

Bank Capital and Financial Stability: An Economic Trade-Off or a Faustian Bargain?

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Abstract

Financial crises impose large and persistent social costs, making banking stability important. This article reviews the central issues surrounding the role bank capital plays in financial stability. Because the socially efficient capital level may exceed banks' privately optimal capital levels, regulatory capital requirements become germane. But such requirements may entail various bank-level and social costs. Thus, despite agreement that higher capital would enhance banking stability, recognition of these costs has generated theoretical disagreement over whether capital requirements should be higher. Empirical evidence reveals that, in the cross section of banks, higher capital is associated with higher lending, higher liquidity creation, higher bank values, and higher probabilities of surviving crises. Moreover, increases in capital requirements are met with modest declines in lending. The overarching message from research is that lower capital in banking leads to higher systemic risk and a higher probability of a government-funded bailout that may elevate government debt and trigger a sovereign debt crisis. Thus, capital regulation reform, as well as tax policy, should seek to increase bank capital. This article discusses the contemporary thinking on these issues and concludes with open research questions.

1. INTRODUCTION

Per the economist's view, bank capital is the amount of equity with which a bank chooses to finance itself. The regulatory view is similar but broader: What qualifies as regulatory capital typically includes other sources of financing such as preferred stock.¹ Because the rich variety of regulatory definitions of capital all assign a central role to equity, I refer to bank capital simply as common equity (paid-in capital plus retained earnings) in the bank.

Bank capital is arguably one of the most important targets of micro- and macroprudential regulation in banking all over the world. It also occupies center stage in global regulatory capital accords—such as the Bank for International Settlements, or Basel accords for short—that seek to constrain and provide common guidelines for capital requirements set by national regulators. The reason is simple. How much capital a bank has affects its risk-management incentives and determines its ability to withstand economic shocks. Banks are especially vulnerable to such shocks because banks take on many risks in providing valuable economic services through qualitative asset transformation (QAT)—a process whereby the nature of a bank's assets is typically different in many dimensions from the nature of its liabilities (see Bhattacharya & Thakor 1993; for more on QAT as an essential part of relationship banking, also see Boot & Thakor 2000). For example, banks provide maturity transformation by financing loans of longer maturities than the bank's deposits. Banks also provide liquidity transformation by financing relatively illiquid loans with liquid (withdrawable on demand) deposits [Calomiris & Kahn (1991) develop a model of liquidity transformation by banks in which the optimal deposit contract can lead to bank runs. Hellwig (1994) distinguishes between maturity transformation and liquidity transformation in an environment with technology-induced interest rate risk.] Banks specialize in credit screening² and fund risky borrowers, while providing their depositors less risky claims on the bank. They achieve this through a combination of credit analysis, monitoring, and diversification.³ These activities spawn risks that make banks vulnerable to shocks associated with not only economic fundamentals, but also perceptions about their soundness that may even be unrelated to economic fundamentals. These shocks can jeopardize the bank's continued access to funding and trigger a collapse, which can be socially very costly. Kupiec & Ramirez (2013) estimate that during 1900–1930, a bank failure shock involving 1% of system liabilities led to a 15% points decline in industrial production and a 6.5% points reduction in GNP growth within three quarters; in the absence of intervention, the macroeconomic effects are protracted. Luttrell, Atkinson & Rosenblum (2013) estimate that the

¹Regulators define different “types” of capital such as “tier one,” etc., as well as a host of capital ratios. In the past, even intangibles such as goodwill have been included in some forms of regulatory capital. Most theories of capital covered in this survey deal with equity as capital and capital requirements that correspond most closely to the “leverage ratios” used by regulators.

²Ramakrishnan & Thakor (1984) provide a formal theory of financial intermediation based on the role of banks as specialists in credit screening. Millon & Thakor (1985) point out that this role of banks is consistent with the growth of loan sales and syndicated loan markets in which originating banks provide credit screening and then sell these loans so as to avoid funding them. This is similar to banks avoiding deposit funding by securitizing loans. Eschewing funding does not lead to incentive problems in Ramakrishnan & Thakor (1984) and Millon & Thakor (1985) because the default/repayment outcome on each loan is assumed to be observable and the intermediary's compensation can be made contingent on it.

³It is useful to distinguish between diversifiable risks and macro risks (e.g., interest rate shocks). The economic role of banks involves taking on diversifiable risks and reducing contracting costs through the process of intermediation (e.g., Diamond 1984 and Ramakrishnan & Thakor 1984). As for macro risks, banks may simply wish to condition contracts on these risks. Inefficiencies in either diversifying idiosyncratic risks (possibly due to reputational concerns) or contractual incompleteness that impedes conditioning contracts on systematic (macro) risks can make banks more fragile. See Thakor (2005) for a model in which reputational concerns with honoring loan commitments result in banks taking on risks correlated with macroeconomic shocks.

subprime crisis of 2007–2009 resulted in an output loss of \$6 trillion to \$14 trillion, with the wide range due to the uncertainty about how long the economy will take to return to precrisis output levels. Capital helps the bank to cope with the shocks that may precipitate crises. Bank capital is akin to “braking distance”—the more capital the bank has, the longer the distance between it and economic failure and, thus, the greater is the amount of time the bank’s managers have to sight impending danger and make decisions that increase the bank’s odds of survival.⁴

Not only does higher capital lower the probability of bank failures and crises, but it can also speed up the postcrisis recovery of the economy. The reason is that better-capitalized banks have stronger screening incentives (e.g., Coval & Thakor 2005) and monitoring incentives (e.g., Holmstrom & Tirole 1997, Mehran & Thakor 2011), so they are in a stronger position to lend. Empirical evidence in support of this is provided by Cooke & Koch (2014), who document that large banks with relatively low capital ratios slowed down the lending recovery after the subprime crisis.

A noteworthy feature of banks is the possibility of contagion in bank failures—the possibility that the failure of one bank can trigger the failures of other banks because an individual bank’s failure is informative about potential problems at other banks. This happens in part because banks often hold assets whose risks are highly correlated across banks, and evidence indicates that during 2000–2006, the period leading right up to the crisis, this correlated risk taking grew, with systematic risk in banking increasing substantially.⁵ An immediate implication is that seemingly idiosyncratic failures of a handful of banks often raise financial stability issues for the whole economy, as these failures can spread and become a full-blown crisis through the endogenous generation of systemic risk.⁶ This is a key reason why banks are the recipients of *de jure ex ante* guarantees such as federal deposit insurance and *de facto ex post* bailout protection from the government. However, as shown by Merton (1977), the value of the deposit insurance put option to the bank is decreasing in bank capital, which engenders moral hazard associated with

⁴Using a study of bank holding companies during 1992–2006, Berger et al. (2008) document that banks set their target capital levels substantially above well-capitalized regulatory minima and operated with more capital than required by regulation, probably to protect against potential regulatory penalties for falling below regulatory minima. I do not believe, however, that this necessarily indicates that there was sufficient capital in banking from a social efficiency standpoint, especially when one considers that the documented capital buffers were not related to asset volatility (Flannery & Rangan 2008), and that US investment banks, which were at the epicenter of the subprime crisis, had much lower capital levels than did bank holding companies. This may have been because these investment banks were guided by the Basel II capital requirements, which left institutions with the discretion to use internal models to calculate required capital. Furthermore, even for institutions that were not guided by Basel II, regulatory capital requirements may be too low to deal with systemic risk issues. Moreover, Berger & Bouwman (2013) provide empirical evidence that commercial banks with higher capital have a greater capability of surviving a financial crisis and that small banks with higher capital are also more likely to survive during normal times. Beltratti & Stulz (2009) investigate whether precrisis bank attributes explain performance during the crisis. They show that large banks with more tier-one capital at the end of 2006 had significantly higher returns during the subprime crisis (for a deeper discussion of these issues, see Thakor 2014c).

⁵Bhattacharya & Purnanandam (2011) document that idiosyncratic risk in commercial banking was cut in half and systematic risk doubled during this period. Acharya & Yorulmazer (2007) show that there is a “too-many-to-fail” problem in bank closure policy that gives banks incentives to herd on asset portfolio choices, increasing systemic risk. Farhi & Tirole (2012) provide a theory in which the possibility of bailout assistance by regulators induces banks to make correlated asset choices and become highly levered. Acharya & Thakor (2013) develop a model in which the liquidation of one bank induces the creditors of other banks to also liquidate, even though the creditors observe nothing suspicious about the bank, and having lower capital in banks exacerbates this contagion. Acharya & Yorulmazer (2008) show that the regulator may be better off providing liquidity assistance to solvent banks to buy out failed banks, rather than bailing out failed banks.

⁶It is useful to distinguish between “systemic risk” and the more familiar “systematic risk.” The latter is correlated with the economy and hence not diversifiable, and the former threatens the whole system. Although systemic risks are typically systematic, not all systematic risks are systemic.

the proclivity of banks to be excessively highly leveraged. As such, a bank's privately optimal capital structure may diverge from the social optimum, rationalizing capital requirements as an important tool of prudential regulation. Capital requirements are relied upon as a source of individual bank safety and therefore—through the contagion argument—of financial system stability.

The above summarizes the regulatory view of bank capital. Per the aims of microprudential regulation, an individual bank should have sufficiently high capital to give its shareholders and managers enough “skin in the game” to manage the bank prudently and limit the exposure of the deposit insurance fund. In addition, because precluding failures of individual banks lowers the likelihood of contagion, the macroprudential goal of financial system safety and soundness is also served. Although not the focus of this article, tools such as risk-based deposit insurance premia, portfolio restrictions, and risk management stipulations can also be used to control risk.

However, bankers often get tetchy when higher capital requirements are proposed. A detailed discussion of why is deferred to a later section, but for now it suffices to note that bankers argue against higher capital requirements on the grounds that doing so would have a chilling effect on bank profitability and lending as well as on economic growth.⁷ According to commonly used arguments in academic research, the decline in lending could come from either demand or supply effects. Banks may respond to higher capital requirements by shedding assets so that they are in compliance with the higher requirements without having to raise additional equity (a reduction in loan supply) or they could raise loan prices, causing a decrease in loan demand (see below for empirical studies that have disentangled these effects). In effect, banks point to a variety of costs of higher capital requirements, including lower values of banks, that would have to be borne to achieve greater stability. The argument that higher capital in banking may involve significant costs has been endorsed by some in the literature (e.g., Diamond & Rajan 2001), but others strongly disagree (e.g., Admati et al. 2013 and Admati & Hellwig 2013, who advocate substantially higher capital requirements in banking and discuss what they view as fallacies in the public discourse on bank capital). Such theoretical disagreement about whether it is a good idea to increase capital requirements in banking raises three important questions:

1. Will higher capital levels in banking lead to lower lending and liquidity creation by banks?
2. Will requiring banks to keep more capital increase funding costs for banks and diminish their values even if doing so is socially optimal?
3. What are the systemic risk implications of higher capital in banking?

The first two questions are related. Lower lending and liquidity creation may accompany higher capital levels in banking if higher capital is associated with a higher funding cost for the bank. In addressing these three questions, I review the theoretical literature and follow with a brief review of the empirical literature.

From a theoretical standpoint, two views have focused on two different aspects of capital structure. One says that higher capital improves banks' incentives to make efficient asset portfolio choices and strengthens their incentives to monitor borrowers (for the monitoring channel, see

⁷Pfleiderer (2012) quotes Josef Ackerman, CEO of Deutsche Bank, from a November 20, 2009, interview: “More equity might increase the stability of banks. At the same time, however, it would restrict their ability to provide loans to the rest of the economy. This reduces growth and has negative effects for all.” For a review of the literature on this issue and an estimate of the potential effects of higher capital requirements on bank lending, also see Hanson, Kashyap & Stein (2011).

Holmstrom & Tirole 1997). Mehran & Thakor (2011) make a similar point in a dynamic model, whereas Allen, Carletti & Marquez (2011) show that higher bank capital may enable banks to gain greater market share, a result for which Berger & Bouwman (2013) provide empirical support. From this standpoint, higher capital banks are associated with more lending and liquidity creation as well as higher bank values (see Mehran & Thakor 2011).⁸ The other standpoint says that higher capital may either directly reduce banks' liquidity and transaction services or lead to less efficient contracting resolutions and higher agency costs, thereby leading to lower liquidity creation by banks (see Diamond & Rajan 2001). Yet, both viewpoints seem to agree that higher capital in banking would reduce bank fragility and systemic risk. I examine these theories in more detail in the next section.

The discussion that follows distinguishes between higher capital levels (or ratios) in banking and higher regulatory capital requirements. Empirical tests that examine the effects of capital levels primarily document cross-sectional relationships, whereas empirical tests of the effects of changes in capital requirements are essentially intertemporal in nature, focusing on how bank lending responds when there is, say, an increase in capital requirements. On the issue of capital levels, empirical evidence suggests that banks with higher capital have a higher probability of surviving a financial crisis (see Berger & Bouwman 2013) and also gain a competitive edge in deposit and loan markets (see, e.g., Calomiris & Mason 2003). Moreover, higher capital in banking is associated with higher liquidity creation by large banks that provide the vast majority of liquidity creation in the United States but with lower liquidity creation by small banks (see Berger & Bouwman 2009)⁹ and the relationship between total bank value and capital is positive in the cross section (see Mehran & Thakor 2011). Note, however, that all these empirical studies measure cross-sectional equilibrium choice of banks and, hence, do not address optimal capital requirements. Evidence on the issue of capital requirements indicates that when there is a transition from one structure of capital requirements to another—as was the case in 1987 with the adoption of the Basel I capital requirements that introduced measures of asset risk in the calculation of capital requirements—nontrivial transitional effects may arise in the form of lower bank lending. Thakor (1996) develops a theoretical model and provides empirical evidence that the adoption of risk-based capital requirements under Basel I and the passage of FDICIA in 1991 caused banks to substitute risky lending with Treasury investments and, thus, may have (procyclically) prolonged the economic downturn. The question not completely addressed by this research is whether the reduced lending due to higher or more risk-sensitive capital requirements is a good or a bad thing for society, given the propensity of banks to herd and overlend to some sectors (for a theory of banks herding in their asset choices, see Acharya & Yorulmazer 2007).

