Chapter 8: Bank Stress, Failure and Crises

A. Bank Stress and its Measurement

Bank stress concerns the risk of bank capital loss, or risk of bank insolvency. Bank stress is important because economic activity, money creation and the payments system are all highly dependent on the international banking system, which by its nature, is quite fragile. Thus, widespread failure in the banking system, or a systemic bank crisis, is often considered more devastating than failure in other industries. This is because bank failure often leads to failure of bank customers; that is, failure of the banking system is likely to lead to severe distress in the economy as a whole. Banking regulators around the world concern themselves with safety in the banking system to maintain the strength of their economies.

The CAMELS System

The Basel Committee is an international organization concerned with bank safety and soundness. Individual regulators and banking firms have implemented specific tools to gauge soundness and safety. For example, in 1979, U.S. bank regulatory agencies created the *Uniform Financial Institutions Rating System* (*UFIRS*) and the Federal Reserve System developed the *CAMELS* rating system to help gauge the risk of member banks.[1] This CAMELS system, variations of which are implemented in other countries, is an acronym representing six important components of a bank's risk condition, as presented by the Federal Reserve Bank of St. Louis (2020):

1. **C**apital adequacy, the quality and adequacy of bank capital
2. **A**sset quality, the quality of bank assets
3. **M**anagement, the capability of the board of directors and management to identify, measure, monitor, and control the risks of the bank's activities and to ensure that the bank has a safe, sound, and efficient operation that is in compliance with applicable laws and regulations;
4. **E**arnings, the quantity, sustainability, and trend of the bank's earnings;
5. **L**iquidity and
6. **S**ensitivity to market risk, the degree to which changes in interest rates, foreign-exchange rates, commodity prices, or equity prices can adversely affect the bank's earnings, capital, and liabilities subject to market risk.

Bank examiners and supervisors assign banks scores ranging from one (best: strongest performance and risk management practices) to five (worst: strongest performance and risk management practices) for each of the 6 factors. In addition, bank examiners and supervisors assign banks a composite score ranging from one (best: basically sound in every respect) to five (worst: extremely high probability of imminent failure) based on a weighted average of the six factors. Banks with composite scores less than two can be considered to be low-risk institutions, while banks with scores greater than three are considered risky. While these ratings are generally disclosed only to supervisory officials and the bank's board and senior executives. But, the scores are used by investors and other financial institutions because they are fairly easily "reversed engineered" and synthesized by financial research companies.

[1] See the Federal Deposit and Insurance Corporation (2018)

Value at Risk

The 1996 amendment to the 1988 Basel Accord permits banks to use their own portfolio models to compute capital requirements. Among the better-known of these models is the *Value-at-Risk* (*VaR*) model (See Jorion (2007)). Value-at-Risk measures the loss size or threshold over a given period of time consistent with a specified probability. Roughly speaking, *VaR* calculates the maximum loss that might be reasonably expected (defined by some probability) in a given time frame. For example, assuming that risk is measured by standard deviation of returns from a normal distribution, *VaR* might be calculated as follows:

$$VaR = Asset\ Value \times Daily\ return\ standard\ deviation \times Confidence\ interval\ factor \times the\ Square\ Root\ of\ time$$

$$VaR = Asset\ Value \times \sigma \times z \times \sqrt{t}$$

Asset value is the total value of the bank or its relevant component. The daily return standard deviation σ is typically applied to this asset value. The confidence interval factor z is obtained from the probability that this loss will be exceeded (typically a z-value corresponding to a probability such as 99% from a normal distribution). While the model can be restructured differently, the unit of time t is given in days.

One might ask "What's the most that I can lose on this investment?" The easy answer is "Everything." It might be more useful to ask "At a 99% (or 1%) threshold, what's the most I can lose?" This is essentially what *VaR* seeks to answer.

Suppose that we need to find the loss value that we can expect to incur at most 1% of the time. Thus, we need to find a z-value corresponding to 1% or 99% on a cumulative normal distribution table. Now, consider Figure 8.1. From a normal distribution (See the table in Appendix 3.B; add .5 to .49 to obtain 99%, interpolate and find that the corresponding z-value is 2.326), we determine that the left-most area under the curve to the left of 2.326 standard deviations to the left of the mean corresponds to 1%. Thus, 1% of the area under the normal curve lies to the left of 2.236 standard deviations to the left of the mean of the normal distribution. On an Excel spreadsheet, we obtain the same value with the normal inverse cumulative distribution function =NORMINV(0.01,0,1).

Now, suppose a bank with $1 billion in its derivative asset portfolio seeks to compute its *VaR*. The portfolio experiences a 0.5% daily standard deviation in its daily returns. The bank seeks to determine the size of a loss that has a 1% probability of being incurred over a single 5-day week:

$$VaR = \$1{,}000{,}000{,}000 \times .005 \times 2.326 \times \sqrt{5} = \$26{,}005{,}471$$

Thus, assuming that daily asset returns are normally distributed (again, often a questionable assumption), uncorrelated over time and with a standard deviation of .005, there is a 1% probability that the bank will experience a loss exceeding $26,005,471 during any given 5-day week. The one-tailed z-value corresponding with the 1% confidence interval is 2.326. Thus, 99% of the time, losses realized by the institution will either be less than the computed VaR figure or profit levels will be positive. There are a wide variety of *VaR* systems and a number of alternative systems are used by banks, including the *CreditMetrics* system developed by J.P. Morgan/Chase.

VaR methodology and application have been heavily criticized, in large part due to *VaR*'s reliance on potentially false assumptions and giving traders and institutions false hopes concerning their ability to measure and control risk. Perhaps the most important of these criticisms concerns the assumption of normally distributed returns. Notice in Figure 8.1 the depiction of the narrow tails, suggesting that the most disastrous outcomes (sometimes referred to in a risk measurement context as black swans) are very unlikely (See Taleb (2010)). If worst case or near-worst case scenarios are not actually rare, those situations may be parts of "fat tails," and their probabilities might be underestimated by the thin tails consistent with a normal distribution. Thus, do consider the implications of the normal distribution before relying too heavily on that assumption. Remodel with another distribution if necessary. Similarly, if standard deviation is not the best or most complete measure of variability of returns, or if variability of returns does not provide a good indicator of risk, then adapt the *VaR* methodology to a more appropriate measure of risk, and/or rely on other risk measurement methodologies.

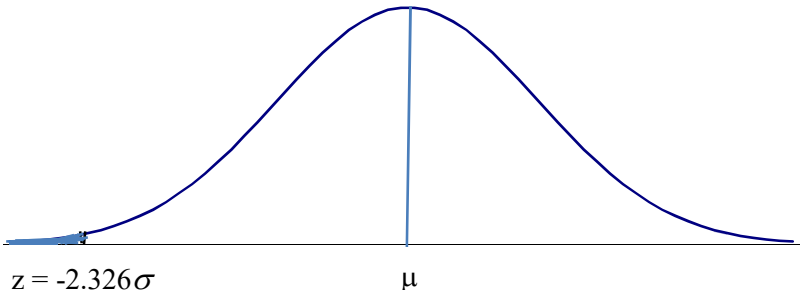

Figure 8.1: Bottom 1% Area Under the Normal Curve

Stress Testing

Among the important components of Basel III and the 2010 U.S. Dodd-Frank Act (the next chapter discusses details of Dodd-Frank) as well as other bank safety measures is the process of stress testing. A stress test is an analysis of forward-looking hypotheticals, which might include a simulation designed to determine how the financial institution (affiliate thereof, portfolio or even individual instrument) might withstand a negative event, shock, series of events and shocks or an economic crisis. A stress test tends to focus on bad or worst-case scenarios and is required by Basel III to be an integral part of a banks overall governance and risk management programs.

In the United States, government regulators, primarily the Fed oversees an annual assessment of two related tests for all banks and certain other financial institutions with assets exceeding $10 billion. The first is the Comprehensive Capital Analysis and Review (CCAR), which focuses on the bank's capital adequacy with respect to its planned capital distributions (dividend payments and common stock repurchases, etc.) over the relevant time frame. The CCAR requires bank affected banks to submit annual capital plans and capital distributions, describing their internal processes for determining capital adequacy. Banks are required to test their capital ratios against three scenarios provided by the Fed: baseline, adverse, and severely adverse in order to assess whether they have sufficient forward-looking plans and planning processes to deal with potential capital shortfalls.

The second of the Fed-supervised testing programs is the Dodd-Frank Act Supervisory Stress Test (DFAST), which focuses on the impact of stressful economic and financial market

conditions on the capital adequacy of the bank and certain other institution. These tests are conducted semi-annually by the Fed and independently by banks themselves with asset levels exceeding $10 billion. The tests often use the same data, systems and procedures as the CCAR tests, but are conducted separately. Smaller banks ($10-50billion) are exemot from the CCAR tests.

The Fed will specify a series of adverse conditions that will serve as the DFAST hypotheticals for the affected institution. For example, prior to the 2020 year, the Fed proffered a scenario that featured a 6-point increase in unemployment, a 50% drop in stock values, a 70% increase in the VIX market volatility index, a 25% drop in home values and a 35% drop in commercial real estate values, as well as severe recessions in the eurozone, the U.K. and Japan (Heltman [2019]. In order to pass a test, the bank must demonstrate that it can maintain a minimum (e.g., 4.5%) Tier 1 common equity ratio under the severely adverse scenario.

A very simple example stress test, for example, might concern a bank's financial reaction to a loss of deposits or a significant increase in interest rates. Since many banks fund long-term assets with short-term liabilities, interest rate increases can be expected to reduce the overall equity capitalization of the institution; bank equity declines due to a greater decrease in long-term asset value relative to short-term liability value. A sufficiently large interest rate increase might render the institution insolvent. A stress test might be designed to determine how interest rate increases of varying levels would impact the bank's balance sheets, particularly capital levels. More generally, a stress test could be designed to determine how a series of adverse events might impact a bank's balance sheets, again, particularly with respect to capital levels. In the U.S., periodic stress tests are conducted by both banks' internal risk management teams and by government regulators.

Stress Test: Illustration

Table 1 illustrates a very simple hypothetical scenario in which a bank, initially with $180 billion market value in long-term mortgage assets, funded with $162 billion in short-term deposits experiences an increase in interest rates, from their initial level of 3% to a much higher level of 10%. Suppose that all mortgages mature in 10 years, with balloon payments (one-time payment at maturity) of $240.9 billion (the PV of $240.9 billion in 10 years is $180 billion or 240.9 billion/$(1+.03)^{10}$). Further suppose that the bank's deposits mature (and rolls over at the then prevailing market interest rate) in 1 year, with a balloon payment of $166.86 billion (the PV of $166.86 billion in 1 year is $162 billion or 166.86 billion/(1+.03)). Thus, the bank's current equity market value is $18 billion, or $180 billion - $162 billion.

