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## Conclusion and Policy Implications

The banking crisis that shocked the US economy and many other major economies in 2008–09 revealed the need for stronger banking systems. Equity capital of banks is the bulwark against bank failure, because it provides a cushion to absorb losses without defaulting on debt and provoking a panic. The postcrisis Basel III reforms accordingly call for higher bank capital as the centerpiece of strengthening the international banking system. Better supervision, including through the use of stress tests, is an important complement to higher capital.

This study examines whether the capital reform has been correctly gauged or gone either too far or not far enough. The framework of the analysis is economic optimization. Higher bank capital provides a benefit to the economy by reducing the probability of banking crises and accordingly reducing the chance of severe recessions with output loss. The cost to the economy from imposing higher capital requirements is that there is a resulting increase in the average cost of capital to banks as they shift from low-cost debt to high-cost equity capital. As banks pass along these higher costs in the form of higher lending rates—and there is some spillover to higher lending rates in nonbank finance (such as corporate bonds)—the cost of investing in physical plant and equipment increases, reducing the expansion in the stock of productive capital in the economy. The optimal amount of bank equity capital is that amount at which the marginal benefit to the economy from avoiding banking crises equals the marginal cost to the economy from lower formation of capital stock available to cooperate with labor in the production process.

Some economists have argued that banks should hold extremely high levels of equity capital because there is a theoretical reason why there would be no increase in capital cost at all. This theory is the Modigliani-Miller (1958) theorem of capital structure irrelevance, which states that the sourcing of a firm's capital as between debt and equity makes no difference whatever to the average cost of capital. The reason is that as investors perceive less risk in the firm as it deleverages from debt and moves to equity, they will provide equity at a cheaper unit cost than before. The starting point for an analysis of optimal capital requirements, then, is to test whether and to what extent the Modigliani-Miller (M&M) theorem holds for banks.

Chapter 3 conducts tests for US banks on this question. It concludes that slightly less than half of the M&M offset attains in practice. As a consequence, some cost is passed along to the economy when higher bank capital requirements are imposed, even if this cost is only about half of what would be predicted if the M&M effect were ignored altogether.

With an estimate of the M&M offset in hand, chapter 4 estimates the optimal level of equity capital. It first estimates a benefits curve, relating the value of crisis losses avoided to the level of bank capital. It then estimates a corresponding cost curve for the economy, relating output lost as higher capital requirements are imposed, based on the higher cost of capital to the economy. The cost relationship turns out to be an upward-sloping straight line. The optimal capital ratio occurs where the slope of the benefits curve equals the slope of the cost line, such that marginal benefits equal marginal costs.

The central finding is that although Basel III has made major improvements, it has not gone far enough. For the large international banks that dominate the banking aggregates, the new requirements are set at 9.5 percent of risk-weighted assets. Risk-weighted assets represent only a little more than half of total assets, because holdings such as OECD sovereign debt enjoy a zero risk weight and other assets with strong collateral (such as mortgages) also have relatively low risk weights. The Basel III target corresponds to capital of slightly more than 5 percent of total assets.

In contrast, the analysis of chapter 4 finds that the optimal capital ratio is 12 to 14 percent of risk-weighted assets (or 7 to 8 percent of total assets), with the higher end reflecting a conservative 75th percentile instead of the median outcome in the possible outcomes under differing assumptions. The Basel III capital requirements thus need to be increased by about one-third to reach optimal levels.

This study also touches on several major issues surrounding these policy questions. Chapter 5 examines total loss-absorbing capacity (TLAC), which adds other categories of finance to equity in gauging whether the bank could absorb losses. I believe that nonequity TLAC is a poor substitute for equity,

because it is precisely the kind of instrument that will experience panic runs when bank stress develops (and some of it, simple subordinated debt, could not be mobilized without entering into bankruptcy resolution). The chapter also addresses the potential problem that the Dodd-Frank reform in the United States and the Banking Recovery and Resolution Directive in the European Union have gone too far in shifting from lender-of-last-resort capacity to forced bail-ins that, although designed to protect taxpayers, may exacerbate panics and do more harm than good to the economy.

Chapter 6 addresses recent research that contends that there is too much finance already in the advanced economies and that it is choking off growth. If this diagnosis were correct, a growth benefit of curbing finance through increasing capital requirements would need to be incorporated into the optimal capital calculations. Instead, the chapter finds that the too much finance diagnosis is a case of statistical illusion.

Finally, the study also provides a critical review of the literature on bank capital requirements with respect to economies of scale and the issue of too big to fail (TBTF).

