Quantifying the Effects on Lending of Increased Capital Requirements

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Introduction

There is a strong consensus that reform of the financial regulatory system must include significant increases in the capital requirements for banks. All else equal, this should make the banks safer by providing a greater cushion to survive the mistakes and accidents from which they inevitably suffer. Higher capital requirements should also discourage transactions of lower economic value by creating a higher hurdle rate, since the extra units of capital need to be paid for by additional expected return. Some of the regrettable transactions that seemed attractive during the bubble might not have been undertaken at a higher hurdle rate.

Unfortunately, higher capital requirements are not free. At the margin, the increased hurdle rates are likely to: make it harder for businesses and individuals to obtain loans, raise the cost of loans, lower the interest rates offered to depositors and other suppliers of funds, and reduce the market value of the common stock of existing banks. One of the keys to determining the exact right size for an increase in minimum capital levels is to quantify these effects.

Summary

The analysis presented here strongly suggests that the U.S. banking industry could adjust to higher capital requirements on loans through a combination of actions that would not wreak havoc on the system. Not surprisingly, the adjustments would need to come from a set of actions, since the rebalancing appears tough to achieve with any single move. Fortunately, the banks do have a variety of levers to pull which should allow them to make the transition.

These findings imply that there would likely be relatively small changes in loan volumes by U.S. banks as a result of higher capital requirements on loans retained on the banks' balance sheets. The various actions required to restore an acceptable return on common equity appear unlikely to be large enough,

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even in the aggregate, to significantly discourage customers from borrowing or move them to other credit suppliers in a major way.

These findings may seem counterintuitive given the large percentage increase in required common equity devoted to lending considered here and the strong focus of bank managements on rationing that common equity. Three points may help clarify the results. First, banks are highly levered institutions -- the great bulk of the funding for a loan comes from deposits and debt. Even though common equity is expensive, it accounts for less than a fifth of the cost of a typical loan. Second, higher equity levels reduce the risk of a bank and therefore lower the returns demanded by debt and equity investors, reducing the cost of each dollar of debt or equity supporting the loans. Third, as shown in detail below, reasonable actions by the banks can restore returns on equity to levels that are attractive to investors. Thus, there should be the ability for banks over time to raise new equity sufficient to maintain their loan volumes. It is true that large amounts of capital would need to be raised, but this appears quite feasible given a reasonable phase-in of the new rules. A four percentage point increase in the level of common equity as a percentage of the roughly $7.5 trillion of loans in the U.S. banking system would require about $300 billion of new equity. This would represent approximately a 20% increase in the existing $1.4 trillion of equity.[2] Put another way, this could be obtained by retaining roughly two years worth of the system's earnings, assuming even a 10% ROE for the banks as a whole. In practice, a mixture of capital raising and earnings retention would likely provide the needed capital.

A forthcoming paper will examine the extent to which competitive pressures from other financial intermediaries and classes of investors would change these conclusions. However, the fuller competitive analysis is unlikely to alter the conclusion that the volume and pricing of bank lending would not be affected in a large way. The required adjustments to restore an acceptable return on equity are simply too small, in the author's opinion, to create a large degree of change.

[2] The banking system in the U.S. has approximately $1.4 trillion of common equity according to the FDIC, of which roughly $1.0 trillion is tangible common equity. For reference, a 10% return on common equity would therefore be about a 14% return on tangible common equity.

Previous research and scope of this paper

There is a long history of academic research on bank capital and regulatory requirements.[3] Two of the strands of research are of particular relevance. The first involves the creation of theoretical economic models to determine: whether changes in minimum bank capital requirements should lead to actual increases in capital, the level of associated increases in loan prices and decreases in availability, and the overall effects on bank safety. The second strand examines the actual changes in bank capital, loan pricing, and loan availability resulting from regulatory changes, such as the introduction of the "Basel 1" capital regime.

This paper takes a pragmatic approach to answering a more specific question: what are the likely effects on loan pricing and availability of an increase in minimum capital requirements for U.S. banks over the next few years? The specificity allows us to focus on the key variables and relationships as they exist here today. Thus far, the debate and analysis surrounding bank capital increases has been heavily qualitative. There is a need to supplement these important considerations with numbers.