Another issue of some import is the highly publicized aversion of bankers to higher capital requirements. Socially optimal capital levels may exceed privately optimal capital levels because individual banks do not internalize the social costs of large-scale bank failures induced by contagion effects, so one reason for the aversion of bankers may simply be that capital requirement may compel the bank to keep capital that it does not view as privately optimal. However, as discussed below, exploring more fully the reasons why banks resist higher capital requirements illuminates issues that are not exposed by the private-versus-social optimum divergence. An

⁸This is a cross-sectional implication; i.e., in the cross section of banks, what is the relationship between bank capital and outcome variables such as lending and bank values?

⁹Such liquidity refers to both the dollar volume of liquidity creation and liquidity creation per dollar of capital. However, because all banks are heterogeneous and each bank chooses its privately optimal capital in equilibrium, not all large banks should necessarily increase capital. Yet, in the cross section, large banks with more capital do create more liquidity.

important reason for understanding the banker's viewpoint is that capital regulation in banking is largely, and appropriately, an exercise in political economy, with bankers, academics, regulators, and politicians all providing input that shapes the final outcome. In this sense, banking may be no different from any regulated industry, but the political economy of banking is more complex than that of most other industries because of the role of large government safety nets in bank regulation, and also because adopting initiatives that lower systemic risk are difficult to garner popular support for, especially in the face of assertions that such initiatives will reduce lending.

Much of the discussion in this article rests on the central premise that banking stability is desirable and financial crises are not. This view is based on the value typically associated with intertemporally smooth consumption for individuals and stable economic growth and employment levels. However, the analysis by Reinhart & Rogoff (2009) of financial crises over the past eight centuries shows a recurring pattern of high leverage in financial institutions that facilitates rapid growth in bank lending and fuels asset price bubbles that precipitate financial crises when they burst. This raises an intriguing question about how one should think about the costs and benefits of financial crises. To the extent that bull markets that precede financial crises have positive economic value—for example, the almost-unprecedented economic growth in the decade prior to the subprime crisis—perhaps we should take the benefits of the precrisis economic growth and high asset values into account in computing the net cost of a crisis. If high bank leverage facilitates the precrisis bull market and also increases the probability of a crisis, then both effects ought to figure in the cost-benefit calculation. I address this issue in Section 5.

I then move on to a brief discussion of capital regulation proposals in which I take a “helicopter” view of the research and try to piece together various seemingly disparate threads into a coherent story that permits a reasonable assessment of capital regulation proposals. Systemic risk is now the 800-pound gorilla regulators have to wrestle with, and if this risk is not contained, it necessitates either government liquidity assistance or outright massive bailouts. As the Irish and Icelandic experiences have shown us, such intervention may call for resources that the affected sovereign governments do not have, i.e., we may have a “too big to save” problem that triggers a sovereign debt crisis as the government substantially spikes up its debt to finance the bailout. What our research tells us is that sufficiently high capital in banking may be, in combination with other remedies, an effective antidote to excessive systemic risk and, therefore, also protection for sovereign governments. Thus, my discussion focuses on the pros and cons of implementing higher capital requirements and the manner in which different capital adequacy proposals seek to infuse more capital into banking. Increasing capital into banking is unlikely to be costless because it may result in a loss of some of the private and social benefits associated with leverage that the literature has thoughtfully articulated, including a diminished likelihood of precrisis bull markets. Nonetheless, the reduction in systemic risk and the consequently lower probability of a sovereign debt crisis suggest an overall net benefit from raising capital levels. One can view this as augmenting “private deposit insurance” because it strengthens the protection of depositors both directly and through incentive effects. I argue that we should also seriously consider a change in the tax code to reduce the tax disadvantage of equity and facilitate a transition to higher capital levels. The scope of this article is limited to bank capital as a source of stability; other tools of prudential regulation such as liquidity requirements are not discussed. Nonetheless, I do discuss “narrow banking” as an alternative approach to enhancing banking stability. In this discussion, I address briefly how capital regulation may adapt if the economy consisted of two types of banks—narrow banks with insured deposits that are limited to very safe investments and banks with a broader lending mandate that do not have deposit insurance.

This paper is related to Dewatripont & Tirole (2012), who develop a model to examine how prudential regulation should respond to macroeconomic shocks. They distinguish between scarce

“inside” equity—provided by the manager or by some block shareholder with influence over management—and elastically supplied “outside” equity (provided by unaffiliated investors), and they argue that both debt and outside equity can be used to give efficient contingent control to discipline the bank manager. They show that, after bad performance, control should shift from outside equity to debt, unless shareholders recapitalize the bank. They criticize the Basel capital regulation for not distinguishing between microeconomic and macroeconomic shocks and thereby being too tough in recessions and too lenient in booms. However, unlike the focus of this paper, their paper is not about the link between the level of capital in banking and banking stability, nor is it about the level of optimal capital requirements. Rather, it is about how capital requirements should change across the business cycle. In that sense, their paper argues neither for nor against higher capital requirements.

The rest of this article is organized as follows. In Section 2, I sketch a very simple model of a bank that provides QAT and chooses its capital structure. The idea is to present a model that captures many of the elements of banking models that endogenize the bank’s capital structure choice. I use this highly reduced-form model first to explain the relationship between bank capital and stability. The model is then used to explain the various theories that have touched on the issue of bank capital structure, how contagion effects arise, and potential divergence between the privately optimal and socially optimal capital structures of banks. Section 3 then turns directly to the three central questions provided above. Section 4 takes up the issue of why bankers are typically averse to higher capital levels. Section 5 examines the net costs and benefits of crises and discusses capital regulation reform and narrow banking. Section 6 concludes.

2. A SIMPLE MODEL OF A RISKY BANK AND ITS CAPITAL STRUCTURE

Think of a three-date model of a bank in a world without deposit insurance. At $t = 0$, a bank has inside shareholders who provide E (inside) of their own equity and raise \hat{E}_0 of outside equity as well as debt (all deposits for simplicity) of D_0 that matures at $t = 1$. Let $E_0 = E(\text{inside}) + \hat{E}_0$. Then the bank invests the total amount $D_0 + E_0$ in (a) cash and marketable securities equal to C_0 and (b) loans equal to L_0 . The balance sheet must balance, so

$$C_0 + L_0 = D_0 + E_0. \quad (1)$$

The bank’s capital structure decision is denoted by $k \equiv \frac{E_0}{D_0 + E_0}$, which is referred to as the bank’s “capital ratio” in book value terms. The loans mature at $t = 2$ and are illiquid. If carried by the bank on its books until $t = 2$, the loans will be worth a random variable, L_2 , with a probability distribution $F(\cdot|m, k, \theta)$, where m is the amount of screening, monitoring, and advising done by the bank and θ is the bank’s asset (or risk) choice. One can think of L_2 as the total loan cash flow at $t = 2$. If liquidated at $t = 1$, the loans will be worth a constant $\bar{L}_1 < L_2$.

It is standard to assume that cash and marketable securities are zero-net present value (NPV) investments, but the bank may earn rents on its loans owing to its expertise in credit screening and monitoring. Assume that all agents are risk neutral and the riskless interest rate is zero. Let r_D^0 be the interest rate the bank must promise its first-period depositors, and let $\alpha \in (0, 1)$ be the share of ownership inside shareholders must sell at $t = 0$ to raise \hat{E}_0 . The capital market is competitive and when external financing is available, it can be raised to give the bank’s financiers an expected return of zero. In the case of deposits, the bank may provide transaction and liquidity services (e.g., Song & Thakor 2007), in which case the total value of the interest paid on deposits plus the value of these services must be at least as great as the depositors’ reservation return of zero. Let $\nu(D_0)$ be the value of these services to the depositors if deposits stay in the bank one period. The standard assumption is that $\partial \nu / \partial D_0 > 0 \forall i \in \{1, 2\}$. All deposits have a one-period maturity.

Let $p \in (0,1)$ be the probability that new deposits can be procured to replace first-period deposits) at $t = 1$, and let $1 - p$ be the probability that funding will not be renewed (at any price) and the bank will be forced to liquidate its loan portfolio. Let B be a bankruptcy cost associated with such liquidation. For bank i , we can write p as a function $p(k_i, K_{-i}, \xi)$, where k_i is bank i 's capital structure, $K_{-i} = \{k_1, k_2 \dots, k_{i-1}, k_{i+1}, \dots, k_N\}$ is the vector of capital structures of all N banks in the economy except bank i , and ξ is the realization of some exogenous uncertainty at $t = 1$. Although I suppress the arguments of r_D^0 to reduce notational clutter, r_D^0 should be thought of as a function $r_D^0(k_i, K_{-i})$. If the bank's deposit funding is renewed at $t = 1$, then let $r_D^1(k_i, K_{-i})$ be the deposit interest rate the bank must promise on its second-period deposits.

Suppressing the arguments of p, v_1, v_2, r_D^0 and r_D^1 , as well as the superscript i on loan, deposits, and cash values for bank i , the total value of bank i to its shareholders at $t = 0$ can then be written as

$$V_0^i = \iint p \text{Max} \left\{ 0, L_2 + C_0 - D_0 [1 + r_D^0] [1 + r_D^1] \right\} dQ(\xi) dF(L_2 | m_i, k_i, \theta_i) \\ + \int [1 - p] \text{Max} \left\{ 0, \bar{L}_1 + C_0 - D_0 [1 + r_D^0] \right\} dQ(\xi) - \int [1 - p] B dQ(\xi) \quad (2) \\ - W(m_i),$$

where W is the cost of monitoring; recall that B is a bankruptcy cost. B can also be thought of as the charter value the bank's shareholders would lose upon bankruptcy, i.e., it is available only for a solvent bank. In Equation 2, the B term can be written as $-B + B(p)B$, so the term has the same interpretation as the expectation of the bank's charter value if we ignore the constant B , which does not affect the optimal choices of the decision variables to maximize V_0^i . Thus, the first-period deposit rate, r_D^0 , solves

$$\int p \left\{ D_0 [1 + r_D^0] + v \right\} dQ(\xi) \\ + \int [1 - p] \left[\text{Min} \left\{ \bar{L}_1 + C_0, D_0 [1 + r_D^0] \right\} + v \right] dQ(\xi) \quad (3) \\ = D_0.$$

The expression in Equation 2 describes the expected payoff the bank's shareholders receive, given the deposit pricing expressed in Equation 3. The first term on the right-hand side of Equation 2 is the expected payoff to the bank's shareholders if the bank lasts two periods. The probability of this is p , and the shareholders receive the maximum of 0 and the difference between the asset portfolio payoff, $L_2 + C_0$, and the two-period repayment obligation to depositors, $D_0[1 + r_D^0][1 + r_D^1]$. The expected value of this is computed with respect to the exogenous uncertainty ξ and the random loan payoff distribution F . The second term on the right-hand side of Equation 2 is the bank's shareholders' expected payoff if the bank lasts only one period, and the third term is the expected bankruptcy cost. Both the second and third terms are multiplied by $1 - p$. The last term in Equation 2 is the nonstochastic monitoring cost.

To see Equation 3, note that in the state in which the first-period depositors can be paid off and deposits replaced at $t = 1$, depositors receive their full promised repayment amount $D_0[1 + r_D^0]$. This state has probability p . With the complement of this probability, the bank is liquidated at $t = 1$, and depositors are paid either their promised amount or $\bar{L}_1 + C_0$, whichever is smaller. Each of these terms includes the relevant value of liquidity and transaction services to depositors,

ν , expressed as a function of the deposits raised, D_0 . This describes the breakeven condition (Equation 3) that determines r_D^0 .

The expected value of the loan proceeds at $t = 2$, $\int L_2 dF(L_2 | m_i, k_i, \theta_i)$, exceeds the promised repayment to second-period depositors, $D_0 [1 + r_D^0] [1 + r_D^1]$, at $t = 2$, where the second-period deposit rate, r_D^1 , solves

$$\int \left[\text{Min} \{ L_2 + C_0, D_0 [1 + r_D^0] [1 + r_D^1] \} + \nu \right] dF(L_2 | m_i, k_i, \theta_i) = D_0 [1 + r_D^0]. \quad (4)$$

The first-period depositors are repaid $D_0 [1 + r_D^0]$, so that the bank needs to raise that amount from second-period depositors and promise a repayment at $t = 2$ equal to $D_0 [1 + r_D^0] [1 + r_D^1]$. To raise outside equity \hat{E}_0 , the bank's insiders sell ownership α_i in the bank, which is a solution to

$$\alpha_i V_0^i [1 + r_e]^{-1} = \hat{E}_0, \quad (5)$$

where r_e is the two-period return on equity (ROE) demanded by outside shareholders, with

$$[1 + r_e] > [1 + r_D^0] [1 + r_D^1]. \quad (6)$$

The bank chooses its screening investment m_i , its capital structure k_i , and its asset-risk θ_i , taking as given the capital structure choices of all other banks (which will also pin down their choices of m and θ) to maximize the value of the initial shareholders' stake in the bank:

$$\text{Max}_{m_i, k_i, \theta_i} [1 - \alpha_i] V_0^i \quad (7)$$

subject to Equations 3, 4, and 5. This model is quite general because it attempts to include as special cases many different models that have been developed in the literature. I now discuss various features of this model.

