Bank Deposits and Credit As Sources of Systemic Risk

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THERE ARE MANY DIFFERENT WAYS TO DEFINE A FINANCIAL CRISIS. INDEED, THE ECONOMICS AND FINANCE LITERATURE IS FILLED WITH TERMS LIKE PANIC, FINANCIAL CRISIS, RUNS, SYSTEMIC CRISIS, OR CONTAGION.[1] THERE IS IN FACT LITTLE AGREEMENT ON EVEN THE RUDIMENTARY DEFINITIONS OF A FINANCIAL CRISIS, THE SEQUENCE OF EVENTS CONSTITUTING A CRISIS, OR THE CAUSES OF THESE EVENTS.

The professional discussion divides itself into two broad categories. Macroeconomists typically are concerned with explaining business cycle fluctuations and determining when a recession will degenerate into a depression.[2] They are equally interested in the financial system's role as a propagator of this process because most depressions have been accompanied by serious disruptions in the financial system, including banking failures and panics. Eichengreen and Portes, for example, define a financial crisis as "a disturbance to financial markets, associated typically with falling asset prices and insolvency among debtors and intermediaries, which ramifies through the financial system, disrupting the market's capacity to allocate capital within the economy. . . . Our definition implies a distinction between generalized financial crisis on the one hand and bank failures, debt defaults and foreign-exchange market disturbances on the other" (1991, 10).

Financial economists examine the micro behavior of market participants to explain disruptions in financial markets (see Diamond and Dybvig 1983; Chari and Jagannathan 1984). They have tended to focus on banking panics and runs and the reasons depositors withdraw funds rather than on the macro consequences for employment and output in the real economy per se.

While differing in their emphases, the micro and macro approaches to analyzing financial stability share several themes. The first focuses on alternative explanations for why a crisis occurs. One prominent thesis argues that the financial system is inherently unstable and is therefore vulnerable to random shocks. Shocks simultaneously cause market participants to lose confidence in the system and exchange their bank deposits for currency. Others believe that such herd behavior cannot be explained solely by shocks that, like animal spirits, randomly induce depositors to run from bank deposits to currency. They offer more behaviorally oriented explanations and models, the most prevalent being models based on the existence of information asymmetries between borrowers and lenders. These models attempt to show that it is sometimes rational for depositors to attempt to withdraw their funds in such a way that it creates a run on the banking system.

Most of the analysis in the random shock and information asymmetries models concentrates on aggregate behavior, assuming essentially that all market actors—both depositors and institutions—are identical. It does not admit differences among depositors and institutions or even the presence of more than one institution in the financial system. When the analysis recognizes more

realistic features of market and financial structure, researchers are better able to examine the process by which a shock or problem in one part of the country or sector of the economy is transmitted to other sectors or the system as a whole. These transmission models, representing the second main theme in the literature, have not been the focus of much empirical work and tend to be relatively undeveloped.

The third area investigates the causes of financial crises and their impact on the real economy. For example, do financial crises cause declines in real economic output, or are they instead manifestations of deeper problems in the real economy? What are the channels of transmission? Do deposit runs cause liquidity problems, which in turn induce contractions in lending, thereby affecting real output and production? The final area of analysis examines the role of government policies—both macro and micro—in generating financial crises as well as lessening their potential severity.

The remainder of this article explores these issues in more depth. The discussion gives particular attention to the possible linkages between deposits and credit availability as the transmission mechanism for crises since runs on deposits and payments system disruptions are believed to be transmitted to the real economy through a credit channel.

Random Shocks and Inherent Financial Instability

At the macroeconomic level, models such as those proposed by Minsky (1982) and Kindleberger (1978) embody the claim that the banking system is inherently unstable. Minsky argued that a capitalist economy, and especially its banking system, is inherently unstable. Furthermore, this instability is endogenous, originating within the system itself. He defined instability as "a process in which rapid and accelerating changes in the prices of assets (both financial and capital) take place relative to the prices of current output" (1982, 13).

Simply stated, Minsky assumed that during relatively stable times firms engage in balanced financing, by which he meant that cash flows are sufficient to cover principal and interest payments. However, as the economy grows and enters the expansion phase of the business cycle, firms begin to reach for profits, presumably because of management's preference for short-term gains. Firms start to leverage up, and banks, in particular, begin to shorten the maturity structure of their liabilities relative to their assets. Expanding returns by funding long-term investments with short-term borrowing is driven by the desire to take advantage of an upward-sloping term structure with long-term interest rates exceeding short-term rates.[3] This period of leveraging, which Minsky labels a period of speculative finance, is still one of relative stability.

Cash flows from investment are still sufficient to cover principal payments as debts. This speculation ultimately degenerates into what Minsky calls a period of Ponzi finance, in which cash flows cover neither principal nor interest payments. Debt refunding requires new debt issuance, the proceeds of which are used to cover required interest and principal debt payments. During this period, an exogenous shock will result in a collapse of both the financial system and the real economy. The shock, which can come from many different sources, serves as the trigger for collapse. Minsky was silent on the exact mechanisms by which this happens.

Do financial crises cause declines in real economic output, or are they instead manifestations of deeper problems in the real economy?

Commenting on Kindleberger's (1978) similar view, Schwartz observes that "those who regard banks as inherently unstable assume no connection between monetary policy and the price conditions under which economic agents make decisions. Proponents of inherent instability see a recurring historical pattern in which many bankers abandon conservative standards of asset management during business expansions only to be caught short when booms collapse. For them instability resides in economic agents. Benevolent government then comes to the rescue. This is the central thesis offered by Charles P. Kindleberger in his 1978 book" (1986, 11).

