competition, they gravitate towards both higher and more uniform levels of leverage. Such competitive effects—combined with our earlier Modigliani-Miller-based calibration results—suggest one reason why tougher capital regulation of financial firms is appealing: it would seem to have the potential to reduce 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 effect on the cost of credit to borrowers, but the pressure it creates for activity to migrate outside of the regulated banking sector.

A Financial Reform Report Card

To conclude the paper, we briefly compare our proposals to policy reforms that have emerged in the second half of 2010. Our focus is primarily on the recommendations made by the

Basel Committee on Banking Supervision in September of 2010 as part of the so-called "Basel III" process (see BCBS 2010 for a summary). In spite of its importance, we will say less about the Dodd-Frank legislation that was signed into law in the summer of 2010. This is because our analysis has been centered on capital regulation and closely related issues, the implementation of which has been taken up in more specific numerical detail in Basel III; conversely, we have not attempted in this paper to speak to a number of the other central elements in Dodd-Frank, such as consumer protection, regulation of over-the-counter derivatives, and resolution authority.

We have stressed the importance of requiring that financial firms have both more capital, and, crucially, higher-quality capital. On this score, Basel III looks quite good. It raises the minimum common equity requirement from 2 percent of risk-weighted assets to 7 percent (this is inclusive of a "capital conservation buffer"). While we have argued for a higher number, this is clearly a significant step in the right direction. Moreover, systemically-important institutions will be required to have an additional, as-yet-undetermined increment in terms of equity capital, which, if it turns out to be material, would be further good news.

The major shortcoming on the equity capital front is its very slow phase-in; the new requirements do not become fully effective until January 2019. The motivation for this slow phase-in is the concern that if banks are asked to comply with the higher ratios in a more compressed time frame, they will do so by shrinking their balance sheets rather than by raising new external equity capital, thereby causing a further credit crunch. While we agree that this might be a legitimate worry if the phase-in is truncated and no other offsetting steps are taken, our above analysis suggests an obvious alternative: during the phase-in period, regulators should push those banks that are shy of the new capital standards to *raise new dollars of equity*, rather than giving them the option to adjust via asset shrinkage. The U.S. stress tests conducted in 2009

showed that this approach can work, and if it were applied again the phase-in period could be made much shorter with little adverse impact on credit supply.

We also discussed the usefulness of time-varying capital requirements. Here the Basel Committee proposes an additional *countercyclical buffer* that will range between 0 and 2.5 percent, and which is to be implemented on a country-by-country basis. As the report states: "The purpose of the countercyclical buffer is to achieve the broader macro prudential goal of protecting the banking sector in periods of excess aggregate credit growth. For any given country, this buffer will only be in effect when there is excess credit growth that is resulting in a system wide build up of risk." This too is a step in the right direction, though we worry that the wording chosen by the Basel Committee may be problematic, as it would seem to require an affirmative finding of "excess credit growth" for the requirement to kick in; one can easily imagine that it will be politically challenging for regulators to make this case when they ought to.

Other elements of the reform package remain less well-developed. For example, on the key topic of debt maturity, the Basel Committee introduces the concept of a "net stable funding ratio" test—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. However, the details regarding the design and calibration of this rule remain to be worked out, with an "observation period" to begin in 2012 and the introduction of the standard itself put off until 2018. Thus while one might take some comfort from the fact that the Committee has recognized the importance of debt-maturity-regulation, implementation is still a long ways off.

Similarly, while the Basel Committee continues to study various forms of contingent capital, it has not yet reached any final conclusions; a review is scheduled to be completed in mid-2011. Interestingly, however, Swiss banking regulators have chosen to move forward on

their own on this front. The Final Report of the Swiss Commission of Experts proposed that the two big Swiss banks (UBS and Credit Suisse) be required to have 19 percent total capital by 2019. Of this, 10 percent would have to be in common equity (a higher standard than the 7 percent under Basel III) while the remaining 9 percent could, at the bank's discretion, take the form of contingent convertibles that would convert when the ratio of equity to assets hit a predetermined trigger value.[17] This "opting" approach to contingent capital is, both qualitatively and quantitatively, closely in line with what we described above.

Finally, perhaps the most glaring weak spot in financial reform thus far—one that cuts across both the Dodd-Frank legislation and the Basel III process—is the failure to fully come to grips with the importance of the shadow banking system. As we have emphasized, if one takes a macroprudential view, the overarching goal of financial regulation must go beyond 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 short-term debt *anywhere in the financial system*.