2.1. Feature 1: Loan Monitoring

In many models, the bank's capital structure choice impacts its loan monitoring choice, which then affects the bank's loan payoff distribution. For example, higher monitoring may shift this distribution to the right in the sense of first-order stochastic dominance. The monitoring cost, W , is typically assumed to satisfy $W' > 0$, $W'' \geq 0$ (see, for example, Holmstrom & Tirole 1997; Allen, Carletti & Marquez 2011; Mehran & Thakor 2011).

2.2. Feature 2: Asset Portfolio Choice

The bank can choose in which asset to invest, and this choice of θ is also affected by the bank's capital structure choice. Many papers have modeled this to capture the bank's incentive to engage in risk shifting. That is, the bank may choose to invest in an excessively risky (possibly socially inefficient) asset either to exploit the deposit insurance put option (see Merton 1977) or simply in response to the usual shareholder-bondholder agency conflict (see Jensen & Meckling 1976). These risk-shifting incentives get stronger as the bank becomes more highly leveraged, so a bank

with higher equity capital is less prone to engage in risk shifting: Examples of the large literature that has examined the benefit of equity in attenuating asset-substitution moral hazard include Biais & Casamatta (1999), Hellwig (2009), and Edmans & Liu (2010).

2.3. Feature 3: The Direct Effect of Capital Structure on the Bank's Cash Flows

As explained above, the bank's choice of k_i affects L_2 indirectly by influencing the bank's loan cash flows. However, there can also be a direct effect if bank leverage produces debt tax shield benefits or induces its creditors to monitor the bank (as in Calomiris & Kahn 1991) or solves a holdup problem (as in Diamond & Rajan 2001). This is consistent with the assumption in Equation 6 that equity is costlier than debt. Another way that the bank's capital structure can directly impact the bank's cash flows is if core deposits produce rents for banks as a result of the provision of liquidity as well as transactions and other services to depositors¹⁰ (for models along these lines, see Song & Thakor 2007, Allen & Carletti 2013, DeAngelo & Stulz 2014). This deposit-rent feature is captured by $\nu(D_0)$.

2.4. Feature 4: Probability of Nonrenewal of Bank Deposits at $t = 1$ Followed by Liquidation Depends on the Bank's Capital Structure Decision as well as the Capital Structure Decisions of Other Banks

A more highly levered bank is more likely to be threatened with liquidation by its creditors, and this liquidation probability may also be increasing in the leverage levels of other banks if creditors deduce information about one bank by observing what is happening at other banks. Acharya & Thakor (2013) model this form of "capital-structure contagion," with cross-sectional commonalities in asset holdings. Farhi & Tirole (2012) develop a model in which the prospect of imperfectly informed regulatory forbearance induces banks to become highly levered and make correlated asset choices.

Related to this, it is worth noting that much of the rationale for central bank intervention to bail out failing banks that are unable to renew deposits is rooted in the desire to avoid fire sales of assets by financial institutions that can lead to a downward price spiral (see Shleifer & Vishny 2011). In this regard, the systemic risk implications of capital requirements are important. If banks have target capital ratios, regardless of whether they are imposed by regulators, investors, or bank managers, the defensive reactions of banks to negative income shocks will depend on these target ratios. As a first approximation, the inverse of this target ratio represents the multiple of losses that is equal to the assets banks sell in order to get back to target (e.g., Blum & Hellwig 1995). The strength of fire-sale externalities thus depends on bank capital. This is a different kind of capital structure contagion from the one in Acharya & Thakor (2013) and Farhi & Tirole (2012).

2.5. Feature 5: Probability of Nonrenewal of Bank Deposits at $t = 1$ Followed by Liquidation Depends on an Exogenous Uncertainty Beyond the Bank's Control or on Insolvency Concerns

The assumption that the nonrenewal probability, p , depends on an exogenous uncertainty, ξ , captures the idea that there may be runs on the bank due to panics, sunspots, or other phenomena

¹⁰In many banking theories, the distinction between deposits and other forms of financing is made on the basis of the demandable and sequential-service-constrained nature of deposits. The formulation here recognizes the additional distinction that deposits are a way for the bank not only to raise financing, but also to provide financial intermediation services.

that are unrelated to the bank's fundamentals (e.g., Bryant 1980, Diamond & Dybvig 1983). More in line with practice, we could also make p dependent on asset risk θ or a noisy but informative signal of θ . That is, it can be assumed that some depositors come to know θ at $t = 1$ or are able to get an informative hint about what it will be at $t = 2$. As such, this signal may raise concerns about the possible insolvency of the bank and cause these depositors to withdraw funding, thereby causing others (who are uninformed) to infer news considered sufficiently bad that they may wish to follow suit. The possibility of runs based on fundamentals, such as those in Chari & Jagannathan (1988), may then result. Empirical evidence suggests that such insolvency concerns are typically the reason for bank runs (e.g., Gorton 1988).

2.6. Feature 6: Maturity Transformation—Deposits Mature Before Loans

A key element of this model is that the bank's first-period deposits mature at $t = 1$, whereas its loans mature at $t = 2$. This creates refinancing risk and is at the heart of how a bank could fail. Unlike nonfinancial corporations, it is possible for a bank's financial health to be in the "eyes of the beholder" in the sense that the bank is healthy (or not) if depositors agree (or do not) to renew financing. Because their decision not to renew financing may be unrelated to fundamentals, a mere adverse shift in perceptions can lead to a bank's failure. However, this problem arises only because banks engage in "maturity transformation," making loans of longer maturity than deposits. It is useful to distinguish between maturity transformation and liquidity transformation, as has been pointed out by Hellwig (1994). While with both types of transformation, banks finance long-maturity assets with short-maturity deposits, liquidity transformation simply means giving depositors access to their funds before the long-term assets in which these funds are invested have paid off, i.e., depositors have access to the liquidity they would not have if they had invested directly in the long-term assets. Under the Diamond & Dybvig (1983) assumptions, Hellwig (1994) argues that liquidity transformation is desirable. Maturity transformation involves depositors also being immunized against interest rate shocks that can affect the value of their claims. Hellwig (1994) argues that such insurance is undesirable and that "early" withdrawers should bear this risk.

Hellwig's (1994) incentive compatibility constraint is designed to ensure that a money market fund cannot lure late consumers away from the bank. This constraint precludes a priori the kind of "insurance" considered in Diamond & Dybvig (1983). Using a continuous-time model, von Thadden (1998) shows more generally that the Diamond & Dybvig (1983) contracts may not be feasible outside their simple three-date model.

2.7. Feature 7: Cash Holdings of Banks and the Demandable Nature of Bank Deposits

In this model, the bank uses a part of its financing raised at $t = 0$ to invest in cash. Compared with nonfinancial corporations, banks typically keep far more cash on hand. The best way to understand why is to imagine a continuous time setup in which all deposits are demand deposits, so depositors can withdraw their funds at any date t at a moment's notice. To meet these stochastic withdrawal needs, banks will keep cash on hand and typically far more than held by a nonfinancial firm. But a standard time-value-of-money argument indicates that holding cash is costly (for a discussion of the free-cash-flow problem, see Jensen 1986). So the bank must trade off reducing liquidity risk against the cost of holding cash. In this model, it is assumed implicitly that the cash the bank keeps on hand is not enough to fully meet deposit withdrawals at $t = 1$ if all depositors choose not to renew funding.

2.8. Feature 8: Bankruptcy Cost Associated with Premature Liquidation

A dissipative cost, B , is associated with the bank being prematurely liquidated at $t = 1$. This may be viewed as the cost associated with the bank losing a valuable charter (Keeley 1990) or some other form of bankruptcy cost (e.g., Diamond & Rajan 2000). To focus on the basic economics of banking as the determinant of capital structure, most theories of bank capital structure are developed in a setting without deposit insurance or other forms of government protection. The effect of these government guarantees is, not surprisingly, to encourage more leverage, as the discussion in Section 4 shows.

3. USING THE MODEL TO UNDERSTAND BANK CAPITAL AND STABILITY: THEORIES AND EMPIRICAL EVIDENCE

Various theories of bank capital and stability can be understood within the context of the model provided in Section 2. These theories are now discussed. A discussion of the empirical evidence then follows.

3.1. Theories of Bank Capital and Stability

Below, I discuss theories that have addressed the issue of how bank capital is predicted to affect bank lending, liquidity creation, and shareholder value in banking. These theories fall into three groups. These groupings are provided for expositional convenience only and should not be interpreted as competing theories. Rather, these theories focus on different aspects of the bank's capital structure choice.

3.1.1. Group 1 theories: higher leverage benefits the bank because of deposit rents. In Group 1 theories, deposits have rents associated with them, which induces the bank to favor them as a source of financing. The rents can be private for the bank, some kind of surplus, or both. Different from nonfinancial corporations, banks have a big chunk of their liabilities in the form of deposits that are an essential part of the financial intermediation services that banks provide. [On the basis of an international sample of banks, Jayaraman & Thakor (2013) report that, on average, a bank's capital structure comprises 8% equity, 75% deposits, and the rest in other forms of debt and preferred stock.] The focus of different banking papers on different services means that papers also discuss different sources of rents. For example, Song & Thakor (2007) focus on transactions services provided to depositors that produce both quasi-rents for banks and consumer surplus for depositors. DeAngelo & Stulz (2014) focus on the provision of liquidity services to depositors as a source of rents. In De Nicolo & Turk Ariss (2010), deposit rents arise from the market power enjoyed by the bank. So, just as steel is a factor of production in the making of a car, deposits are a factor of production in what a bank produces. But unlike steel for a car company, deposits are also a bank liability. That is, deposits are both a liability and a factor input for the bank. The Song & Thakor (2007) analysis does not focus on bank capital structure—it is concerned with the optimal mix of purchased money and core deposit liabilities. However, De Nicolo & Turk Ariss (2010) focus on the capital structure implication of these rents, and DeAngelo & Stulz (2014) argue that these deposit rents are one reason why high leverage in banking is hardwired by the bank's production process.

Although deposits are a factor of production in banking, this fact alone is not sufficient to argue that banking must necessarily be characterized by higher leverage (for further discussion on this issue, see Acharya et al. 2012). To see why, note that the rents associated with the provision of

valuable services to depositors represent an important reason why banks are willing to invest resources in building branch networks to gather deposits, and are willing to pay premia for core deposits or branches purchased from other banks, to consolidate and get larger (e.g., De Nicolo & Turk Ariss 2010). However, such deposits and associated rents are not inexhaustible. So imagine a bank that has harvested all core deposits as is cost effective for the bank and now has a particular D_0 in Equation 1. To impose a high capital requirement on the bank, we just need to ask the bank to put as much equity, E_0 , on its balance sheet as is necessary to achieve the desired capital ratio $k^* = E_0/[D_0 + E_0]$. This equity would be in addition to all the deposits that the bank has gathered and would not replace any deposits. If the bank's lending opportunities are not large enough to fully absorb $D_0 + E_0$, the bank can invest the remainder, $D_0 + E_0 - L_0$, in marketable securities that have zero NPV.¹¹ Viewed this way, no value loss seems to be associated with requiring the bank to finance with as much equity as is deemed efficient for prudential regulation because none of this equity needs to replace rent-generating deposits. Because the bank is investing the additional equity in zero-NPV investments, outside shareholders' reservation rate return of zero is satisfied. Thus, these shareholders have no reason to deny the bank funding, unless there is a debt overhang problem, something I discuss later.

The reasoning that higher capital requirements can be satisfied without replacing deposits is counter to the standard assumption in capital structure models that the size of the firm is held fixed as capital structure is varied. For example, Modigliani & Miller (1958) also hold the firm's investment policy fixed and examine whether capital structure affects firm value. However, it is inappropriate to extend this logic to argue that banks should be highly levered—as a theoretical matter, the bank should be allowed to grow to accommodate higher equity capital after all rent-producing deposits have been gathered. One may argue that bigger banks may create bigger “too-big-to-fail” problems, but the idea of infusing more equity capital in banks is to reduce the probability of banks needing to be rescued in the first place. In other words, the result that banks should be highly levered owing to the presence of rent-producing deposits should not arise simply because one assumes that the bank has some arbitrary fixed size, thereby ruling out the possibility of having more equity in the bank by fiat.

The argument above—that there is no value loss from requiring the bank to finance with as much equity as prudential regulators would like—can fail in three ways. First is to consider a general equilibrium setting in which there is an aggregate (socially) optimal level of bank deposits and higher capital requirements can force banks to keep less than that level in deposits. Gale (2010) makes this point in a model in which the socially optimal deposit level achieves efficient risk sharing between investors with different levels of risk aversion. The idea that the safety and liquidity associated with bank deposits (and similar instruments such as Treasuries) have social value is empirically supported by Krishnamurthy & Vissing-Jorgensen (2010), who document that investors are willing to give up yield for safety. Their evidence also suggests, however, that bank deposits are not unique in this regard.