Minsky puts forth certain stylized facts that would be observed, although they are not the outcome from any specified model.[4] The first is that, during an expansion, credit expands at rates that exceed the growth of

1. For representative examples see Smith (1991), Kaufman (1995), Donaldson (1992), Bartholomew, Moe, and Whalen (1995), and Eichengreen and Portes (1991). See Benston and Kaufman (1995) for a review of the evidence on fragility.

2. Eichengreen and Portes (1991) require declines in real output for a true financial crisis to occur.

3. Before 1910, however, the most common yield curve in the United States was downward-sloping.

4. It is generally argued that the theory as put forth by Minsky is not a unified theory that yields testable hypotheses. See, for example, Sinai (1977), Lintner (1977), Mishkin (1991), and Schwartz (1986).

income or the capital stock. Second, interest rates and nominal asset prices must be increasing at a rapid rate. Third, debt maturities must become shorter, and, fourth, some exogenous shock must occur to cause a change in expectations. Finally, governments must fail to intervene in ways that cushion any asset reevaluations accompanying any changes in expectations.[5]

Bernanke and James (1991) suggest a different view of the causal relationship. For them, a precipitating force that could lead to a financial collapse is a deflation. Deflation adversely affects credit quality by reducing borrower equity cushions. When companies finally default, intermediaries become owners of illiquid, real assets. To reliquefy their balance sheets, banks are induced to reduce lending and call in loans. Those banks that are unable to reliquefy fail, and, by implication, deposits will be destroyed. In this scenario, credit problems lead to a reduction in bank deposits, contracting the money supply.

Micro random shock models pay no particular attention to the source, or nature, of the random shock that causes depositors to line up.

The chief distinction from the picture Minsky and Kindleberger paint is that Bernanke and James see banks as passive bystanders in the process. They are not required to take on more risk, nor do they have to misprice risk or adjust their balance sheets to take on more interest rate or maturity risk. The model also suggests that crises occur only during and after an exogenous shock has induced a deflation. Bernanke and James are careful to argue, however, that while deflation is a necessary condition for a crisis to occur, it is not sufficient. They highlight several aspects of banking structure that, if present, also help increase the likelihood that financial institutions would experience a crisis. These include (a) lack of branch banking, (b) universal banking and the commingling of banking and commerce, and (c) funding though short-term, foreign deposits. Thus, banking and financial structure can either mitigate or accentuate the likelihood that a financial crisis will result during a deflationary period.

Unlike the macroeconomists' models discussed, the random shock models of the financial economists, most closely associated with Diamond and Dybvig (1983), look more deeply at the structure of the deposit contract and the process by which it is redeemed.[6] Because deposits are payable upon demand at par, they offer depositors nearly costless liquidity, provided that not all depositors wish to withdraw their funds at the same time. With sequential servicing, in which depositors are treated on a first-come, first-served basis, depositors, especially if they are geographically dispersed, rationally know that not everyone can withdraw simultaneously. If bank loans are inherently not marketable, or cannot be easily liquefied, then at the first hint of potential trouble, it is rational for depositors to step to the head of the line rather than incur costs to determine whether and exactly when deposits will be paid.

These micro random shock models pay no particular attention to the source, or nature, of the random shock that causes depositors to line up. Depositors just decide to run, and once they do, all depositors run. These models also do not consider the credit side of the balance sheet as a factor in crises, other than the fact that loans are less liquid than deposits so that banks cannot pay all claims in currency. Nonetheless, they make it easy to see that shocks affect depositors' willingness to hold bank deposits, and, when that willingness is reduced, a contraction in credit follows as loans must be liquidated to meet the deposit-redemption demand.

The Diamond and Dybvig model approximates the situation that prevailed in early U.S. history. Individual banks issued their own bank notes to the public, promising to redeem these notes at par for specie.[7] Since note issues typically were not backed 100 percent by specie, periodic liquidity problems arose whenever noteholders became concerned that a bank might not be able to honor its redemption commitment and suspend convertibility of deposits into specie. Runs on individual banks and the system sometimes occurred, and these resulted, albeit infrequently, in cumulative contractions in the money stock.[8] Suspension of convertibility of deposits into specie was a common way for early banks to deal with temporary liquidity problems. It often resulted, however, in a decline in purchasing power since the value of deposits declined. By shifting the cost of nonconvertability at least temporarily to the creditors (depositors) of the bank, they gave all liability holders an important incentive to worry about bank solvency.

Diamond and Dybvig (1983) investigate the suspension of convertibility as one equilibrium solution to the problem of runs, but they do not consider the price level effects or how the costs of suspension of convertibility are distributed because their model has only a consumption good and no currency. Another weakness of their model is that there is only one bank in the system, and hence runs are on the banking system as a whole and involve flights to the currency rather than runs on one of many banks in the system.[9]

For these early banks, avoidance of runs meant maintaining public confidence. Depositors needed to

believe that the institution could convert notes into specie in sufficient amounts and would not need to suspend convertibility.[10] Indeed, the first forms of public regulation designed to deal with the problems involving suspension of convertibility imposed reserve requirements specifying permissible ratios of notes to specie. The regulations sought to assure public confidence by requiring banks to engage in minimal maturity intermediation, maintain sufficient specie reserves, and have adequate capital and liquidity.[11]

Information Asymmetries Models

The micro random shock models have been less than satisfying, both because they appear generally inconsistent with economic events, as will be discussed in the next section, and because many economists find it hard to believe that people randomly decide to run without some just cause rooted in economics. Recent modeling efforts have applied concepts of information asymmetries to derive conditions that might make it rational for depositors to engage in runs on banks. Under the information asymmetries models, banks are viewed as being "opaque" to depositors and thus costly for depositors to monitor. With imperfect and costly information, a type of Akerlof (1979) lemons model applies in which depositors have a great deal of difficulty distinguishing between healthy and unhealthy banks. Any shock or news event that might induce depositors to reassess their bank's riskiness (in combination with the sequential servicing constraint) will cause depositors to assume that all banks are riskier than previously believed. Under these circumstances, it is more rational for depositors to withdraw funds than to seek out and evaluate costly information or risk losing their funds by not withdrawing. In these models, as in the micro random shock models, the source of the shock is not specified, in that no particular cause is suggested for a failure. But usually it is hypothesized that the shock originates in credit markets and in releases of relevant news about bank asset quality. The model's predictions are consistent with the view that shocks are more likely to result from disturbances in the real sector than from the default of a single borrower.

