Can We Explain Banks' Capital Structures?*

BY MITCHELL BERLIN

Bank capital has been much in the news during the recent financial crisis. In 2008 and 2009 the U.S. government injected $235 billion of capital into the banking system as part of the Troubled Asset Relief Program (TARP). In 2009, bank regulators carried out a full-scale evaluation of the capital adequacy of 19 large banking organizations, ultimately requiring 10 of these organizations to increase their capital levels. While most commentators agree that regulatory capital levels are too low for large organizations — especially large organizations that create systemic risks — financial economists have only recently been paying attention to what factors actually govern banks' capital choices. In this article, Mitchell Berlin discusses how understanding bank capital decisions over the 20-year period prior to the recent crisis can provide insights that may help us to evaluate reform proposals.

After posing the question, "Why are banks so averse to raising equity?" a recent column in *The Economist* answers, "The usual laws of corporate finance do not seem to apply to banks." The reason the column suggests is that deposits are insured; so uninsured sources of funding (such as equity) are relatively expensive. This view is fairly widespread, and not just among business columnists. Indeed, most theoretical models of the banking firm assume that banks hold the minimum amount of equity required by regulation.[1]

While this view appears plausible, it actually contradicts the evidence of the last 20 years, which shows that banks do not appear to hold the minimum amount of equity required by regulators. Furthermore, while banks are typically highly leveraged compared with most nonfinancial firms, this doesn't mean that similar forces are not at work when banks and nonfinancial firms choose their capital levels. To the contrary, empirical work by banking scholars supports the view that market forces have been an important determinant of banks' capital decisions since the early 1990s.

Bank capital has been much in the news during the recent financial crisis. In 2008 and 2009 the U.S. government injected $235 billion of capital into the banking system as part of the Troubled Asset Relief Program (TARP).[2] And in 2009, bank regulators performed a full-scale evaluation of the capital adequacy of 19 large banking organizations, ultimately requiring 10 of these organizations to increase their capital levels.[3] While most commentators agree that regulatory capital levels are too low for large organizations — especially large organizations that create systemic risks — financial economists

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[1] To be fair, theorists often assume that banks hold the minimum capital level mainly as a matter of convenience when they are not primarily concerned about the bank's choice between debt and equity.

[2] This total includes capital injected into a range of financial institutions, not all of which were commercial banking organizations. See the report from the Government Accountability Office for more details about TARP.

[3] See the Board of Governors' two accounts of the Supervisory Capital Assessment Program (SCAP).

have only recently been paying attention to what factors actually govern banks' capital choices. Understanding bank capital decisions over the 20-year period prior to the recent crisis can provide insights that may help us to evaluate reform proposals. (See *Some Bank Capital Reform Proposals*.)

CAPITAL STRUCTURE IN NONFINANCIAL FIRMS

While banks may be special along a number of dimensions, in the first instance, banks are firms. So to understand bank capital, a sensible starting point is to take stock of our current knowledge about capital structure decisions by firms in general. First, some terminology: We can think about capital structure in a few equivalent ways. Sometimes it is easiest to talk of the firm's *leverage ratio*, the value of the firm's debt divided by the value of its total assets. Alternatively, we sometimes talk of its *capital ratio*, the value of the firm's equity (or, often in the case of banks, some broader measure of regulatory capital) divided by the value of its assets.[4]

The Dynamic Tradeoff Model. Capital structure has been an active area of research in financial economics for the last 50 years.[5] Despite inevitable differences of opinion among researchers, the current consensus is that the empirical evidence is consistent with a dynamic tradeoff model in which firms choose a target leverage ratio to which they actively adjust over some period of time. Furthermore, alternative views in which firm managers make financing decisions with little or no thought to hitting a target leverage ratio have received little empirical support to date. But even its proponents recognize that the standard model has limited power to explain firm capital structure decisions.[6]

In the standard model, a firm

[4] Regulators use the term "leverage ratio" to refer to the value of a bank's tier 1 capital over total assets. (See *Bank Capital Regulation* for a definition of tier 1 capital and other regulatory terminology.) Throughout the text, I will use the term "capital ratio" to refer to common equity divided by assets and I will specify whenever I use some regulatory measure of capital or assets.

[5] Most accounts of the modern theory of capital structure begin with the *capital structure irrelevance* theorem of Nobel laureates Franco Modigliani and Merton Miller, who showed conditions under which a firm's capital structure does not affect its value. Subsequent researchers have systematically examined the effects of relaxing these conditions.

[6] See, for example, two recent reviews of the capital structure literature by Christopher Parsons and Sheridan Titman and by Murray Frank and Vidhan Goyal.

Some Bank Capital Reform Proposals

In addition to the widespread view that banks should be required to maintain higher capital levels than under Basel I, banking researchers and policymakers have made a number of proposals to reform bank capital regulation.