Second is a partial-equilibrium variant of the above. Starting with the assumptions that banks provide some valuable liquidity service, and that there is an optimal bank size, one may argue that asking the bank to hold equity can make it too big. Millon & Thakor (1985) provide a formal model of optimal bank size in which diversification benefits from getting bigger are traded off

¹¹The assumption that unlimited zero-NPV investment opportunities are available is a pervasive assumption in finance and lies at the heart of basic valuation—the NPV rule in capital budgeting. No-arbitrage equilibrium pricing of marketable securities would also imply that what the bank would pay for such securities should equal the present value of the future cash flows of the security—a zero-NPV investment.

against the intrafirm incentive problems that increase in size. DeAngelo & Stulz (2014) have also recently argued that asking banks of some optimal finite size to hold equity reduces the bank's liquidity creation, so it is both privately and socially optimal to let banks be highly levered.

Third is if adding equity to the bank's capital structure adversely affects all the bank's cash flows, not just the marginal cash flows generated by the investment of the additional equity (see Section 2.3). In that case, adding equity on top of rent-earning deposits is no longer an innocuous exercise in expanding the bank's portfolio of zero-NPV investments because adding equity changes the bank's capital structure and therefore its cash flows from all its loans. This is the central argument in the group of theories discussed next.

3.1.2. Group 2 theories: higher leverage benefits the bank because it leads to more discipline and hence more lending and liquidity creation by banks. Some theories conclude that leverage disciplines banks and thereby elevates lending and liquidity creation. In effect, as uninsured debt increases, the bank has less equity capital to absorb losses, so creditors are more exposed to risk. As a result, creditors have stronger incentives to monitor the activities of bank management and to raise the cost of the bank's debt to reflect their higher risk exposure. Such monitoring should be considered as being provided by block creditors (see Mehran & Mollineaux 2012). The essence of these theories is that the nature of the debt contract reduces agency costs of various sorts and that the nature of the equity contract does not lend itself to such agency-costs reduction.

This effect of debt exists in theory for all firms, not just banks. However, it is viewed as being stronger in banks than in nonfinancial firms because of the demandable nature of bank deposits as well as the short-term nature of debt funding in nondepository financial intermediaries. This idea was first exploited by Calomiris & Kahn (1991), who note one benefit of the sequential service constraint associated with demand deposits—depositors who withdraw first are allowed to withdraw all their deposits and the bank responds sequentially until all its funds are exhausted: It gives early withdrawers a higher expected payoff than it does late withdrawers. As a result, information about the bank's financial condition becomes valuable to depositors and generates incentives for some depositors to engage in costly auditing of the bank. These informed depositors will withdraw their funds if they suspect problems at the bank. Their withdrawals may induce others to withdraw as well, triggering a run on the bank. The fear of a run can keep the bank honest. Per the argument by Calomiris & Kahn (1991), equity lacks this premature-withdrawal threat and is therefore not endowed with the same disciplining potential. Thus, absent sufficient demand deposits, the bank will simply be unable to raise the financing needed to make loans. However, Calomiris & Kahn (1991) do not necessarily provide a maximum-leverage prescription because their paper predicts only that a sufficient amount of demandable debt is needed to discipline the bank and ensure prudent choices that include not only good loans, but also adequate capital levels.

In a similar vein, Diamond & Rajan (2001) propose that the fragility associated with high bank leverage is necessary for banks to create liquidity. Their argument is that banks have a holdup problem. The bank's insider may refuse to collect repayments from borrowers unless the bank's financiers are willing to give the insider a greater share of the surplus. This makes loans illiquid. But if the funding comes in the form of deposits, then depositors can resolve the holdup problem by threatening to withdraw their funds prematurely. Equity cannot do this. Thus, Diamond & Rajan (2001) reason that high leverage is needed to solve contracting problems in banking—a priori illiquid banks should be funded with liquid demand deposits.

The notion that some “market discipline” may be provided by uninsured subordinated debt holders of banks was codified in the Basel II Capital Accord, which identified three pillars of bank regulation: capital requirements, regulatory monitoring, and market discipline (see DeCamps, Rochet & Benoit 2004). In practice, some question how effective debt monitoring has been as

a source of discipline that impacts the portfolio choices of banks and enhances stability. Deposit insurance eliminates much of the monitoring incentive of retail depositors. Wholesale creditors are not similarly protected. These creditors, especially in the shadow banking sector, seem to have responded to perceived insolvency problems at the institutions they fund by shortening the maturity of the debt they supply. As with Lehman Brothers and Bear Stearns, this maturity eventually shrinks to overnight funding, and market discipline is typically manifested in funding being eventually cut off. By the time this happens, however, it is often too late for the institution, which is already insolvent. The shortness of the debt maturity, which may even substitute for debt monitoring that seeks to influence the bank's asset choice, provides creditors a greater measure of protection than longer-maturity debt would, but it also threatens banking stability. The principal value of this form of market discipline must lie in its *ex ante* incentive effect on the bank. Paradoxically, however, the time that it is observationally most salient that this discipline is working is when creditors actually refuse to renew funding, which means a high posterior probability that the incentive effect failed. Indeed, the strongest incentive effect of debt discipline based on the threat of funding nonrenewal may be to encourage banks to keep more capital, so as to make it less likely that creditors will pull the plug.

3.1.3. Group 3 theories: Higher capital leads to better asset choices and more monitoring of borrowers by banks. Group 3 theories highlight the positive aspects of bank capital. These theories fall into three subgroups. The first subgroup comprises older theories that build on the insight by Jensen & Meckling (1976) of an asset-substitution moral hazard problem in banking. They argue that equity represents a call option on the bank's total assets and that the bank's equity value can be increased by investing in riskier assets (Merton 1977). Bank capital attenuates this moral hazard. Although some papers argue that excessive equity may perversely induce greater risk taking by banks (e.g., Besanko & Kanatas 1996; Calem & Rob 1999; Hellmann, Murdock & Stiglitz 2000), numerous models have used as their centerpiece this argument that higher capital leads to lower risk-taking by the bank (see, for example, Merton 1977; Furlong & Keeley 1989; Coval & Thakor 2005; as well as the review by Bhattacharya, Boot & Thakor 1998). Also prescribing high bank capital is the theory in Coval & Thakor (2005). However, the argument in that paper is not one of asset-substitution moral hazard because it contains a theory of financial intermediation based on the idea that intermediaries can provide a "beliefs bridge" between optimistic entrepreneurs and pessimistic investors. Rather, a bank needs enough capital to be viable such that the capital incents the bank to screen loan applicants and assure investors that only creditworthy entrepreneurs will be funded.

The view that more tangible equity capital is needed in banking to suppress the risk-taking appetites of thinly capitalized banks was in vogue in the 1980s, especially in the aftermath of the S&L crisis in the United States. This idea was at the heart of many landmark regulatory reforms, such as the Basel I Capital Accord in 1987, FIRREA (Financial Institutions Reform, Recovery, and Enforcement Act) in 1989, and the FDICIA (FDIC Improvement Act) in 1991.¹² It is also one of the factors that underlies the strong endorsement of significantly higher capital requirements in banking by Admati et al. (2010).

The second subgroup of Group 3 theories argues that higher capital improves banks' ability to absorb risk, QAT exposes banks to risks, and these risks increase with the amount of QAT

¹²The Basel I Capital Accord was an agreement among banking regulators in countries that were signatories to the Basel Accord to adopt a common set of minimum capital standards that accounted for the (credit) risks in the bank's assets and also off-balance-sheet items like loan commitments.

provided by the bank. For example, the greater the liquidity created, the greater are the likelihood and severity of losses associated with having to sell illiquid assets to meet customers' liquidity demands (e.g., Allen & Santomero 1998, Allen & Gale 2004, Berger & Bouwman 2009). Capital absorbs risk and expands banks' risk-bearing capacity (e.g., Bhattacharya & Thakor 1993, Repullo 2004, Coval & Thakor 2005).

The third subgroup of Group 3 theories relies on the idea that the shareholders of better-capitalized banks have more to lose from bank failure and are therefore more likely to engage in costly borrower monitoring. This idea was given legs by Holmstrom & Tirole (1997), who developed a model in which higher capital provides stronger incentives for banks to monitor their borrowers and there is an interaction between bank capital and borrower capital. Enhanced bank monitoring improves not only the terms of financing and access to bank credit for borrowers, but also their access to nonbank sources of finance because those financiers also benefit from the improvement in borrower credit quality due to the bank's monitoring. Whereas Holmstrom & Tirole (1997) provide a static model, Mehran & Thakor (2011) develop a dynamic variant in which bank equity capital not only strengthens the bank's monitoring incentives, but also enhances its survival probability, thereby increasing the value of its relationship loans and creating a positive-feedback effect that further strengthens the bank's incentive to monitor.¹³ Allen, Carletti & Marquez (2011) show that higher bank capital can help the bank increase its market share. Whereas this literature takes the existence of valuable bank-borrower relationships as a given and asks how bank capital affects the value of these relationships, Boot & Thakor (1994) develop a theory of how intertemporal loan contracting can foster the development of enduring relationships. These monitoring-based theories of bank capital structure reinforce the idea that bank capital has a beneficial impact in diminishing bank risk and, hence, enhances financial system stability that the earlier asset-substitution, moral-hazard theories had highlighted.

There is another way in which an increase in information-sensitive equity can reduce adverse selection and increase the force of equity-based governance in banking. Boot & Thakor (1993) show that splitting a firm's total cash flows into debt and equity creates a more information-sensitive claim (equity) and stimulates greater information acquisition by investors, thus lessening the impact of adverse selection on the stock price. Thus, by increasing equity capital, whose value is to a lesser extent (than debt) distorted by government guarantees, investors can have greater information acquisition about the bank, thereby improving transparency and governance.

3.2. Putting the Theories Together: What Do We Learn?

At first blush, it appears that these three groups of theories are incompatible with each other. To some extent, extracting a single coherent message from them is also difficult. Nonetheless, it is useful to begin by first establishing common ground among them.

Consider Group 1 theories in which deposit rents arise in response to liquidity provision. They rely on earlier models whose theories provide the microfoundations for deposits to provide liquidity services, such as Diamond & Dybvig (1983), where deposits facilitate (cross-states)

¹³In a dynamic analysis of the evolution of financial system architecture, Song & Thakor (2010) highlight another role of bank capital. They show that banks and capital markets exhibit three forms of coevolution. As banks evolve in response to improvements in credit screening, they securitize credits of higher qualities. This encourages greater investor participation and stimulates capital market evolution, which makes it cheaper for banks to raise equity capital and permits the bank to meet the endogenously generated risk-sensitive capital requirements associated with lending to previously excluded high-risk borrowers. Thus, greater capital in banking allows the banking sector to serve a larger set of borrowers, and capital market development facilitates this.

consumption smoothing for depositors; Gorton & Pennacchi (1990), where deposits represent an information-insensitive claim that protects the uninformed against wealth expropriation;¹⁴ or Greenbaum & Thakor (2007), where deposits are wealth safeguarded. In all these theories, the value of the bank's services decreases in the probability of the bank's failure. That is, safer banks provide more valuable liquidity services. Consequently, higher levels of capital in banks and deposit insurance help to enhance the provision of liquidity services. DeAngelo & Stulz (2014) reach a different conclusion about the relationship between bank capital and liquidity services. In their model, the bank's asset portfolio is riskless, so equity capital has no benefit in terms of reducing bank failure costs (as in Diamond & Rajan 2000) and enhancing bank stability. As such, to provide an economic rationale for high bank leverage in response to a liquidity premium, their model relies on banks controlling asset risks effectively enough so that high leverage is consistent with safe debt. However, when banks cannot eliminate all asset risks, liquidity provision may be jeopardized by high leverage. As Boot & Greenbaum (1993, p. 267) note, "Another possible reason for capital requirements is the risk of bank runs deriving from the *liquidity role* of banks (see Diamond & Dybvig 1983). Since the bank run argument is based on costs associated with the liquidation of the bank's assets, higher capital requirements may convince the public that the value of assets net of liquidation costs will not fall below the value of deposits." Thus, when banks have risky asset portfolios, capital has a potential role to play in enhancing liquidity creation. This point is also recognized by DeAngelo & Stulz (2014) who acknowledge that when the idealized conditions they assume do not hold, there can be substantial benefits to regulations that limit bank leverage.

In both Group 1 and Group 2 theories the opposite conclusion is reached—high bank leverage goes hand-in-hand with high liquidity creation by banks. However, Admati & Hellwig (2013) point out an inconsistency between these two sets of theories. In Group 1 theories, deposits are liquid because they are safe and information-insensitive. In Group 2 theories (which introduce agency problems absent in Group 1 theories), deposits must be information-sensitive to discipline the bank. Group 3 theories also recognize agency problems within banks, but they focus on the role of these problems in the bank's relationship with its borrowers. They conclude that higher bank capital leads to better discipline and hence more stable banks that create more relationship-lending surplus.

The common ground among the Group 2 and Group 3 theories, which are the theories in which the role of bank debt in providing liquidity and transaction services is microfounded (Group 1 theories rely on this role to rationalize deposit rents), is that higher bank leverage makes individual banks more failure-prone¹⁵ and may even increase systemic risk (e.g., Farhi & Tirole 2012, Acharya & Thakor 2013). Where these theories disagree is on the economic benefit of leverage. Group 2 theories say that bank leverage provides discipline, whereas Group 3 theories say the opposite—equity provides the appropriate incentives. By construction, however, equity has no governance role in Group 2 theories and debt has no governance role in Group 3 theories. Thus, juxtaposition of the two viewpoints is difficult, although that is precisely what Acharya, Mehran & Thakor (2013) attempt. Their paper recognizes the tension that is suggested between the need for higher leverage to ensure greater market discipline and the need for higher equity to attenuate asset-substitution moral hazard. It proceeds to characterize the bank's optimal capital structure when both market discipline and attenuation of asset-substitution moral hazard are present.