Macroeconomists have articulated a form of this same asymmetric information hypothesis in attempting to counter the inherent instability arguments. As Schwartz describes it, "a widely held belief in the United States and the world financial community is that the default of major debtors—whether companies or municipalities or sovereign countries—could lead to bank failures that would precipitate a financial crisis. . . . A financial crisis is fuelled by fears that means of payment will be unobtainable at any price and, in a fractional-reserve banking system, leads to a scramble for high-powered money. It is precipitated by actions of the public that suddenly squeeze the reserves of the banking system. In a futile attempt to restore reserves, the banks may call loans, refuse to roll over existing loans, or resort to selling assets. . . . The essence of a financial crisis is that it is short lived, ending with a slackening of the public's demand for additional currency" (1986, 11).[12]

Under this scenario, a banking crisis is precipitated by the failure of a major debtor, which induces a sudden shift in the public's demand for currency. In turn, banks scramble for reserve assets by curtailing lending and selling assets. By implication the decline in lending and refusal to roll over existing credits leads to a decline in economic output. The process becomes systemic in that

5. *Minsky argues that the ability to intervene is directly correlated with the size of government; and big government, with its revenue capacity, has the resources to support, through fiscal and monetary policies, a longer run-up of leverage. Also, through its lender-of-last-resort capabilities, it can soften the landing during an exogenous shock period by supporting a gradual rather than precipitous liquidation of assets. It thereby avoids the corresponding collapse of credit, bank failures, and destruction of the money supply.*
6. *For other examples of models in this mode see Haubrich and King (1984), Cone (1983), Jacklin (1987), Wallace (1988), Bhattacharya and Gale (1987), Smith (1991), and Chari (1989).*
7. *In the Diamond and Dybvig (1983) model there is really no nonbank money in circulation. Individuals deposit a real consumption good in the bank in exchange for a deposit or warehouse receipt. This consumption good is close, but not identical, to specie.*

   In early U.S. banking, it was not uncommon for notes issued by out-of-area banks to trade at discounts, which reflected several factors, including transportation and transaction costs, lack of information on the issuing bank, and uncertainties about the creditworthiness of the issuing bank. This lack of par clearance in no way affected the ability of state bank notes to function as money.
8. *For discussions of the evidence on runs see Kaufman (1988) and Gorton (1987).*
9. *Because of the way the model is constructed, runs necessarily have an adverse impact on the real economy.*
10. *For a discussion of these early bank runs see Kaufman (1988) or Bryant (1980).*
11. *Clearinghouses and other banks in the region often provided temporary credit to institutions experiencing liquidity problems (see Kaufman 1988). Kaufman (1994) notes that bank capital ratios were substantially higher during this period than they were after deposit insurance was introduced.*
12. *Although Schwartz articulates this view, she clearly does not believe it is correct or that the policies designed to protect against the events are appropriate.*

problems in one or several major creditors raise questions about the quality of bank assets in general and induce the public to switch to holding currency.

The hypothesis implies a direct linkage between increased demand for money and the availability of credit—and hence the ability to finance and maintain the real economy. The information the public perceives is not assumed to be bank specific; instead, it is the fact that the information concerns the quality of banking assets in the aggregate that increases the private sector's demand for currency relative to deposits. The channel envisioned in this scenario results in banks calling in loans and building up liquidity to meet the public's desire for currency.

Recent modeling efforts have applied concepts of information asymmetries to derive conditions that might make it rational for depositors to engage in runs on banks.

Empirically, three elements are necessary for this view to hold. First, there must be a credit-related shock that affects the public's desire to hold currency relative to deposits. Second, this shock must induce a liquidation of deposits for currency by the public. Third, bank credit must contract.

There are several important differences between the various random shock models and asymmetric information models. First, Minsky's random shock model includes leveraging up of both bank and corporate balance sheets across the board, and, furthermore, it does not require an inflationary environment. Second, the collapse that results is not driven by runs forcing institutions to liquefy balance sheets to meet deposit withdrawals. Third, under this type of model financial institutions accommodate the leveraging up of balance sheets by underpricing credit risk. They also take on more interest rate and maturity risk by shortening the maturity structure of liabilities relative to assets. Fourth, no interdependence among either borrowers or lenders is necessary for a collapse to take place. Finally, the direction of causation, in terms of propagators of the crisis, appears to run through credit channels by eroding depository institution real equity values. Only if institutions fail is the money supply affected.

In the random shock model of Diamond and Dybvig (1983), the crisis does not result from asset mispricing or from rational economic behavior but rather from an exogenous event. Since there is only one bank in the economy in this model, runs take the form of flights to currency (or more precisely, the consumption good) and not to other healthy banks. The panic is due solely to the existence of the sequential servicing requirement discussed above and the fact that bank assets are not perfectly liquefiable.

Like the micro random shock models, the asymmetric information models do not rest upon systematic ex ante asset mispricing or other problems of bank behavior. Changes in expectations and market assessment of bank asset quality, combined with the opaqueness of bank balance sheets and sequential servicing, make runs a rational customer response.