A number of researchers have proposed that banks be required to maintain a layer of contingent convertible debt. The element common to all versions of this proposal is that when bank capital falls below some level, the debt converts to equity, thereby reducing the bank's leverage automatically. Proposals differ in the details of how conversion is triggered. For example, in Mark Flannery's proposal, conversion is triggered when the market value of equity falls below a predetermined level. Alternatively, the Squam Lake Working Group for Financial Institutions proposes that conversion should be triggered only when both the book value of equity falls below a predetermined level and bank regulators announce that there is a systemic crisis.*

Other researchers have proposed that banks be assessed a higher capital charge based on some measure of their contribution to systemic risk. This approach seeks to address the issue that banks will not take into account the costs they impose on other institutions, and ultimately taxpayers, when they take risks that increase systemic risk. For example, Viral Acharya, Lasse Pedersen, Thomas Philippon, and Matthew Richardson have proposed that bank capital requirements (or a systemic risk insurance fee) be partially based on a financial institution's contributions to episodes of severe stock market declines. Other researchers have proposed other measures of an institution's contribution to systemic risk; for example, Tobias Adrian and Markus Brunnermeier propose that capital charges be based on the covariance between an institution's stock price and those of other large financial institutions.

It is important to note that contingent capital schemes and schemes that impose capital charges for systemic risk are potentially complementary approaches.

* The various proposals contain extended discussions of the main issues in dispute. Flannery views his scheme more as a means of mobilizing market discipline and early regulatory intervention than as a mechanism for recapitalizing a financial system already in serious crisis. The Squam Lake group worries that conversion triggers based on the market price of equity will lead to market manipulation that would increase instability. It views conversion primarily as a means of recapitalizing institutions once the system is already in crisis.

chooses its target leverage to balance the benefits and costs of increasing its debt level. Much of the literature has focused on the deductibility of interest payments as the primary benefit of higher debt: A firm's interest payments to bondholders and other lenders are treated by the firm as an expense and, thus, lower the firm's tax bill. In contrast, dividend payments to the firm's stockholders are not deductible. If this were the whole story, firms would choose to be fully debt financed. But debt also generates costs. A highly levered firm with a lot of interest payments can get into trouble in difficult financial times. At the minimum, a firm may be forced to postpone investment projects and use all incoming cash to meet interest payments. At the worst, a firm might actually face default and bankruptcy if it can't pay its creditors. (In contrast, postponing or cutting dividend payments do not lead to default.) These costs are usually grouped under the term *costs of financial distress*.

Factors That Reliably Affect Leverage. Empirical studies that cover different time periods, samples of firms, and countries indicate that a firm's leverage tends to be higher when a firm is larger, when it has more *tangible assets*, and when its *market-to-book* ratio — the value of the firm's stock divided by the book value of its assets — is lower. Most researchers interpret these factors as evidence that concerns about financial distress play an important role in the firm's capital structure choice. Large firms have more diversified sources of cash, and thus, they are less likely to face a sudden cash shortfall. A firm's tangible assets include machines and inventories, assets that could potentially be sold much more easily than a firm's intangible assets: its trademarks, its reputation for quality, brand recognition, or the accumulated knowledge of its workforce. In the event of a decline in cash flows, a firm may be able to avoid default by selling some of its tangible assets. The market-to-book ratio is often interpreted as a measure of the firm's *growth opportunities*, for example, future investment activities that investors see as valuable — and, thus, raise the firm's stock price — but which are not yet embodied in assets in place. When a firm has valuable growth opportunities, it may be particularly costly when declines in cash flow force it to delay new investments.[7]

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In addition, researchers have found that a firm's leverage depends importantly on its industry and that its leverage is high when the firm's own profitability is low. These factors don't fit as comfortably into the tradeoff model. The importance of industry effects simply shifts the inquiry one step further back: What is it about an industry that explains high or low leverage? And while the negative relationship between profits and leverage can be squared with some versions of the tradeoff model, the effect is probably best viewed as an unexplained empirical regularity.[8]

Firms Actively Adjust Toward a Target. While firms may have a target leverage ratio, factors often shift a firm away from its target; for example, a sudden increase in sales might increase retained earnings, thereby reducing the firm's actual leverage ratio. Since new debt issuance is costly, the firm may take some time to get back to its target. In surveys of chief executive officers and chief financial officers, over 70 percent of the firms report that they have either a strict target or a target range for their leverage ratio.[9] This survey evidence is supported by formal empirical studies, but researchers report widely disparate estimates of the speed with which firms adjust, with estimates ranging from very slow (Eugene Fama and Kenneth French estimate that firms adjust at a rate of 7 to 10 percent per year) to very fast (Mark Flannery and Kasturi Rangan (2006) estimate an adjustment rate of 34 percent per year), and researchers are far from achieving consensus. Furthermore, studies disagree as to whether the target is fixed or whether it may vary over time in a systematic way.

