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Banking Trends

How and Why Bank Capital Ratios Change Over the Business Cycle

Small-bank and large-bank capital ratios behave quite differently. To understand the difference, look at the data.

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The views expressed in this article are not necessarily those of the Federal Reserve.

Bank capital is one key measure of a bank's health. Capital is an indicator of a bank's value, and in a recession, it can help cover losses and allow the bank to remain viable. During an economic downturn, undercapitalized banks may have to sell assets, restrict their lending, or worse, fail. These actions can deepen a recession, creating ripple effects throughout the region or even nationally, economically impacting the average bank customer. In a recession, a weak capital position not only can hurt a bank's own profits but also can pose problems for other banks and for the economy as a whole.[1] Do banks' capital decisions during upturns anticipate such an event, or might they worsen these effects? To shed some light on this question, I closely examine the data and answer the following questions: How do bank capital ratios—their capital divided by assets—change over the business cycle in the U.S.? And what factors drive the changes in bank capital ratios?

In aggregate, I find that capital ratios fall when GDP rises. However, since 2000, the top 1 percent of banks have held over 70 percent of assets, reaching a high of 80 percent, so I examine this correlation for different groups of the asset distribution. At the largest banks—the top 1 percent of the asset distribution—there is an inverse, or countercyclical, relationship between the bank's capital ratio and GDP growth. As GDP grows more quickly, capital ratios at the largest banks tend to fall, and this drives the results across the entire industry. At the smallest banks—the bottom 50 percent—the relationship is procyclical. As GDP grows more quickly, small-bank capital ratios tend to also rise.

This raises the question: Which part of the capital ratio is responding to changes in GDP? It could be assets, capital, or some combination. I find that the assets of large banks grow faster than GDP when GDP is growing, whereas the assets of small banks grow more slowly than GDP. Further, I find some evidence that large banks invest in riskier assets as GDP increases.

These results provide some support for efforts to pursue more targeted financial regulation. Since the 1980s, minimum capital ratios have been a feature of banking regulation for all banks. Since the Great Recession, banking regulation has shifted focus to creating regulation for some of the largest financial institutions. By imposing more regulations specifically on the global systemically important banks (GSIBs), regulators aim to safeguard against industry-wide concerns without imposing an undue burden on smaller banks for which the cost of complying with regulations can be very expensive.[2] This article provides some support for this type of regulation, as the data documented here demonstrate key differences in priorities for banks of varying sizes over the business cycle.

*See **The Largest Banks Are Subject to Different Capital Requirements.***

In Aggregate, Bank Capital Ratios Are Countercyclical

Regulators monitor various measures of capital adequacy, the aforementioned capital ratios. The most important of these are the Risk-Weighted Capital Ratio and the Leverage Ratio. Both measure Tier 1 Capital—also known as core capital—which is mostly made up of common stock and retained earnings. However, these ratios differ in the measurement of assets.

Risk-Weighted Capital Ratio = Tier 1 Capital / Risk-Weighted Assets

The Risk-Weighted Capital Ratio accounts for the riskiness of a bank's assets. For example, a Treasury security is one of the safest assets a bank can hold, since it has a very low likelihood of defaulting; therefore, it is weighted 0 percent. A commercial loan is riskier, with a significant likelihood of default, so its risk weight is 100 percent. If a bank holds $100 of Treasury bonds and $100 of commercial loans, its risk-weighted assets are $100 = $100 x (0%) + $100 x (100%).

There's a strong argument for taking account of the risk of default in determining a bank's capital adequacy, but regulators find it especially difficult to quantify these risks accurately. Banks have an incentive to shift their portfolios toward assets whose risk exceeds the assigned risk weights, because riskier assets have a higher return than safer assets. Even the best-designed regulatory risk weights can't fully account for all risks, especially when banks that are better informed than regulators about their own portfolios can profit by taking more risks.[3] So capital requirements also use a more naïve measure of assets.