Now, we subject our hypothetical bank to stress, in particular, an increase to 10% in all interest and discount rates. The market value of mortgages would fall to $93.26 billion ($240.9 billion/$(1+.10)^{10}$) while the value of deposits would fall to $151.69 billion ($166.86 billion/1.1). Obviously, asset value dropped by far more than liability values, and we see that equity value becomes negative. The bank is now insolvent (negative equity) after the interest rate increase; the bank has failed its stress test. The example, based on only a single scenario (simulations usually examine many thousands) and a single stressor (interest rate) with only one variant (increase by 7%), is certainly oversimplified. But, it does illustrate the importance of the essential features of the stress test, the balance sheet and a source of bank stress.

Basel III and many economy-wide banking regulators (including the U.S. Fed, as mandated by Dodd-Frank) require banks to conduct periodic stress tests under a variety of hypothetical scenarios. Larger banks have been using stress tests since the early 1990s as internal

self-assessment tools of the type required by Basel I, but more recently, these tests have been conducted by bank regulators as well.

A bank that fails its stress test will make its failure known to regulators and will normally be required to submit a plan of action and to take action to increase its capitalization. Cutting or eliminating dividends and stock buybacks is typically a starting point. Acquiring additional capital by selling shares of stock or subordinate debt is another possible action.

Pro-Forma Balance Sheets: Before and After Interest Rate Stress

$billions

Balance Sheet at Low Interest Rate:				**Balance Sheet at High Interest Rate:**			
Assets		Capital		Assets		Capital	
		Deposits	162			Deposits	151.69
		Equity	18			Equity	-58.43
Totals	180		180	Totals	93.26		93.26

$\text{Asset Value} = \$180\text{bil.} = \frac{\$240.9\text{ bil.}}{(1+.03)^{10}}$

$\text{Deposit Value} = \$162\text{bil.} = \frac{\$166.86\text{bil.}}{(1+.03)^{1}}$

Equity Value = $18bil. = $180bil. - $162bil.

$\text{Asset Value} = \$93.26\text{bil.} = \frac{\$240.9\text{ bil.}}{(1+.10)^{10}}$

$\text{Deposit Value} = \$151.69\text{bil.} = \frac{\$166.86\text{ bil.}}{(1+.10)^{1}}$

Equity Value = -58.43bil. = $93.26bil.-151.69 bil.

Table 1: Simplified Bank Stress Test

Living Wills

In addition to stress testing, Dodd-Frank requires that bank holding companies with total consolidated assets exceeding $50 billion and certain smaller, but complex banks periodically submit resolution plans. These resolution plans are informally known as *living wills*, and are submitted to the Federal Reserve and the Federal Deposit Insurance Corporation. Similarly, European banks are required to submit living wills to their regulators as per the Bank Recovery and Resolution Directive (BRRD). The resolution plan will describe the bank's strategy for its rapid and orderly resolution without disrupting the financial system in the event of distress or failure. Such plans are expected not to impose risk of government or taxpayer bailout, but can include fully wiping out shareholder equity, bailing in unsecured and non-retail creditors, selling assets and businesses to a third-party buyers, creating a bridge bank, and takeover by regulatory authorities.

In addition to living wills, most banks are required or expected to maintain *recovery plans* that detail contingency plans for retaining functioning business operations while the bank is experiencing heightened financial or operational stress still insufficient for imminent liquidation or resolution. The goal of these plans is to prepare the stressed bank's return to normal operations. The stressed bank's recovery plan will detail the activities needed to restore its financial and operational strength following triggers, or events that indicate stress. The bank will identify credible survival options that might include improving liquidity, raising capital, eliminating shareholder dividends, reducing costs, selling assets and restructuring.

B. Bank Failure and its Resolution

A *bank failure* occurs when the bank cannot fulfill its obligations to depositors and/or other creditors. Failure arises when the bank has become insolvent or illiquid, and cannot raise

cash needed to make necessary payments. Most theories of bank failures arise from the observation that bank balance sheets are mismatched in terms of maturities; banks tend to finance long term assets with short term deposits. When a large proportion of depositors prefer liquidity (easy access to cash in the short term), while banks invest for the longer term, banks are exposed to the risk of a *run*, in which depositors demand more cash in the short term than banks are able to produce from their long term investments. The sudden withdrawals associated with a run can force the bank to liquidate otherwise profitable assets at a loss, and can cause a bank to fail.

However, bank runs are by no means the only cause of bank failure. Other causes of bank failure include bad loans (credit risk) and high risk activities such as proprietary trading. Esssentially, and scenario in which bank assets, particularly liquid assets are insufficient to fulfill its obligations can lead to a bank failure. In the United States, the Government Accountability Office (GAO [2013]) defines a bank failure as "the closing of a bank by a federal or state banking regulatory agency." Table 2, drawn from U.S. Code, provides a listing of conditions that lead to the regulatory closing of a U.S. bank.

Resolving Bank Failures

Pre-20th century failed banks were typically liquidated by authorities and their records were seized. In 14th century Venice, bankers failing to honor deposits were subject to arrest and imprisonment. Kohn [1999] noted that "it was not unusual in Venice for a failed banker to flee the city with the bank's books and then to negotiate personal immunity in exchange for their return."[2] Such circumstances were common throughout Europe. On the other hand, the Catalonian banker Francesch Castello was beheaded in front of his failed bank in 1360.[3] More recently, Washington Mutual CEO Alan H. Fishman was offered approximately $19 million (he declined 2/3rds of it) for 17 days on the job when his bank (approximately $307 billion in assets) failed in September, 2008. His predecessor received $14 million for his one year of service. Clearly, there are many ways to deal with a failed bank. Under current regulations in the U.S., Europe and Japan, bank failures tend to be costly to regulatory authorities, who seek to minimize these costs.

[2] p. 21
[3] Usher [1943], p. 242.

(5) Grounds for appointing conservator or receiver

The grounds for appointing a conservator or receiver (which may be the Corporation) for any insured depository institution are as follows:

(A) Assets insufficient for obligations.— The institution's assets are less than the institution's obligations to its creditors and others, including members of the institution.

(B) Substantial dissipation.— Substantial dissipation of assets or earnings due to—

(i) any violation of any statute or regulation; or

(ii) any unsafe or unsound practice.

(C) Unsafe or unsound condition.— An unsafe or unsound condition to transact business.

(D) Cease and desist orders.— Any willful violation of a cease-and-desist order which has become final.

(E) Concealment.— Any concealment of the institution's books, papers, records, or assets, or any refusal to submit the institution's books, papers, records, or affairs for inspection to any examiner or to any lawful agent of the appropriate Federal banking agency or State bank or savings association supervisor.

(F) Inability to meet obligations.— The institution is likely to be unable to pay its obligations or meet its depositors' demands in the normal course of business.

(G) Losses.— The institution has incurred or is likely to incur losses that will deplete all or substantially all of its capital, and there is no reasonable prospect for the institution to become adequately capitalized (as defined in section 1831o (b) of this title) without Federal assistance.

(H) Violations of law.— Any violation of any law or regulation, or any unsafe or unsound practice or condition that is likely to—

(i) cause insolvency or substantial dissipation of assets or earnings;

(ii) weaken the institution's condition; or

(iii) otherwise seriously prejudice the interests of the institution's depositors or the Deposit Insurance Fund.

(I) Consent.— The institution, by resolution of its board of directors or its shareholders or members, consents to the appointment.

(J) Cessation of insured status.— The institution ceases to be an insured institution.

(K) Undercapitalization.— The institution is undercapitalized (as defined in section 1831o (b) of this title), and—

(i) has no reasonable prospect of becoming adequately capitalized (as defined in that section);

(ii) fails to become adequately capitalized when required to do so under section 1831o (f)(2)(A) of this title;

(iii) fails to submit a capital restoration plan acceptable to that agency within the time prescribed under section 1831o (e)(2)(D) of this title; or

(iv) materially fails to implement a capital restoration plan submitted and accepted under section 1831o (e)(2) of this title.

(L) The institution—

(i) is critically undercapitalized, as defined in section 1831o (b) of this title; or

(ii) otherwise has substantially insufficient capital.

(M) Money laundering offense.— The Attorney General notifies the appropriate Federal banking agency or the Corporation in writing that the insured depository institution has been found guilty of a criminal offense under section 1956 or 1957 of title 18 or section 5322 or 5324 of title 31.

Table 2: Grounds for Appointing an FDIC Conservator or Receiver
(Source: http://www.law.cornell.edu/uscode/text/12/1821)

FDICIA and Failed Bank Resolution

Resolutions of U.S. federally chartered bank failures are covered by the Federal Deposit Insurance Act of 1991 (FDICIA) and are administered by the Federal Deposit Insurance

Corporation (FDIC).[4] When FDIC elects to step in to resolve a distressed bank, it can act as either a:

1. conservator, by operating the failed bank as an ongoing concern, or
2. receiver, by winding down the operations and liquidating the assets of the failed bank.

Unlike other business failures, commercial bank failures are exempt from Federal Bankruptcy Code, and are handled outside the court system.

The primary goal of FDIC in its capacity as receiver is to resolve the failure in the least costly manner and recoup as much value from its assets as is possible. At the same time, FDIC has a public responsibility to retain public confidence in the banking system, largely by assuring bank customers that they will be able to fully access their deposits in the most timely manner. In carrying out this responsibility, FDIC prepares an inventory of assets, collects on liabilities and sells assets without the court oversight one would expect in a bankruptcy. FDIC has the right to allow or disallow claims on the failed institution's assets as well as repudiate certain contracts and eliminate employment bonuses.

Regulatory Remedies for Bank Failure

The FDIC is required by legislation (FDICIA of 1991) to resolve the failed bank in the least costly manner to the Deposit Insurance Fund, and to recoup as much value from its assets as is possible. FDICIA did allow for a "too big to fail" exemption, which, as of late 2016, has not been fully resolved by implementation of Dodd-Frank. Prior to resolving the distressed institution, FDIC (or the Fed in the case in which its authority applies) can:

1. *Suspend Deposit to Cash Convertibility* (This means to temporarily prohibit depositor withdrawals)
2. *Serve as the Lender of Last Resort*: (Undertaken by the Fed through its discount window)

When a decision has been made to resolve the distressed institution, the FDIC (or, in some cases other regulators) can:

1. *Arrange the Acquisition of the Troubled Bank*: A stronger bank simply acquires the troubled bank, though this typically occurs with central bank encouragement and assistance. In most instances, perhaps as much as 80% of the time, the FDIC will seek a healthy buyer for the failed bank (known as a *purchase and assumption transaction* - P&A) or at least some of its assets. Prospective bidders can contact FDIC (through *FDIC Connect*) to seek permission to bid, and must have CAMELS ratings of 1 or 2 (described earlier).
2. *Establish a Bridge Bank*: Here, FDIC charters a new bank to receive the failed bank's assets and insured deposits, normally with reduced capital requirements and other regulatory concessions and operates it for up to 5 years.
3. *Bail out the Distressed Bank*: A perhaps overused colloquial term for lending to a distressed institution.