## **Summary of Empirical Results**

### **Size of the Modigliani-Miller Offset**

The tests in chapter 3 find that for US banks, only 45 percent of the M&M offset attains in practice. As banks increase the share of their equity capital, which has a considerably higher unit cost (say, 10 percent real) than their debt finance (say, 2.5 percent real), the average cost of capital to the banks will rise, because investors will reduce the unit cost of equity capital only enough to offset 45 percent rather than 100 percent of the potential increase in average cost of capital. This finding is important, because the M&M hypothesis of capital structure irrelevance is the lynchpin of the argument of some economists that banking can be made much safer through much higher capital requirements at no resulting cost to banks or the economy.

### **Long-Term Costs of Banking Crises**

Chapter 4 provides new estimates of the economic cost of banking crises. After taking account of the facts that on the eve of crises economies are frequently at above-potential output and productive capital not created because of the crisis would have had a finite life, it estimates the discounted total costs of a banking crisis at 64 percent of one year's GDP, almost the same as the median estimate in BCBS (2010a). Whereas some might argue that damages are far higher because of hysteresis (a permanent decline in

productivity or labor force participation), it can conversely be argued that the damage estimate is overstated because several advanced economies that did not have banking crises in the Great Recession nonetheless experienced major output losses. Moreover, applying what would appear to be a more meaningful historical base period (1977–2015) significantly reduces the central expected probability of a banking crisis otherwise computed if attention is instead limited to a shorter period more heavily dominated by the Great Recession (1985–2007), as in BCBS (2010a). The analysis of chapter 4 sets the annual base probability of crisis at 2.6 percent, rather than 4.6 percent as in BCBS (2010a).

### **Benefits of Higher Capital Requirements**

The benefit of higher bank capital requirements is the reduction in the probability of a banking crisis multiplied by the damage from such a crisis. Chapter 4 adopts the evidence in BCBS (2010a) on the response of crisis probability to the level of capital. This probability shows substantial curvature, such that after capital reaches about 7 percent of total assets, there is very little additional reduction in the probability of a crisis (see table 4.2). The calculations apply the ratio of equity capital to total assets. Based on US and euro area bank averages, risk-weighted assets (which for example apply zero weight to OECD sovereign debt) are only about 55 percent of total assets. The corresponding level at which the crisis probability curve turns nearly flat is about 13 percent for capital relative to risk-weighted assets.

### **Economic Cost of Higher Capital Requirements**

The analysis then turns to the impact on the economy on the side of higher cost of capital. Because the M&M offset is not complete, higher capital requirements raise the average cost of capital to banks and thus the rate they charge borrowers, with a likely partial spillover to rates charged for nonbank finance as well. After considering the base average cost of capital to the economy, the proportionate increase in this cost as a consequence of higher capital requirements, and the response of capital formation in a long-term aggregate production function, chapter 4 estimates that an increase in the capital requirement by 1 percent of total assets would reduce long-term GDP by 0.15 percentage points. This figure is substantial, because it refers to the full future time path of GDP and thus occurs annually. The impact is larger than implied by typical macroeconomic models, which refer to shorter time horizons and thus do not capture the full effect of reduction in the capital stock and may include offsetting feedback effects (especially those models that build in a monetary policy response).

## The Optimal Capital Ratio

The optimal ratio of capital for banks occurs where the slope of the crisis-avoidance benefits curve equals the slope of the upward-sloping line relating economic cost to the capital ratio. After considering more than 2,000 combinations of low, central, and high magnitudes for the key parameters in the model, chapter 4 finds that the median result for the optimal capital ratio is 7 percent of total assets and the 75th percentile prudential result is 8 percent. The optimal capital ratio for banks is thus 7 to 8 percent of total assets. This level corresponds to 12 to 14 percent of risk-weighted assets. In comparison, Basel III sets the requirement even for the largest banks at only 9.5 percent of risk-weighted assets. By implication, the Basel III target for capital should be increased by 25 to 45 percent. Although this increase would be substantial, it is far less than the increase needed to reach the capital requirement of 20 to 30 percent of total assets called for by Admati and Hellwig (2013)—more than three times as high as the optimal range identified in chapter 4.

## Implications for Basel Targets

The optimal range of bank capital estimated in chapter 4 is the same as the median across 15 other studies reviewed in chapter 2. Those studies show a median of 13 percent as the optimal ratio of common equity tier 1 capital to risk-weighted assets (table 2.1), the midpoint of the 12–14 percent range identified in chapter 4. Even if one accepts this benchmark as the desirable target, however, two key issues of implementation arise.