Leverage Ratio = Tier 1 Capital / Assets

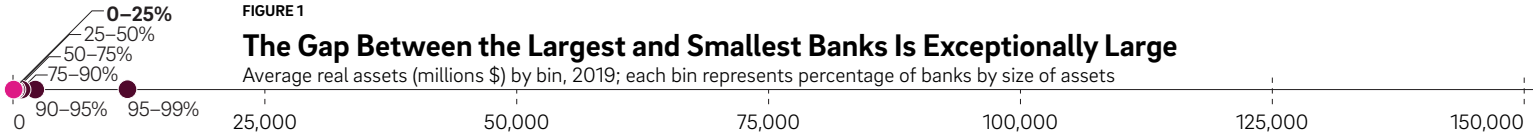
The Leverage Ratio considers all assets, without regard to their riskiness. Regulatory monitoring of this metric helps safeguard against rapid growth in unsafe portfolio strategies, as rapid growth in portfolio risk might not be captured in the Risk-Weighted Capital Ratio. Again, in our simplified example, if a bank holds $100 of Treasury bonds and $100 of commercial loans, its assets are $200 = $100 × (100%) + $100 × (100%).

I first constructed aggregated capital ratios using quarterly Call Report data for commercial banks.[4] The aggregate ratio is the sum of Tier 1 Capital across all banks, divided by the sum of assets for all banks for each quarter from 1996 to 2019. Since the economy is growing on average, we need some way to distinguish periods in which the economy is growing more quickly than average (an upturn) from periods in which the economy is growing more slowly than average (a downturn). To do this, I separate the growth trend from the business cycle for the capital ratios and for the log of real GDP from the U.S. Bureau of Economic Analysis (BEA) via Haver Analytics.[5] As GDP rises relative to trend, bank capital ratios tend to fall, regardless of whether we consider total assets or risk-weighted assets. Like others who

FIGURE 1

The Gap Between the Largest and Smallest Banks Is Exceptionally Large

Average real assets (millions $) by bin, 2019; each bin represents percentage of banks by size of assets



Source: Call Reports aggregated and available through the National Information Center (NIC) of the Federal Reserve System.

have examined bank capital ratios, I find that, in aggregate, bank capital is countercyclical to GDP.[6]

However, the Largest and Smallest Banks Behave Differently

A fundamental fact of the U.S. banking industry is that small banks hold more capital relative to assets than large banks. Large banks have more diverse portfolios, so they can participate in more industrial sectors and geographic areas than small banks. Everything else being equal, a bank with a diversified portfolio has lower risk and can safely hold less capital. When the oil and gas (O&G) industry suffers a downturn, a very large bank may face some losses on its O&G portfolio, but a small bank in Fort Worth, Texas, may sustain huge losses on its entire portfolio.

I find that large and small banks' capital ratios also change differently as GDP changes (Figure 2).[7] I divide banks into seven bins based on their assets. Asset percentiles keep the bin sizes proportional to the total number of banks, which has been declining during the sample period. For the top 1 percent of banks, which declined in number from 120 to 60 institutions over the 30-year sample, both the Leverage Ratio and Risk-Weighted Capital Ratio move countercyclically, and the relationship is statistically significant.[8] Both capital ratios also move countercyclically for the top 5 percent of banks, although the relationship is statistically significant only for the Risk-Weighted Capital Ratio. In contrast, for the bottom 75 percent of banks, which are considerably smaller, both capital ratios move procyclically.[9]

Why do small-bank capital ratios move procyclically while capital ratios move countercyclically in the aggregate? It is important to remember exactly how big a bank in the top 1 percent is compared to a bank in the bottom 25 percent. For example, in 2019, a bank in the top 1 percent had an average $287 billion in real assets compared to the $63 million for the average bank in the bottom 25 percent (Figure 1). So, when banks are aggregated, the largest banks, which hold the largest share of assets, also dominate the relationship for capital ratios. Yet the capital ratios of 75 percent of banks actually have a procyclical relationship with GDP.