Most economists would agree with the statement, "It takes a model to beat a model." This means that to evaluate a particular model, researchers compare it to alternative models, mainly by asking how well

[7] The reader may note that none of the enumerated factors are clearly related to the tax benefits of debt. Until John Graham's work, the consensus view was that taxes had limited ability to explain firms' leverage decisions. Recent dynamic models have uncovered more evidence for the importance of taxes, but research continues to suggest that firms do not take on as much debt as models would predict. See Graham's article, as well as the literature reviews cited in footnote 6 for fuller discussions of taxes and capital structure.

[8] This negative relationship is consistent with Stewart Myers's pecking order model, examined in the next section.

[9] See John Graham and Campbell Harvey's article.

each explains the facts, in this case, firms' capital structure choices.[10] To date, no alternative to the dynamic tradeoff model has found strong empirical support. In particular, researchers have found only limited support for alternative models that predict no target leverage ratio. The most influential of these is Stewart Myers's pecking-order model, in which firms finance investments out of cash whenever possible, sell debt only if cash flows are too low, and sell new equity only as a last resort. According to this view, a firm's leverage ratio increases when its cash flows drop and it is compelled to sell new debt to finance expenditures, and its leverage ratio declines when cash flows increase and internal funds build up. In contrast to the assumption of tradeoff models, a firm manager in a pecking-order type world will make no attempt to actively adjust toward some target.[11]

Limits of the Dynamic Tradeoff Model. The empirical importance of industry effects and of other variables that might be interpreted in ways that have little to do with a tradeoff between tax savings and the costs of financial distress, for example, firm size, firm profitability, or market-to-book value, limits our confidence in the dynamic tradeoff model. Furthermore, in an important recent paper, Michael Lemmon, Michael Roberts, and Jaime Zender highlight the limited explanatory power of the model. They find that, even including industry effects, the traditional model explains at most 30 percent of the variation in firms' capital structures; an economist would say that the model has *limited power* to explain the data. Perhaps more important, Lemmon and his co-authors find that firm *fixed effects* have a lot more explanatory power than all of the traditional factors put together. A fixed effect is a persistent factor associated with a particular firm: We know it's there, and we know that it helps explain the firm's choice of capital structure; we just don't know what it is. This finding is a challenge for the tradeoff theory because it suggests that much of the variation in firms' leverage is potentially explicable by some model of firm decision-making, just not the one we have.

The controversy over the speed of adjustment toward the target and the stability of the target presents further challenges for the theory. The model is less persuasive when the speed of adjustment is slow; a firm that adjusts to its target over a period of 10 or 15 years begins to look more and more like a firm with no target at all. And the problem with time-varying targets is much like the problem with firm fixed effects and industry effects. A theory that depends on factors (firm, industry, time) that help "explain" a firm's leverage ratio in the statistical sense, but without any underlying economic intuition, may not be very useful as a guide to understanding or prediction.[12]

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BANK CAPITAL STRUCTURE

Bank Capital Levels Over Time. Banks are highly levered firms. In Reint Gropp and Florian Heider's international sample of large banks in 2004, median leverage was nearly 93 percent in book value terms and just over 87 percent when measured in market value terms. Compare this with the median book and market leverage of Frank and Goyal's sample of nonfinancial firms in 2004 of 24 percent and 23 percent, respectively.[13]

Bank capital levels have not always been so low. In the U.S., commercial banks had equity-to-asset ratios (measured at book value) of over 50 percent in 1840.[14] This ratio fell continuously until 1945, at which point it remained roughly stable in the 6 to 8

[10] Of course, it is possible for different models to help explain different aspects of a firm's decision-making or for one model to explain decision-making by some types of firms, for example, large firms, but not others.

[11] See Frank and Goyal's review article for further discussion of the empirical evidence for and against the pecking-order model and other models that predict no target, for example, Malcolm Baker and Jeffrey Wurgler's view that managers' decisions to issue securities are driven by attempts to time the market.

[12] Other recent challenges to the dynamic tradeoff model are even more fundamental. For example, Xin Chang and Sudipto Dasgupta show that simulations with random stock and bond selling can generate dynamic capital structures that look a lot like a firm moving toward a target.

[13] That said, banks are not unique in maintaining high leverage ratios. For example, in Ivo Welch's listing of the 30 most highly levered firms in February 2006, only 11 were financial firms and none were commercial banks.