The analysis presented here, while intended to be broadly realistic, is necessarily simplified. It does not represent a proposal by the author for any specific changes in capital requirements. Formulating a specific proposal would require more formal analysis of distributional effects across the banking industry and its customer base, substitution effects among different activities within the banks (such as investments in securities), issues of global coordination, the consideration of interactions with other regulatory changes, and transition issues. In addition, as mentioned above, the analysis needs to be complemented by the study of the constraints introduced by the existence of other financial sectors that will be examined in a subsequent paper.

[3] Please see the two papers by VanHoose in the References section at the end of this paper for extensive reviews of the literature.

How are loans priced?

The core of any lending decision boils down to a fairly simple mathematical formulation to determine whether a requested credit provides sufficient return to merit making the loan:

Equation 1

$$\text{Is } L*(1-t) >= (E*r_e)+((D*r_d)+C+A-O)*(1-t), \text{ where}$$

- L = Effective interest rate on the loan, including the annualized effect of fees
- t = Marginal tax rate for the bank
- E = Proportion of equity backing the loan
- r_e = Required rate of return on the marginal equity
- D = Proportion of debt and deposits funding the loan (assumed to be the amount of the loan minus E)
- R_d = Effective marginal interest rate on D, including indirect costs of raising funds (such as the cost of running a branch network)
- C = The credit spread, equal to the probability-weighted expected loss
- A = Administrative and other expenses related to the loan
- O = Other offsetting benefits to the bank of making the loan

In simple terms, the rate on the loan needs to cover the cost of funds, any expected credit losses, plus administrative expenses. This preliminary hurdle rate may be reduced by other benefits to the bank from making the loan. For example, many of the largest commercial banks have built their investment banking arms in part on the propensity of corporations to direct their investment banking business, which is generally lucrative, to those banking groups that also supply them with loans. As a result, loans to large companies prior to the crisis were often underpriced on a stand-alone basis, in recognition of the relationship benefits.

Should the mix of equity and debt affect loan pricing?

Modigliani and Miller (M-M), in their classic work from 1958, demonstrated that a company's overall cost of funds would be unaffected by the mix of debt and equity, under idealized conditions. An increase in the proportion of equity, which will always be more expensive than debt, would be exactly offset by a decrease in the costs per unit of both debt and equity in recognition of the lower risk of insolvency.

This is a powerful finding that has been very useful to economists and financial market participants. If those idealized conditions fully applied to U.S. banks, there would be no need for the rest of this paper, since requiring banks to hold more equity would have no effect on the aggregate cost of funds and therefore would not affect lending behavior. However, there are a number of important ways in which the classic M-M assumptions do not apply. The differences make funding with a high proportion of equity significantly more expensive than funding largely with debt, which is why banks in the U.S. generally have more than ten times as much debt and deposit funding as they do common equity funding.

Explicit and implicit government guarantees of deposits and debt

The borrowing costs for banks have usually been substantially below what one would expect for a highly levered firm, as a result of government guarantees. Most importantly, there is an explicit guarantee from the FDIC on roughly two-thirds of the deposits. Not surprisingly, about 80% of the debt and deposit funding of U.S. banks on average is from deposits, since the guarantee makes them very cheap. In addition, most of the loans in the banking system are made by banks that are viewed as "too big to fail." These banks benefit from a rational assumption by investors that the government will not let the bank default on its debt or will, in the worst likely case, limit the damage. These guarantees make a bank's cost of debt and deposits far less sensitive to the riskiness of the institution than was assumed by M-M. While there is some indirect protection for equity investors, it is much less, as evidenced by the fact that many stockholders in banks lost very large sums of money in this financial crisis, even though government actions did lessen the damage somewhat. Thus, the relative insensitivity of bank debt costs to creditworthiness provides a major incentive for banks to hold more debt and less equity.

Taxes

M-M assumed that the tax treatment of debt and equity was equivalent. In practice, debt is tax-deductible for U.S. corporations while equity payments are not. This is partially offset to the extent that investors are taxed more favorably on equity than debt holdings, which leads investors to alter their required pre-tax returns to reflect the tax benefit. However, the offset is only partial in today's U.S. tax environment for the large majority of investors. In fact, for pensions and other tax-exempt investors there is usually no offset at all, as there is no difference in tax treatment between the two asset classes.

Thus, the tax difference biases banks towards raising as much debt and deposit funding as they can, consistent with other corporate objectives, such as their overall risk management strategies.