Empirical Evidence on Systemic Risk

When examined carefully, many of these alternative explanations of panics and financial crises appear to overlap, differing only slightly in their details. Separating them empirically can therefore be very difficult. Empirical tests of various hypotheses about financial crises and panics have generally focused on the National Banking Era and the period of the Great Depression. The reason for studying these periods is that no broad-based panics have occurred since (in part because of the existence of federal deposit insurance and lender-of-last-resort actions followed by the Federal Reserve). In this section, the empirical evidence is examined to determine which of the models appear to be more consistent with the data.

The question of whether this empirical work provides useful insights or is relevant today is a legitimate one, given the changes in financial structure and markets, the rise of technology, the proliferation of information, and the globalization of markets. This issue will be addressed in the next section.

The Random Shock and Financial Fragility Hypothesis. Given the lack of precision in specifying the models, does the evidence suggest that one or more of the models may be correct? With respect to the macro models, critics of the Minsky financial fragility hypothesis argue that it does not yield testable hypotheses and is inconsistent with the data (see Sinai 1977; Lintner 1977; Mishkin 1991; Schwartz 1986). As mentioned previously, for the hypothesis to hold, a sequence of several factors must be present: debt burdens increasing faster than the growth of income or capital stock, interest rates and nominal asset prices increasing rapidly, debt maturities at depository institutions becoming shorter, an exogenous shock occurring to cause a change in expectations, and, finally, governments failing to intervene in ways that would provide a soft landing to any asset revaluation that must accompany the change in expectations.

Unfortunately, data do not readily exist for examining a number of the conditions Minsky sets forward. As an alternative Table 1 lists the periods of economic recession with information on when panics took place and, where possible, what possible shocks may have

TABLE 1 Panic Dates and Causes

Panic Date	Business Cycle Peak and Trough	Percentage (and Number) of National Bank Failures	Prepanic Interest Rate Movement	Percent Change in Currency-to-Deposits Ratio from Previous Year's Average	Possible Prepanic Exogeneous Shock
October 1857	Fall 1853–July 1857	NA	Rates fell until the recession began. Spread on bonds did not widen until after the onset of the recession.	NA	With failure of Ohio Life and Trust, reserves were pulled from New York City banks. First bank failures occurred in September. Several railroads went bankrupt in September, and major runs on New York banks in October culminated in specie suspensions in mid-October.
September 1873	October 1873–March 1879	2.8 (56)	Rates rose about 5 percentage points in August, five months before the beginning of the recession. Spread on bonds did not rise until the month of the panic and did not rise prior to that.	14.5	Crisis began when New York Warehouse and Security Co. failed on September 8. Other failures and suspensions followed: Kenyon, Cox & Co., Jay Cooke & Co., and Fisk & Hatch. Panic-selling on the New York Stock Exchange led to closing of the market for ten days. The initial failures appeared related to debt problems and problems with railroad bonds.[a]
June 1884	March 1882–May 1885	0.9 (19)	No obvious pattern preceded the panic. With the exception of a three-month period, spreads on bonds declined steadily for two years prior to the panic.	8.8	On May 6 Marine National Bank failed. The Wall Street brokerage firm Grant and Ward was linked to a bank that failed on May 8. That failure was followed by a run on Metropolitan National Bank and suspension of several other banks. However, an inflow of foreign capital and the issuance of clearinghouse notes moderated the panic. It appeared the clearinghouse notes provided a signal to the market of bank solvency.
No panic	March 1887–April 1888	0.4 (12)	——	3.0	——

(Continued on page 10)

TABLE 1 Panic Dates and Causes (cont.)

Panic Date	Business Cycle Peak and Trough	Percentage (and Number) of National Bank Failures	Prepanic Interest Rate Movement	Percent Change in Currency-to-Deposits Ratio from Previous Year's Average	Possible Prepanic Exogeneous Shock
November 1890	July 1890–May 1891	0.4 (14)	Rates did not rise appreciably until after the recession had begun. Spread on bonds was essentially flat for a year preceding the panic.	9.0	New York Stock Exchange prices began falling in early November. On November 11 Decker, Howell & Co. failed, involving the Bank of North America. On November 12 a stock broker failed, and on November 15 Baring Brothers failed in London.
May 1893	January 1893–June 1894	1.9 (74)	Rates rose beginning in January 1892 approximately 2.5 percentage points in the seven months preceding the recession. Spread was essentially flat for more than one year preceding the recession.	16.0	On February 26 the Philadelphia & Reading Railroad went into receivership, and on May 4 National Cordage Co. failed and a stock market crash followed. New York banks weathered the situation until banks in the West and South experienced runs and began withdrawing reserves from New York City banks to meet liquidity needs. In August there was a general suspension of specie payments. National banks were reopened after examination and certification by the Comptroller of the Currency.
October 1896	December 1895–June 1897	1.6 (60)	Rates rose only about 75 basis points in the three months preceding the peak of the expansion but rose substantially in the three months before the panic. Spread on bonds did not widen until after the beginning of the recession and peaked just prior to the panic.	14.3	The period of 1895–96 was a mild, paniclike period. Although the New York Clearing House Association made emergency credits available in the form of loan certificates, none were used.
No panic	June 1899–December 1900	0.3 (12)	——	2.8	——

No panic	September 1902–August 1904	0.6 (28)	——	–4.1	——
October 1907	May 1907–June 1908	0.3 (20)	Rates were flat preceding the recession and rose only slightly thereafter. Spread on bonds was essentially flat prior to the beginning of the recession.	11.5	Stock market declined in October. During the week of October 14, five New York members of the New York Clearing House Association and three outside banks required assistance. These banks had been used to finance speculation in copper-mining stocks. On October 12 Knickerbocker Trust Co. (third largest in New York City) began to experience clearing problems, and it suspended operations on October 22.
No panic	January 1910–January 1912	0.1 (10)	——	–2.6	——
August 1914	January 1913–December 1914	0.4 (28)	——	10.4	This crisis was linked to problems in London and disruptions to payments on discount bills by foreign (European) borrowers. London stopped discounting foreign bills, and the effect was to disrupt New York banks, who were in a net debt position during the summer (as apparently was usual). New York banks were forced to remit gold, draining reserves. Both London and New York Stock Exchanges closed on July 31, and a panic threatened.