[4] FDICIA is discussed in Appendix 9.A.

4. *Liquidate and Pay Depositors' Insured Deposits*: Deposits in excess of insured limits are normally considered unsecured liabilities. This is usually the most expensive resolution method, and normally occurs only when no acquisition bids are received.

C. Contagion, Interconnectedness and Systemically Important Financial Institutions

One might argue that the primary function of banks as financial institutions is to fund illiquid and high-risk long-term assets with highly liquid and low-risk liabilities in the form of deposits. That is, unlike other financial institutions, the primary functions of banks are to engage in maturity and risk transformation. These functions make banks very fragile institutions since depositors can withdraw bank funding at any time. The close relationships among banks renders the entire banking system fragile as the failure of any one bank to fulfill its obligations impinges on the ability of the others to fulfill their own.

Contagion

Bank contagion (related to *systemic risk*) refers to financial difficulties at one bank that spill over to other banks, or to the banking system as a whole. *Bank crises* are characterized first by depositor runs in fractional reserve systems (banking systems that allow banks to lend funds in demand deposit accounts), in which large numbers of depositors seek to withdraw their deposits, at much the same time, leading to significant liquidity problems. These withdrawals are problematic, because the combination of fractional reserves and asset/liability mismatches inhibit the bank's ability to fulfill large numbers of withdrawal requests. These withdrawals, once known by the public, can trigger additional withdrawals, destabilizing the bank, diminishing the credibility of related financial institutions, potentially causing runs on related or interconnected banks (bank contagion), ultimately leading to a banking panic or crisis. A bank panic occurs when bank depositors (this could be broadened to creditors) suddenly demand that banks convert their claims into cash. A *systemic banking crisis* occurs when all or most banking capital and liquidity are destroyed by bank runs.

There are two primary ways that risk spills over from one bank to others in the system. The first is a type of counterparty contagion. As one bank fails to fulfill its obligations to a second, the second bank sees its risk of default rise as well. Thus, the failure of one bank can threaten the survivability of banks to which the first is obliged, with the threat of failure spreading as a contagion from one bank to another, threatening the entire banking system. This counterparty contagion occurs through contractual relationships between banks. Banks sharing correspondent relationships share this sort of contagion risk. Second, the failure or threat of failure to a bank can be interpreted as a signal that other similar banks are similarly threatened. Thus, the failure of a bank might serve as a signal that banks serving the same market, facing the same geographic environment, subject to the same government policies, etc. might be similarly threatened. Thus, risk of failure in one bank can amplify the risk of failure of another bank.

This type of destabilization of the banking system, such as that occurring from 1929-33 in the U.S. and in many other world economies is costly. Such costs tend to be more significant in developing and emerging economies. First, and most obviously, affected banks lose value, equity value and value to other stakeholders from creditors to employees lost in institutional failure. Second, there are significant public and social costs to bank failure. Government authorities assume costs when they try to mitigate the costs and spread of the distress. The indirect costs are likely more significant since bank failure leads to distortions and reductions in real economic activity as the real sector is deprived of capital, and these costs and destabilizing

effects are more than additive in the event of widespread panics (See, for example, Honohan and Klingebiel (2000)). More so than other types of financial crises, banking crises inflict particularly large social costs. For example, stock market price collapses unaccompanied by banking crises (e.g., U.S. in 1987 and 2000) did not cause severe macroeconomic consequences (see Calomiris and Mason [2003]) as did the early 1930's and other banking crises.

Empirical studies (e.g., Kaufman [1994] and Saunders [1987]) conducted on the U.S. banking system during most of the 20th century characterized by the Fed's active use of the discount window suggests that banking contagion is a fairly small risk during most periods. Hasan and Dwyer [1994] found a larger contagion risk during the 19th century pre-Fed era when there was no discount window lending. Thus, these papers suggest that lending through the discount window has reduced contagion risk over the past century to a small level.

Systemically Important Financial Institutions and Interconnectedness

A *systemically important financial institution* (SIFI) or *too big to fail* institution (often a bank) is one whose failure has the potential to trigger a financial crisis. *Systemic importance* relates to the impact of one institution on others in the system. The Basel III Accord issued by the Basel Committee on Banking Supervision focuses on SIFI capital requirements and capital surcharges imposed on systemically important banks as designated by individual country regulators. In the U.S., Dodd–Frank Wall Street Reform and Consumer Protection Act of 2010 (See Appendix A to this chapter) defining systematically important financial institutions to be those with more than $50billion in assets. The 2018 Economic Growth, Regulatory Relief, and Consumer Protection Act raised this limit to $250 billion, reducing the number of systemically important banks from 38 to 12. Thus, only a small number of U.S. banks are now subject to regulator-mandated stress tests and other costly oversight provisions imposed on systemically important financial institutions.

Unfortunately, it is more than difficult to determine which banks expose economies to risk of systemic banking crisis, though bank size and *bank interconnectedness* are presumed to play key roles. Interconnectedness can be characterized as linkages with other components of the banking or financial system, usually through intra-financial system assets and liabilities. Measuring bank size is relatively straightforward, but measuring interconnectedness is much more problematic. Bank complexity, substitute financial infrastructure unavailability (i.e., other banks performing similar functions) and its global (cross-jurisdictional) activity can also be important contributors to systemic importance.

Consider the following statement concerning bank interconnectedness by Randall Kroszner [2010]:[5]

> *Accompanying the diminished role of banks has been an increase in the length and complexity of financial intermediation chains. Rather than a single bank accepting deposits from households and making commercial loans to firms or mortgage loans to other households, the financial system has evolved so that a lending household might purchase shares in a money market mutual fund that holds commercial paper issued by a bank that engages in a repurchase agreement with a securities firm that has a special purpose vehicle that issues asset-backed securities that funds a pool of residential mortgages and that purchases credit derivatives from other financial institutions to hedge*

[5] This is Kroszner's illustration of a financial intermediary chain.

its exposure to these securities and others in its portfolio, etc. You get the picture.

Thus, interconnectedness can also include or be impacted by shadow banks, non-bank institutions, banks in other countries, etc. Any link broken in such a complex chain can lead to a banking crisis.

All Global Systemically Important Banks and Domestic SIBs headquartered in the U.S. and Europe are required by Basel III to submit updated living wills (resolution plans) each year to their regulators. In addition, Basel III requires that G-SIBs maintain minimum a capital ratios as described in Chapter 3.

As we will discuss in the next chapter, the basic capital requirement for all banks and investment companies is 8%, including a minimum of 4.5% Common Equity Capital Tier 1 (CET1 = Common Equity/Risk Weighted Assets). The 8% minimum must include 6% CET1 plus Additional Tier 1 capital, where the additional Tier 1 capital can include derivative or hybrid instruments such as warrants that can be converted into Tier 1 capital. In addition, systemically important banks must maintain additional capital levels of 0-5% depending on their risk-taking and their perceived levels of importance.

D. Early European Bank Crises

We characterized a systemic banking crisis above to be a scenario that occurs when all or most banking capital and liquidity are destroyed by bank runs. Bank crises are characterized by depositor loss of confidence in the banking system, resulting in severe waves of bank failures.

The Roman Banking Crisis

In C.E. 33, the Roman Emperor Tiberius cut back on public works building programs undertaken by his predecessor Augustus, and then hoarded large sums of cash. This hoarding led to a shortage of cash, exacerbated by usury regulations. A real estate bubble induced by a law requiring lenders to invest a portion of their capital in land further tightened the availability of money. A collapse of real estate prices set the stage for the banking crisis that was to follow as bankers began to call back loans. After an embezzlement in a major trading company and the loss of three heavily laden spice ships in a Red Sea hurricane, a leading banking partnership at the time run by Quintus Maximus and Lucius Vibo called in loans from the affected trading and shipping companies. These loan calls led to a depositor run on the bank. Contagion spread as other banks such as the Brothers Pettius and the Corinthian bank of Leucippus, both of whom having dealt with Maximus & Vibo suspended operations or failed (Davis (1910)). Thus, a full-fledged panic in the banking industry ensued, which led to bankruptcies and a roughly 4-year recession (Thornton and Thornton (1990)).Tiberius responded to this panic by providing a massive bailout from his stockpile of cash interest-free loans to bankers in an attempt to stabilize the market. Banks receiving these bailouts were expected to supply interest-free secured loans for three years. The bailout enabled debtors, generally enabled land-owning elites, to repay their loans and retain their social and economic status.

While Rome suffered a true banking panic in the first century, Medieval bank failures tended not to exhibit the levels of interconnectedness that banks exhibited during Roman times or today. A level of interconnectedness occurred within city-states such as Florence and Venice, but not on a major geographic scale. Bank failures during the medieval era tended not to occur in waves, nor did they result in the types of massive banking crises that we have observed over the

past 200 years. Nevertheless, these failures were significant as they did have important effects on local and international economies.

Medieval Banking Crises

We introduced the rise and fall of the Bardi and Peruzzi banking families in Chapter 2. As we discussed, prior to the Black Death plague in the late 1340s, intermittent 14th century poor weather conditions (the "little ice age") in Northern Europe led to numerous crop failures. These crop failures, deteriorating relations between Florence and Naples that caused Neapolitans to withdraw deposits and a Florentine government debt default weakened these banks considerably. Extensive lending in the mid-14th century to King Edward III of England for his part in the Hundred Years War with France was disastrous to the Florentine banking families. Edward III simply repudiated his country's war debts in 1343. Robert, the Angevin King of Naples, also defaulted on his debts, and more general mismanagement of banking operations resulted in massive Florentine banking defaults. Depositor runs and these defaults forced the Peruzzi family bank failure in 1343 (along with the Acciaiuoli) and the Bardi three years later (Kohn (1999) and de Roover (1963)), leading to vanishing credit opportunities, significant economic upheaval and decline in Florence.

The slow decline of the de Medici banking empire in the late-1400s was largely rooted in mismanagement, particularly in foreign branches of the bank, family distractions into Church and political affairs and the Pazzi Conspiracy (a partially successful assassination attempt by rival banking family of Pazzi on Lorenzo and his brother Giuliano de Medici, the latter of whom who died). By 1494 the Medici bank had closed its branches and was nearly bankrupt as Lorenzo's sons were unable to manage the operations, particularly those outside of the Italian Peninsula, and invading French forces caused members of the family to flee. The Medici were expelled from Florence between 1494 and 1512. However, the Medici fortune remained and was directed towards new arenas of power as the family regained its influence. The family sponsored great artists such as Botticelli, da Vinci and Michelangelo, financed the invention of the piano and production of opera, and was able to engage very successfully in the church and return to the political realm.