### Minimum or Behavioral Norm?

The first issue is whether to think of the optimal target as a minimum that banks should maintain or as an actual level that they tend to maintain in practice that exceeds a lower required minimum. At end-2014, 31 large bank holding companies in the United States representing more than 80 percent of total bank assets held common equity tier 1 capital amounting to 11.9 percent of risk-weighted assets (Federal Reserve 2015a), even though the Basel III minimum for G-SIBs is only 9.5 percent. Should one conclude that equity capital in the large US banks is already sufficient, because in practice it is already at the low end of the optimal range calculated?

How to treat the behavioral capital cushion has been a source of ambiguity in this literature. Thus, as discussed in chapter 2, a major reason why two OECD researchers (Slovik and Cournède 2011) conclude that adverse growth effects of higher capital requirements would be considerably larger than calculated by the Macroeconomic Assessment Group chaired by the

Bank for International Settlements (MAG 2010) is that they assume that banks would maintain a large cushion of about 3.5 percentage points above the Basel III target.

One way to think about the cushion is that it is a voluntary countercyclical component that could be expected to melt away under economic conditions less favorable than business as usual. Another way to think about this issue is to infer that the behavioral cushion implies that the system would be safe enough if the target were set at the lower end of the optimal range (12 percent of risk-weighted assets) rather than the higher end (14 percent). By implication, if the Basel III minimum for global systemically important banks (G-SIBs) were raised from 9.5 to 12 percent, large banks could be expected to hold somewhat more than 12 percent in normal years, perhaps placing them at the 14 percent higher end of the optimal range in practice. It would be difficult to argue that such a consequence would be undesirable, especially to the extent that one would expect some erosion of the cushion under more unfavorable conditions. In short, the “behavioral cushion” consideration does not fundamentally change the estimates of chapter 4, but it suggests that the lower end rather than the upper end of the optimal range might reasonably be pursued in fine-tuning Basel III.

### **Equity or Alternative Total Loss-Absorbing Capacity?**

A closely related question is whether to count nonequity total loss-absorbing capacity—namely, contingent convertible and subordinated debt—as effectively meeting part of the capital requirement. For the reasons set forth in chapter 5, nonequity TLAC is likely to be a poor substitute for equity. Subordinated debt cannot be mobilized without going into resolution (i.e., expedited bankruptcy), but avoiding bankruptcy of the main banks should be a central policy priority, because of the risk of contagion. A stronger equity target is needed rather than reliance on a large dose of nonequity TLAC. In light of the behavioral cushion just discussed, an operational compromise would be to set the equity minimum at 12 percent of risk-weighted assets and to allow only 6 percent of the total 18 percent TLAC for large banks to comprise nonequity TLAC.

### **Dealing with the Risk-Weighting Problem**

During the Great Recession, it became evident that measured capital adequacy could become dangerously misleading as a consequence of the risk-weighting process, including through the use of internal models—as vividly illustrated by the case of Lehman Brothers. With the average ratio of risk-weighted to total assets at about 55 percent for US and European

banks (BCBS 2010a), it would seem desirable to give serious consideration to setting a minimum acceptable ratio of risk-weighted to total assets of, say, 45 percent. If a bank's ratio of risk-weighted assets to total assets fell below this threshold, for purposes of capital adequacy, its "adjusted" risk-weighted assets would simply be set at 45 percent of total assets. The overall effect of risk weighting would thus not be allowed to shrink risk-weighted assets to less than about four-fifths the amount that would be expected from the usual average.

In early 2016 the Basel Committee on Banking Supervision released a consultative document on revisions to Basel III rules that would reduce the variation in credit risk weights resulting from the application of internal risk models (BCBS 2016b). One approach the document mentioned was an "aggregate output floor" set at 60 to 90 percent of the risk weighting that would result from standardized approaches rather than internal models. In late 2016 negotiators met in Santiago, Chile to address this "Basel IV" issue of limitations on internal models.<sup>1</sup>

In the United States, the use of internal models for risk weighting has already been severely constrained by the Collins Amendment to the Dodd-Frank legislation, which provides that "generally applicable" risk-based capital requirements serve as a floor for banks' regulatory capital. US regulators have indicated that in implementing Basel III capital rules, capital requirements calculated under the standardized approach will be used to implement the Collins Amendment (PwC 2016). Higher floors for risk weights from internal models would thus primarily affect European and perhaps other non-US banks.<sup>2</sup>

A complementary way to deal with the risk-weighting problem would be to raise the Basel III leverage ratio to a more meaningful level and give it equal weight with the risk-weighted ratio in assessing capital adequacy. However, care would need to be given in setting the mapping from the ratio of capital to total assets used in this study to the Basel III leverage ratio, because the latter uses a denominator that is different from (and at least for US banks, significantly larger than) total assets. The Basel ratio is against "exposure," which includes not only assets but also securities financing

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1. "Basel Bust-Up," *Economist*, November 26, 2016, 67.