[a] Sprague ([1910] 1968) notes that all the failures were due to criminal mismanagement or to neglect or violation of the National Banking Act and not to questions about bank solvency.

Source: Gorton (1988) and Schwartz (1986), except for Panics of 1857 and 1893 (Mishkin 1991).

existed. Looking first at the timing of the panics relative to the peaks and troughs of the business cycles shows that in only one instance was there a panic before the peak of the business cycle. In most cases, the panic occurred anywhere from three to six months after the business cycle had peaked. Such long lags would seem to be logically inconsistent with Minsky's view.

Mishkin (1991) devotes considerable attention to the rate pattern and to risk premiums and their relationship to the onset of panics. In general, the spread between rates on high- and low-quality bonds rose before the panic began. However, these spreads generally widened after the recession started rather than before as the Minsky hypothesis would require.[13]

Evidence suggests that recession, and not a triggering bank failure, is the critical factor in determining whether a panic will occur.

The Asymmetric Information Hypothesis versus Micro Random Shock Models. Gorton (1988), Mishkin (1991), and Donaldson (1992) specifically investigate the information asymmetric hypothesis in detail. Examining the National Banking Era and the post–Federal Reserve Era through 1933, Gorton models depositor behavior in terms of the currency/deposit ratio. He poses two questions. First, if panics are random events, then is the model predicting a different currency/deposit ratio during panic periods than exists in other times? Second, are panics predictable in terms of movements of perceived risk? From these two questions Gorton suggests the following testable hypothesis: "Movements in variables predicting deposit riskiness cause panics just as such movements would be used to price such risk at all other times. This hypothesis links panics to occurrences of a threshold value of some variable predicting the riskiness of bank deposits" (1988, 751). Such predictive variables might be extreme seasonal fluctuations, unexpected failure of a large corporation (usually a financial corporation), or a major recession.

A third question Gorton asks is whether certain predictors of risk stand out as important predictors of panics. Finding no evidence that panics are random events, he concludes that there is strong support for the asymmetric information hypothesis. Furthermore, panics appear to be predictable ex ante. Evidence also suggests that recession, and not a triggering bank failure, is the critical factor in determining whether a panic will occur. Gorton explains: "the recession hypothesis best explains what prior information is used by agents in forming conditional expectations. Banks hold claims on firms and when firms begin to fail (a leading indicator of recession), depositors will reassess the riskiness of deposits" (1988, 778). In short, causation seems directed from the real sector to the financial sector rather than vice versa.

Donaldson (1992) extends Gorton's analysis using a somewhat different specification of the model and weekly data between 1867 and 1907 to determine whether panics are systematic and predictable events. Unlike Gorton, Donaldson rejects the conclusion that panics are systematic events and argues that the data are more consistent with the random shock model than the asymmetric information model.[14] However, for the panics of 1914 and 1933 (which required expansion of the money supply during crisis periods), he finds behavioral patterns of earlier panics had been dampened. Given that the later panics followed the creation of the Federal Reserve in 1913 and passage of the Aldrich-Vreeland Act of 1912, this finding suggests that government involvement to increase liquidity can truncate panic situations. He concludes that panics are therefore special events. But he also finds evidence that panics are more likely to occur when seasonal and cyclical factors are present.

Mishkin (1991) formulates the asymmetric information hypothesis somewhat differently. He argues that key variables help to capture differences in depositor assessment of bank risk. In particular, during periods of financial distress high-quality firms will be less affected and lenders will have less uncertainty about the riskiness of such firms than they will have for low-quality firms. To the extent that these risks are priced, an important index of asymmetric information uncertainty should be captured by the spread between the rates on high- and low-quality bonds, by stock prices (as a measure of net worth and collateral value), and by interest rates (as a measure of agency costs and adverse selection). His analysis, like that of Gorton (1988), supports the information asymmetries hypothesis to the extent that the proxy variables are in fact good proxies. He concludes that most financial crisis periods begin with an increase in interest rates and a widening of the spread between high- and low-quality bonds and a decline in stock prices, rather than with a panic. "Furthermore," Mishkin observes, "a financial panic was frequently immediately preceded by a major failure of a financial firm, which increased uncertainty in the marketplace" (1991, 97). He also asserts that the information hypothesis offers a better explanation than the macro theories of financial fragility for the pattern of rate spreads and stock market movements both before and after a panic as well as the panic's likely occurrence.

Finally, Park (1991) argues that the provision of bank-specific information overcame the information

asymmetries that played a role in runs on banks. In particular, by analyzing the panics of 1873, 1884, 1893, 1907, and 1933 he concludes that clearinghouse and government intervention were effective devices in settling panics but only when they provided information on bank-specific solvency.[15] In the panic of 1884, a run was abated following certification of solvency by the Comptroller of the Currency and by subsequent extensions of clearinghouse certificates to Metropolitan National Bank, which was the bank suffering the greatest withdrawals.

The panic of 1893 followed a long period of depression during which banks suffered prolonged periods of withdrawals of gold and uncertainty about U.S. adherence to the gold standard. Gold hoarding culminated in suspension of convertibility, and repeal of the Sherman Silver Act was promised by the president. Banks lifted the suspension of convertibility, and the runs stopped. Because no systematic attempt was made to release information on individual banks, public confidence in all banks remained low until the source of uncertainty—lack of confidence in U.S. maintenance of the gold standard—was removed. Park (1991) interprets the Comptroller of the Currency's certification of individual bank solvency before their reopening following the panic of 1893 as the major information factor that quelled depositor uncertainty.