As the 15th century was drawing to a close, a tight money supply in Venice, high taxes to support significant military expenditures for continued war against the Turks led to severe financial strains in the city. The depositor runs and financial panic that resulted in 1498–1499 caused three of the four main private banks (known as the four columns of the Temple) in Venice to fail and a fairly short-lived economic depression.

Selected Post-Medieval European Bank Crises

Pre-20th century bank failures were frequent, and became more costly as the 20th century approached while banking activities became more internationalized. Many early European bank failures, including those of the Medici of Florence and the Riccardi of Lucca can be attributed at least in part to monarchies that refused or were unable to honor their obligations. Such failures were often associated with wars, particularly to losing combatants.

Selected 18th Century European Bank Crises

Early bank failures in Europe tended not to involve significant contagion, particularly on an international scale. One exception was the 1763 failure of the Dutch banker Leendert Pieter de Neufville, who innovated the use of acceptance loans, a form of securitized credit rather similar

to today's asset-backed commercial paper. When the Seven Years' War ended, with significantly mismatched balance sheet maturities, he could not fulfill his obligations. His failure led to a confidence crisis and failure of other banks, many of which already being overleveraged, in northern Europe. As the global financial system continued to integrate, the incidence of such contagion-influenced international banking crises increased.

The Credit and Commercial Crisis of 1772, as many crises that were to follow, occurred after a huge U.K. credit boom that help fund agricultural production in North America and the West Indies. The crisis started in London when Alexander Fordyce, a partner in the banking house Neale, James, Fordyce and Down, lost huge sums shorting shares of the East India Company. On June 8, he fled to France to evade his repayment obligations. Within a month, a banking panic led to convertibility suspension or the bankruptcy of 20 large banking houses and spread to Amsterdam, and to a lesser extent, elsewhere in Europe. The East India Company was particularly hard hit by the crisis, which left the Bank of England with huge quantities of tea as seized collateral. The Bank of England attempted to unload its surplus tea at above-market prices on the North American colonies, which along with tea taxes imposed by Parliament, injured relationships with the colonies.

Selected European Crises through the 1930s

Nineteenth century English banking panics occurred in 1825, 1847, 1857 and 1866, all before the Bank of England began its policy of injecting liquidity to bail out the system. One of the most prolific European bank bailouts was later, arising from the Barings Brothers Bank crisis of 1890, when Barings defaulted on £21 million in loans secured by Argentinean securities. Barings was a major investor in Argentina when the country defaulted on its debt. Following Bagehot's dictum, the Bank of England formed a consortium of lenders that included the Banque de France, numerous other central banks and U.K. banks including the Rothschilds. The consortium was able to save both the U.K. banking system and Barings from failure, though Barings never again achieved its level of prominence. But, the key here is that the Bank of England did follow Bagehot's dictum, and this near-failure and near-system-wide panic were averted by the Bank of England bailout.

After a turbulent 1920s, European banks began an era marked by financial distress and panics. Shortly after the first wave of U.S. bank panics, Credit-Anstalt, a systemically important universal bank founded and headed by the Rothschild family, and by far the largest bank in Austria collapsed in May, 1931. The collapse of this poorly capitalized bank followed difficulties of its primary industrial borrowers and a forced merger with a second, even more troubled Austrian bank. The failure led to the collapse of the Austrian stock market, Austrian bank runs and, due to its interconnectedness, European banking crises of the 1930s, which were particularly acute in Germany and Central Europe and set off a second round of banking runs in the U.S. The failure provided additional fodder for Nazis to blame Jews for German economic and social troubles. Many countries, including the U.K. left the gold standard within a few months, which impaired international lending and trade.

E. Pre-21st Century U.S. Bank Crises

The United States has suffered many bank panics and crises, 11 between 1820 and 1914 and three (including the S&L Crisis in the late 1980s) between 1930 and 2020. Several of these crises led to economic depressions or severe recessions. Major banking crises subsided after the Great Depression, to resurface in 2008. Over this period, the U.S. banking system operated under

significant regulation under the watchful eyes of an active central bank and federal government deposit insurance. Obviously, the banking environment starkly contrasts with the environment a century before.

Pre-Civil War U.S. Bank Crises

The first banking crisis in the United States arose when William Duer, Assistant Secretary of the Treasury under Alexander Hamilton (Hamilton's and Duer's wives were cousins) used information and connections obtained in his official position, along with substantial leverage to speculate in new U.S. debt and various bank stock issues. He resigned his position in 1791 after learning that Treasury officials were to be prohibited from speculating in Treasury securities, but continued to use his inside connections for speculative purposes. Duer conspired to acquire large loans to purchase large quantities of U.S. debt securities, hoping to control those markets. His speculation and subsequent default and failure was a major cause of the Panic of 1792.[6] Geisst [2004] wrote that "The New York City economy crashed along with him, and Duer was nearly disemboweled by an enraged mob that chased him through the streets. He died in debtors' prison a few years later." Contributing to Duer's shenanigans was the expansion of credit by the Bank of the United States which ultimately led to a run on it. The panic was short-lived as Hamilton encouraged the Bank of the United States to make collateralized loans at high rates and supported other banks in their efforts to continue to extend credit. In addition, Hamilton was able to have the Treasury engage in open market operations to purchase securities.

The U.S. went on to experience bank panics in 1819, 1837-9, 1857, 1873, 1884, 1890, 1893, 1907 and 1933, more banking crises than in any other significant banking system up to the Great Depression (Tilly (2009)). Excepting the first and last, all occurred after the de facto demise of the Second Bank of the United States and all predated the full implementation of the Federal Reserve System. Aside from the 1893 panic, all were largely centered or became centered in the New York and nearby markets, and several were linked to crises in the U.K.

The U.S. Panic of 1819 was driven by European reactions to the Napoleanic Wars, land speculation and general incompetence on the part of the Second Bank of the United States. Similarly, a panic in 1825 followed a stronger British panic that was a further reaction to a post-Napoleonic Wars leading to a stock market bubble and contraction. While the Second Bank's early mismanagement was disastrous, it reformed considerably under Langdon Cheves and Nicholas Biddle. Nevertheless, it had many enemies, particularly Andrew Jackson, and was to come under severe pressure during the Jackson presidential administration.

The Panic of 1837 was much more significant as it led to a major U.S. recession that lasted roughly 5 years. Prior to the Panic, U.S. president Andrew Jackson and Treasury Secretary Roger B. Taney had crippled the Second Bank of the U.S. by transferring all of its assets to state banks. Many of these state banks along with others issued currency that was to be worthless, known as "wildcat money" issued by "wildcat banks." The panic, following the collapse of the New Orleans cotton broker Herman Briggs & Co. resulted from a decline in cotton prices, speculative lending practices, particularly in western states, a collapsing land bubble and slave values and a variety of international monetary issues. After the New Orleans cotton broker collapse, the panic started when New York City and New Orleans banks suspended redemption of commercial paper and paper currency for gold. Bank failures were rampant, and as much as

[6] The formation of the NYSE shortly followed, partly in reaction to the Panic of 1792 and the related market manipulation, an example of an early effort at market self-regulation as the charter members of the new exchange realized that the market needed to be perceived as having integrity in order to survive.

90% of factories closed. Newly inaugurated president Martin van Buren reacted by seeming to follow the hands-off political philosophy of Thomas Jefferson and Andrew Jackson, and dealt with a hostile Congress as the crisis worsened. Conditions were particularly bad in the South as cotton, real estate and slave prices collapsed.

In Chapters 1 and 2, we discussed the New York Clearing House Association system that was used as a sort of lender of last resort during the 60 years prior to the founding of the Federal Reserve System. In addition to providing clearing services, this private clearinghouse system supported ("bailed out") distressed (illiquid) banks seeking to avoid failure, and mitigated the effects of contagion through the banking system. The New York Clearing House provided clearinghouse loan certificates to distressed banks, which were IOUs backed by suitable collateral, typically illiquid but valuable assets. These certificates were used by banks as a temporary substitute for specie and legal tender (cash) to settle accounts between banks. All members of the New York Clearing House were exposed to any losses arising from unpaid clearinghouse loan certificates. In order to protect itself and its members, the Clearing House set capital requirements, audited its member banks and penalized members for violating rules, much as a modern-day regulator such as the Fed might. However, the Clearing House limited their activities to New York City, a necessity because of the lack of modern communication ability.

The U.S. Panic of 1857 was less tumultuous, mostly impacting the Great Lakes region and the East. To a large extent, the panic was related to the financing of railroad construction in the West and land speculation. A number of securities brokers failed after having borrowed from eastern banks to finance their investments in securities markets, leading to the failure of the Ohio Life Insurance and Trust Company and soon extending to other banking companies, including Philadelphia's Bank of Pennsylvania. Bank runs ensued quickly throughout the country, owing in part to the new construction of the telegraph system. However, the panic resolved in about two months, and only a small number of banks ultimately failed during the panic, though a relatively mild recession did follow. Members of the New York Clearing House Association (see Chapters 1 and 2; Now the Clearing House), formed only a few years earlier in 1853, issued clearinghouse loan certificates, distributed by the Clearing House and backed by securities held by member banks to be used as a sort of currency to help banks maintain liquidity and settle their balances.

Gilded Age Bank Crises

The American Gilded Age (referring to a thin gold veneer on the outside but base metal inside) spans from the National Currency Act of 1863-4 through the founding of the Federal Reserve in 1913. This period, also known as the National Banking Era, corresponded with significant economic growth that was marred by a number of banking crises, beginning with the Banking Panic of 1873. The panic was rooted in Europe, including the German decision to abandon the silver standard and the resulting decline in its price. European demand for American agricultural products declined as did European investment in the U.S., particularly after the Austrian stock market crashed. Americans were beginning to doubt the value of their currency, then called greenbacks. In the U.S., the over-expanded railroad industry was an important trigger. The panic was sparked in the U.S. by the failure of Jay Cooke & Co., a major investment bank (See Chapter 2). Cooke's failure followed its investment in the Northern Pacific Railroad and the railroad's inability to secure adequate bond financing. The failure of Cooke sparked a stampede on the New York Stock Exchange. The U.S. stock market collapsed after the failure and the NYSE closed for 10 days. New York had to call in the militia to maintain order. Over 25% of U.S. railroads failed. More brokerage and investment banking institutions were

bankrupted and over 100 banks failed throughout the U.S. in a chain reaction. As in 1857, the New York Clearing House issued clearinghouse loan certificates to help banks maintain liquidity and settle their accounts, which helped to ease the panic. The Panic of 1873 set off the economic depression that lasted from 1873 to 1879, known as the Great Depression until 1893.