Differences in Both Asset and Capital Growth Explain This Divergent Relationship

Recall that the capital ratios have both a numerator (Tier 1 Capital) and a denominator (either risk-weighted assets or total assets). It is worthwhile to consider whether one of these variables drives the capital ratio changes over the business cycle more than another. For example, one possible reason why large banks' capital ratio might fall is that large banks are more aggressive than small banks in paying out retained earnings to their stockholders when the economy is growing. That is, the changes in the numerator are the main source of difference between large and small banks. Alternatively, large-bank capital ratios might fall because assets (either risk-weighted or unweighted)–the denominator–grow faster than GDP. Are the differences between large and small banks driven by different payout policies or by different opportunities for expanding business?[10]

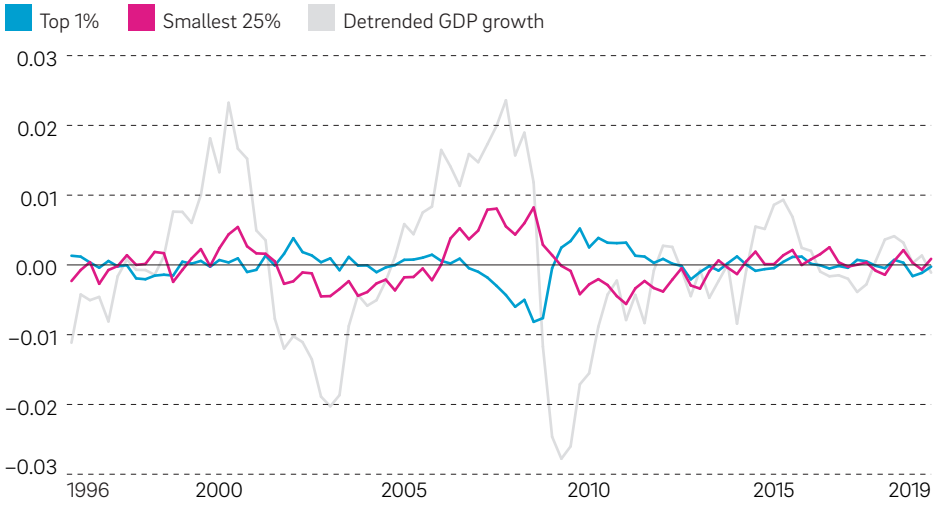
Large banks' Tier 1 Capital is negatively correlated with GDP, but the correlation is statistically insignificant–that is, the relationship is relatively weak. On the other hand, assets and GDP are strongly positively correlated for large banks (Figure 3). For large banks, the negative relationship between the ratios and GDP, therefore, is driven primarily by their assets' stronger response to business cycle fluctuations. In addition, risk-weighted assets are positively correlated with GDP for the largest 1 percent of banks. The positive relationship between risk-weighted assets and GDP indicates that large-bank portfolios are not only growing larger but also increasing in riskiness.

FIGURE 2

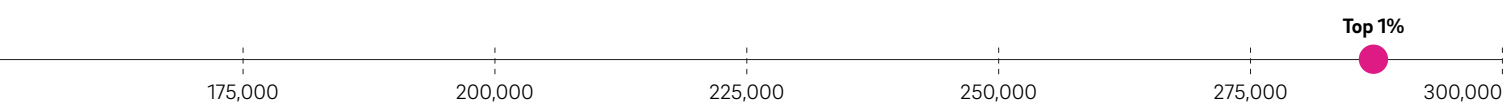
Assets at the Largest Banks Grow with GDP, Lowering the Leverage Ratio

At the smallest, assets shrink and capital grows as GDP grows, raising their leverage ratio.

Change in leverage ratio for largest and smallest banks, compared to change in GDP



Source: Call Reports aggregated and available through the National Information Center (NIC) of the Federal Reserve System



The Largest Banks Are Subject to Different Capital Requirements

Basel III is an "internationally agreed set of measures developed by the Basel Committee on Banking Supervision" in response to the Great Financial Crisis of 2007–09.[12] The Basel Committee provides regulators with additional tools to help prevent financial crises. Some of these standards have been in effect in the U.S. for a long time. For varying types of capital measurements, all banks are subject to a minimum requirement proportional to the bank's risk-weighted assets. The Common Equity Tier 1 ratio is set at 4.5 percent. Common Equity includes items such as common stock value and retained earnings. The Tier 1 Capital Ratio is Common Equity + Additional Tier 1 Capital. Tier 1 Capital adds items such as preferred shares or minority interest, which together make up Core Capital. The Tier 1 Capital Ratio minimum requirement is set at 6 percent. Finally, there is the Total Capital Ratio, which adds Tier 2 Capital, such as bank reserves, provisions, and some additional capital instruments. This ratio is set at 8 percent.