In the panic of 1907, the problem began with runs on individual New York banks and trust companies that had been directly or indirectly associated with a failed attempt to corner the market in copper stocks. Only intervention by the New York Clearing House Association, which attested to the solvency of banks experiencing runs and provided financial assistance, resolved the situation. Again, release of firm-specific information appeared to have addressed the information asymmetries and helped stabilize the crisis.[16] Unlike other cases, in the panic of 1907 runs did not affect all banks, and, indeed, some New York Clearing House member banks experienced reserve inflows (Park 1991).

Transmission Models. Neither the basic random shock models nor the information asymmetry models specifically address the issue of which mechanisms transmit panics or financial crises through the economy. In fact, no models admit more than one institution, a condition that would be necessary to model customers simply transferring funds from an unhealthy to a healthy institution as distinct from retreating to currency.[17] The models provide no information on what, if any, real impacts such funds transfers among banks have. Nor have the models addressed when depositors will run on one bank and when they will run on the entire system.

Researchers have addressed the question of transmission mechanism more indirectly by attempting to generalize from the basic models. For example, Calomiris and Gorton (1991) maintain that it is the sequential servicing constraint imposed in the Diamond and Dybvig–type models that can induce banks to run on other banks. Such runs are especially likely when banks are geographically dispersed but are permitted to count interbank deposits as legal reserves, as under the National Banking system. Two other regulatory constraints—restrictions on branching and on the payment of interest on interbank deposits—have also been regarded as important.[18]

The structure of the National Banking system prior to creation of the Federal Reserve in 1913 added a further source of instability to the economy. Under that system, legal reserves for National Banks included not only cash in vault but also deposits in Reserve City and Central Reserve City banks. In such a fractional-reserve banking system that has pyramiding of reserves, a run on an individual bank could more easily have systemic, systemwide effects. Shocks originating in the countryside, for example, could induce country banks to

13. The exception is the panic of 1873.

14. As a robustness test, he also reruns the analysis using monthly data as Gorton does and gets similar results to those found by Gorton. He concludes that monthly data are too spaced out to provide a sharp test of the hypothesis.

15. A more complete test of the Gorton-Mishkin-Park hypothesis about information asymmetries would be provided by examining fund flows from individual solvent and insolvent institutions. Relying upon aggregate statistics can be only circumstantial, not conclusive.

16. The Roosevelt administration, following the declaration of the bank holiday on March 6, 1933, employed this same policy.

17. Smith (1991) does provide a model in which banks are permitted to hold funds at a Reserve City bank. Bhattacharya and Gale (1987) provide a model with geographically dispersed depositors and banks. Again, however, these models only look at the interdependence among banks through the interbank deposit markets.

18. See also the discussions in Haubrich (1990), Bordo (1986), and Williamson (1989). All emphasize the advantages over U.S. banks that banks in Canada and other countries that permitted branching had in weathering panics. Calomiris and Schweikart (1991) have explored in detail for the United States the effects that structure had on failure rates in different states with different branching statutes. They show that branch banks had both lower failure rates and in general paid lower premiums on their notes during the crisis of 1857 than banks in other parts of the country.

improve their liquidity positions by recalling interbank deposits from the Reserve City and Central Reserve City banks. Hence, panics were also endemic to the structure of the system as a whole, and it is clear how a panic or run in a rural region could blossom into a systemic crisis for healthy banks in Reserve Cities and Central Reserve Cities. Chari (1989) addressed this issue directly in considering a model of spatially separated banks. He argued that the most likely source of a shock that would cause country banks to withdraw reserve funds was seasonally related, with differences in currency demands rising significantly during planting and harvest times.

Inferences about financial crises and systemic risk drawn from study of the banking situation during the National Banking Era and early 1900s are not particularly meaningful or relevant in today's economic environment.

Calomiris and Gorton (1991) attempted to determine specifically whether panics were transmitted from rural areas through the National Banking system, as the analysis suggested, and also whether the patterns were more consistent with the random shock or information asymmetries models. They found that three important differences between the models have empirical implications.

The first concerns the origin of problems. The random shock model suggests that shocks would occur in rural areas because of seasonal demands for currency. In contrast, the asymmetric information model implies that adverse economic news related to asset-quality problems would precede a panic.

Second, the two theories would seem to predict different patterns of failures during a crisis. The asymmetric information model suggests that banks whose asset portfolios were closely linked to the specific shock would be more prone to failure whereas the random shock model would predict that failures would be experienced in the areas suffering currency withdrawals.

Finally, the models differ in the conditions required to resolve a crisis. In the random shock model, the key to resolving a panic is liquefication of assets. In the asymmetric information model, it is the effectiveness of mechanisms initiated to resolve depositor uncertainty about bank solvency.

Calomiris and Gorton's exhaustive investigation of the sources of panics between 1873 and 1907 led them to reject the idea that seasonal money-demand shocks were the cause of banking panics. Rather, their analysis suggests that panics originated in bad economic news and bank vulnerability to that news. Moreover, their inspection of failure patterns shows virtually no support for the random shock model. Finally, they conclude that in terms of resolving crises, the mere availability of currency, which would provide the ability to liquefy assets, was not sufficient to stop panics during the periods studied. Again, this conclusion suggests that the asymmetric information model was more consistent with the data than was the random shock model.

Smith (1991) provides some specific evidence on country banks' behavior vis-à-vis their holdings of cash reserves as compared with reserves held in the form of interbank deposits when panics occurred. He provides analysis of some anecdotal and other evidence, derived mostly from Sprague ([1910] 1968), about the behavior of Reserve City banks during the crises of 1873, 1893, 1907, and 1930–33.