The Panic of 1884 was much smaller in scale and its effects were less severe than the Panic of 1873. First, the Marine National Bank and the securities broker firm Grant and Ward (co-founded by former president U.S. Grant) failed as a result of speculation and the Ponzi scheme operated by Ferdinand Ward and James Fish, a partner in both failed firms. The Second National Bank experienced a run after its president John Eno embezzled $3 million and fled to Canada. The Metropolitan National Bank then closed temporarily after another run, which was set off by (false) rumors that its president was speculating on railroad securities with money borrowed from the bank.

Similarly, another panic 6 years later, the Panic of 1890 was limited in scale and duration. The failure of the brokerage firm Decker, Howell & Co. threatened failure of its bank, the Bank of North America. When depositors feared the bank would fail, they began a bank run, which spread to other banks. The banker J.P. Morgan then led a consortium of 9 New York City banks in extending credit to the Bank of North America. The New York Clearing House issued loan certificates, restoring faith in the Metropolitan Bank, other banks and the banking system, ending the crisis. Neither the 1884 nor the 1990 panics were severe enough for banks to suspend convertibility of cash deposits into cash.

In many respects, the Panic of 1893 was similar to the Panic of 1873, with both rooted in railroad overbuilding, both resulting in deep economic depressions, with unemployment rates rising as high as 20%. Per capital GDP in the U.S. fell by an estimated 8% in 1893 and by another nearly 7% in 1894. As loan defaults rose, New York banks suspended making cash payments and prohibiting large withdrawals, followed by banks in other cities. Over 600 banks failed or suspended operations, and citizens and banks hoarded cash. The banking crisis had two phases, with the first starting in the interior of the U.S. and spreading to New York and the second starting in New York and spreading to the interior (Carlson (2002)).

Some attribute the Panic of 1893 to the Sherman Silver Purchase Act of 1890, which required the U.S. Treasury to significantly increase its purchases of silver (e.g., see Dupont (2014)). These purchases worried many that the United States would abandon the gold standard. Such concerns drove up the demand for gold, which drained the Treasury's holdings, diminishing the financial system's liquidity and the Treasury's holdings of gold. Ultimately, panic struck the stock market in 1893, particularly the shares of the Philadelphia and Reading Railroad and of other railroad industry firms. The U.S. government intervened little as economic downturns were regarded by President Cleveland and others to be natural parts of business cycles, and there was no central bank to inject cash into the system. However, as in 1857 and 1873, the Clearing House issued clearinghouse loan certificates to help banks maintain liquidity and settle balances between banks, but settling the bank crisis did not prevent approximately 5 years of recession.

The 1906 San Francisco earthquake triggering a liquidity crunch had left the wider U.S. economy rather fragile. In 1907, three speculators with banking backgrounds, F. Augustus Heinze, his brother Otto and Charles Wyman Morse (an experienced market manipulator), incurred huge losses in a dismally failed effort to corner the stock of United Copper to squeeze short-sellers (a "bear squeeze"). Runs, largely by "country banks" on New York banks associated with the three speculators ensued, which initially abated when the New York Clearing House

Association issued loan certificates to the affected banks, summing to about 14% of total currency value, but only those banks that were Clearing House members.

Knickerbocker Trust, New York's third largest trust company, like most other trust companies, was not a Clearing House member. Trust companies, which issued unsecured loans, were major financiers for investors and speculators on Wall Street, including the effort to corner the United Copper market. When news broke that its president, Charles T. Barney was an affiliate of Morse, a run ensued on Knickerbocker. The National Bank of Commerce extended loans to Knickerbocker, which then sought aid from the Clearing House. Clearing House aid had been denied to Knickerbocker because it was not a Clearing House member, and was denied to the National Bank of Commerce because the requested aid was perceived to be an indirect request on behalf of Knickerbocker. Then Knickerbocker sought aid from the banker J. P. Morgan, which was denied because it had engaged in "rule-breaking" activities, was insolvent anyway and did not participate in the Clearing House system. Morgan believed that a bailout of Knickerbocker would exacerbate the moral hazard problem for banks.

Knickerbocker collapsed, which spread fear throughout the system, and banks and individuals began withdrawing their deposits from New York City banks and trust companies. Within 10 days of the Knickerbocker failure, 24 bank failures followed. Banking holidays (temporary bank closures) were declared in several western states and depositor access to their deposits was limited in other states. A full-fledged banking panic ensued, but was mitigated by Morgan, who pledged his own funds and convinced other bankers and industrialists such as Rockefeller to do the same in order to shore up the banking system. Their bank deposits, particularly a $10 million Rockefeller deposit at National City Bank improved bank reserves. These deposits along with $100 million in National Clearing House loan certificates rescued the banking system though there was still a crisis in the stock markets. The severity of this bank crisis along with the reliance on a private citizen to bail out the banking system ultimately led to the creation of the Federal Reserve System in 1913.

The Banking Crisis of 1907 led to the Aldrich-Vreeland Act of 1908, which established the National Monetary Commission charged with studying bank crises and to recommend reforms to the banking system. After roughly five years of study, hearings, legislative debate and much contention, The Federal Reserve Act of 1913 was signed into law by President Wilson.

Bank Crises During the Great Depression

The U.S. stock market famously crashed in October 1929 and the country fell into its worst depression ever. Romer (1990) argued that this crash created economic uncertainty that reduced household purchases. Banks made fewer loans to companies and industrial production reductions followed (e.g., Calomiris and Wilson (1994)). Nervous depositors began increasing their withdrawals from banks in late 1930, hoarding cash and gold, which forced banks to begin liquidating loans. This shrinkage in bank assets decreased the U.S. money supply, further shrinking the economy and causing monetary deflation. 761 U.S. banks failed between November 1930 and January 1931 (Friedman and Schwartz (1963)). While the bank failure rate slowed after early 1931, it increased considerably in 1932. Ultimately, from 1930 to 1933 almost 10,000 banks failed and on March 6, 1933 a 4-day national bank holiday was declared, which ultimately ended the banking crisis, but the depression raged on despite the founding of the Federal Deposit Insurance Corporation to insure bank deposits.

The banking panic that accompanied the Great Depression was different from the U.S. panics that preceded it. First, the country had already entered a depression before banks began

failing in late 1930, whereas earlier panics occurred near the peaks of business cycles. Great Depression bank panics were more widespread than earlier panics, and depositor total losses were greater (Calomiris and Gorton (1991)). Banking panics occurred during three fairly distinct waves between 1930 and 1932. Although three waves are generally identified, a much larger number of bank failures occurred outside these waves and in some respects, one or more of these waves may have had stronger regional than national qualities (Wicker (1996)).

Discount window lending by the Fed had occurred during 1920-21, saving the economy from a banking crisis at that time, but borrowing banks were stigmatized. The Fed continued to discourage and stigmatize lending through its discount window through the 1920s, and only "stigmatized" lending was available from the Fed discount window in 1930. Furthermore, only about a third of U.S. banks were members of the Federal Reserve System at this time. Banks cut their own lending in 1930, preceding and during the crisis, as became more typical after the Great Depression. A number of banks failed in 1930, but many more in 1932 and 1933. Unit banking (prohibitions on branching) seem to have been closely associated with bank runs, which were significantly more common where branching was prohibited than where branching was allowed. This effect was more pronounced when single-branch banks operated in geographic regions dominated by a single industry (Calomiris (1990), Wheelock (1995)). Canadian banks during the era were permitted to branch and did not experience a crisis despite lacking a central bank until 1935.

The causes of the Great Depression and the banking panics from 1930-33 are still being debated. But, there are a number of possible contributors. The stock market crash played some role, perhaps serving as a trigger in the economic collapse that was to follow. It does seem that the Fed and the U.S. government did allow the rampant speculative lending that preceded the crash. Banks loaned liberally to investors and investment institutions who purchased securities on margin (bought shares with borrowed money) and engaged in a variety of risky and questionable investment practices. For example, Caldwell & Company, a Nashville, Tennessee municipal bond trading house, was virtually bankrupted by the 1929 market crash. Caldwell, which already controlled the Bank of Tennessee, purchased the holding company of the National Bank of Kentucky through a stock swap, using the bank to lend itself needed cash as it tried to bail itself out of its crisis. Depositors en-masse withdrew their funds from Caldwell-affiliated banks, sparking a widespread panic on almost all the banks in the region of Nashville, causing 120 to fold in the greater area.

The United Kingdom may have contributed to the later U.S. banking panic when it departed the gold standard in late 1931, creating fear that the U.S. would follow. In many respects, it appears that the Fed failed to fully engage its discount window, which might have mitigated the banking crisis as well as the Great Depression itself. But, the Fed was not the only blameworthy government entity. For example, the Smoot-Hawley Tariff Act signed into law by President Herbert Hoover in 1930 dramatically increased the cost of imported goods and led U.S. trading partners to retaliate with their own tariffs and trade restrictions. The protectionist trade wars that followed were costly to all major international economies and persisted through World War II.

F. The Financial Crisis of 2008

The worst banking crisis since the 1930s was in many respects as much a shadow banking crisis. *Shadow banking* occurs when essential activities that are normally conducted by banks, are undertaken by less regulated institutions, typically by investment banks, and perhaps

by certain mutual funds, nonbank banks and hedge funds. The 2008 crisis was less characterized by "old-fashioned" runs on banks by panicked depositors, and more by panics in repo, commercial paper and other short-term funding markets in which institutions refused to provide the usual short-term funding that banks and shadow banks relied on. Essentially, the 2008 crisis was a system-wide run by institutional providers of credit.

The Lead up to the Crisis

In Chapter 6, we discussed some of the securities and markets that facilitated growth in U.S. mortgage markets, and in Chapter 7, we focused more on moral hazard and related questionable behavior in such markets. Nevertheless, by the spring of 2007, there were increasing reports in the U.S. of troubled mortgages and weakening of the securitized assets and portfolios that contained them. Large numbers of mortgage borrowers experienced significant declines in their home values, particularly borrowers characterized as subprime or Alt-A, with many left with negative equity positions in their homes. In addition, refinancing of adjustable rate and teaser rate mortgages and loss of job income further pressured borrowers and secondary mortgage markets. Tensions increased during late June and July of 2008 when two of investment banker's Bear Stearns' subprime mortgage funds failed.

These spring 2007 reports had followed a period of rapid U.S. residential construction and the 2006 peak of U.S. housing prices. The April 2007 bankruptcy of New Century, a U.S. REIT (Real Estate Investment Trust) specializing in sub-prime mortgages, was the first major sub-prime failure. Housing prices continued to decline, and by the end of 2007, Countrywide Financial Corporation, one of the largest banks in the United States, was seeking shelter (it was absorbed by the Bank of America). In the U.K., Northern Rock experienced the U.K.'s first depositor run in 150 years in February, 2008 before the bank was nationalized, and was ultimately purchased in 2012 by Virgin.