[14] The numbers prior to 1980 come from the article by Allen Berger, Richard Herring, and Giorgio Szegö. Note that the numbers are not strictly comparable over time and so should be viewed as an indicator of trends.

percent range until the 1970s. Examining the figure at the bottom of the page, we see that the weighted average book value equity ratios for bank holding companies (BHCs) had declined to the 4 to 6 percent range by 1980 and then rose to 6 percent in the latter half of the 1980s, mainly in response to the imposition of uniform capital guidelines in 1985.[15] (*See Bank Capital Regulations* for a summary description of U.S. bank capital regulation and for definitions of all terms.)

Bank capital ratios increased dramatically after 1990, when Basel I capital requirements were first imposed. Book equity-to-asset ratios for large BHCs rose from approximately 6 percent in the late 1980s to over 8 percent in the 1990s and 9 percent until the financial crisis of 2008. The rising trend since 1990 is even more striking in market value terms. The average market value of bank equity to the market value of assets for the largest 100 BHCs rose from 6 percent in 1990 to over 15 percent from 1996 through the second half of 2007.[16]

Banks Hold More Capital Than the Regulatory Minimum. The rise in bank capital ratios since 1990 also corresponded to an increase in *regulatory* capital ratios. For their sample of large BHCs, Flannery and Rangan (2008) find that risk-weighted tier 1 capital ratios rose from under 8 percent in 1986 to over 10 percent by 1995. This ratio showed a declining trend through 2006 but remained above 8 percent throughout the period, comfortably above the 6 percent level required for a bank to be considered well-capitalized for regulatory purposes and well above the regulatory minimum of 4 percent.[17]

Examining the entire distribution of large BHCs' regulatory capital ratios, Flannery and Rangan (2008) show that by 1992 more than 95 percent of large BHCs had tier 1 capital ratios at least 1.5 percentage points higher than the regulatory minimum. This percentage rises to 100 percent for most years through 2001. Berger and his co-authors (2008) examine a larger sample of BHCs and show that this trend continued through 2006.[18] They show that 99 percent of large BHCs had tier 1 capital ratios that qualified them as well capitalized in 2006. The lion's share of these firms had tier 1 risk-weighted capital ratios between 10 and 12 percent.

Banks Actively Manage Toward a Target. It is clear that throughout the 1990s and into the 2000s, banks overwhelmingly held capital levels greater than the regulatory minimum, but this raises a question: What factors determine banks' capital levels? One possibility is that the bank capital

[15] A bank holding company is any company that controls one or more commercial banks. The figure displays bank capital ratios both for the largest 100 BHCs and for a larger group of BHCs. The figure also displays unweighted average capital ratios to show that the main trends are not driven by a small number of very large banks.

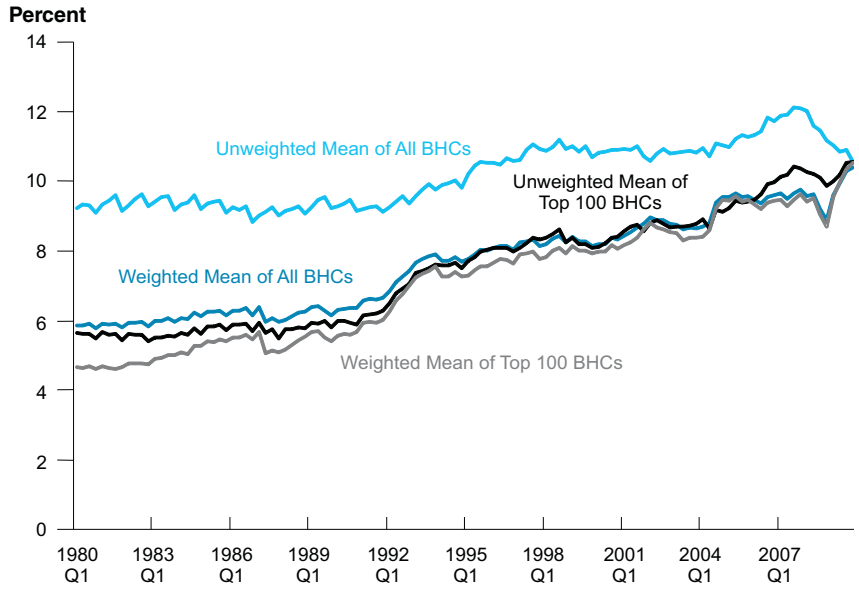
[16] Flannery and Rangan (2008) show that the increase in the average capital ratio corresponds to a rightward shift in the entire distribution of market values of equity from the 1986-1989 period to the 1998-2001 period. The 2008 article by Berger and co-authors suggests that this distribution continued to shift rightward through 2006, although they focus on regulatory capital.