Smith describes the situation leading up to the panic of 1873, indicating that interbank deposits were concentrated in seven of the New York City banks. These interbank deposits constituted about 45 percent of the sources of funds for the New York banks and were the base upon which their bond holdings and loans were built. These banks were clearly vulnerable to demands by country banks for withdrawal of reserves, and funds were especially tight in the few months before the crisis. When the key triggering events occurred (see Table 1), a combination of circumstances made the crisis severe. In addition to having virtually no excess reserves, several of the banks were in weak financial condition. As subsequent events would prove, several had been the victims of fraud and defalcations, probably accounting in part for their financial weakness. Clearly, however, the institutions' problems stemmed primarily from reserve withdrawals and their inability to call in loans in that economic environment rather than from major credit problems in the New York Central Reserve City banks.

The Reserve City banks experienced similar problems caused by currency outflows during the panics of 1893 and 1907. Thus, it seems clear that reserve outflows, coupled with the lack of excess currency reserves at the Central Reserve City banks in New York and Chicago, forced contractions in loans and finally resulted in the suspension of currency payments. Smith notes that currency suspension was the prime transmission mechanism of panics once a triggering mechanism occurred. He also concludes that the problems during the 1930–33 period originated in the rural agricultural areas as well and were intimately intertwined with the correspondent banking system.

Despite a fairly clear pattern in the transmission mechanism of panics emanating from large reserve-deposit withdrawals (rather than from uncertainties about credit quality in Reserve City banks, as the Minsky hypothesis would imply), a number of questions remain. For example, Tallman (1988) indicates that

looking at the data over longer time periods does not suggest a clear linkage between the incidence of panics and either increases in currency demand relative to deposits or contractions in loans. He presents evidence that loan contractions occurred at several intervals during the period between 1893 and 1907, for example, that exceeded the declines during periods when panics occurred. Similarly, during some periods of time between 1873 and 1930 the number of bank failures far exceeded those observed during panic periods. Finally, Tallman provides aggregate data on the growth in loans relative to high-powered money and on the growth of manufacturing output between 1873 and 1914. Two observations are important. First, loans do increase in the years prior to panic periods, but the panics occur after loan growth has fallen significantly. Second, numerous periods during the interval show the same patterns in loan and output growth and decline but are not accompanied by a panic. These aggregate data do not reveal whether there are differences in the loan-contraction periods in terms of their concentration in particular parts of the country during episodes of panic and nonpanic periods.

Causal Direction. The research evidence seems to indicate fairly consistently that the dynamics between financial panics and changes in real economic output begin in the real sector and move to the financial sector rather than starting in the financial sector. There are no examples in U.S. history of the economy operating at high levels of output when a financial crisis occurred that resulted in a contraction in the real economy. As the discussion in the previous sections suggests, however, banks were sometimes under pressure and were forced to call in loans. It seems reasonable to assume that once problems in the financial sector become severe, there could be negative feedback effects to the real sector.

Indeed, Bernanke (1983) has made precisely this point. Financial crises can have real effects outside the normal reserve/loan transmission mechanism because of the disruptions to the intermediation process. Bank failures disrupt borrower/lender relationships and make attaining financing more difficult and costly. But this observation should not obscure the fact that financial crises are better viewed as creatures of recession and economic downturns rather than primary causal agents precipitating the downturns.

The Role of Government. A substantial body of evidence indicates that government actions have played significant roles in contributing to crises as well as in mitigating them. For example, Sprague ([1910] 1968) notes that lack of access to a reliable lender of last resort to provide short-term liquidity can help escalate a period of financial tightness into one of crisis. Friedman and Schwartz (1963) argue that several Federal Reserve actions during the Great Depression contributed to both its duration and magnitude. For instance, they observe that the Federal Reserve's failure to liquefy the assets of many small nonmember institutions (the Fed was not obligated to lend to nonmember banks), together with its insistence that it would lend only upon sound collateral, added to the number of bank failures. This policy, in conjunction with the Fed's attempt to adhere to the rules of the gold standard, contributed to a 33 percent decline in the money supply and clearly exacerbated the severity of the recession.

While it has become fashionable to criticize the Fed for its policy failures during the Great Depression, it is also the case that government interference affected financial soundness long before the Fed was created. For example, during the National Banking Era the monetary base was tied, except for a period of suspension, to gold and silver specie monies through the Treasury.[19] When the United States adhered to the gold standard, fluctuations in the gold supply expanded and contracted the monetary base, directly affecting banks' lending behavior. Decisions about how much in the way of international gold flows would be permitted before conversion could be suspended was a matter of Treasury and government policy. European central banks, and to a lesser extent the U.S. Treasury, often intervened to prevent loss of gold reserves by raising short-term interest rates. Government policies frequently exacerbated gold flows and, by implication, induced fluctuations in the monetary base. For example, following passage of the Sherman Silver Purchase Act in 1890, foreigners' concern that the United States would remain on the standard precipitated gold outflows and contributed to the panic of 1890.[20]

Tallman and Moen note that each panic after 1897 was preceded by unusual gold flows. They conclude that political uncertainties concerning the U.S. commitment to the gold standard were important influences on gold flows and, hence, the U.S. monetary base. Political conditions outside the United States also affected gold flows. For example, in 1907 the Bank of England responded to problems in the London money markets by raising its discount rate to stem potential speculative

19. Specifically, the monetary base included gold coin, gold certificates backed 100 percent by gold, silver dollars, silver certificates, other small silver coins, U.S. notes and other Treasury fiat, and national bank notes. See Tallman and Moen (1993).

20. Tallman and Moen (1993) indicate that this uncertainty was greatly reduced with the discovery of large gold supplies in the late 1890s.

outflows of gold to the United States. At that time London was the most important market for discounting U.S. trade bills. The increase in the discount rate not only disrupted the flow of gold to the United States but also discouraged the discounting of trade bills and caused a liquidity crisis in the United States.