The U.S. financial system took a significant blow in March 2008 when Bear Stearns, one of the largest investment banks in the United States, collapsed, to be rescued by JP Morgan Chase with backing from the Federal Reserve. The special lending facilities of the Federal Reserve opened the discount window to investment banks to prevent an industry-wide collapse, which surely would have hit the banking sector hard. IndyMac Bank FSB, another major depository institution, failed in July 2008, was nationalized and then sold to IMB Holdco, a consortium of private equity investors led by Steven Mnuchin. IMB Holdco renamed the remainders of IndyMac to OneWest Bank, which was later acquired by the CIT Group in 2015.

In a manner similar to many earlier banking crises (less true with the Great Depression crises), the 2008 U.S. banking crisis followed a period of substantial growth in lending, largely attributable to:

1. Removal or easing of regulations on banking and other financial institutions, such as passage of the Commodity Futures Modernization Act of 2000, which exempted Over the Counter swaps and derivatives from regulation by both the Commodities and Futures Commission (CFTC) and the Securities and Exchange Commission (SEC). Such regulatory lapses contributed to the rapid growth of the *sub-prime mortgage* (home loan issued to a borrower with a poor credit rating) and securitization markets. Similarly, the 2004 relaxation of the Net Capital Rule, which allowed 5 major investment banks to significantly reduce their capital (all five failed or nearly failed during the financial crisis). Perhaps, the most significant was the Financial Modernization Act of 1999 (also

known as the Gramm-Leach-Bliley Act) ending Glass-Steagall banking restrictions, allowing for both shadow banking and for depository banks to participate in higher risk securities market activities. Such deregulatory activity, including all of these acts, are discussed in the next chapter, and the absence of comprehensive regulatory restraints helped enable shadow banking firms such as Lehman Brothers play active roles in purchasing, owning and distributing high-risk assets.

2. Regulatory supervision of major investment banks was inadequate, in part because of inadequate supervisory resources, particularly in the S.E.C. (See, for example Duffie (2019) on the S.E.C. supervisory limitations). The increasing reliance on market-disciplining mechanisms also failed to reign in investment bank risk-taking, in part because of the complexities of financial instruments and accounting statements and lack of overall transparency.
3. Policies of all then-recent presidential administrations and enactment of legislation served to encourage wide-spread homeownership and homeowner leverage. For example, the Community Reinvestment Act of 1977 required the Federal Reserve and other federal banking regulators to encourage financial institutions to serve the credit needs of communities in which they do business, including low- and moderate-income neighborhoods. The Federal Housing Enterprises Financial Safety and Soundness Act of 1992, in addition to providing for regulation of Fannie Mae and Freddie Mac, established HUD-imposed housing goals to ensure mortgage financing of affordable housing in central cities, rural and other underserved areas. That is, Fannie Mae was required to serve the following markets: low- and moderate-income and underserved. The goals of the Act were to increase home-ownership among low-wealth and minority groups. Laudable goals, surely, though these efforts might have yielded unintended consequences. Essentially, the federal government undertook great effort to encourage and enable family homeownership, regulated financial institutions, in large part cooperated, fanning the heat in mortgage markets.
4. The creation of new types of loans, other financial instruments such as sub-prime mortgages and mortgage-based derivatives such as CDOs, etc, and financial processes such as securitization. These new instruments and processes gave banks opportunities to take a variety of types of new positions in mortgage risk, and the presence of these instruments made it more difficult for regulators to accurately gauge risk.
5. Relatively low rates of interest over many years. However, in the 2-3 years leading up to the crisis, interest rates had begun to rise, particularly hurtful to mortgage borrowers with variable rate mortgages.

The Crisis

The financial crisis moved into full swing in September 2008 when Freddie Mac (Federal Home Loan Mortgage Corporation - FHLMC) and Fannie Mae (the Federal National Mortgage Association - FNMA) were placed under U.S. government conservatorship. Lehman Brothers, the major investment bank that had practically morphed into a subprime mortgage hedge fund, filed for Chapter 11 bankruptcy protection on September 15, 2008. This bankruptcy was momentous, as Lehman-related instruments and assets became toxic, institutions were wary of any collateral that might include Lehman and Lehman counterparty instruments. This toxicity froze interbank lending markets both in the U.S. and in Europe and even led to runs on money

market funds and credit reductions to industry. The core of the world financial system failed to effectively perform its essential functions on behalf of the real economy.

The American International Group (AIG, the huge insurer underwriting substantial amounts of risk in the MBS markets) failed later in the month as did Washington Mutual Bank. The huge U.S. broker Merrill Lynch was on the brink of failure and was absorbed into Bank of America. The investment banks Goldman Sachs and Morgan Stanley obtained Fed "fast-track" approval to become bank-holding companies so that they could receive Fed aid as deposit banks if needed. By October 2, a $700 billion Toxic Asset Relief Plan (TARP) was passed by Congress and later, the Obama administration announced an increase to $250,000 of the FDIC deposit insurance limit per account. The Fed extended up to $9 trillion in government-backed loan guarantees in a fund created after the failure of Bear Stearns. Banks began hoarding cash and the United States had entered its worst recession since the Great Depression.

Note that the 2007-09 financial crisis in the United States did not involve a wide-spread depositor bank panic, at least in the traditional sense. However, it is clear that banks were obviously inextricably linked to the crisis and bank funding did dry up. The United Kingdom has experienced no wide-spread banking panics after the Bank of England followed Walter Bagehot's suggestions to engage in discount window lending. The experience of these two countries might suggest that while the creation of government central banks has not prevented all types of financial failures and crises, central banks might be able to at least mitigate or maybe eliminate banking depositor panics.

The Aftermath

In the U.S. banking industry, the G.A.O. [2013] reported that 414 FDIC insured banks and thrift institutions failed over the 4-year period 2008-2011. Many of these failures were rooted in the U.S. sub-prime financial crisis. The majority (85%) of these banks held less than $1 billion in assets, with disproportionate numbers failing in Georgia, Florida, Illinois, California and Minnesota. Many of these failed banks also had implemented aggressive growth strategies using nontraditional, riskier funding sources and seemed to maintain weak underwriting and credit administration practices. Such aggressive growth tactics have been characteristic of failures in many earlier eras.

More generally, the direct longer term consequences of the crisis are more difficult to know with certainty, and many factors were likely to have contributed to the hardships that were to follow. The U.S. stock market lost a combined total of almost $8 trillion between late 2007 and March, 2009. Another $9.8 trillion was lost in residential real estate market value. A deep recession in the United States certainly followed the crisis, with the unemployment rate reaching almost 10% and millions losing their homes, but it is a bit harder to know whether the crisis actually caused the recession. Perhaps, both the financial crisis and the recession shared common causes.

The Managing Director of the IMF, Dominique Strauss-Kahn, blamed the world-wide financial crisis, which was then just emerging on "'regulatory failure to guard against excessive risk-taking in the financial system, especially in the U.S." Somewhat similarly, Levin–Coburn Report undertaken by the U.S. Senate concluded that the crisis resulted from "high risk, complex financial products; undisclosed conflicts of interest; the failure of regulators, the credit rating agencies, and the market itself to rein in the excesses of Wall Street." Some observers, including the economist Paul Krugman, decried the lack of appropriate regulation of shadow banks,

referring to "benign neglect." Numerous other commissions and reports also attributed the crisis, more than any other cause, to widespread failures of financial regulation and supervision.

Nearly all observers found the state of U.S. regulation to be in need of major revision, though there was much controversy as to what form it should take. In a painfully contentious process, the U.S. Congress undertook to overhaul financial regulation, resulting in the Dodd-Frank Act of 2010 and other legislative actions that we will discuss in the next chapter. Populist movements (e.g., the Tea Party) egged on austerity measures, hampering the ability of the government to implement fiscal measures to stimulate the economy. Resentment towards the federal government ran deep, helping to install Donald Trump as U.S. president in 2016 (Tooze (2018)).

Outside the U.S.

The U.S. banking crisis spilled over or was concurrent with crises of many banking systems, particularly in Europe, as over a third of U.S. mortgage securities were taken up there. Effects were immediate and harsh on the U.K., where the economy lacked a significant manufacturing base, with an economy that was largely dependent on financial services, real estate, and retail sales. The U.K. quickly responded to the banking crisis, with the Bank of England creating the Bank Recapitalisation Fund in 2008 and arranging the October 2008 bailouts of RBS (Royal Bank of Scotland), HBOS (Halifax and Bank of Scotland) and, in early 2009, Lloyds. On the fiscal side, the U.K. cut the V.A.T. in November, 2008.

Belgium had to bail out two of its largest banks, Fortis and Dexia. Spain, which enjoyed substantial GDP growth rates during the late 1990's and early 2000's, experienced a crisis due in large part to its bubble in real estate prices. A €100billion credit package was secured from the EU to bail out its banking system. Instead of nationalizing banks, Spain restructured and reduced their sizes as part of its bailout programs, and in many instances, extended loans to banks.

Russia was already in economic recession, hurting from a decline in oil prices and embroiled in regional conflicts such as with Georgia. Ukraine was also in recession, due to slumping steel prices, a reduction of gas supplies from Russia and already extant banking issues.

Ireland experienced one of Europe's highest growth rates in GDP in the years leading up to the financial crisis, particularly in its financial industries. However, after a collapse in domestic property values and becoming the first Eurozone country to experience recession, Ireland quickly responded to the Lehman Brothers collapse by guaranteeing €440billion in debt of 6 Irish-owned financial institutions (e.g., AIB, which ultimately was effectively nationalized, and the Bank of Ireland) and one non-Irish bank. The country injected billions into its major banks, taking back equity stakes, and created a National Asset Management Agency to purchase bad loans from these institutions.

Iceland experienced particularly dramatic growth in its banking industry during the years preceding the U.S. financial crisis. By the second quarter of 2008, Iceland's external debt was more than 7 times its GDP and asset levels of its three largest privately-owned banks added to more than 11 times the country's GDP, leading to the Central Bank of Iceland being unable to act as a lender of last resort. All three of these banks defaulted in late 2008 following runs on their deposits in the Netherlands and the United Kingdom, resulting in the largest systemic banking collapse ever in the world relative to the size of a national economy. Without the ability to bail out major banks, Iceland placed its banks into receivership. This collapse led to 90% drop in Icelandic stock prices and an economic depression in 2008–2010. A number of Icelandic bankers were imprisoned for a variety of crimes, including fraud, insider trading, market

manipulation, embezzlement, breach of trust and tax non-compliance. By 2012, Iceland seemed to have recovered quite successfully.