Economists and practitioners have observed a number of other factors that could cause firms to choose higher or lower levels of equity in their capital structures, including: information asymmetries; conflicts of interest between managers, equity investors, and debt investors; and rating agency constraints. As a result, there is no definitive answer as to the optimum capital structure for a bank.

Nonetheless, it seems clear that banks have powerful economic incentives to rely much more heavily on debt/deposits than on equity for their funding, and this is what we observe in the real world. Therefore, it is reasonable to assume that there will be economic costs to forcing the banks to hold a higher proportion of equity. Appendix A shows a stylized example of how an analysis that starts with M-M assumptions and then adds the effects of guarantees and taxes could produce results similar to the "combined case" that we use below to illustrate one potential set of adjustments by banks.

What are the current capital requirements?

U.S. bank regulators use a dual set of tests for capital requirements. Simplifying somewhat, banks must generally have a ratio of "Tier 1" capital to total assets of at least 4% to be considered well-capitalized. Tier 1 capital consists of the book value of the common equity, minus most intangible assets such as goodwill, plus the book value of certain preferred equity, with the total adjusted for a few accounting items. Historically, U.S. regulators appeared comfortable with the composition of Tier 1 capital if at least half represented tangible common equity. Of late, regulators have wanted to see a higher proportion in the form of common.

In addition to this leverage ratio, regulators also use risk-weighted ratios. Each asset category is multiplied by a pre-defined weighting of from 0-100% meant to reflect its riskiness. (There are a few cases where the weighting exceeds 100%, such as for loans to insolvent or struggling companies, but these tend not to have a large effect on the total ratio.) The ratio of Tier 1 capital to risk-weighted assets must equal or exceed 6% in order for the bank to be considered well-capitalized. The risk-weighted leverage ratio will virtually always equal or exceed the straight leverage ratio, since the risk-weightings

seldom exceed 100%. Thus, the same Tier 1 capital level is divided by a risk-weighted assets figure that is usually substantially less than the non-weighted figure for total assets.

How might banks respond to higher capital requirements: the base case scenario

Predicting the response of the banking system to higher capital requirements is extremely complex, but it is possible to put some bounds on the extent of potential responses by using the loan pricing equation. We begin by looking at each variable individually to determine the extent of action necessary if that variable were the only one used to restore acceptable profitability to the loan business.

The following base case assumptions are used for illustration. They are based on rough averages for the U.S. banking system as a whole, as reported by the FDIC, combined with a large dose of the author's judgment informed by his two decades as a financial institutions investment banker. The assumptions represent a reasonable starting point for comparisons, but should not be regarded as definitive, even on the basis of systemwide averages. Naturally, the situation for any individual class of loans would likely vary even further from these assumptions. Fortunately, the sensitivity analysis in Appendix B shows that the conclusions are not heavily dependent on these particular starting assumptions. Moving the initial required return on equity by 5 percentage points produces results broadly consistent with the base case, as does moving the cost of debt or the credit spread by a similar amount.

Variable: L

The loan rate is a dependent variable, not an assumption, but it is worth emphasizing that the calculations in this note are focused on determining the rate necessary to produce the target ROE. It is possible that rates at the time of transition to a new regime will be higher or lower than the equilibrium rate, which would either dampen or exacerbate the need for adjustments to lending behavior.

Variable: E = 6.0%

This assumes that the minimum leverage ratio using total assets will be the binding constraint to which banks manage themselves, as opposed to the risk-weighted leverage ratios that are also likely to continue to exist. Thus, each dollar of new lending would require 6 cents of capital, since every dollar of asset counts in full. (With risk-weighted assets, certain less risky assets, including mortgage loans, would

count at less than 100% of their value. Thus the approach here is conservative in the sense that smaller adjustments would be needed if risk-weighted assets were to be the true constraint.)

There are a range of reasonable values to use for a base case. FDIC figures indicate that the banking system currently has a tangible equity ratio of about 7.4%. However, this estimate is too high for our purposes, since much of this equity capital was originally borrowed at the bank holding company level as debt and then invested in the bank subsidiary as common equity. Its cost to the banking group as a whole, which is what would need to be recovered in the loan pricing, would be the cost of the holding company debt. On the other hand, the largest bank holding companies had a tangible common equity ratio of about 4% immediately prior to the stress tests and the subsequent capital raising. This is likely to be too low a figure for several reasons. Capital ratios are likely to settle out higher than this as the environment stabilizes even without new regulations. Further, the figure is biased downwards by assets in the banking group that are in entities with lower capital requirements and it does not reflect recent capital raising. Thus, 6% seems a reasonable starting point that falls between these levels.