Since the debacle of the Great Depression, U.S. intervention in markets has often had as its objective providing liquidity to avoid a crisis. Numerous examples exist of emergency liquidity having been provided through the efforts of the Federal Reserve either directly or indirectly, such as during the Penn Central scare, the Chrysler problem, the collapse of Drexel-Burnham, and the failure of Continental Illinois Bank, to name just a few. The Federal Reserve has on occasion attempted to provide liquidity not only to cushion problems in interbank markets but also to prevent disruptions in other markets.

While panics do appear to be associated with recessions and deflationary periods, the direction of causation seems to run from the real sector to the financial sector rather than the other way around.

Relevance in Today's World

It can be argued that inferences about financial crises and systemic risk drawn from study of the banking situation during the National Banking Era and early 1900s are not particularly meaningful or relevant in today's economic environment. Pyramiding of legal reserves in private banks is not a structural feature of the present reserve requirement regime. Markets are no longer isolated, and information-availability problems that might have resulted in the past in information asymmetries have been reduced significantly. Communications technology and new instruments have increased the liquidity of all banking assets and have given rise to new markets that make the kinds of liquidity crises that occurred in the National Banking Era unlikely today. Furthermore, the United States has abandoned the gold standard, and thus the domestic money supply is not subject to the random fluctuations and shocks that it was vulnerable to under strict adherence to the gold standard rules. Deposit rate ceilings of the 1930s have been phased out, and branching restrictions, which essentially prevented institutions from achieving geographical diversification, are a thing of the past.

Certainly the focus on protecting the money supply from sudden shocks is no longer of prime policy concern for three reasons. First, it seems unlikely that significant runs to currency will occur (see Kaufman 1988). Deposits still have large advantages over currency for a variety of purposes, and there are many banks to chose from. Runs on individual banks would simply transfer reserves from one institution to another. Second, Federal Reserve policy is likely to provide emergency liquidity to prevent such runs from disrupting other institutions. Finally, while still accounting for the bulk of payment items, checks and currency are no longer the dominant forms in terms of dollar volume of transactions in the economy. The concerns and risks have shifted to other sectors of the payments system that did not exist during the National Banking Era.

Today, the payments system is larger, has many more components (both private and public), and is subject to different risks than in the past. The check/demand deposit system, which accounts for the bulk of individual payments (except for currency), and the one that the present regulatory structure was primarily designed to protect, is small in terms of the dollar volume of payments. The rest are made in the form of computerized transfers of reserve balances on the Federal Reserve's Fedwire system and the privately owned Clearing House Interbank Payments System (CHIPS) and in the form of automated clearinghouse (ACH) transactions. Payments on the former two systems account for about 85 percent of the dollar value of transactions. Closely related to these systems are the automated transfers of book-entry Treasury securities, which also take place on Fedwire and involve substantial volumes of transactions.

Finally, as markets have become increasingly global, timing differences and differences in clearing and settlement conventions can add temporal and other dimensions to credit risks not always found in the domestic markets that characterized earlier times. Many other significant sources of uncertainty can also be identified in the clearing and settlement processes in modern financial markets (see, for example, Eisenbeis 1997 and McAndrews 1997).

Maintaining the integrity of payment flows is a substantially more complicated and difficult problem today than protecting the stock of demand deposits for a number of reasons. First, given the large size of transactions in the system and the size of the system itself, the resources required to support unwinding even a short-run problem may be enormous and could exceed the capacity of private participants to self-insure. Second, because the transactions are electronic and occur instantaneously, monitoring them and the net position of each participant is critical to controlling participants' credit risk exposure. Third, when the international activities of U.S. banks and the links between the U.S. domestic payments system and foreign banking organizations are recognized, it becomes difficult to conceive of ensuring domestic financial stability without also ensuring international financial stability.

Clearly, different types of uncertainties exist with respect to systemic risk exposures today than existed in the past. There is also reason to believe that liquidity problems for borrowers may be significantly different than they were for borrowers in the 1800s. The growth of new mortgage lending instruments and, particularly, the development of home equity lines of credit provide ways for borrowers instantaneously to liquefy previously illiquid assets during tight times. While this ability to liquefy assets more easily may enable borrowers to maintain payments on outstanding debts and lessen the severity of the credit component of a recession, it also suggests introduction of a new discontinuity that might systematically transfer risks to the banking system at a critical trigger point. If during times of financial distress borrowers draw down lines on home equity and similar lines of credit and are then forced into default, the burdens of these defaults will be shifted to the providers of the home equity lines. Should these losses be large, capital might be wiped out, with few options available to lenders to avoid the costs of those defaults. Examples of similar impacts in commercial and real estate lending markets occurred when commercial paper borrowers drew down banks' back-up commitments during the Penn Central and Real Estate Investment Trust (REIT) crises.

Summary and Conclusions

This article has investigated the various theories of financial panics and crises with particular emphasis on the links between credit and deposits. The survey suggests that panics are not random events, as some of the theories may suggest, but neither are they perfectly predictable. Nevertheless, it does appear that information asymmetries about the ability to liquefy deposits were a major contributing factor to banking panics in the past. Moreover, while panics do appear to be associated with recessions and deflationary periods, the direction of causation seems to run from the real sector to the financial sector rather than the other way around. It is not that financial crises cannot exacerbate economic declines; rather, they are not primary causal agents of recessions.

The analysis also suggests that government policies can affect the likelihood of a financial crisis as well as play a role in its solution. These considerations are as relevant today as they have been historically. At the same time, the article raises a cautionary note that the dynamics of crises and how they might play out may be significantly different in the future given recent, rapidly developing changes in the U.S. and world financial system.

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