2. The German Banking Industry Committee has warned that the Basel IV outcome could impose "much higher capital requirements" on German banks. It argues that "the Basel Committee should neither restrict nor prohibit the use of risk measurements based on internal models" ("GBIC on Basel IV Negotiations: Great Danger of German Banks Being Placed at a Considerable Disadvantage," Bankenverband press release, November 7, 2016).

transactions, security lending and borrowing, and margin lending agreements (BCBS 2014a).<sup>3</sup>

## Large Banks versus Small Banks

The findings of this study indicate a need for higher bank capital requirements than under existing Basel III rules. However, the analysis is premised on the resulting economywide benefit from the reduced incidence of banking sector crises. Because larger banks pose the greatest systemic risks, there is a case for leaving the Basel III benchmarks unchanged for smaller banks. Smaller banks that get into trouble are much easier for regulators to place into bankruptcy, resolution, or merger, with minimal stress on the system.

Small banks constitute only a small share of banking sector assets. In the United States in 2015, for example, there were 5,309 banks (FRED 2016). Eighteen bank holding companies or banks had assets of more than \$100 billion, and 3,529 banks had assets of less than \$300 million (Federal Reserve 2016a). The largest banks accounted for 68 percent of total banking sector assets broadly defined;<sup>4</sup> the top 50 banks accounted for 74 percent of total assets. In practice, leaving the Basel III requirements at their current level for “small” banks would affect only a modest portion of the industry by asset volume (albeit a large majority by number of institutions).

## Other Key Policy Issues

### Lender of Last Resort

As discussed in chapter 5, in the United States the Dodd-Frank Act of 2010 weakened the lender-of-last-resort capacity of the Federal Reserve by constraining the use of section 13(3) to programs with wide eligibility (and requiring approval by the secretary of Treasury). The Fed has indicated that it would consider a program with at least five eligible institutions to meet that criterion (Scott 2016, 93). In a crisis, it would be important that the interpretation not conflate eligibility with actual inclusion, as a crisis could start with a single institution.

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3. The ratio's treatment of derivatives tends to reduce the denominator for European banks using International Financial Reporting Standards accounting.

4. At the end of 2015, the total assets of US commercial banks were \$15.5 trillion (Federal Reserve 2016a). The assets of 15 large bank holding companies in their noncommercial bank subsidiaries amounted to an additional \$2.9 trillion, bringing broadly defined banking sector assets to \$18.3 trillion. (Totals for banks and bank holding companies with assets of more than \$100 billion are calculated from 10-K reports and Federal Deposit Insurance Corporation, *Bank Data and Statistics*, 2016, [www5.fdic.gov/sdi/main.asp?formname=compare](http://www5.fdic.gov/sdi/main.asp?formname=compare).)

An important way to restore lender-of-last-resort capacity would be to change the rules such that the nonbank subsidiaries of the large bank holding companies supervised by the Federal Reserve would be given access to the discount window that is currently limited to the depository banks within those holding companies. Without such a change, a large nonbank subsidiary could cause problems for the holding company because of the difficulty of obtaining lender-of-last-resort support through the mechanism of the now-constrained section 13(3).

At a broader level, it is important that in the aftermath of the Great Recession the principle of forceful lender-of-last-resort support of solvent financial institutions in a panic not be lost as a consequence of political backlash against the financial sector. Avoiding taxpayer losses to rescue banks is a proper objective, but by definition lender-of-last-resort lending should not lose money, because it is provided only to solvent banks. Support to the banks in the Troubled Asset Relief Program (TARP) yielded a profit for US taxpayers, not a loss. A more severe financial crisis and recession caused by reluctance to provide appropriate lender-of-last-resort support would cost the taxpayers much more, because of higher unemployment payments and lower general revenue in the more severe recession.