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 safer than they were before, but the overall system of credit creation may not.

[17] See Morgan Stanley Research: "European Banks: €49 Billion of Swiss CoCos," October 4, 2010.

In order to safeguard the system as a whole, careful attention must be paid to not tilting the playing field in a way that generates a variety of damaging unintended consequences. This principle implies regulating the shadow banking sector and the other parts of financial system consistently. This is a complex task, and will no doubt require a variety of specific tools. However, as one concrete first step, we reiterate that it would be a good idea to establish regulatory minimum haircut requirements on asset-backed securities, so that no investor who takes a position in credit assets is able to evade constraints on short-term leverage.

This discussion raises a last question about how such regulation might be implemented. In the U.S. and Europe, macroprudential oversight has been delegated to large councils: the Financial Stability Oversight Committee, and the European System Risk Board, respectively. Membership of both groups consists of the heads of many regulatory organizations. Whether either can function effectively and avoid turf wars is an open question. But these committees will be pivotal in determining whether existing weaknesses in the regulatory system—such as those having to do with the shadow banking sector—can be addressed sensibly.

We are grateful for helpful comments from Charles Goodhart, Arvind Krishnamurthy, Andrew Metrick, Victoria Saporta, Hyun Shin, Andrei Shleifer, René Stulz, Lawrence Summers, Paul Tucker, seminar participants at numerous institutions, and JEP editors David Autor, Chad Jones and Timothy Taylor.

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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**

Notes: This table lists the capital ratios for the four largest U.S. banks as of 2010Q1. Data is from 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%**

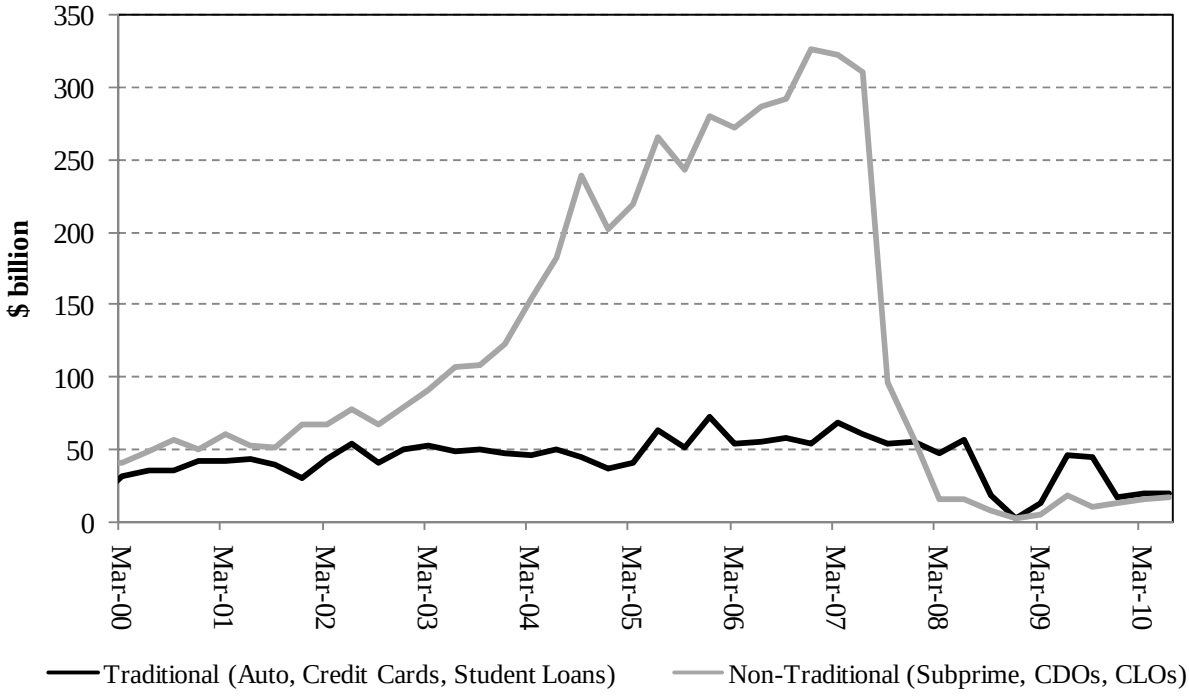
Notes: This table summarizes the liability structure of U.S. Bank Holding Companies as of December 31, 2009**.** The table is based on data from the FR Y-9C reports that Bank Holding Companies are required to file with the Federal Reserve.