A deep European recession also followed the banking crises. Greece, Ireland, Portugal, Spain and Cyprus all suffered widespread banking crises, requiring E.U. and I.M.F. bailout assistance. None of the five governments listed here were able to bail out their banks and each found themselves struggling to pay their own government debt. The European Central Bank began buying government bonds in the Fall of 2012 to shore up financing of individual eurozone countries. National members of the eurozone established the *European Stability Mechanism*, a permanent eurozone bailout fund with five hundred billion euros. Efforts such as these seem to have helped stabilize European markets. Populist and nationalist movements also ran deep in Europe, right-wing nationalist parties to positions of power in many parts of Europe (Tooze (2018)).

G. Causes Underlying Bank Crises

Banking is the most fragile activity in finance. Banking is highly leveraged, even relative to the rest of the financial industries, and the nature of the banking industry lends itself to frequent and costly panics. Banking panics occur in an industry in which most capital (deposits) is provided on a short-term basis to fund assets that are more long-term in nature. Liquid assets are needed to fund satisfaction of bank obligations. When liquid assets shrink unexpectedly or sharply to fund withdrawals of from deposits, the bank eventually becomes illiquid and cannot satisfy its obligations. Depositors realize that time is of the essence in withdrawing their deposits. This causes contagion and spreads to other banks in the system as runs spread to other banks and those banks renege on their obligations as well, turning into a wide-spread banking panic.

Why are there banking panics and crises? This simple question doesn't have a simple answer. We do know that banking crises, including late 19th century and early 20th century panics often follow periods of substantial growth in lending, called credit booms, which are frequently attributed to:

1. Removal or easing of regulations on banking and other financial institutions,
2. The creation and use of new types of loans or other financial instruments.
3. Businesses and financial institutions often increase their risk-taking during a boom, especially later in a boom in order to exploit profit opportunities.
4. Businesses and financial institutions often seek to improve their profitability by borrowing more, leveraging their operations, increasing the frequency of defaults.

While such liberalizations often promote long run economic efficiency and growth, they can lead to poorly-managed credit booms. Credit booms can lead to asset bubbles, inflating collateral prices well beyond their intrinsic values, as we observed in the lead-up to the 2008 financial crisis. Creating and managing new lending policies under liberalized credit regulations or with new financial instruments can be associated with bad loan portfolios and poor bank risk management. Many panics and crises are set off by some sort of shock either in the bnking system or in the wider economy.

In addition, as we discussed earlier, increases in interest rates can increase adverse selection, as only riskier firms are willing to borrow money at the higher rates. Hence, increasing interest rates often, but by no means always precede a financial crisis. As we discussed, banks

often respond to this phenomenon by rationing credit, but increasing riskiness of loan portfolios often result in the absence of credit rationing.

An early view of banking crises is that they are a natural result of the business cycle (e.g., Mitchell [1941], Kindleberger (1978)), further supported by Gorton (1988) who finds a link between business cycles and subsequent panics during the U.S. National Banking era (1863-1813). In such frameworks, the economy experiences some economic shock or goes into recession or depression, these fundamentals lead to non-payment of bank loans, which in turn cause depositors to seek deposit withdrawals.

Many more recent models of banking crises build on the view of Kindleberger (1978) as occurring spontaneously as a result of mob psychology or panic. A panic occurs as a self-fulfilling prophecy. Banking crises often follow asset bubbles, which themselves, might be fueled by excess liquidity and credit. The following lists a few additional rationale for bank crises, all drawing from insufficient bank liquidity:

1. *Friedman and Schwartz (1963)* assert that banking panics are the result of shocks and affect the real economy. They further assert that early 1930s banking panics were not precipitated by weakening macroeconomic indicators; they were panic-based. Failing banks were more illiquid than insolvent, and the crisis was more a "contagion of fear." Insufficient Federal Reserve discount window lending intensified the crisis. The empirical study of Calomiris and Mason (2003) fails to support this panic hypothesis, arguing that weak fundamentals were the cause of most but not all of the bank failures. Regardless, Friedman and Schwartz state that "Federal insurance of bank deposits was the most important structural change in the banking system to result from the 1933 panic and, indeed in our view, the structural change most conducive to monetary stability since state bank note issues were taxed out of existence immediately after the Civil War" (p.434).
2. *Diamond and Dybvig (1983)* argue that banks create liquidity by offering deposits that are more liquid (demand and short maturity deposits) than the assets (business loans) that they hold; that is, depositors prefer the liquidity offered by deposits more so than do borrowers. A bank run is the result of depositors initiating one so as to not be victimized by such a run; that is, bank runs occur because they are expected to occur regardless of borrower investment returns. Such panics are the result of random withdrawal rates. Only the first depositors in line receive their money back. The paper concludes that deposit insurance (relative to suspension of convertibility of currency into gold) best reduces the incidence of runs by eliminating the incentive for the patient depositor to participate in a run.
3. *Allen and Gale (1998)* assert that bank runs are triggered by signals or expectations of low investment returns (economic fundamentals). They conclude that deposit contracts (deposit payouts being a function of time - CDs) and discount window lending can prevent crises.

Exercises

1. A small bank has a loan portfolio with a current value equal to $80,000,000. The portfolio's returns tend to be normally distributed with a 1% daily standard deviation and uncorrelated over time. The bank will use its *VaR* calculation to produce the maximum value of the loss that it is willing to incur on its portfolio at several thresholds. In particular, the bank seeks to calculate its portfolio *VaR* at 95% and 99% over a single day and over a 30-day month. That is, the bank seeks to calculate the maximum loss that it can incur over these two periods at each of these two probability thresholds. What are these four threshold values? How might these *VaR* figures be interpreted?

2. A bank is conducting a very simple stress test example based on its total current market value equal to 80 billion in long-term mortgage assets and $20 billion market value in one-year zero-coupon treasury bills. These assets are funded with $90 billion (market value) in one-year deposits. At present, all interest rates are 3%. All of the bank's mortgages mature in 10 years, with balloon payments (one-time at maturity) of $120.95 billion (the PV of $120.95 billion in 10 years is $80 billion or $120.95 billion/$(1+.03)^{10}$). The Treasury bills and the bank's deposits mature (and roll over at the then prevailing market interest rate) in 1 year. The deposits require a balloon payment of $92.7 billion (the PV of $92.7 billion in 1 year is $90 billion, or $92.7 billion/(1+.03)). The treasuries will produce a payment in one year equal to $20.6 billion. Thus, the bank's current equity market value is $10 billion, or $100 billion - $90 billion, as in the table below. Now, subject the bank to stress, in particular, an increase to 5% in all interest rates. What would be the effect on the bank's capital (equity) and cap (equity to total assets) ratio?

Pro-Forma Balance Sheets: Before Interest Rate Stress

$billions

Assets		Capital	
Treasuries	20	Deposits	90
Mortgages	80	Equity	10
Totals	100		100

3. As we discussed in this chapter, during the U.S. bank crises of the 1930s, unit banking (prohibitions on branching) seems to have been closely associated with bank runs. Such runs were significantly more common where branching was prohibited than where branching was allowed. Furthermore, this effect was more pronounced when single-branch banks operated in geographic regions dominated by a single industry. Why might bank runs be more common where unit banking and single-industry economies prevailed?

4. In the 19th century U.S., the New York Clearing House issued private clearinghouse loan certificates during bank panics. These certificates, essentially promissory notes collectively guaranteed by the Clearing House could be used by distressed banks to satisfy their obligations. Why might these certificates be considered a form of deposit insurance?

5. From 2004 to 2007, not a single bank failed in the United States. Bank failures are painful to nearly all those involved. Government regulators have an obvious interest in preventing bank failures, as they are costly to taxpayers, to other bank stakeholders and to the economy as a

whole. Might a total absence of bank failures constitute a negative signal about a banking system? If so, what?

6.a. Unlike in the United States, the Canadian banking system allowed for widespread branching for banks during the 19th century and early 20th century. Yet the Canadian banking system experienced no major banking panics or crises whereas the U.S. system experienced frequent panics and crises. Bank failures in Canada during this era were both less frequent than in the U.S., and the costs of failure were less (Calomiris and Gorton (1991)). Is it possible that branch banking might have helped prevent major bank failures, panics and crises? If so, how? If not, why not?

b. Deposit insurance was originally instituted in the United States in 1829 with the opening of the N.Y. Safety Fund, which lasted until 1866. At the time, New York did not allow branch banking. In addition, deposit insurance funds later opened in 14 states, including Michigan and Vermont, in which none permitted branch banking (See Caprio and Honohan (2001)). These states tended to have the most fragile banking systems in the U.S. Why might banking instability have been such a problem in these states in which banks had affiliations with deposit insurance funds?

7. In an economy with reasonably low inflation rates, why might one anticipate that money supply typically falls during a banking panic?

8. Banking panics and crises often follow periods of substantial growth in lending, called credit booms.

a. What causes such credit booms?

b. Why might such credit booms cause or at least predate banking panics and crises?

Solutions

1. First, note that normal curve areas (*z*-values) consistent with these probabilities are:

.95: 1.645

.99: 2.326

VaR is calculated for each of the 4 circumstances is calculated as follows:

$$VaR = \$80{,}000{,}000 \times .01 \times z \times \sqrt{t}$$

$$VaR = \$80{,}000{,}000 \times .01 \times 1.645 \times \sqrt{1} = 1{,}316{,}000$$

$$VaR = \$80{,}000{,}000 \times .01 \times 2.326 \times \sqrt{1} = 1{,}860{,}800$$

$$VaR = \$80{,}000{,}000 \times .01 \times 1.645 \times \sqrt{30} = 7{,}208{,}028.86$$

$$VaR = \$80{,}000{,}000 \times .01 \times 2.326 \times \sqrt{30} = 10{,}192{,}021.35$$

Thus, we can infer with 95% certainty that the portfolio's loss on a given day will not exceed $1,316,000. Similarly, we can infer with 99% certainty that the portfolio's loss on a given day will not exceed $1,860,800. We can also infer with 95% and 99% certainty that the portfolio's loss on in a given month will not exceed $7,208,028.86 and $10,192,021.35.

2. As a result of the interest rate increase from 3% to 5%, the market value of mortgages would fall from $80 billion to $74.25 billion ($120.95 billion/(1+.05)^10), the value of treasuries would fall to $19.62 billion ($20.6 billion/1.05), while the value of deposits would fall to $88.29 billion ($92.7 billion/1.05). Obviously, bank asset value dropped by more than liability values, though equity value is still positive. The bank remains solvent after the interest rate increase, though probably undercapitalized at current requirements with a cap ratio equal to 5.58/93.87 = 5.944%.