Variable: r_e = 15.0%

This figure is only a rough estimate, because it is not directly observable. The return that equity investors truly expect when they invest in a bank can only be determined by comparing the purchase price of the stock with their true expectations of future share prices or dividend payments or both. A sense of the required return can be obtained by talking with potential investors, but one cannot realistically get a large enough sample size to avoid judging by anecdotal evidence, and it is difficult to know if they are really deciding in the manner they say they are.

Based on the author's investment banking experience, and discussions with bankers and investors, the 15% figure seems a reasonable guess for what investors will be demanding in a few years when the new capital requirements kick in – higher than a couple of years ago, but lower than investors may be looking for right at the moment. The 15% figure is affected by the relatively high riskiness of banks for the foreseeable future, both due to systematic risk as a leveraged bet on a turbulent economy, and unsystematic risk as individual banks and the industry as a whole sail through uncharted waters.

Variable: D = 94%

This is based on the simplifying assumption that the only sources of funding are common equity and debt/deposits. For this analysis, preferred equity and hybrid securities are counted as debt.

Variable: R_d = 2.0%

The bulk of this represents the cost of gathering deposits, which represent about 80% of the combination of debt and deposits for U.S. banks, according to the FDIC. The direct cost of deposits is close to zero at the moment, given prevailing interest rates, but there are considerable indirect costs of running a branch network or otherwise sourcing deposits. The direct costs of external debt are higher and raise the average modestly.

Variable: C = 1.0%

The loss experience on existing loans will run higher than this, given the severity of the recession, but new loans should average around this level or even lower. The FDIC reported a net charge-off rate for the institutions it covers of 1.29% in 2008, after averaging 0.56% for the five prior years. 2009 will be much worse than 2008 and 2010 could be even worse, but new loans being put in place after the new capital requirements take hold should have far better experience than currently existing loans.

Variable: A = 1.5%

It is difficult to get a good estimate of the direct and indirect administrative costs related to loans, but this seems a reasonable guess and, in combination with the other estimates, results in a net interest margin roughly matching that of the banking system in recent years.

Variable: O = 0.5%

The figure for indirect benefits received by the bank for making a loan would be much higher for some loans, particularly to large corporations, but would be zero for many other loan classes. It is very difficult to estimate and therefore serves as more of a placeholder in this analysis than a solid figure. Its starting value should have little impact on the effects of higher capital requirements, according to the sensitivity analysis.

Variable: t = 30%

This is set somewhat lower than the federal marginal tax rate of 35%, (plus whatever state and local income taxes would apply), based on the assumption that intelligent tax planning can reduce the bank's effective marginal tax rate modestly.

Required changes if only one variable is adjusted at a time

Table 1 shows the extent of the change needed in each variable, if it were the only means of adjusting to maintain an acceptable loan rate at higher levels of required capital. For illustration, the table shows the effects of moving from a 6% equity capital level to an 8% or 10% level. For the reasons noted below, it does not appear clearly feasible for all of the adjustment to be made using any one variable on its own.

Table 1: Adjustment through individual variables

	Equity as a % of the loan		
	6%	8%	10%
Loan rate	5.17%	5.55%	5.94%
Return on equity	15.00%	11.60%	9.60%
Return on debt	2.00%	1.58%	1.14%
Credit spread	1.00%	0.62%	0.23%
Administrative costs	1.50%	1.12%	0.73%
Other benefits	0.50%	0.88%	1.27%

Loan rate

The required increases in loan rates, holding all else equal, might be feasible if there were no competing lending sources. There would be some reduction in demand by borrowers at the higher rates, but the effect does not seem likely to be dramatic. However, as the subsequent paper will explore, the constraints of competitive lending sources would render these price increases infeasible or very difficult.

Required return on equity

It does not appear likely that equity investors would be willing to drop their required return this far. Equity investors are concerned about a much wider range of possibilities than just the risk of bankruptcy or default that bondholders focus on. The reduced risk for equityholders simply does not appear attractive enough to warrant such large declines in required returns. There is still a wide range of potential outcomes for the equityholders, some very bad, without assuming default.