¹⁴Boot & Thakor (1993) show that an optimal security design approach yields the same role for the debt issued by any firm, so riskless debt issued by banks and nonbanks provides the same service as an information-insensitive bank deposit.

¹⁵In discussing the disciplining role of bank leverage in fostering liquidity creation, Rajan (1998, p. 3) notes, "Unfortunately, absent much better financial markets than those that currently exist, the theory suggests we cannot get many of the good things banks do, such as liquidity creation, credit origination, and financial innovation, without banks issuing claims susceptible to runs and thus being financially fragile."

The theories discussed above are concerned with on-balance-sheet lending by banks. But a large portion of bank lending is done via loan commitments, which are off-balance-sheet claims. Huang (2010) reports that 77% of new commercial loans in an average US bank's portfolio are under loan commitments and only 23% are spot loans. Moreover, 46% of banks make no spot loans at all. Because bank loan commitments typically have a material adverse change clause that enables the bank not to keep its commitments (see Boot, Greenbaum & Thakor 1993; Thakor 2005), they are "illusory promises." As such, the bank need not honor them if it believes that the borrower's financial condition has deteriorated significantly between the date the commitment was sold to the borrower and the date the borrower wishes to exercise it. The flexibility afforded to the bank is not trivial. Huang (2010) documents that many banks did not honor their loan commitments during the financial crisis, especially to relatively risky borrowers. The evidence supports the predictions of the theory developed by Boot, Greenbaum & Thakor (1993), who analyze the reputational and financial incentives that banks have to honor their loan commitments. One of the implications of their analysis is that banks that are in a stronger position financially will have stronger incentives not to attempt to "liquefy" their reputational capital by renegeing on their commitment promises. As a result, risky borrowers are less likely to be denied access to funding under loan commitments during an economic downturn if banks are more highly capitalized. This assured access to funding can shorten an economic downturn, so bank capital can serve a countercyclical role. In an economic upturn, however, the reputational incentives of banks may lead to overlending under commitments, as shown by Thakor (2005).

3.3. The Empirical Evidence

The central questions posed in Section 1—whether higher bank capital levels adversely affect bank lending, liquidity creation, and the values of banks—can be settled only empirically, given the divergent predictions from theories. I now briefly review the empirical evidence. The goal here is to arrive at some broad conclusions, rather than provide an exhaustive review.

Let us begin with how capital affects bank screening. Empirical evidence indicates that higher capital leads to stronger incentives for banks to screen borrowers before extending them loans. Purnanandam (2011) documents that banks with higher involvement in the originate-to-distribute mortgage market originated mortgages of poorer credit quality. This effect was stronger for banks with lower capital, which is consistent with prediction of the credit-screening theory developed in Thakor (1996). Additional evidence of the effect of bank capital on bank monitoring is provided by Jayaraman & Thakor (2013), who exploit international data on heterogeneous creditor rights to show that bank equity, rather than bank debt, seems to provide stronger monitoring incentives for banks. I now discuss the empirical evidence on the link between bank capital and lending, with the observation that calibrating the (potential) effects is challenging.

The effect bank capital has on lending raises two questions: (a) What happens to bank lending when bank capital levels increase? (b) What happens to bank lending when regulatory capital requirements are increased? These questions are distinct. Broadly speaking, the empirical evidence suggests that the relationship between the level of bank capital and bank lending is positive in the cross section and positive intertemporally for a given bank. By contrast, lending tends to decline (albeit modestly) in response to an increase in capital requirements. Nevertheless, separating the effect of capital levels from capital requirements is difficult because changes in level can influence whether the bank is in compliance with requirements.

Consider now the effect of the level of bank capital on lending. In general, establishing a causal link between these variables is a daunting task owing to the difficulty of achieving a meaningful segregation of demand and supply effects and also because theory predicts that borrower capital is

a mediating variable in this relationship (see Holmstrom & Tirole 1997). However, a few papers have employed clever identification strategies to establish causal linkages. Peek & Rosengren (1997), for example, examine how the depleted capital levels of Japanese banks due to the sharp decline in the Japanese stock market during 1989–1992 affected lending by the US branches of these banks. They document that these US branches displayed significantly lower lending in response to the lower capital levels of the parent banks. That is, a credit supply shock was induced by an exogenous hit to the capital levels of banks. Although some of the reduced lending may have resulted because the negative shock to capital caused some banks to be out of compliance with capital requirements, some may have also resulted because the amount of capital was too low to be consistent with the level of lending these banks considered as being prudent given their capital. On the basis of this and other studies (e.g., see the review by Hanson, Kashyap & Stein 2011), banks appear to reduce their lending when they experience negative exogenous shocks to their capital.

Bank capital can decline in response to exogenous shocks as well as endogenous pursuit of additional rents. De Nicolo & Turk Ariss (2010) follow up their theory with empirical evidence that bank loan and bank deposit rents are highly positively correlated and that larger loan and deposit rents are associated with lower levels of bank capital and higher probabilities of bank failures. They argue that the pursuit of these rents is an important driver of bank consolidation and systemic risk. Accordingly, greater bank size can impose bigger social costs because these banks tend to have lower capital ratios and are systemically more risky.

What about the effect of bank capital on liquidity creation by banks? Using a comprehensive measure of bank liquidity creation that includes both on- and off-balance-sheet items, Berger & Bouwman (2009) document that higher capital leads to greater liquidity creation for most of the dollar volume of liquidity creation in their sample. That is, the relationship between capital and liquidity creation is positive for large banks, which create most of the liquidity (81%) in the US economy. An exception is the “small bank” subset in their sample, for which higher capital connotes lower liquidity creation. Keep in mind, however, that such studies document cross-sectional equilibrium relationships involving banks at their privately optimal capital levels and with (unobserved) heterogeneity across banks driving different optima.

There is also empirical evidence that having higher capital strengthens the bank’s competitive position and allows it to grow faster by gaining an edge over its lower-capital counterparts in both its deposit and loan markets. Calomiris & Powell (2001) find that capital enhanced banks’ ability to acquire deposits in Argentina in the 1990s. Calomiris & Mason (2003) encounter a similar result for US banks during the Great Depression. In a study of New York banks in the 1920s and 1930s, Calomiris & Wilson (2004) also find that higher capital banks had a competitive advantage in the market for risky loans.¹⁶ Berger & Bouwman (2013) find that higher bank capital is associated with greater (asset) market share. The evidence also indicates that higher capital enables banks to perform their relationship lending role more effectively (see Bolton et al. 2014) and also improves their odds of surviving a financial crisis (Berger & Bouwman 2013).

Moving to capital requirements, one should be careful to distinguish between an increase in capital requirements and a change in the capital-requirements regime that includes a change in both levels and structure. For example, the adoption of the Basel I Capital Accord and the subsequent passage of FDICIA in the United States led to a variety of changes in the structure of capital requirements. Specifically, banks were required to keep capital against off-balance-sheet items for

¹⁶Joining together the insights of Group 2 and Group 3 theories, one may argue that part of the reason for banks to maintain adequate capital is the refinancing pressure created by short-maturity depositors where willingness to renew funding is predicated on the bank having sufficient equity capital.

the first time, and capital requirements varied across assets with different degrees of risk. Moreover, intangible items such as goodwill were phased out from being considered as capital for regulatory purposes. Thakor (1996) documents how this transition to risk-based capital requirements caused US banks to shift some portion of their asset portfolios away from loans and into government securities with zero capital requirements. As a transitional issue, however, one should be cautious not to extrapolate the results to permanent effects. Brun, Fraisse & Thesmar (2013) use the transition of French banks from the Basel I to the Basel II capital-requirements regime to examine the sensitivity of bank lending to changes in capital requirements. Similar to Thakor's (1996) analysis, this regime shift involves a change in the structure of capital requirements. They document fairly large effects but note that the effects fade over time. Moreover, the transition occurred during 2008, when the global financial crisis was raging and many banks were constrained in terms of capital and liquidity. These considerations, and the fact that US depository institutions never implemented Basel II, make generalizations based on their analysis somewhat difficult, but they reinforce Thakor's (1996) finding that the transitional effects may be nontrivial.

On the issue of higher capital requirements, how quickly should banks be required to operate with higher capital ratios? Asking banks to bring their capital ratios up gradually over time, with a phase-in period of, say, three to five years, provides a distinct advantage—banks can cut back on dividends and build up capital via retained earnings, thereby avoiding adverse-selection costs (see Myers & Majluf 1984) or any perceived ownership-dilution costs.¹⁷ There may also be other benefits. Baker & Wurgler (2013) highlight the “low-beta anomaly” in banking. They document that, over the past 40 years, banks with higher capital had lower betas but higher realized stock returns; i.e., on the basis of the capital asset pricing model, these banks' shareholders enjoyed higher returns with lower risk. Baker & Wurgler (2013) interpret these higher realized returns as proxying for higher expected returns *ex ante* and conclude that shareholders in higher-capital banks require higher returns. As a result, higher capital requirements will raise the cost of capital for banks if banks are asked to raise equity to meet these requirements. One way to avoid this higher cost would be to ask the bank to build up capital by retaining earnings, because doing so generates a higher risk-adjusted return for the existing shareholders than does paying out those earnings as dividends. However, this is subject to the caveat that the evidence that lower-beta stocks earn higher returns is an anomaly in the context of the capital asset pricing model.

Gradually phasing in higher capital requirements may also have implications for the competitive reshuffling across regulated banks and unregulated institutions when the former are subjected to higher capital requirements. Aiyar, Calomiris & Wieladek (2012) examine banks in the United Kingdom, where regulators have deployed time-varying, bank-specific minimum capital requirements. They document that regulated (UK-owned) banks significantly reduced lending in response to higher capital requirements, whereas unregulated banks (resident foreign branches) significantly increased lending.

If one focuses primarily on levels, then the evidence reviewed by Hanson, Kashyap & Stein (2011) indicates that even a very large increase in capital requirements is likely to have a rather modest effect on loan interest rates via its impact on the bank's weighted average cost of capital. Their estimate is that if capital requirements go up by 10 percentage points, bank loan rates are likely to increase by 25 to 45 basis points. The effect of this on lending will depend on the price elasticity of loan demand. Kisin & Manela (2013) estimate that the effect of higher capital

¹⁷For example, when FDICIA was implemented in 1991, banks had a similar time period over which certain intangible components of what qualified as regulatory capital were phased out and had to be replaced by tangible capital.

requirements on bank profits is likely to be modest. Their estimate is that a 10 percentage point increase in tier-one risk-based capital requirements would cost ~\$2 billion for all participating banks combined. On a per-bank basis, this is 4% of average annual profits for the average bank, a number dwarfed by the costs to banks of complying with various bank regulations. These kinds of studies are useful because they begin to address calibration issues on which theories of bank capital structure are mostly silent, but in which regulators are particularly interested.

Although much of the literature on this topic is concerned with whether lending declines in response to higher capital requirements, whether such a decline, even if it were economically and statistically significant, is necessarily inimical to social welfare, remains unclear. After all, correlated lending choices by highly levered banks often involve excessive lending, e.g., subprime lending in the 2007–2009 crisis and real estate lending during the S&L crisis. So, if lending declines in response to an increase in capital requirements, it may be efficiency enhancing. Whether it is remains an important question for future research.

Let us now turn to the relationship between bank capital and bank value. Surprisingly little work has been done on this issue. An exception is Mehran & Thakor (2011). The theoretical predictions of their dynamic model are as follows: (a) Total bank value and the bank's equity capital are positively correlated in the cross section, and (b) the various components of bank value in an acquisitions context are also positively related to bank capital. Their empirical tests support these predictions. The results of these tests are consistent with the monitoring-based view of the role of bank capital that features prominently in their theory, and they are robust to a variety of alternative explanations for why acquirers pay more for higher capital targets—growth prospects, desire to acquire toe-hold positions, the desire of capital-starved acquirers to buy capital-rich targets, market timing, pecking order, and the effect of banks with binding capital requirements. Because their theory provides a cross-sectional equilibrium relationship between bank capital and value, their paper is careful to note that it is not necessarily a prescription for higher capital requirements.

Thus, higher levels of bank capital appear to be associated with greater bank lending, more liquidity creation by large banks, bigger market shares for banks, and higher bank values. Moreover, an increase in regulatory capital requirements may be associated with a possibly small effect in terms of reduced lending. However, changes in the structure of capital requirements may have nontrivial (transitional) effects, and there may be a competitive reshuffling of lending from regulated to unregulated banks. Nonetheless, financial institutions seem resistant to keeping higher levels of capital and engage in “regulatory arbitrage” that involves, for example, searching for and shifting to activities with lower capital requirements. For example, Becker & Opp (2014) examine the effect of a recent change in the manner in which capital requirements are computed for the insurance holdings of mortgage-backed securities. The change replaced credit ratings with regulator-paid risk assessments by Pimco and Blackrock. They document that replacing ratings has led to significant reductions in aggregate capital requirements and conclude that insurance industry interests in lowering capital requirements, rather than financial stability concerns, drove this regulatory change. So the question is, Why are bankers so consistently opposed to higher capital requirements? I take this issue up in the next section.