Those large banks considered GSIBs are required to retain an additional 1 to 3.5 percent under Basel III. Basel III also adds a leverage ratio surcharge for the largest banks, set at 50 percent of the GSIB's risk-based capital buffer. In 2020 the Federal Reserve began incorporating stress test results into capital requirements for bank holding companies (BHCs) as well.

The opposite is true of small banks, where assets are significantly negatively correlated with GDP. That is, assets rise more slowly than GDP, and this drives the capital ratio up as GDP increases. Small banks also have a stronger relationship between capital and GDP.

Why Do Large-Bank and Small-Bank Capital Ratios Behave Differently?

One possibility is that small-bank decision-making is driven by local rather than national economic trends. Small banks are often referred to as community banks. As the name suggests, small banks are often closely tied to the communities they serve, and as a result, changes in national GDP could be the wrong metric to use with them. Since upturns and downturns vary across regions, we may get closer to the small banks' economic environment by using a regional measure of GDP. The U.S. Bureau of Economic Analysis provides such a metric for eight regions within the U.S. For each region, I ran the same analysis using the regional GDP, along with the capital ratios and its components for banks that operate only in that region. I found evidence that the relationships for small banks are generally consistent using either local GDP or national GDP.

Another possible explanation is that a lot of regulations were introduced following the Great Financial Crisis (GFC), most of them falling on the largest banks, so the countercyclical relationship between capital ratios and GDP for large banks may no longer hold. When I separate the analysis into time periods around the GFC, the correlations of interest are not greatly affected. Although large-bank capital ratios increased following the GFC, they are still countercyclical.

The literature suggests that there could be a few other reasons why large banks might act differently than small banks. One possibility is that large banks can expand

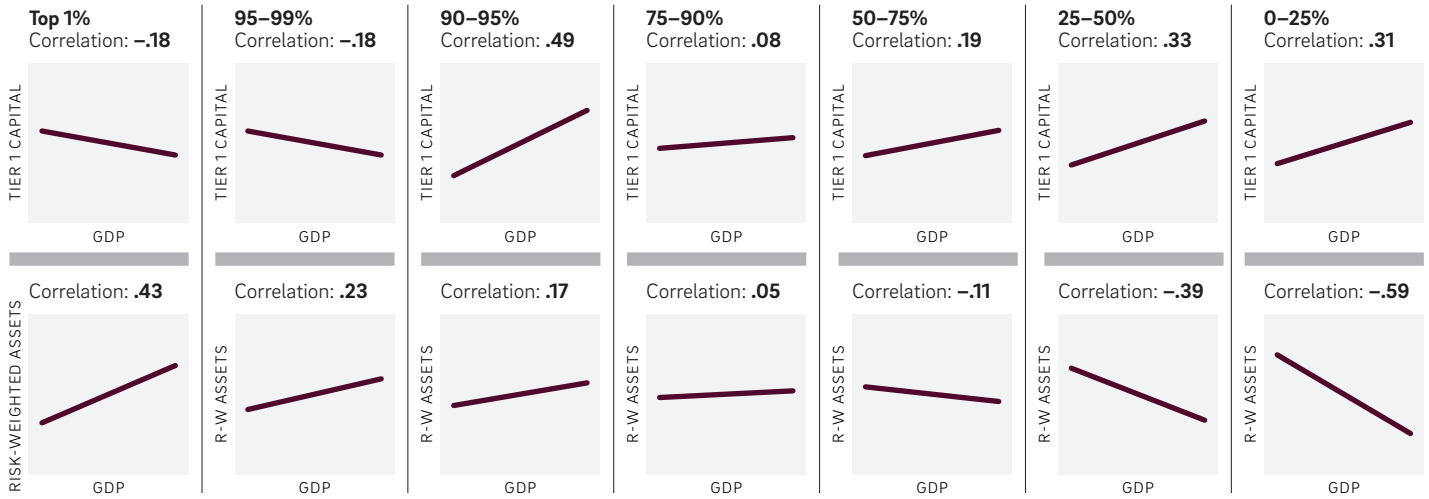
*See **The Bank Balance Sheet.***

FIGURE 3

For the Largest Banks, Capital Falls and Assets Rise as GDP Rises

The opposite is true for the smallest banks.