[17] Interestingly, this decline coincided with an increase in tier 2 capital. Two trends appear to be at work: first, a shift toward riskier assets, and second, a shift toward nonequity sources of regulatory capital. This raises a range of important (and difficult) issues about the appropriate way to measure capital adequacy. To the extent that the risk weights on off-balance-sheet assets (or other assets) were too low — for example, regulation may have underestimated BHCs' commitment to support off-balance-sheet vehicles — BHCs may not have been as well capitalized as they appeared in the early 2000s.

[18] Flannery and Rangan's (2008) sample includes the largest 100 BHCs in each year, while Berger and his co-authors (2008) use a larger sample of all BHCs with assets in excess of $150 million.

FIGURE

BHC Capital Ratios*



*The capital ratio is measured as the book value of common equity over total assets.
Source: Bank Reports of Condition. "All BHCs" refers to BHCs with assets greater than $150 million.

Bank Capital Regulation

Prior to the 1980s, bank regulators had no formal uniform capital requirements, although regulators evaluated banks' capital levels as a part of their regulatory review. In 1985, U.S. bank regulators imposed uniform requirements, largely in response to concerns about the secular decline in bank capital. Banks were required to maintain at least a 5.5 percent *primary capital ratio* — equity plus loan-loss reserves/total assets — and a 6.0 percent *secondary capital ratio* — primary capital plus various subordinated debt instruments/total assets.

The Basel Accord of 1988 first imposed binding capital requirements in 1990, although these were phased in over the next two years. The goals of the Basel Accord were to: (i) raise capital levels for most banks; (ii) increase international uniformity in regulatory capital standards; (iii) adjust capital requirements to better reflect actual credit risk; and (iv) impose capital requirements for some off-balance-sheet exposures. The following provides the basic elements of Basel I capital requirements. (See, for example, Anthony Saunders and Marcia Millon Cornett's textbook for a more complete treatment.) European (but not U.S.) banks have been subject to Basel II capital requirements since 2008.

Tier 1 capital = Common equity + Preferred noncumulative stock + Minority interests in consolidated subsidiaries.[a]

Tier 2 capital = Tier 1 capital + Allowances for loan losses + Perpetual preferred stock + Subordinated debt + Various hybrid capital instruments.[b]

Note: The amounts of some of the components of tier 1 and tier 2 capital are limited to some maximum value. For example, preferred noncumulative stock can be no more than 25 percent of tier 1 capital.

Risk-weighted assets: Each asset has a risk weight, reflecting the risk of default. For example, a Treasury security carries a zero risk weight, while a commercial loan carries a 100 percent risk weight. In addition, off-balance-sheet assets, such as commitments to lend, are assigned a *conversion factor.* For example, an unused two-year loan commitment increases on-balance-sheet assets 50 cents for each dollar of the commitment; that is, the conversion factor is 0.5. Total risk-weighted assets are the sum of all assets, with each asset weighted by its risk weight.

Each BHC, each bank within a BHC, or any stand-alone bank is subject to three basic capital requirements:

Leverage requirement: Tier 1 capital/Total assets must exceed 4 percent.

Tier 1 capital requirement: Tier 1 capital/Total risk-weighted assets must exceed 4 percent.

Total capital requirement: Tier 2 capital/Total risk-weighted assets must exceed 8 percent.

BHCs that wish to engage in international activities and pay lower deposit insurance premiums, among other benefits, must be *well capitalized*. To be well capitalized, the BHC must maintain a tier 1 capital ratio no less than 5 percent, a tier 1 risk-based capital ratio no less than 6 percent, and a tier 2, risk-based capital ratio no less than 8 percent.

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[a] Preferred stock confers no voting rights and pays a fixed dividend. Dividend payments on preferred stock must be paid before common stockholders are paid any dividends, but contractual payments to debt holders have priority over preferred dividends. Unlike a missed interest payment, a missed dividend payment is not an event of default. Unlike for cumulative preferred stock, missed dividend payments on noncumulative preferred stock are not added to future dividend payments. When a BHC owns a majority of the shares of a subsidiary, the subsidiary is consolidated into the balance sheet of the parent BHC. If the BHC owns less than 100 percent of the shares, the equity share is considered a minority interest in its consolidated subsidiary.

[b] Perpetual preferred stock has no fixed maturity and any missed dividend payments are added to future dividend payments. The interest payments on subordinated debt instruments are contractual payments that must be paid before any stockholders receive dividend payments. Failure to make interest payments leads to default. Subordinated debt has lower priority than deposits or senior debt, so depositors (or the FDIC standing in for depositors) or senior debt holders must be fully paid off before subordinated debt holders receive any payments. Hybrid capital instruments included in tier 2 capital refer to a range of securities, including deeply subordinated debt instruments. These have lower priority than ordinary subordinated debt and make interest payments only under specified contractual conditions.

buildup reflected pecking-order behavior and that the capital buildup was an accidental byproduct of the strong revenue growth for banks during this period. This behavior might have been reinforced by regulators' preference to see better capitalized banks.