4. WHY ARE BANKERS AVERSE TO HAVING MORE CAPITAL ON THEIR BALANCE SHEETS?

Banks may prefer high leverage for some of the theoretical reasons discussed above. But there may also be other reasons, including differences between the interests of banks and society and those of bank managers and bank shareholders. Without pretending to be exhaustive, I propose and

discuss a few of these additional explanations for bankers' preference for high leverage: (a) the political economy of banking, (b) tax benefits of debt, (c) deposit insurance put-option effect, (d) catering to ROE-obsessed investors, (e) funding cost advantage, and (f) debt overhang.

4.1. The Political Economy of Banking

Banking and politics are inseparable (see, e.g., Calomiris 2010). Because credit allocation by banks affects the relative allocation of resources across communities, it has far-reaching consequences, many of which matter to politicians. For example, Moskowitz & Garmaise (2006) document the social effects of credit allocation, including effects on crime. Politicians can serve their own economic and social goals by enacting specific regulations that affect this allocation of credit (for example, the Community Reinvestment Act), and the nature of government intervention may depend on the stage of economic development, as argued by Song & Thakor (2012). Bank compliance with such regulations produces private benefits for politicians, in addition to having economic and other consequences for the community. When banks view the cost of compliance as being too onerous, they may negotiate with politicians and regulators to ease the burden. Because many different regulations are negotiated in this manner, with varying marginal costs for banks and varying marginal benefits for politicians and broader society, there are opportunities for "trade." Banks may express a willingness to do more to serve political interests on one dimension in exchange for a lowering of the regulatory burden on another dimension, such as capital requirements. However, I am not suggesting that banks do not view equity capital as costly. Indeed, the rest of this section discusses some of the perceived costs.

Objecting to higher capital requirements may be part of the negotiating game among banks, regulators, and politicians. Even if banks do not view the cost of higher capital requirements as a crushing burden, it may be an optimal strategy for them to represent this cost as high and the impact of higher capital requirements on the economy as being significantly adverse in their negotiations with regulators and politicians. Thakor & Beltz (1994) provide a model in which banks and politicians engage in "barter": Banks accept regulatory burdens such as the Community Reinvestment Act and the Bank Secrecy Act in exchange for regulatory benefits such as deposit insurance. Thus, if banks are sufficiently convincing in their arguments, they may prevail in defeating the push for higher requirements, thereby avoiding the perceived costs of compliance. Even if capital requirements cannot be prevented from increasing, bankers' resistance to them may facilitate the negotiation of a reduced burden with respect to some other regulation. Thus, as long as banks perceive some incremental cost associated with higher capital requirements, the political economy of banking may provide the most straightforward explanation for why banks resist higher capital requirements.

4.2. Tax Benefit of Debt

Similar to other firms, banks enjoy a tax advantage on debt interest payments relative to dividends on equity. As Modigliani & Miller (1963) show, this makes high leverage attractive. However, there is nothing special about banks in this regard. So, if taxes were the driving force, then why are all firms (that pay taxes) not as highly leveraged as banks? Perhaps the answer lies on the cost side, namely that higher leverage has a lower cost for banks than for nonfinancials. Government bailout protection—through policies such as "too big to fail" and "too interconnected to fail"—and deposit insurance notwithstanding, we need more research to understand why leverage should be less costly for banks than for other firms.

There may also be other reasons why the tax trade-offs for banks differ from those for non-financials. Growing empirical evidence indicates that corporate income taxes affect banks in at least two ways: (a) If capital requirements are not binding, higher income taxes encourage banks to increase leverage. (b) When capital requirements are binding, an increase in capital requirements or corporate income taxes leads to more nonbank funding of loans via securitization (see, for example, Han, Park & Pennacchi 2014).

Direct evidence now shows that the capital structures of banks respond to changes in taxes. Schepens (2014) documents that a 2006 change in the Belgian tax code that permitted tax deductibility of some return on book equity led to a significant increase in bank capital ratios. Schandlbauer (2014) documents how an increase in local US state corporate taxes induces well-capitalized banks to increase their leverage and undercapitalized banks to alter the asset side of their balance sheets.

An important difference between banks and nonbanks in terms of corporate taxes is that banks have several close competitors that are exempt from corporate taxes. Included in this list are credit unions, mutual funds, and securitization vehicles. For example, collateralized loan obligations participate in syndicated loans and fund them with debt and equity, but are exempt from corporate taxes. Similarly, mortgage-backed and asset-backed securitization vehicles hold real estate and consumer loans that are funded with debt and equity tranches, but they are also exempt from corporate taxes. In recent years, mutual funds have been increasingly holding syndicated loans that are funded with 100% equity shares, but these funds pay no corporate taxes.

When banks face higher capital requirements (that force them to give up part of their debt tax shield) or higher income taxes, they become less competitive with respect to their tax-advantaged competitors. This induces banks to drive more loan funding to securitization vehicles, leading not only to a lesser reliance on deposits, but also to less credit screening and monitoring of loans. Given the above discussion, this may lead to a reduction in social efficiency based on risk sharing and the demand for riskless deposit-like claims. Empirical evidence supporting this hypothesis appears in Han, Park & Pennacchi (2014).

4.3. Deposit Insurance Put Option

Merton (1977), in a seminal contribution, shows that deposit insurance has an isomorphic correspondence to a common stock put option and that its value declines as the bank's capital increases. This would explain why shareholders of insured banks would be loath to keep high levels of capital. However, empirical estimates (e.g., Ronn & Verma 1986) have found that the put-option effect is significant primarily for banks with low levels of capital. Therefore, this effect was dominant for many thrifts—which operated like “zombies” with negative net worth—during the S&L crisis in the 1980s, but it is unlikely to be a major driver of the behavior of well-capitalized banks during normal times. Nonetheless, I suspect that both deposit insurance and other (less formal) forms of protection such as (no-precommitment) bailouts do play some role in the leverage choices of banks.

4.4. Catering to Return on Equity-Obsessed Investors and Executive Compensation in Banking

It is a mathematical fact that increasing the bank's capital ratio (or reducing its leverage ratio) will reduce its ROE *ceteris paribus*. However, in a world without taxes, a reduction in ROE due to a reduction in leverage is of no consequence for the bank's shareholder value, if the change in leverage is not a distortion away from an optimal capital structure and the bank's operating profit

is unaffected. The reason is that the reduction in ROE is accompanied by a reduction in the shareholders' required rate of return, because the risk to which equity is exposed declines as more equity is infused into the bank (for a fuller explanation, including why the usual objections to higher capital requirements do not stand up to careful scrutiny, see Mehran & Thakor 2011). The only way that an increase in capital in this case can reduce the bank's shareholder value is if there are taxes and, holding the size of the bank fixed, equity replaces debt without affecting the bank's operating profit.¹⁸ But this is the familiar debt tax shield argument of Modigliani & Miller (1963), and it is no different from the point that an all-debt capital structure is optimal in this case for all firms; there is nothing special about banks. The various arguments for why an all-debt capital structure is not optimal when various frictions—such as the agency costs of Jensen & Meckling (1976)—are introduced are also well-known and apply to all firms.

However, a “market segmentation” view says that the equity investors of both depository and nondepository financial institutions care about the ROE of the institution, and they do not lower their ROE expectation when the bank increases its capital, either because they like the tax shield associated with debt or they prefer high leverage due to the option effect of safety nets. As such, managers of financial institutions may be compensated based on ROE. Bhattacharyya & Purnanandam (2011) document that many banks had compensation plans tied to their short-term earnings and that these banks had substantially increased their systematic risk before the crisis. Managers will also prefer high leverage to “cater” to these equity investors (for anecdotal evidence, see Stulz 2008). C. Goodhart (unpublished manuscript) has argued that compensation-based incentives for bank managers to maximize ROE play a major role in inducing high leverage.

4.5. Funding Cost Advantage

Because rating agencies and the bank's creditors know that it enjoys both implicit and explicit government protection against failure, the credit ratings that banks receive on their (uninsured) debts are higher than what they would be in the absence of such protection. Pfleiderer (2012) notes that this ratings advantage may be two to three notches: “Protected” bank debt generates an implicit subsidy for the bank in the form of a lower cost of funding that is not available with equity. As a result, banks have a powerful incentive to be highly levered and oppose higher capital requirements.

4.6. Debt Overhang

Another reason for banks to resist calls for higher capital may be due to the debt overhang problem described by Myers (1977). If banks are highly leveraged, possibly owing to the reasons discussed above, and they suffer negative shocks to their asset values, then shareholders would view injecting additional equity into the bank as a negative-NPV project, even if it increases the total value of the bank, because the gains from doing so would be shared with the bank's creditors. This effect is particularly strong when leverage is high. Recently, Admati et al. (2014) have proposed that the shareholder-bondholder conflict that leads to debt overhang also leads to a “leverage ratchet effect” whereby, once debt is in place, shareholders resist all forms of leverage reduction, even

¹⁸However, changes in capital may not leave the bank's operating profit unaffected. Berger (1995) shows that, at least for some periods, higher capital banks earned higher profits. Mehran & Thakor (2011) document that higher capital banks earn higher ROEs. More recently, Berger & Bouwman (2013) provide evidence that higher capital is generally associated with higher bank profitability in the cross section—this is true for small banks at all times and for large banks during financial crises.

though doing so would increase firm value. In their model, a debt buyback reduces bankruptcy costs but shareholders are unable to appropriate any of the benefits of this value enhancement because all of the benefits accrue to the bondholders. In the context of banking, debt overhang and the reluctance to reduce leverage are particularly interesting because of the interconnectedness among banks. Thus, if one bank issues equity to increase capital, it benefits not only its own creditors, but potentially also interconnected banks. Hence, the persistence of high leverage is especially costly. This provides another perspective on capital requirements.

4.7. What Do We Conclude?

It is difficult to say which of these hypotheses has the most empirical validity; all may be at work to some extent. However, in my view, the political economy of banking, taxes, a debt-funding cost advantage for financial institutions due to safety nets, and debt overhang in excessively leveraged institutions offers plausible reasons for financial institutions to persist in their preference for high leverage. These factors would also explain why even nondepository institutions, such as investment banks, had such high leverage ratios prior to the recent financial crisis. Having said this, in light of the empirical evidence that high-capital banks appear to enjoy competitive, survival, and valuation advantages relative to their low-capital counterparts, the persistence of high leverage in banks continues to pose an interesting question for further study.

5. WHAT WE HAVE LEARNED AND RECENT CAPITAL ADEQUACY AND OTHER RISK-CONTAINMENT PROPOSALS

In this section, I first discuss whether financial crises are the inevitable cost of having high economic growth. Then I attempt to extract an overarching message from the literature discussed above. Finally, I move on to discuss regulatory reform proposals that are responsive to this message.

5.1. Are Financial Crises the Inevitable Price We Must Pay for Economic Growth?

As mentioned in Section 1, high leverage in financial institutions has facilitated expanded bank lending, which, in turn, has helped ignite economic growth and asset price bubbles and then led to financial crises when the bubbles collapsed (Reinhart & Rogoff 2009). One might think that these boom-and-bust cycles suggest that we simply do not learn enough from past mistakes. An alternative view is that we recognize that high bank leverage sacrifices stability, but we are willing to pay that price for the sake of the benefits we derive from high economic growth during the boom. If this viewpoint is correct, then there should be less hand-wringing over excessive bank leverage causing undesirable financial fragility.

Some research lends potential credibility to this alternative view of crises. Thakor (2012) develops a theory of financial innovation in which banks cannot make profits on standard products, so they create innovative financial products on which competition is limited because many potential competitors may disagree that these innovations are worth adopting. However, this disagreement also increases the probability that the bank's investors may choose not to refinance the bank. If sufficiently many banks are unable to refinance, a crisis ensues. The analysis shows that higher capital requirements can reduce this refinancing risk, but at the cost of diminishing financial innovation. Similarly, Brunnermeier & Sannikov (2014) develop a macroeconomic model with a financial sector and financial frictions and show that

securitization and derivative contracts that improve risk sharing may lead to higher leverage and more frequent crises.

Although these factors should cause us to pause and rethink the net costs of financial crises, there are two key questions we need to address in this context. First, which way does the causality run—does high bank leverage lead to economic booms, or does an economic boom induce banks (and households) to become more highly levered? Second, is all the additional bank lending encouraged by high bank leverage socially efficient, or does it lead to negative-NPV investments by borrowers?

On the first question, the theoretical analysis presented in Goel, Song & Thakor (2014) indicates that a boom in real estate prices causes both borrower and bank leverage to increase rationally, even though a boom also increases future financial risk. Their model shows that, when there is positive fundamental shock to house prices, homebuyers must borrow more. Moreover, because higher current house prices rationally imply higher expected future house prices, banks assess that their loans have higher collateral values, which induces banks to increase their own leverage. This asset price cum leverage boom then makes banks more vulnerable to a negative house-price shock in the future and also increases house-price volatility. The model implies a lagged relationship between bank capital in period t and house-price volatility in period $t + 1$, and the paper provides supporting empirical evidence for this prediction. This paper therefore suggests that the causality can run from high asset prices to high bank and borrower leverage. Similarly, Mian & Sufi (2014) provide strong evidence that the substantial increase in US household leverage that was fueled by booming house prices was a major cause of the 2007–2009 financial crisis, and it was indeed the boom that made the high leverage possible.