Changes in Tier 1 capital and risk-weighted assets as GDP grows, 1990-2019; each bin represents percentage of banks by size of assets



Source: Call Reports aggregated and available through the National Information Center (NIC) of the Federal Reserve System.

their balance sheets by accessing sources of funds unavailable to small banks. Large banks have broad access to money markets they can use to expand their assets, whereas small banks are heavily dependent on core deposits.[11] Another explanation is that small banks may be more risk averse than large banks. Small banks have fewer equity holders, which means that negative equity shocks impact individual stockholders more. With individual stockholders bearing more risk, small banks may adopt a more risk-averse approach to their portfolios. These explanations are not mutually exclusive, and understanding the precise reasons for my results is a focus for future research.

Conclusion

Everything else being equal, the banking system is more resilient if banks are better capitalized when a recession hits. The evidence presented in this article provides some support for policymakers to pursue regulations based on the size of the institution. I have shown key differences in the behaviors of small- and large-bank capital ratios and provided some explanation for how and why those differences occur. When these differences create risk for individual banks and the industry, regulators can rely on existing tools and identify the need to create new ones to help guard against worsening the effects of an unexpected downturn. EI

The Bank Balance Sheet

TABLE 1

Balance Sheet of All Commercial Banks

Balance Sheet Information for FDIC Insured Commercial Banks as of 2019, percentages

Assets (Uses of Funds)*	
Reserves and Cash	9.1
Securities	20.6
Loans	55.7
Trading Assets	3.8
Other	10.8
Total	**100.0**

Liabilities (Sources of Funds)	
Deposits	77.8
Trading Liabilities	1.2
Borrowings	5.6
Bank Capital	11.4
Other	4.0
Total	**100.0**

* In order of decreasing liquidity
Source: FDIC via Haver Analytics.

Notes

1 For example, troubles at one bank may cause another bank's depositors and customers to worry about their own bank's health. In turn, they might withdraw funds or refuse to provide credit to their bank, thereby weakening other banks and deepening the downturn. Economists would say that the bank's capital decision generates a negative externality for other banks.

2 See Quarles (2018).

3 For example, under the capital requirements in Basel II, lines of credit with a maturity less than one year had a lower risk weight than lines of credit with maturities greater than one year. Banks found it profitable to provide businesses with a 364-day line of credit, which would be rolled over each year, rather than the more typical 3-to-5-year line of credit. Once regulations changed with Basel III, the share of 364-day lines of credit declined dramatically.

4 Unless otherwise noted, all data in this article come from publicly available Call Reports aggregated and available through the National Information Center (NIC) of the Federal Reserve System.

5 This is the Hodrick-Prescott (HP) filter.

6 Previous research focusing on European banks includes Ayuso (2004) studying Spanish banks and Jokipii and Milne (2008) studying European BHCs. Haubrich (2020) has examined the relationship between capital and GDP for the U.S.

7 Joseph Haubrich also finds that large- and small-bank capital ratios have moved in opposite directions since the 1990s. Haubrich's work examines the cyclicity of bank capital over a long historical period, extending from the 1830s. Furthering this work, I decompose the movements in capital ratios to see whether the differences between large and small banks arise from the changes in capital or the changes in assets as GDP changes.

8 Statistically significant, meaning that $p < 0.05$.

9 These findings are not due to changes in the number of banks in the various size categories. This is a period in which the number of small banks was decreasing dramatically, mainly due to mergers. To make sure that the correlations were not driven by selection effects, I created a panel of small banks that remained in business from 1990 to 2007. The correlations between capital ratios and GDP also held for the panel, although not all correlations were statistically significant, mainly due to the smaller number of small banks in the panel.

10 In the next section, I discuss some of the economic reasons why large- and small-bank capital ratios might move differently.

11 Core deposits are deposits insured by the federal government. The largest share of core deposits comes from households, while other banks and financial intermediaries provide uninsured sources of debt finance to large banks.

12 See Bank for International Settlements (n.d.).

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