Return on debt and deposits

This, too, appears quite unlikely to work on its own to eliminate the problem. Roughly 80% of this funding is from depositors, who are already largely guaranteed by the FDIC, with implicit taxpayer backing, and therefore largely indifferent to capital ratios. Further, under present conditions deposit rates are close to zero, giving them little room to decline, and the indirect costs of raising deposit funds are hard to push down significantly.

Credit spread

Here, too, the changes appear too large to be feasible. The average credit spread could be reduced somewhat by being choosier about which loans to make, but it would be difficult to gain this large a drop without drastically pruning the loan book.

Administrative costs

There may be some room for greater efficiency, but the large banks that dominate the lending business have already put massive efforts into gaining those efficiencies. Again, a drop of this order seems unlikely.

Other benefits

This area is very difficult to quantify and there should be some room for greater cross-selling or other ways of extracting more value. However, it is improbable that this approach could bear too much of the adjustment burden.

A Combined Case

There are many ways in which banks and their investors could adjust by changing multiple variables at the same time. The following is one example of a way it might work.

Table 2: Adjustment through multiple variables			
	Equity as a % of the loan		
	6%	8%	10%
Loan rate	5.17%	5.26%	5.37%
Return on equity	15.00%	14.50%	14.00%
Return on debt	2.00%	1.90%	1.80%
Credit spread	1.00%	0.95%	0.95%
Administrative costs	1.50%	1.45%	1.40%
Other benefits	0.50%	0.55%	0.60%

Not surprisingly, this illustrative case seems strikingly more feasible than any of the single-variable adjustment scenarios. Each of the assumed adjustments seems reasonably achievable for the system as a whole, both as a result of actions at individual banks and as the result of market share shifts to the more efficient banks.

Loan rate

An increase of 9 or 20 basis points for the system as a whole appears eminently feasible without any major impact on demand for loans. There do exist many substitutes for bank loans, but they are incomplete substitutes and/or more expensive, as will be explored in the subsequent paper. Consumer loans are generally insensitive to price changes that are small enough to be expressed in basis points. Small businesses tend to be tied to the banking system in general, and to their specific relationship to banks in particular, by a combination of information asymmetries and an insufficient scale to access the capital markets. Large corporations have generally moved most of their funding to the capital markets already. The portion that remains is mostly in the form of revolving loans or contingent commitments, which are very difficult to move to the capital markets and do not fit naturally with the non-bank financial sector. There would clearly be switching behavior at the margin, but it is unlikely to be large if the banking system hikes loan pricing by 20 basis points on average.

Return on equity

It seems reasonable that equity investors would give some benefit in their calculations to the greater stability that banks would have with higher capital ratios. As Appendix A shows, a lowered equity hurdle rate of half to a full point appears to be consistent with a modified version of M-M that takes into account taxes and implicit and explicit debt guarantees.

Return on debt/deposits

Creditors ought also to be willing to drop their required returns at least modestly to reflect the lowered risk. On the deposit side, part of the adjustment might be a shift in deposit market share towards more efficient banks whose indirect cost of raising deposits is lower.

Credit spread

Banks ought to be able to reduce credit risk marginally by turning down less attractive loans and by imposing covenants or other features that reduce the bank's risk of loss. The 5 basis point reduction was chosen because it appears achievable from changes in covenants and loan protections without the necessity to turn down more loans. Thus, the drop in loan supply appears unlikely to be significant.

Administrative costs and other benefits

These small changes would seem feasible, if banks found it necessary to alter the way they do business. This is one area where reductions in compensation could make a significant difference. Market share shifts could also account for a significant part of the change.

Combined Case with no adjustments in bank behavior

Some readers may find the 20 basis point change in loan pricing in Table 2 to be small enough to wonder whether banks may choose to charge somewhat more for loans while making no other changes in their behavior. Therefore, Table 3 leaves the credit spread, administrative costs, and other benefits constant across the different capital levels. The return on equity and return on debt levels are determined entirely externally, by outside investors, and therefore would still be reduced as capital levels rise.

It seems unlikely that banks would accept even the 24 basis point loan price increase shown in the 8% equity case without making other adjustments. Even if some banks did, others would not. Further, an average 45 basis point increase is likely to generate considerably more movement to other financial sectors than the 20 basis points shown in Table 2. While the set of assumptions in Table 3 may not be realistic, these figures do provide a benchmark for the change in loan price necessary on its own to counteract the higher capital requirements, assuming that investors do soften the effect by lowering their return criteria in light of the lower risk – as they theoretically should and are highly likely to do in practice.