The evidence strongly suggests that this is not the case. Beginning

with a study of the 1980s, Berger and co-authors, in their 2008 paper, find that banks sold new equity when their earnings increased, a finding at odds with pecking-order behavior. Examining the capital buildup of the 1990s, Berger and co-authors find that BHCs systematically offset new equity issues carried out to finance mergers by redeeming existing shares, also consistent with active management of their capital ratios. Furthermore, Flannery and Rangan (2008) estimate an empirical model of bank market capital ratios for the 1990s and conclude that the mechanical effect of increases in earnings accounts for only 3 percent of the capital buildup in the 1990s. So, as in the literature for nonfinancial firms, researchers do not find much support for pecking-order models of bank capital.

What Do We Know About Banks' Target Leverage? It is important to note that the literature on what determines banks' target leverage ratios is relatively small, the samples and model specifications are different, and not all findings are consistent; so all results should be regarded as preliminary.[19] I focus primarily on those results that are consistent across studies and that pertain to leverage ratios or capital ratios (common equity/assets) measured at market prices.[20]

Consistent with the literature on nonfinancial firms — and also with many other studies in the banking literature — all researchers find a positive relationship between banks' asset size and target leverage. That is, larger banks are less well capitalized. This finding is consistent with the view that larger banks are better diversified and less likely to breach their target leverage.[21] Also in line with the previous capital structure literature, researchers find that most of their models' explanatory power comes from a firm-specific fixed effect, again, a reflection of our limited understanding of the cross-sectional variation in bank capital structure choices. Existing research also agrees that banks adjust quickly toward their target; indeed, the adjustment speeds exceed the top end of the range previously estimated for nonfinancial firms.[22]

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Finally, the studies by Gropp and Heider and by Flannery and Rangan (2008) document a negative relationship between bank leverage ratios and a measure of bank asset risk, although Flannery and Rangan (2008) find this result only for the second half of their sample period, 1994-2000. This result is consistent with the view that bank leverage decisions are driven by market pressures; that is, investors or other bank counterparties demand that a bank with more portfolio risk be better capitalized.[23] The view that market pressures increased in the late 1990s is in tune with other empirical research showing that the costs of uninsured funding sources became more risk sensitive in the 1990s. Interestingly, Flannery and Rangan (2008) find no such relationships for the 20 largest U.S. banks. They argue that market participants view the largest banks as too big to fail and that this suppresses the relationship between risk and leverage.

Researchers have tried to distinguish between two possible types of explanations to explain variations in capital levels over time and across banks. The first possibility

[19] I focus on the results of Berger and co-authors (2008), Flannery and Rangan (2008), and Gropp and Heider, all of which cover sample periods through at least 2000. These articles contain references to earlier contributions that address similar questions for earlier time periods.

[20] The leverage ratio is comparable to the measure typically used in studies of nonfinancial firms. Furthermore, regulatory definitions of capital pose difficult questions about the quality of the capital, for example, whether the instruments included in capital should be thought of as equity or debt. And risk-weighted measures of assets raise a host of questions about whether the risk weightings are reasonable.

[21] It is also consistent with the view that larger banks were undercapitalized, in particular, that their capital provisions were too low given the probability of very bad economic outcomes, so-called tail risk.

[22] Interestingly, Flannery and Rangan (2008) find that adjustment speeds are faster for banks nearer their minimum capital requirement and that banks with poor regulatory ratings adjust relatively slowly. They interpret the latter result as evidence of the difficulties such banks face in selling new equity.

[23] Flannery and Rangan (2008) do not find a negative relationship between leverage and risk for the first half of their sample period, 1987-1994. Their interpretation is that market forces became more important in determining bank capital structure decisions throughout the sample period. We should be cautious in our interpretation of a negative relationship between asset risk and bank leverage. Better capitalized banks may simply choose to take fewer risks, perhaps reflecting the risk preferences of the owners or managers.

is that regulatory capital requirements actually determine bank capital but that banks hold some cushion above the required capital level to reduce the likelihood of a regulatory intervention or the need to raise capital or reduce assets at short notice. The second possibility is that bank capital levels are determined in the market, perhaps according to some tradeoff model similar to the model in the standard capital structure literature. (Indeed, Gropp and Heider estimate a canonical tradeoff model, with only small alterations to account for certain distinctive characteristics of banking firms.)