Table 3
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**
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 (assembled from bank Call reports). 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.

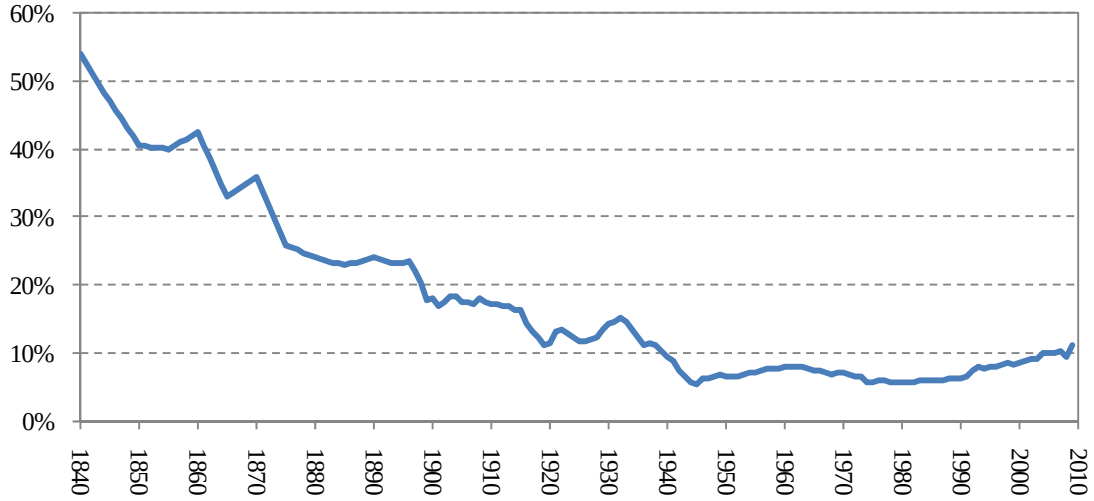
Figure 1
Quarterly Issuance of Asset-Backed Securities (ABS), 2000-2010Q2



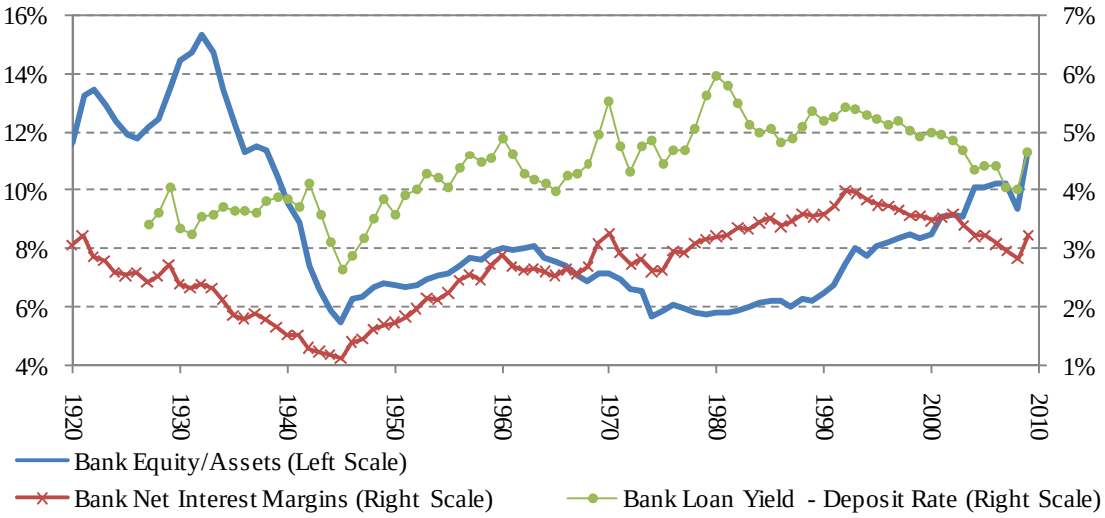
Notes: The figure plots the quarterly issuance of traditional versus non-traditional ABS. The data underlying this figure come from Thompson SDC. Traditional ABS includes securitizations backed by auto loans, credit card receivables, and student loans. Non-traditional issuance includes ABS backed by subprime mortgages, collateralized debt obligations (CDOs), and collateralized loan obligations (CLOs). While the non-traditional category includes securitizations backed by subprime mortgages, it does not include securitizations backed by prime mortgages, such as mortgage-backed securities guaranteed by Fannie Mae or Freddie Mac.