Highly levered borrowers are prone to be associated with asset-substitution moral hazard and high default risk. Carrasco & Salgado (2014) have developed a model in which borrowers have correlated strategic defaults. Some borrowers default because they expect other borrowers to default. Joining together their result with insights from other papers exposes another dark side of bank leverage. If positive asset price shocks induce banks to become more highly levered (Goel, Song & Thakor 2014), then their monitoring incentives become weaker (e.g., Holmstrom & Tirole 1997) and they make riskier loans (e.g., Mehran & Thakor 2011). The higher resulting loan defaults for these borrowers may induce other borrowers to default (Carrasco & Salgado 2014) and hence elevate systematic risk through correlated defaults that threaten many banks in the economy. Eventually, this risk may even become systemic.

The second question—whether high bank leverage leads to good or bad additional lending—does not have a conclusive answer. Nonetheless, empirical evidence does suggest that banks with lower capital invest less in screening borrowers, thereby making loans of poorer quality. The paper by Purnanandam (2011) (discussed above) provides this evidence in the context of mortgages. This diluted screening expands bank lending as more borrowers are (erroneously) found to be creditworthy. This is consistent with the Mian & Sufi (2014) evidence on the high levels of precrisis mortgage borrowing by some subprime borrowers who accounted for a large fraction of defaults just prior to and during the 2007–2009 crisis. Goel, Song & Thakor (2014) refer to the diluted screening incentive as “intermediation thinning.” Screening incentives and lending standards may also be affected by other factors. For example, Sengupta (2014) develops a model in which reduced heterogeneity in funding costs among lenders leads to a lower likelihood of screening. However, credit expansion driven by diluted bank screening creates a fragile foundation for sustained economic growth.

To sum up, asset price booms fueled by high bank leverage are often associated with diluted screening by banks and thus involve socially inefficient loans, creating unsustainable economic growth with a high probability of a future crisis. Asking banks to keep higher capital during

booms—as part of countercyclical capital regulation—will reduce the incidence of bad loans and diminish the likelihood of future crises. This will not be costless, as some financial innovation, and the economic growth that accompanies it, may have to be sacrificed as a result of the insistence on higher bank capital during booms. Nonetheless, the achievement of higher capital during booms will have to be through higher capital requirements for banks, as the incentives of banks during such periods will be to be more highly leveraged.

If high bank leverage is such a contributor to financial crises, with attendant negative economic consequences, why do we see a recurrence of leverage-induced boom-bust cycles? Thakor (2013) develops a model that provides a possible answer. If the abilities of banks to manage risks are unknown and are inferred over time and there is “model uncertainty” in the sense that economic agents are also learning whether outcomes are attributable to the skills of bankers or are just pure luck, then the longer the good times last and the higher is the (rational) posterior belief that bankers have high skills and that outcomes are skill dependent. This leads to successively higher levels of risk taking by banks and asset growth in the economy. Eventually, a crisis results if observed aggregate defaults cause investors to shift their beliefs such that they now believe the model is one in which outcomes are luck dependent and the level of risk taking that banks are engaged in is excessive.

5.2. What Is the Overarching Message?

The theories developed by Acharya & Yorulmazer (2007) and Farhi & Tirole (2012) show that the anticipation of regulatory assistance of some sort when sufficiently many banks fail can induce correlated asset choices among banks, leading to elevated systemic risk. Thakor’s (2013) model, discussed above, highlights the fact that the elevation of systemic risk is more pronounced during the good times, when loan defaults are low and banks are doing well. Theories that emphasize the market discipline of debt rely on the threat of creditors cutting off funding as the source of that discipline (e.g., Calomiris & Kahn 1991). Recently, Acharya & Thakor (2013) have shown that, when banks make correlated asset choices and creditors are the random recipients of signals about the possible impairment in the values of these assets, a “liquidation contagion” across banks may be induced by their leverage choices. That is, the liquidation of one bank—resulting from either an idiosyncratic cash flow signal or a systematic asset-value impairment signal received by its creditors—can increase the odds of another bank being liquidated even if its creditors do not observe any adverse signal about their own bank. This contagion effect becomes stronger as banks become more highly levered. Thus, even when the market discipline of debt is effective, it induces contagion as a result of creditors’ insolvency concerns and may cause an increase in systemic risk. Simply put, when we have highly levered banks, the distinction between micro and macro risks can begin to get blurred as idiosyncratic shocks suffered by a handful of banks can increase systemic risk.

One way for the regulator to respond to this heightened systemic risk is with unconditional bailouts. But as Acharya, Mehran & Thakor (2013) show, this also destroys all market discipline on banks. Moreover, to the extent that bailouts minimize/eliminate haircuts that creditors would otherwise experience but wipe out bank shareholders, the discussion in the previous section reveals that bank debt gains a funding advantage relative to equity, which further encourages leverage.

The more highly levered the banking system then, the greater the systemic risk—the more likely it is that banks will make correlated asset choices and that they will fail together. As Acharya, Dreschler & Schnabl (2013) have argued, such en masse failures require the sovereign government of the country in which these failing banks are domiciled to step up and rescue them, which increases its own indebtedness, generating taxpayer anticipation of higher future taxes to pay down the debt, with attendant adverse consequences for real-sector productivity and growth. In

some cases, the borrowing capacity of the country may simply be exceeded by the size of the required bailout, or even if this “event horizon” is not reached, the size of the incremental indebtedness can trigger a sovereign debt crisis due to the negative economic consequences of high government debt that Acharya, Dreschler & Schnabl (2013) discuss. An alternative to bailing out banks before they fail—especially if failure is likely to be due to funding for banks being cut off due to adverse-selection-induced insolvency concerns—is for the central bank to buy out some of the “toxic assets” on the balance sheets of banks. As Tirole (2012) shows, this can unfreeze credit markets. But this too can increase sovereign indebtedness and threaten a sovereign debt crisis.

A simple solution to this high systemic cum sovereign debt risk is to require banks to have higher levels of equity capital. Granted, some of the putative benefits of bank debt—market discipline, liquidity creation, risk sharing, the provision of a safe and liquid security, etc.—that have been discussed above may need to be sacrificed to have a more highly capitalized banking sector. But this may be a cost well worth bearing to minimize the specter of catastrophic banking sector bailouts that may simply be unaffordable (for a discussion of some implementable schemes to regulate systemic risk, see Acharya, Engle & Richardson 2012). In a sense, requiring banks to keep more capital is a form of “private deposit insurance” that protects the government from prohibitively expensive future bailouts.

Another simple solution is to have deposit insurance and other forms of government guarantees for depositors limited to “narrow banks.” These are financial institutions that issue demandable liabilities and invest in assets that have little or no nominal interest rate and credit risk. Prior to the early twentieth century, many US banks functioned similarly to narrow banks, and banking failures were associated largely with banks that deviated from the narrow banking model (see Pennacchi 2012). Such a shift moves the discussion away from capital requirements to redefining the boundaries of the bank to limit the safety-net provision exposure of taxpayers. I discuss the merits of this proposal later in the context of theories of why financial intermediaries exist.

Finally, although there has been little recent discussion of risk-based deposit insurance premia as a tool for moderating bank leverage and curbing excessive risk taking, the design of such premia deserves greater attention. The model by Chan, Greenbaum & Thakor (1992) indicates that incentive-compatible schemes would be difficult to design in perfectly competitive banking systems. However, we are not at the perfect-competition stage in banking, so further research on such schemes as a tool of prudential regulation seems warranted.

5.3. Reform Proposals to Increase Capital in Banking

The most direct way to inject more capital into banking to enhance banking stability would be to raise equity capital requirements as a percentage of total assets, including off-balance-sheet items, and possibly link these requirements to the bank’s (observable) risk. Bhattacharya, Boot & Thakor (1998) discuss this in their review of bank regulation in the context of theories of financial intermediary existence, and the importance of doing so has recently been emphasized by Admati et al. (2010) as well as C. Goodhart (unpublished manuscript). However, as discussed above, many believe that increasing capital requirements beyond a certain point can entail costs, including more activities transitioning from the regulated banking sector to less regulated sectors that have lower capital requirements, such as the shadow banking system.

As an alternative to raising capital requirements, some have sought indirect ways to bring more capital into banking. For example, Flannery (2005) introduces the idea of contingent capital or contingent convertibles (CoCos). A CoCo is debt that is converted to equity in response to a triggering event, such as the bank’s capital falling below a critical level. So the bank can operate with relatively high leverage (and avail itself of all the perceived benefits of doing so) until things go

sufficiently sour that the CoCo conversion transforms some debt into equity. In anticipation of this, the bank's shareholders would, in theory, have weaker ex ante incentive to engage in inefficient risk shifting at the bondholders' expense. Many variants of CoCos have emerged in a variety of proposals on capital requirements, including French et al. (2010).

CoCos have the advantage of dealing with some of the distortions caused by high leverage, while satisfying bankers' desire to operate most of the time with relatively high leverage.¹⁹ However, they also present shortcomings, including ambiguity regarding whether the IRS would allow them to be treated as debt for tax purposes, so the debt tax shield argument in favor of CoCos is tenuous.²⁰ Another potential drawback is the possibility of multiple equilibria. Sundaresan & Wang (2014) show that a CoCo with a conversion trigger based on the market value of equity does not in general lead to a unique equilibrium.²¹ Moreover, with CoCos, the bank's shareholders bear all the losses up to a prespecified amount, but they can shift some of these losses on CoCo bondholders once these losses exceed the prespecified amount. Berg & Kaserer (2014) focus on this aspect of CoCos and show that, as a consequence, the kinds of CoCo bonds issued by banks thus far can actually worsen asset-substitution moral hazard and debt-overhang problems. Even though alternative designs of CoCos may be able to overcome the problems of multiple equilibria, market-based triggers, debt overhang, and perverse incentives to pursue tail risks (e.g., Berg & Kaserer 2014, Calomiris & Herring 2011), there are still many questions about CoCos, such as the appropriate choice of the conversion trigger and its potential manipulation (for a relevant design, see Pennacchi, Vermaelen & Wolff 2014) and the wisdom of introducing a new, potentially difficult-to-value security with uncertain market and tax-treatment prospects. Another source of uncertainty with CoCos stems from the unpredictability related to the beliefs of investors about the extent to which governments will be willing to impose losses on CoCo holders in the event of a crisis.

Other alternatives have also been proposed. Hart & Zingales (2011) propose that banks must maintain equity levels that are high enough to ensure that the prices of their credit default swaps stay below a prespecified level. Aimed at banks with traded credit default swap contracts, their proposal would also force banks to issue equity when credit default swap prices rise above the prespecified level. Duffie (2011) suggests that when the bank has unacceptably low capital, it should be required to make a preemptive rights offering at a relatively low price to existing shareholders to make it very costly for them not to exercise their rights. Exercise of their rights would inject more equity capital into the bank when most needed. Bulow & Klemperer (2013) propose that banks replace all nondeposit existing unsecured debt with equity recourse notes, which are long-term bonds with the feature that any principal or interest payments payable on a date when the stock price is lower than a prespecified price would be paid in stock at that prespecified price. In light of the result by Sundaresan & Wang (2014), we would need to consider whether equity recourse notes are also subject to multiple equilibria/nonexistence problems.

¹⁹As indicated above, a reason why one has to be cognizant of the potential objections of bankers is the political economy of bank regulation. Banks collectively represent a significant group that influences the kinds of regulations that are eventually imposed on banks, so academic views that seem insensitive to these concerns may have limited effect.

²⁰As a matter of policy, the IRS does not opine on the tax treatment of hypothetical instruments/situations. Thus, unless an instrument is actually created and used, one cannot say for sure how the IRS will treat it. At a New York Federal Reserve conference in 2010, Wall Street analysts expressed skepticism that CoCos would be treated as tax deductible.

²¹Glasserman & Norvzi (2012) study the same equilibria problems that Sundaresan & Wang (2014) study, but with a model that permits continuous trading in the bank's stock. They show that when conversion terms transfer value from CoCo investors to shareholders, the "no equilibrium" result continues to hold. However, with continuous trading and conversion terms that transfer value from shareholders to CoCo investors, there is a unique stock price equilibrium.

Moreover, if providing investors with access to information-insensitive debt claims is one of the perceived benefits of bank debt (a benefit identified by Gorton & Pennacchi 1990), then the debt involved in CoCos and equity recourse notes is the wrong kind of debt because it is highly information-sensitive, unless CoCos are designed to be nearly default-free (and hence information-insensitive) as in Pennacchi, Vermaelen & Wolff (2014). Note that CoCos are a form of “bail-in” debt where creditors are not bailed out by the government, and thus in practice default-free CoCos are unlikely. European banks will soon be required to use (risky) bail-in debt and expose creditors (and even depositors) to losses in bankruptcy.

One potential criticism of these proposals to get banks to operate with more equity capital is that banks would be forced to give up some debt tax shield benefits. Apart from the fact that this objection is of questionable relevance in a regulatory policy discussion of banking stability, it would be conceptually—although perhaps not politically—easy to deal with this by affording special tax treatment for at least some portion of bank dividends, something similar to the 2006 change in the Belgian tax code [see the above discussion of the paper by Schepens (2014)]. The lost revenue to the Treasury is likely to be significantly lower than the cost to taxpayers of bailing out inadequately capitalized failing banks. In short, the lost-tax-benefit argument is specious when it is used as an objection to higher capital requirements, and the discussion should include possible changes in the tax code that lessen the tax disadvantage of equity for banks.