To this point, researchers have not found a way to persuasively distinguish these hypotheses in the data, although, in my view, Flannery and Rangan (2008) present the most convincing evidence against the equity cushion view. They show that bank asset volatility is not positively related to the excess of book capital over required capital (the cushion), inconsistent with the view that the cushion is chosen to protect the bank against the risk of poor outcomes that would breach the regulatory capital requirement.[24]

THEORIES OF BANK CAPITAL STRUCTURE

Although there is a large theoretical literature on what makes banks special, a surprisingly small number of banking theorists have addressed banks' capital structure decisions. While the empirical evidence doesn't yet firmly reject the view that banks hold the regulatory minimum plus some cushion, the high capital levels of the last 20 years have led some theorists to explore optimal capital decisions driven by market pressures, in the context of the modern theory of the banking firm.[25]

Banks Hold Illiquid Assets and Provide Liquid Liabilities. The high leverage we observe for banks is closely related to what makes banks special. First, unlike those of nonfinancial firms, banks' liabilities are used as money (for example, demand deposits) and as a safe store of savings that can be called on at short notice (for example, certificates of deposit). More recently, other types of bank liabilities, for example, asset-backed securities, have served as collateral for a host of financial transactions.[26] Since liquid liabilities are a primary output of the banking firm, we should expect banks to be highly levered. At the same time, to be useful in exchange or as a source of liquid savings, banks' liabilities need to have little risk of default and, even more important, should not require customers to carry out a careful evaluation of the bank's assets. (Imagine having to examine a bank's annual report each time you accept a check drawn on that bank.)

Meanwhile, bank assets are risky. While a diversified portfolio of loans is less risky than any single loan, a bank must monitor its loans to ensure that portfolio returns are adequate to pay off the bank's depositors and other creditors. Besides the view that bank capital is determined by regulatory requirements, there are (broadly) two different views of the role of bank capital, both of which revolve around the view of banks as specialists in monitoring borrowers. But the underlying mechanisms are quite different.

Bank Capital Promotes Monitoring. In a number of models, the banker's incentive to monitor borrowers depends on stockholders' equity investment. In particular, recent articles by Franklin Allen, Elena Carletti, and Robert Marquez, and by Hamid Mehran and Anjan Thakor use this idea to explain why banks would hold capital in excess of regulatory requirements. In these models the banker acts in the interests of the bank's stockholders, perhaps because he or she has substantial stockholdings or because his or her pay is tied to the bank's stock price. Although the models differ in many significant ways, they share a similar basic intuition: Stockholders gain only when profits are positive, that is, when enough loans are repaid to cover the bank's debt payments. The more equity invested by stockholders, and thus the lower the bank's leverage, the smaller the share of the loan revenues that must be paid out to debt holders when revenues exceed debt payments. Thus, the gains from increasing the

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[24] This is consistent with the results of Berger and co-authors (2008), who do not find any relationship between earnings volatility and book leverage or any other measures of regulatory capital.

[25] Samu Puera and Jussi Keppo's article presents a formal model in which a bank holds an equity cushion above its regulatory capital requirement. The size of the cushion reflects the bank's costs of securing funds from outside investors in the event that it suffers losses.

[26] See Gary Gorton's account of securitization and the repo market.

likelihood of successful loans through monitoring are greater when the equity investment is greater.

This is only half of the story because it doesn't explain the limits on the bank's equity. In both models, the authors simply assume that equity is a relatively costly means of funding loans, mainly to focus attention on the relationship between monitoring and leverage. Among other factors, a higher relative cost for equity funding might arise if (i) deposits are insured; (ii) insiders have more information about the quality of the bank's portfolio than potential outside equity investors; or (iii) we take into account the value of producing bank liabilities that facilitate exchange.

Each of the models contains interesting empirical predictions. In particular, Allen and his co-authors show theoretically that banks will hold more capital when they lend in more competitive markets. This prediction illustrates an important feature of their model: market discipline is imposed by borrowers, rather than capital markets. Intuitively, borrowers gain when they are monitored more closely by banks, and banks' incentives to monitor are stronger both when bank capital is higher and when borrowers pay higher loan rates. Everything else equal, borrowers prefer that banks charge lower loan rates; so when loan market competition is strong, banks compete for borrowers by lowering rates and holding more capital. When competition is weak, banks can charge higher loan rates and hold less capital without undermining their commitment to monitor. This prediction has yet to be tested empirically.