Figure 2
U.S. Bank Capital Ratios and Loan Spreads

Panel A: Book Equity to Assets for U.S. Banks, 1840-2009



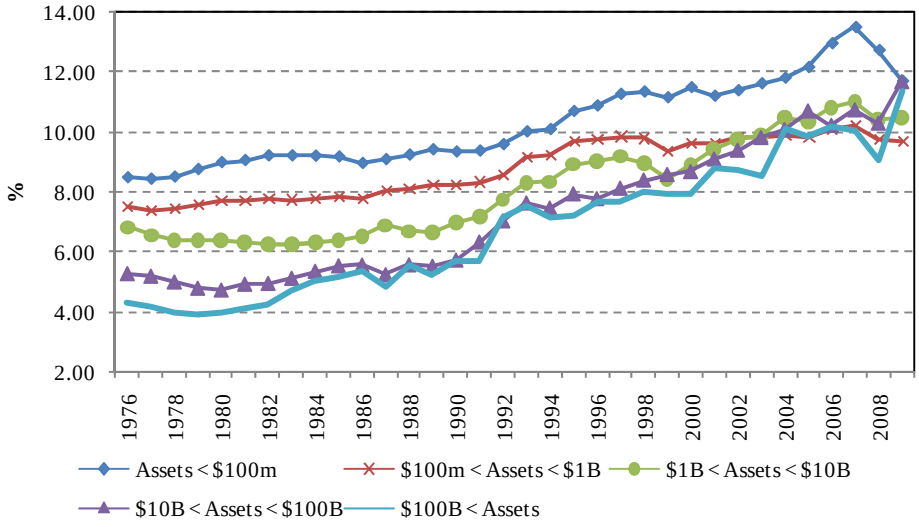
Panel B: Relationship between Loan Spreads and Bank Equity/Assets, 1920-2009



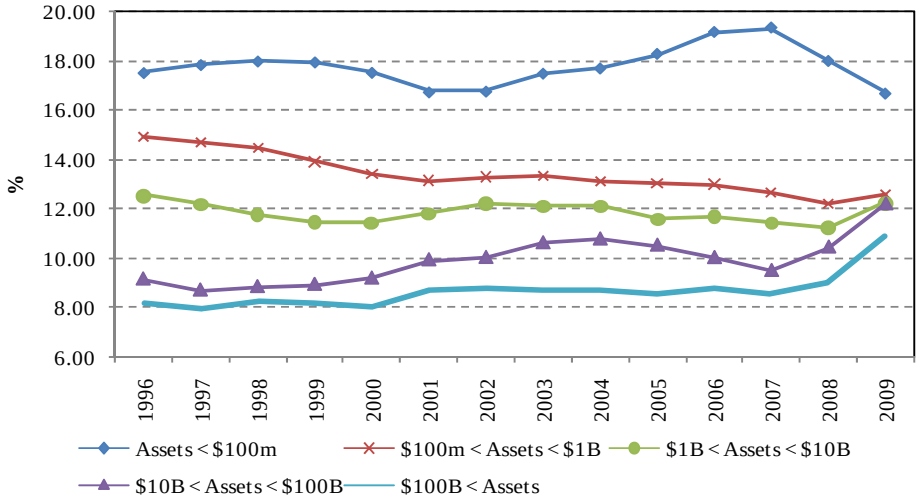
Notes: Panel A plots the ratio of book equity to book assets for U.S. commercial banks from 1840-2009. Panel B plots two measures of bank loan spreads versus equity/assets from 1920-2009. Data from 1840-1896 is based on Berger, Herring, and Szego (1995) who use data from the Statistical Abstracts of the United States. Data from 1896-1919 is based on data for All Banks and is from the Federal Reserve's All Bank Statistics, 1896-1955. Data from 1919-1933 is based on 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 from the FDIC's Historical Statistics on Banking. We measure loan spreads using either the net interest margin (net interest income over earning assets) or the yield on loans minus the rate paid on deposits (interest income on loans over gross loans minus interest expense on deposits over deposits).

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. The figure is based on data from bank Call reports. 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.