Table 3: Adjustment through multiple variables

	Equity as a % of the loan		
	6%	8%	10%
Loan rate	5.17%	5.41%	5.62%
Return on equity	15.00%	14.50%	14.00%
Return on debt	2.00%	1.90%	1.80%
Credit spread	1.00%	1.00%	1.00%
Administrative costs	1.50%	1.50%	1.50%
Other benefits	0.50%	0.50%	0.50%

Securitization, regulatory arbitrage, and gaming of the system

Higher capital requirements will also produce greater incentives to avoid or minimize those requirements. This would likely spur an increase in securitization, as banks became relatively "worse" long-term holders of assets and therefore found it even more worthwhile to transfer the assets to investors who do not face increased capital requirements. (This will be discussed further in the subsequent paper.)

Another way of reducing the capital requirements would be to transfer the assets to related entities that have lower capital requirements. For example, if bank holding companies do not face quite as tough capital requirements as banks themselves, then it could make sense to sell the loan to the holding company or another company in the group. Even if the formal minimum ratios are identical, as they largely are now between banks and their holding companies, the effective penalties for dropping below the thresholds may be less for holding companies or other non-banks. Thus, there will be a significant interaction between the changes to the resolution regime for non-banks, the new rules for Tier 1 Financial Holding Companies, and the potential for actions taken within banking groups.

There could also be a push to sell assets to some new type of off-balance sheet entity, analogous to the now-discredited SIV structure. Regulators, legislators, and accountants will doubtless make this tougher, but it is unlikely they will be able to eliminate it altogether. For example, a banking group could sponsor a hedge fund or mutual fund that invested in its own bank loans, so that it could profit from management fees while removing the bulk of the assets from its books. (Again, this will be discussed further in the subsequent paper.)

Other influences on capital levels

Although regulatory minimum capital requirements are critical, they are not the only determinants of the capital levels that banks choose to hold. First, most banks will attempt to hold capital sufficiently above the minimum requirements to give them some flexibility on capital raising if they hit hard times. The size of that cushion could be different under a new capital and regulatory regime than under the existing one. It could be lower if banks view the new requirements as inherently too conservative or it could be higher if they see the penalties of slipping below the minimums as being tougher than now. Second, regulators may indicate, subtly or more directly, that banks should hold significant cushions above the minimums, in which case the effective minimums will be higher than the stated ones.

Third, banks, especially the larger ones, care about their debt and counterparty ratings from rating agencies such as S & P and Moody's. These ratings affect their costs and their opportunities to participate in many trading and investment banking-related activities. The agencies have already made a number of ratings adjustments, suggesting that any future toughening of capital requirements from them will be proportionally considerably less than the regulatory changes, which may somewhat dampen the impact on bank capital levels. Stronger banks may choose to hold a smaller cushion over their minimum regulatory capital levels than they would if the rating agencies toughened their stance further.

Fourth, the most sophisticated banks also place weight on their own models of economic capital. Simply put, they have elaborate mathematical models that are intended to show the probability of net losses of various sizes going forward. A bank may wish to have enough capital to handle economic losses from a shock that they believe would occur only every 250 years, equivalent to a 40 basis point probability of loss in any given year. If the figure from their capital model is higher than the regulatory minimums,

then they will choose to hold an additional cushion to keep capital high enough to cover their economic exposure. If it is lower, then they still have to hold the minimums, but may feel freer to take risks in areas that are not fully captured by regulatory capital requirements. One reason that banks were comfortable with some of their riskier behavior prior to the crisis was that their models told them that rating agency and regulatory capital requirements were too conservative in measuring the banks' aggregate risks. Banks will be more cautious for at least awhile about trusting their economic capital models, but they are well aware that regulatory requirements are blunt instruments and are unlikely to fit their own situations as well as a precisely tailored model would.

Nature of changes to capital requirements

This note has used a simplified set of assumptions about the changes to minimum capital requirements. The ratio of tangible common equity to total assets has been assumed to be the binding constraint. This may overstate the need for adjustments to lending behavior for two reasons. First, it is possible that a leverage ratio using risk-weighted assets may be the more binding constraint, in which case some assets will be weighted at less than 100%, requiring proportionally less capital to back them. For example, most mortgage loans would be weighted at 50% and therefore would need only half the capital that was assumed above in the loan pricing calculations.