Recently, Acharya, Mehran & Thakor (2013) have proposed a new capital requirement design that is intended to inject more capital into banking without diluting any possible incentives that uninsured creditors may have to impose market discipline on banks. They propose two kinds of capital requirements: (a) a “regular” capital requirement that could be tier-one capital or just a leverage ratio that includes only common equity as a percentage of total assets (both on-balance-sheet and off-balance-sheet assets) and (b) a requirement to keep additional capital in a “special” capital account. The authors further propose that this special capital account be built up via retained earnings so as to avoid adverse-selection and transaction costs associated with issuing equity in the market. They also advocate requiring the bank to invest it in a relatively safe and liquid security such as a US Treasury bond. The key innovation is that this special capital account belongs to the banks’ shareholders as long as the bank is solvent, but if the bank has to be bailed out, this capital accrues to the regulator rather than the bank’s creditors. Thus, as far as the bank’s uninsured creditors are concerned, the special capital is invisible because they can never get it, and the creditors’ incentives to monitor/discipline the bank are unaffected by this special capital. However, the shareholders risk losing it in the event of failure, so they have more skin in the game and their risk-shifting propensity is weakened. The scheme thus generates equity discipline by increasing the shareholders’ exposure, while not making the creditors’ claim any safer, thereby preserving debt discipline as well. Such an outcome is particularly germane in their analysis when the possibility of a government bailout is introduced, because this destroys debt discipline.

5.4. Narrow Banking

As Pennacchi (2012) notes, narrow banks have existed for hundreds of years in many varieties, ranging from a 100% Reserve Bank, which keeps all of its deposits as cash or reserves with the central bank, to a collateralized demand deposit bank that raises funds through demand deposits and invests them in money market instruments with low credit risk and interest rate risk. Following financial crises, it is common for narrow bank reform proposals to emerge as an organizational form that should be adopted broadly for all banks, with (insured) demand deposits being essentially backed by an equal amount of relatively safe marketable assets as collateral. For example, Pollock (1992) proposes that only such deposits should be insured and all other nondemandable

bank liabilities should be uninsured. Merton & Bodie (1993) offer a similar proposal but require that the collateral be restricted to US Treasury bills or equivalent instruments. Given investments in such safe assets, they reckon that deposit insurance is unnecessary. Other variations have been proposed recently. Kotlikoff (2011) proposes having two kinds of mutual funds, one that operates like a Reserve Bank and offers payment services and another that purchases risky loans via auctions and finances these loans with equity issues to investors. Ricks (2012) provides a proposal that combines narrow banking with capital requirements. In this proposal, banks have deposit insurance and pay risk-based insurance premia. Investments would initially be limited to safe assets such as cash reserves and Treasury bills, and though banks are allowed later to invest in loans, they are first required to hold more capital and pay risk-based deposit insurance premia.

None of these proposals has been implemented. Yet, it is useful to consider their merits on theoretical grounds. I discuss this from the vantage points of two sets of theories: those that emphasize the liquidity creation services banks provide to depositors (e.g., Diamond & Dybvig 1983) and those that emphasize the screening and loan origination services banks provide to their borrowers (e.g., Ramakrishnan & Thakor 1984, Coval & Thakor 2005).

If the *raison d'être* for a bank is to provide liquidity services, or consumption smoothing as in Diamond & Dybvig (1983), then a narrow bank that finances largely with demand deposits and invests mainly in Treasury securities of various maturities seems well equipped to provide these services. Because the bank's entire assets are invested in securities that are traded in a liquid market, the bank should be able to satisfy any interim withdrawal needs of its depositors by either selling these securities at a moment's notice or by offering them as collateral to obtain funds instantaneously from the central bank or another bank. Such a bank can therefore provide liquidity transformation services without taking credit risk. Unlike the bank in Diamond & Dybvig (1983) that can be brought down by a bank run because of its illiquid asset investments, a narrow bank can provide depositors the necessary consumption smoothing (and, more broadly, liquidity and payments services) with minimal risk of a bank run.

Now consider the bank as a provider of screening and loan origination services. A narrow bank would not provide these services for risky loans. However, banks that provide these services ought not to be financed with (insured) demand deposits. These loans can be financed with a combination of equity and long-maturity debt. Thus, the economy would have two kinds of banks—narrow banks that would have insured demand deposits and would provide payments and other services to depositors and uninsured banks that provide asset services but avoid demand deposit financing.

The main idea behind this two-bank-types structure is that financial intermediary existence theories that focus on the bank's role in asset-side services (loan screening, origination, monitoring, etc.) do not require the bank to be funded with (sequentially service-constrained) demand deposits.²² In addition, financial intermediary existence theories that rely on the provision of services to demand depositors do not depend on the screening/monitoring value generated by the bank for its borrowers. The narrow bank proposal essentially splits these asset and liability services, stipulating that deposit insurance be limited to the narrow bank that provides services on the liability side of the bank's balance sheet. Deposit insurance for the narrow bank would be provided only because it would insulate depositors against the interest rate risk arising from its maturity transformation. Hellwig's (1994) analysis indicates, however, that depositors should

²²In Diamond & Dybvig (1983), a bank run arises in part because demand deposits satisfy a first-come, first-served constraint called the sequential service constraint.

bear this risk, in which case the bank would not be exposed to it and deposit insurance would be unnecessary.

Whereas the insured narrow bank can operate with relatively low equity, uninsured banks may be subject to higher capital requirements if there are social externalities associated with the disruption of relationship lending owing to bank failures that are not internalized by individual banks and the government cannot credibly precommit to not bailing them out, as we saw during the crisis of 2007–2009 (for an analysis of relationship lending, see Boot & Thakor 2000). However, one could also argue that this uninsured segment of the financial services industry ought to be left truly uninsured and the government should avoid bailouts as well as capital regulation, letting market forces dictate how much capital these banks keep.

There is nothing radical about having capital requirements and other forms of prudential regulation associated with financial intermediaries that do not have deposit insurance. Such requirements have existed for uninsured intermediaries (e.g., brokerage houses, investment banks, and the like) for quite some time. However, the nature of capital regulation will change in an economy with insured narrow banks and uninsured banks with a much broader lending mandate. In a sense, the sector of the economy we currently call “shadow banking” would expand, but these banks may be subject to higher capital requirements.

I note that such a proposal, if implemented, would not be without potential economic costs. Besides making loans, banks also make loan commitments (see, for example, Boot, Greenbaum & Thakor 1993). Kashyap, Rajan & Stein (2002) have shown that cost synergies exist for banks that have liquid assets on hand due to demand deposits and have a demand for access to that liquidity by borrowers who have purchased loan commitments. It therefore makes economic sense for the same intermediary to accept demand deposits and make risky loans via loan commitments. Interesting future research could examine the cost-benefit trade-offs of narrow banking in a model that is sufficiently general to capture the risk-mitigation benefits of narrow banking, the potential economic costs of functional separation in banking, and the optimal prudential regulation that would emerge in such a setting.

6. CONCLUSION

In this article, I have reviewed the literature on the relationship between bank capital and stability. Higher capital contributes positively to financial stability. On this issue, there seems to be little disagreement.

There is, however, disagreement in the literature on whether the high leverage in banking serves a socially useful economic purpose and whether regulators should permit banks to operate with such high leverage despite its pernicious effect on bank stability. This disagreement seems at least as strong as that over the causes of the subprime crisis (see Lo 2012). Some of the disagreement is between those who emphasize the potential benefits of higher capital requirements in terms of reducing systemic risk and those who believe that sufficiently high capital requirements will generate various costs and cause key financial intermediation services to migrate to the unregulated sector.

This disagreement is valuable because it raises the important issue of calibration: How high should capital requirements be before these costs exceed the stability benefits? We do not have a strong base of research to answer this question. Our theories are primarily qualitative in their characterizations, so definitive statements about the precise levels of optimal capital requirements are elusive. But more empirical research along the lines of Hanson, Kashyap & Stein (2011) and Kisin & Manela (2013) can yield useful insights. Theoretically, settling the issue of whether capital requirements ought to be designed to protect against systematic tail risks may yield some progress.

We must, however, remain cognizant of what we have learned about the potentially endogenous dependence of these risks on the capital structures of systemically important institutions.²³

I have also discussed a variety of possible reasons why banks may oppose higher capital requirements. We would do well to understand not only the academic arguments on this issue, but also the arguments of bankers and the political economy of capital regulation. A factor of some significance may be that bank managers often have compensation that rewards them for ROE, suggesting that regulatory concern with the level of executive compensation may be misplaced. What matters more are the conditioning variables for compensation.

One point of view about capital regulation appears to be that bank capital structures are optimally chosen in equilibrium, so capital requirements that distort leverage choices away from these (private) optima will generate costs that we should try to avoid, or at least balance against the benefits of enhanced stability that come with higher capital. This view does not negate the rationale for capital requirements, however. The reason is that although these private optima may maximize bank equity value, the distorting effects of government safety nets can create a gap between what is privately optimal for banks and what is optimal for society, so the trade-off is between the social benefits of higher bank capital and its costs as perceived by banks. Many of these costs are linked to the tax disadvantage of equity relative to debt as discussed earlier, and thus represent an issue that requires an integrated approach to tax policy and prudential bank regulation. The other point of view is that, even though observed capital structures may be privately optimal, these may be the private optima of bank managers and may diverge even from bank value maximization. The paper by Bhattacharya & Purnanandam (2011) provides some evidence consistent with this, showing that executive compensation may have induced bank managers to make risk choices that benefited managers but not shareholders. In this case, the existing evidence on the positive cross-sectional relationship between bank capital, on the one hand, and lending, liquidity creation, and bank value, on the other, would suggest potential benefits even to the shareholders of individual banks from capital regulation that elevates capital levels in banking.

Given the disagreement in the theoretical literature about the desirability of raising capital requirements to enhance banking stability and the fact that empirical evidence, although highlighting the benefits of higher capital in the cross section of banks, does not conclusively settle the issue, the academic debate is likely to continue. In the meantime, policymakers must decide, and their decisions have profound consequences. To guide these decisions, I believe the perspective in Section 5.2 is useful. Higher capital in banking should be thought of as “private deposit insurance” that reduces the contingent liability of the government related to prohibitively expensive future bailouts. These bailouts are necessitated by the correlated failures of highly leveraged banks that make correlated asset choices that endogenously create systemic risk. Higher capital in banking can stanch this systemic risk by altering incentives at the individual bank level, thereby diminishing the threat of a sovereign debt crisis engendered by the need for a dramatic increase in government debt to finance a bailout of the banking industry. These benefits seem large enough to justify the possible loss of bank-level as well as social benefits associated with the replacement (in the aggregate) of some bank debt with equity. Changes in the tax code to reduce the tax disadvantage of equity would lessen the bank-level cost of reducing leverage and facilitate a transition to higher capital levels. Moreover, it would be best to achieve the transition in a phased-in manner, so banks can build up higher capital levels via lower dividends and higher

²³If large and interconnected institutions—those considered to be important systemically—take on systematic tail risks, then these tail risks can easily become systemic in that they threaten the whole system.

earnings retentions. This will avoid adverse selection and other costs associated with equity issues. Making more effective use of risk-based deposit insurance pricing may be a useful complement to capital regulation.

Many important questions remain for future research. First, if banking stability is an important goal, how can regulators, anticipating the political economy of banking, come up with implementable approaches to adopting significantly higher capital requirements? Second, how do we deal with the shadow banking system and the inclination of regulated entities to circumvent capital requirements on regulated activities? As the 2007–2009 crisis illustrates, the shadow banking system is large and can threaten financial stability. Third, because banks that are “too big to fail” or “too interconnected to fail” can jeopardize financial stability by getting into financial distress, should such banks be asked to keep more capital and, if so, how much more? How useful will stress tests be in the calibration required to address this question? Fourth, what are the interactions among bank capital, interbank competition, and financial crises?²⁴ Fifth, will making banks less opaque by requiring greater information disclosure make banks less fragile?²⁵ Sixth, what does an integrated theory of capital structure—one that characterizes the optimal capital structures of nonfinancial firms and financial intermediaries within the same model—look like?²⁶ Finally, what are all the trade-offs involved in the implementation of narrow banking?

These are towering challenges for future research, but their exploration promises to significantly deepen our comprehension of the relationship between bank capital and stability. What may emerge is a more nuanced understanding of the manner in which higher capital requirements should be designed to dampen systemic risk, reduce the extent to which banks dip into the public till in providing their financial intermediation services, and overcome some of the political-economy impediments to implementing these requirements that have been discussed in this article. The importance of such advances is hard to overstate, given how high the stakes are in increasing bank stability and diminishing the devastating and protracted real losses associated with financial crises.

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²⁴Anginer, Demirguc-Kunt & Zhu (2014) document that greater competition causes banks to take on more diversified risks and reduces systemic risk.

²⁵Surprisingly, the answer is no if the information is about bank strategy and subject to multiple interpretations. See Thakor (2014b), who shows theoretically that greater disclosure may lead to greater disagreement and elevate the bank’s refinancing risk, even though it lowers its initial cost of capital.

²⁶This is of potentially great theoretical significance because the current debate on bank capital seems to be hampered by a theoretical schism between those who argue that Modigliani & Miller (1958) and theories of capital structure for nonfinancial firms have no relevance for banking and those who argue that there are many lessons from these theories that carry over to banks (e.g., Miller 1995; for recent papers that have developed integrated models of capital structure for banks and nonbanks, also see Gornall & Strebulaev 2013, Thakor 2014a).

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