Pro-Forma Balance Sheets: After Interest Rate Stress

$billions

Assets		Capital	
Treasuries	19.62	Deposits	88.29
Mortgages	74.25	Equity	5.58
Totals	93.87		93.87

3. Diversification is the key to each part of this question. Unit banking prevents banks from diversifying geographically. Single-industry economies prevents economic and labor diversification, which represents a danger to any unit bank within that geographic region. Note that Canadian banks during the era were permitted to branch nationally and did not experience a crisis.

4. From the perspective of depositors, clearinghouse loan certificates acted as a form of deposit insurance because they, in effect, transformed claims on a single distressed bank into claims on the bank plus coinsurance supplied by the coalition of member banks of the Clearing House.

5. Failure is a normal process in a healthy market. The absence of bank failures might indicate stagnation or lack of dynamism in the banking industry or even the economy as a whole. If banks do not fail, perhaps we should ask whether regulators are properly gauging risk and whether inefficient banks are prevented from being replaced by more efficient banks. In addition, we should be wary of cronyism, for example, whether non-market forces such as the government are propping up inefficient banks, thereby simply forestalling failure or healthy competition.

6.a. It is possible. First, recall the discussion on the chapter concerning how unit banking seemed to have been associated with banking failure and crises during the Great Depression. Branch banking allows for bank geographical diversification, across state lines, into different economic environments, etc. This diversification may well limit banking risk and failure. In addition, widespread unit banking offices make it more difficult for banks to coordinate their responses to regional and national level shocks, worsening liquidity and solvency in the banking system and the ability for the banking industry and government to respond to crises.

b. Banking stability have been such a problem in these states in which banks had affiliations with deposit insurance funds for a number of potential reasons. First, states with fragile banking systems might have the greatest demand for deposit insurance. Second, unit banking, or lack of branch banking might have contributed to banking fragility due to lack of bank portfolio diversification and the resultant increase in bank risk.

7. In a fractional reserve banking system, most of the money in the economy is reflected in bank deposits, particularly demand deposits of checking accounts (See Chapter 1). Banking systems rely on the depositor confidence that they will be able to convert their bank deposits to cash whenever they choose. Loss of this confidence causes depositors to rush to withdraw their deposits before other depositors do the same. Multiplier effects cause deposit declines to more dramatically reduce credit and overall money supply. Such decreases in credit and money supply tend to reduce consumption and investment and overall economic output.

8.a. Credit booms preceding banking panics and crises are often attributed to:

1. Removal or easing of regulations on banking and other financial institutions,
2. The creation of new types of loans or other financial instruments.
3. Businesses and financial institutions often seek to improve their profitability by borrowing more, leveraging their operations, increasing the frequency of defaults.

b. Banking panics and crises might result from credit booms because:

1. Credit booms can lead to asset bubbles, inflating collateral prices well beyond their intrinsic values, as we observed in the lead-up to the 2008 financial crisis.
2. Creating and managing new lending policies under liberalized credit regulations or with new financial instruments can be associated with bad loan portfolios and poor bank risk management.
3. Many panics and crises are set off by some sort of shock either in the banking system or in the wider economy and exacerbated by leverage created by the credit boom.
4. Eventual increases in interest rates can aggravate adverse selection, as only riskier firms are willing to borrow money at the higher rates, with the economy being more fragile as riskier firms predominate.

References

Allen, F. and D. Gale (1998): “Optimal Financial Crises,” *Journal of Finance* 53, 1245-1284.

Bordo, Michael D. (2007): "A Brief History of Central Banks," *Commentary*, Federal Reserve Bank of Cleveland. Accessed July 15, 2013, <http://www.clevelandfed.org/research/commentary/2007/12.cfm>.

Calomiris, Charles (1990): “Is Deposit Insurance Necessary? A Historical Perspective,” *Journal of Economic History* 50, 283-95.

Calomiris, Charles W. and J. Mason (2010): “Banking crises yesterday and today,” *Financial History Review* 17(1). pp. 3–12.

Calomiris, Charles W. and J. Mason (2003): “Fundamentals, Panics, and Bank Distress during the Depression,” *American Economic Review* 93, 1615-1647.

Caprio, Gerard and Patrick Honohan (2001): "Finance for Growth: Policy Choices in a Volatile World," A World Bank Policy Research Report. The International Bank for Reconstruction and Development/The World Bank.

Carlson, Mark A. (2002): "Causes of Bank Suspension in the Panic of 1893," Board of Governors of the Federal Reserve System WP No. 2002-11, Accessed April 11, 2020 <https://ssrn.com/abstract=301527 or http://dx.doi.org/10.2139/ssrn.301527>

CFA Institute. (2007). Self-Regulation in today’s securities markets: Outdated system or work in progress? (Vol. 2007, No. 7). Codes, Standards and Position Papers. CFA Institute Centre for Financial Market Integrity, September.

Davis, William Stearns (1910): *Influence of Wealth in Imperial Rome*. Norwood, Massachusetts: Norwood Press: Berwick & Smith Co.

Diamond, Douglas W., and Philip H. Dybvig (1983): “Bank Runs, Deposit Insurance, and Liquidity.” *Journal of Political Economy* 91(5): 401–19.

Duffie, Darrell (2019): "Prone to Fail: The Pre-Crisis Financial System," *Journal of Economic Perspectives* 33 (1), pp. 81–106.

Dupont, Brandon (2014): “Henceforth, I Must Have No Friends: Evaluating the Economic Policies of Grover Cleveland," *The Independent Review* 18 (4), pp. 559–579.

FDIC Office of Audits (2004): "Observations from FDIC OIG Material Loss Reviews Conducted 1993-2003," Audit Report No. 04-004 (January 22).

Federal Deposit Insurance Corporation (2018): " Basic Examination Concepts and Guidelines," Chapter 1 from *Risk Management Manual of Examination Policies*, online at <https://www.fdic.gov/regulations/safety/manual/section1-1.pdf> Accessed 2020/01/09.

Federal Reserve Bank of St. Louis (2020): "Safety & Soundness Supervision," Accessed March 28, 2020, <https://www.stlouisfed.org/bank-supervision/supervision-and-regulation/safety-soundness-supervision>.

Friedman, Milton and Anna J. Schwartz (1963): *A Monetary History of the United States, 1867-1960*. Princeton, NJ: Princeton University Press.

GAO (2013): "Financial Institutions: Causes and Consequences of Recent Bank Failures," Report to Congressional Committees.

Geisst, Charles R. (2004): *Wall Street: A History*. Oxford University Press.

Goodhart, Charles (1985): *The Evolution of Central Banks: A Natural Development?* London:

Gorton, Gary (1988): “Banking Panics and Business Cycles,” *Oxford Economic Papers* 40, 751-781.

Gorton, Gary and Lixin Huang (2001): "Banking Policies and the Origin of Central Banking," Unpublished working paper, Wharton Financial Institutions Center, University of Pennsylvania.
Gorton, Gary and Anthony M. Santomero (1990): "Market Discipline and Bank Subordinated Debt: Note." *Journal of Money, Credit and Banking,* 22(1), pp. 119-128.
Hasan, Iftekhar, and Gerald Dwyer (1994): "Bank Runs in the Free Banking Period," *Journal of Money, Credit, and Banking* 26, 271-288.
Helton, John (2019): " Banks sail through year's first round of stress tests," *American Banker*, June 21. Accessed 2020/12/26 at https://www.americanbanker.com/news/banks-sail-through-years-first-round-of-stress-tests#:~:text=The%20fundamental%20difference%20between%20DFAST,bank%27s%20actual%20capital%20management%20plan.
Honohan, Patrick and Daniela Klingebiel (2000): "Controlling the Fiscal Costs of Banking Crises." Unpublished Policy Research Working Paper 2441, World Bank, Washington, D.C.
Jorion, Philippe (2007): *Value at Risk: The New Benchmark for Managing Financial Risk*, 3rd ed.
Kaufman, George (1994): "Bank Contagion: A Review of the Theory and Evidence," *Journal of Financial Services Research* 8, 123-150.
Kindleberger, C. (1978): *Manias, Panics, and Crashes: A History of Financial Crises*. New York: Basic Books.
Kohn, Meir (1999): "Early Deposit Banking," Unpublished working paper, Department of Economics, Dartmouth College.
Kohn, Meir (1999a) "Merchant Banking in the Medieval and Modern Economy." Unpublished Working Paper, Dartmouth College. Accessed June 25, 2018: <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.200.4404&rep=rep1&type=pdf.>
Kroszner, Randall (2010): Interconnectedness, Fragility and the Financial Crisis. Unpublished working paper, University of Chicago Booth School of Business. Accessed May 22, 2018. https://fcic-static.law.stanford.edu/cdn_media/fcic-testimony/2010-0226-Kroszner.pdf
Mitchell, W. (1941): *Business Cycles and Their Causes*. Berkeley: University of California Press.
Ragalevsky, Stanley V. and Sarah J. Ricardi (2009): "Anatomy of a Bank Failure," *Banking Law Journal*, 867-902.
Romer, Christina (1990): "The Great Crash and the Onset of the Great Depression," *The Quarterly Journal of Economics* 105 (3), pp. 597–624.
de Roover, Raymond (1963): *The Rise and Decline of the Medici Bank: 1397-1494*. Cambridge, Massachusetts: Harvard University Press.
Saunders, Anthony (1987): "The Interbank Market, Contagion Effects and International Financial Crises," in Richard Portes and Alexander Swoboda, eds., *Threats to International Financial Stability*. Cambridge: Cambridge University Press.
Stigler, George (1971): "The Theory of Economic Regulation," 2(1) *Bell Journal of Economics and Management Science*, 3-21.
Taleb, Nassim Nicholas (2010): *The Black Swan: The Impact of the Highly Improbable* (2nd ed.). London: Penguin.

Teall. John L. (2018): *Financial Trading and Investing*, 2nd ed. San Diego, California: Academic Press.
Thornton, M.K. and R.L. Thornton (1990): "The Financial Crisis of A.D. 33: A Keynesian Depression?," *Journal of Economic History* 50(3), pp. 655-662.
Tilly, Richard (2009): Banking Crises In Three Countries, 1800–1933: An Historical and Comparative Perspective Lecture Delivered at The Award of the Helmut Schmidt Prize in German-American Economic History, Ghi, December 10, 2009.
Tooze, Adam (2018): *Crashed: How a Decade of Financial Crises Changed the World*. New York: Viking.
Usher, Abbott Payson (1943): *The Early History of Deposit Banking in Mediterranean Europe*. Cambridge, Massachusetts: Harvard University Press.
Wheelock, David C. (1995): "Regulation, Market Structure, and the Bank Failures of the Great Depression," *Review*, Federal Reserve Bank of St. Louis, March/April, pp. 27-38.
Wicker, Elmus (1980): "A Reconsideration of the Causes of the Banking Panic of 1930," *Journal of Economic History* 40 (September), pp. 571-83.