An important issue is the related question of lender-of-last-resort access for large nonbank institutions that are not subsidiaries of bank holding companies, which the tightening of section 13(3) could unduly constrain. The Dodd-Frank Act requires that the Federal Reserve provide supervision for systemically important financial institutions, which include not only the large US bank holding companies but also insurance companies AIG and Prudential and the US operations of Barclays, Credit Suisse, Deutsche Bank, and UBS (Federal Reserve 2016b). The simplest way to ensure lender-of-last-resort availability for these systemically important nonbanks (and foreign banks) would be to clarify that they would qualify for a program under section 13(3). An even more straightforward means to the same end would be to provide that, because such firms are under Federal Reserve supervision, they have access to the discount window in the face of a liquidity crisis.

## **Too Big to Fail**

The call to break up the large banks has enjoyed considerable popularity in the United States.<sup>5</sup> A salient ongoing issue is the extent to which a too big to

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5. Democratic presidential primary candidate Bernie Sanders urged breaking up the large banks, and both the Republican and Democratic platforms in the 2016 election called for reinstatement of the Glass-Steagall Act, which separated depository institutions from brokerage and insurance activities—a step that would substantially reduce the size of the largest bank holding companies.

fail problem exists and, if it does, whether the combination of Basel III and the post-Great Recession reforms have fixed it.

The principal response of regulatory reform to TBTF has been to impose additional capital requirements on the largest banks (an extra 2.5 percent of risk-weighted assets in required equity and an additional 9 percent in non-equity TLAC for G-SIBs). In the United States, the Dodd-Frank Act sought to end TBTF by providing for Orderly Liquidation Authority to ensure that large banks can be smoothly shut down. The Federal Deposit Insurance Corporation (FDIC) subsequently set forth the corresponding implementing mechanism, the Single Point of Entry resolution of the holding company while keeping its viable subsidiaries operating.

As discussed in chapter 5, much of the analytical framework on this issue has focused on an implicit TBTF subsidy to risk taking, which some empirical studies demonstrate. However, empirical evidence seems to be emerging that since the crisis the implicit subsidy has disappeared or even turned negative, as investors consider the additional regulatory burdens on the largest banks and (perhaps) ponder the new orderly resolution arrangements (which in the case of the European banking union include mandatory bail-ins of creditors). Moreover, data for the United States show that the largest banks did not experience proportionately larger losses than medium-sized banks in the Great Recession, which they would have done if they had systematically taken on excessive risk induced by a TBTF subsidy.

Even if the largest banks did not, or no longer, gamble with anticipated taxpayer money, dominance of the sector by a few large banks would involve an inherent potential external diseconomy in the form of the systemic spillover from the collapse of one or more of them. The central question is whether there are efficiencies from economies of scale that exceed or compensate for the spillover diseconomies of scale.

The results of research on banking economies of scale remain ambiguous. Some recent analyses show decisively important returns to scale. One study purporting to show no returns to scale when using social pricing is contradicted by another study showing the persistence of economies of scale even pricing at smaller-bank funding costs. Methodological challenges include the problem of biased estimation if a single parametric output function (such as the translog) is applied across the full size range and the problem of ambiguity in measuring what is the “output” and what are the “inputs” in the production function. Nor is there a readily accessible literature setting forth, in case studies or otherwise, analysis of key functions that can only be accomplished by large banks.

At the same time, it is taken for granted that in many other sectors (automobiles, aircraft, pharmaceuticals), large size is essential to efficiency. It

is by no means evident that the prior assumption should be that in banking there are no important economies of scale. Nor is it clear that the prior assumption should be that there are no economies of scale in today's economy that warrant the relatively much larger sizes of the biggest banks in comparison to their sizes two decades ago.

In the United States, observers who worry about large bank size per se might take some comfort from the fact that in recent years the size of the largest US banks has shrunk from the peak level reached in 2007 and that their assets are considerably smaller relative to GDP than in Europe, Canada, Australia, and Japan (see chapter 5). The assets of the 10 largest US banks fell from 72 percent of GDP in 2007 to 62 percent in 2015, and the assets of the top five US banks account for 50 percent of GDP in the United States versus about 200 percent in Canada and Australia and about 125 percent in Japan and Germany (chapter 5).

The most direct implication of this study for this issue, however, is that the possible TBTF problems nevertheless underscore the importance of ensuring that bank capital is adequate to minimize the risk of financial crises. Achieving the right balance between economies of scale and negative externalities arising from large scale is best ensured by making certain that the likelihood of crises is reduced through stronger capitalization. The importance of adequate capitalization is further reinforced if one is skeptical about the plausibility of “immaculate bankruptcy” under the Orderly Liquidation Authority. It seems optimistic to presume that business as usual would continue at the major subsidiaries of a failed large bank holding company in resolution—the central premise of Single Point of Entry.