Mehran and Thakor's paper has a host of empirical predictions, most notably the prediction that bank equity capital and bank value will be positively related in the cross-section. Intuitively, a bank with a low cost of capital has a comparative advantage in monitoring borrowers, and a bank that monitors more will have a higher value. In the cross-section, Mehran and Thakor argue that we should observe that banks with more equity capital will also be more valuable. They find support for this hypothesis in their empirical analysis of merger deals in the U.S. between 1989 and 2007.[27]

Deposits Promote Monitoring; Bank Capital Reduces Bank Failures. Douglas Diamond and Raghuram Rajan present a model in which bankers are hired by the bank's suppliers of funds, for example, depositors or stockholders, to monitor borrowers. In their model, bankers seek to grab as large a share of borrowers' payments as they can; that is, bankers don't automatically share a common interest with any of the bank's claimants, either its borrowers or its suppliers of funds. If there were a single banker and a single depositor, the banker would threaten to withdraw his expertise and knowledge about the borrower, that is, to stop monitoring and force the depositor to accept lower interest payments. Since the loan is much less valuable without the banker, the banker can use his or her threat to walk away to capture a significant share of the firm's loan payments at the expense of the depositor.[28]

But things are different if there are lots of depositors. Diamond and Rajan argue that, in this case, the deposit contract has a strong disciplinary effect if, when multiple depositors withdraw funds at once, a run on the bank develops.[29] Faced with the threat of a depositor run, the banker will choose to monitor borrowers (or else the loan will not pay off) and will make promised payments to depositors. Deposits are *hard* claims that impose discipline on bankers.

If a hard-working banker could always pay off his or her depositors, Diamond and Rajan's model would predict that banks could be fully funded by deposits. The threat of a run would impose discipline, but the threat would never actually be carried out. But bank loans can go bad for reasons other than poor monitoring or an attempt by the banker to keep loan revenues, for example, an economic downturn. In this case, the banker may be unable to pay off depositors, depositors will run, and many loans will have to be liquidated inefficiently.

This is where bank capital comes in. Bank capital serves as a buffer in the event of a decline in loan revenues. Equity is a *soft claim*. In the event that depositors withdraw their funds, stockholders take a loss to ensure that all depositors can be paid off and fewer loans have to be liquidated.[30] But this creates a tradeoff: The better capitalized the bank, that is, the more heavily

[27] Using goodwill — the difference between the purchase price of a bank and its book value of assets — as a proxy for the value of the bank's continuing relationships with its borrowers, Mehran and Thakor also predict (and find empirical support for) a positive relationship between equity capital and goodwill. This result is consistent with Flannery and Rangan's (2008) and Gropp and Heider's finding that a BHC's leverage is lower when its market-to-book ratio is higher.

[28] The reader who finds this story too melodramatic should view it as a metaphorical way of modeling the very realistic conflicts between managers and claimants that can't be easily resolved through incentive contracts.

[29] For a run to develop, the deposit contract must require the bank to pay off depositors who want to withdraw their funds on a first-come, first-served basis. In the banking literature this is called a *sequential service constraint*.

[30] Actually, in the model, bank capital might also take the form of long-term subordinated debt. It is important that the depositors have priority, but in the model, there is no real distinction between equity and long-term subordinated debt. Thus, in Diamond and Rajan's model, market forces would affect regulatory capital, not just equity.

the bank is financed by soft claims, the weaker the discipline imposed on the banker. Since it reduces the threat of a run, bank capital ensures that the banker captures a larger share of the bank's profits.

While Diamond and Rajan's model has been quite influential — increasingly so, since the financial crisis reminded banking scholars that banks might actually fail — there has been no systematic attempt to test whether it helps explain variations in bank capital over time or in the cross-section.[31]

CONCLUSION

While the experience of the 1990s and 2000s is inconsistent with the view that banks hold only the minimum required amount of equity, it is difficult to address *The Economist's* claim that the usual laws of corporate finance do not apply to banks. Over 50 years of theoretical and empirical research into nonfinancial firms' leverage decisions has identified factors that are consistently related to leverage, but one would be hard pressed to say that we have a firm understanding of the usual laws of corporate finance. Empirically, too much of the variation in nonfinancial firms' capital structures is explained by dummy variables representing the firm's industry and the firm itself. While this is better than no explanation at all, it is more an invitation to further research than a settled set of laws.

Furthermore, while banking researchers have rejected the simple view that capital requirements are binding, they have only begun to explore the determinants of bank leverage decisions empirically or theoretically. For example, the banking literature has yet to establish convincingly whether bank capital decisions are determined by market pressures — perhaps including pressures from borrowers as well as investors — or whether they are best explained as banks meeting regulatory requirements while holding an extra equity cushion.

While these issues do not directly answer the pressing question of how much capital banks should hold, they are directly relevant to the inquiry. In particular, capital requirements are much more difficult to enforce when they are binding; if banks wish to hold less than the regulatory minimum (or the minimum plus a cushion), they have a strong incentive to evade these requirements through a variety of strategies. This incentive increases as the difference between the regulatory requirement and the desired level of capital increases. Understanding the extent to which market forces are working with or against a new capital regulation should help policymakers understand the costs of enforcement.

[31] Mehran and Thakor argue that Diamond and Rajan's model counterfactually predicts a negative relationship between a bank's value and its capital level in the cross-section.

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