Second, the binding constraint may turn out to be Tier 1 capital to assets, rather than equity to assets. Tier 1 capital includes certain forms of preferred stock. Investors generally demand lower returns on this preferred stock than they require on the common stock of banks, since there is a greater certainty of receiving that return. This would lower the weighted cost of capital relevant to the lending decision, making it at least somewhat less painful to adjust to the new rules. The weighted cost of capital might also drop faster as bank capital ratios rise than the pure cost of common equity would, since preferred returns are significantly more sensitive to default risks. In some ways they are even more sensitive than debt rates for banks, since preferred shares are viewed as having less of an implicit government guarantee. These effects could be important, if in fact Tier 1 capital is the binding constraint, but the sensitivity analysis suggests that the overall conclusions would still apply at lower starting costs of capital.

There may be an effect in the opposite direction if the new rules create an anti-cyclical adjustment mechanism for capital requirements. If banks know that a loan they put on the books today may require more capital later, they will need to build in a higher return. It is true that they could sell off many of the loans in the future to reduce their capital requirements, but they would be doing so at a time when others were taking the same action for similar reasons, which does not make for good negotiating leverage on pricing. The higher capital ratios may be triggered by a financial boom that makes loans more valuable, but there is no guarantee of this. Thus, variability in future capital requirements adds a risk factor that banks would likely price in to some degree, although perhaps it would not have a very strong effect on up-front lending behavior.

New capital versus existing capital

A bank's equity capital going forward will consist of two pieces, the "captive" equity capital that was raised in the past, plus cumulative earnings, and new capital that is raised in the future. It is clear that new capital will have to be offered a return attractive enough to induce investors to buy the stock, whereas captive equity investors do not have a choice of getting their money back. They could sell to other investors, but this does not directly affect the bank.

Theoretically, a bank's management team could decide to keep its existing capital base and allow equity investors to take the hit from higher capital requirements. The bank could sell off loans or other assets sufficient to bring its asset levels into line with its capital under the new requirements. Return on equity going forward would be reduced if no other actions were taken, doubtless hurting the stock price, but the bank would escape the need for new capital, thus avoiding a direct effect on the stock price.

In practice, managements would work very hard to keep the stock price from falling and to minimize any unavoidable decline. Declining stock prices directly reduce the value of the shares that senior managers are forced to hold and probably reduce compensation levels of the most senior managers, according to agreed bonus formulae. Managers are at greater risk for their jobs when stock prices fall, as well. Also, shrinking the firm to match the new capital requirements would likely lead to layoffs and other painful actions.

Thus there is likely to be relatively little damping effect on the required adjustments to lending behavior as a result of the theoretical possibility of making existing investors take the hit. It may be that competitive factors would render it impossible to restore an acceptable ROE at the existing stock price, but it would be the presence of these other factors, not the existence of captive equity investors, that created the limitations.

Could the presence of a large stock of existing loans cause managers to "overshoot" in their adjustments in order to capture extra ROE from new loans to raise the average for all loans on their balance sheet? Probably not to any significant extent, for several reasons. First of all, competitive pressures that will be discussed in the subsequent paper mean that banks are hardly in full control of their fate. Even within the banking sector, such actions could spur new start-ups that were not burdened with the need to compensate existing equityholders for the loss in value from regulatory changes. They would be in a position to offer a better deal to consumers and businesses, while still earning an acceptable ROE under the new conditions. In addition, a large percentage of loans would mature before the new capital requirements take hold, given the likelihood of an extended phase-in of the provisions. Even mortgages have historically had average lives much shorter than their full maturities, due to prepayments as people move, get divorced, refinance, or otherwise find it desirable or unavoidable to pre-pay a mortgage. The large majority of non-mortgage loans are for even shorter periods.

Appendix A: Modified Modigliani-Miller analysis

Effects of guarantees and taxes on an M-M based analysis: three cases

Table A1: Case without guarantees or taxes			
Equity as a % of total capital	**6%**	**8%**	**10%**
Cost of equity	14.50%	13.95%	13.40%
Cost of debt and deposits	4.00%	3.82%	3.65%
Weighted-average cost of capital (WACC)	4.63%	4.63%	4.63%

Table A2: Case with guarantees but no taxes			
Equity as a % of total capital	**6%**	**8%**	**10%**
Reduction in cost of equity due to guarantees	1.00%	0.90%	0.80%
Reduction in cost of deposits and debt due to guarantees	2.20%	2.10%	2.00%
Cost of equity	13.50%	13.05%	12.60%
Cost of debt and deposits	1.80%	1.72%	1.65%
Weighted-average cost of capital (WACC)	2.50%	2.63%	2.75%

Table A3: Case with guarantees and taxes			
Equity as a % of total capital	**6%**	**8%**	**10%**
Effective marginal tax rate for bank on deposits and debt	30%	30%	30%
Effective marginal investor tax rate on deposits and debt[1]	10%	10%	10%
Effective marginal investor tax rate on equity returns	10%	10%	10%
Cost of equity[2]	15.00%	14.50%	14.00%
Cost of debt and deposits[2]	2.00%	1.91%	1.83%
Pre-tax WACC	2.78%	2.92%	3.05%
After-tax WACC	2.22%	2.39%	2.56%

1. The 10% investor tax rate on deposits and debts corresponds to a 30% tax rate on the interest portion. Roughly 2/3 of the bank's expense is for non-interest costs of gathering deposits.
2. The required cost of equity and debt rise to maintain the same after-tax return to investors as in the cases with no taxes

Appendix B: Sensitivity analysis

Fortunately, the overall conclusions are not highly sensitive to the base case assumptions, but are more affected by the relative movement in the capital requirements. Tables B1 and B2 show the effect of starting out with a required equity return of 10% (five points lower than in the base case) or with a required debt return of 7% (five points higher than the base case.) The latter serves also as a proxy for all the other variables besides return on equity, since a 5 point move in any of the tax deductible variables would have the same effect.

Effects of using starting required ROE of 10%

Starting with a lower ROE requirement of 10% would result in a correspondingly lower starting loan rate of 4.74%. Requiring more equity at this lower equity cost would not be as harmful and therefore would push up the required loan rate by only 24 and 49 basis points respectively, compared to 38 and 77 basis points in the base case. The reduction in the effect on loan rates moves it closer to being feasible to simply increase rates and leave everything else constant, but it still might not be possible in a competitive environment with non-bank institutions existing. Either way, putting the entire burden of the adjustment on the cost of equity remains quite improbable, requiring a drop of 2.1 or 3.4 points, respectively.

Table B1: Effects of using starting required ROE of 10%

Equity as a % of the loan	6%	8%	10%
Loan rate	4.74%	4.98%	5.23%
Return on equity	10.00%	7.90%	6.60%

Effects of using starting debt return of 7%

Using our base case assumptions, including a required return on equity of 15%, but raising the required debt return to 7%, results in a required loan rate of a little under 10%. This loan rate goes up by 28 and 57 basis points, respectively as capital requirements increase, as compared to 38 and 77 basis points in the base case. Higher equity

Table B2: Effects of using starting debt return of 7%

Equity as a % of the loan	6%	8%	10%
Loan rate	9.87%	10.15%	10.44%
Return on equity	7.00%	6.69%	6.36%

levels become relatively less harmful since the debt rate is closer to the equity rate. However, the difference between the after-tax cost of funds between the two funding sources is still high enough to have a real effect. Under the same assumptions, the return on debt has to drop by 31 and 64 basis points to bear the full burden of higher capital requirements, compared to 42 and 86 basis points in the base case. This feels like a less unreasonable possibility when the debt rate is 7% in the first place, although it would still likely be very difficult to achieve in an environment with non-bank competition for investments.

Table B3 shows an example combined case, modeled after Table 2 in the body, but using a required return on equity of 10% as the starting case. The overall conclusions do not appear to be much altered by the use of the lower required ROE.

Adjustment through multiple variables at 10% ROE

The adjustments to the loan rate and to the required return on debt can be somewhat smaller in the modified base case, since the 10% starting required return on equity means that the increased capital levels are not as damaging. Nonetheless, this does not really affect the overall conclusion that the combined adjustments to tougher capital requirements seem broadly feasible.

Table B3: Adjustment through multiple variables at 10 percent ROE

	Equity as a % of the loan		
	6%	8%	10%
Loan rate	4.74%	4.78%	4.85%
Return on equity	10.00%	9.50%	9.00%
Return on debt	2.00%	1.95%	1.90%
Credit spread	1.00%	0.95%	0.95%
Administrative costs	1.50%	1.45%	1.45%
Other benefits	0.50%	0.50%	0.55%

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