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PREVENTING FINANCIAL CRISES: AN INTERNATIONAL PERSPECTIVE

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ABSTRACT

In recent years the possibility of an international financial crisis has increased because of greater liquidity of international financial markets, an increase in corporate indebtedness and the decline of the banking industry. Using an asymmetric information analysis, this paper outlines what signals a central bank might look for to determine if a financial crisis is occurring and then describes how central banks might operate and cooperate to prevent financial crises.

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INTRODUCTION

In recent years there has been a growing concern with the fragility of the international financial system. The stock market crash in October 1987 was a world-wide phenomenon that created fears of a major financial collapse which could severely damage the global economy. The recent collapse of the real estate market has also been a world-wide phenomenon and has led to bankruptcies of major real estate developers both in the United States and abroad.

Because of the rapid growth of nonperforming loans, bank failures in the United States occurred at a record pace for the post World War II period in the 1980s and early 1990s. Unfortunately, the problems in the banking industry have not been restricted to the United States. Norway recently experienced the near failure of several of its banks including some of the largest, while even in countries like Switzerland and Germany, banks have been running into trouble. Regional banks in Switzerland have failed and in January 1993, BfG Bank, a German bank needed a capital infusion from its parent company, Credit Lyonnais, because it suffered a DM 1.1 billion ($700 million loss) in 1992. The collapse of real estate values in Japan has left many Japanese banks with huge losses, with the result that the Japanese government has even considered a bank bailout plan.

In September 1992, a speculative crisis in the foreign exchange market almost brought down the Exchange Rate Mechanism of the European Monetary System. The system was saved, but only after intervention by European central banks which is estimated to have cost them anywhere from four to six billion dollars in foreign exchange losses. As a result, the prospects for European monetary union have been substantially diminished.

Given these events, it is not surprising that government policymakers, especially central bankers, have been growing more concerned about the potential damage that an international financial crises might have on the global economy. Several questions with regard to international financial crises have thus become of paramount importance in recent years: What actions need to be taken to prevent international financial crises? How can we identify financial crises that require government intervention from other events in financial markets, although quite dramatic, in which intervention is not needed. What principles should guide how policymakers respond to an international financial crisis? What are the costs of

policies designed to prevent or limit the spread of an international financial crisis?

Fortunately, the new literature on asymmetric information and financial structure which has developed in the last twenty years can help provide answers to these questions. In this lecture, I will outline how this literature provides a far more precise definition of what a financial crisis is than earlier literature does. Then with an understanding of the nature of financial crises, we can go on to examine how policymakers might best prevent international financial crises.

WHAT IS A FINANCIAL CRISIS?

Earlier Views on Financial Crises

Up until recently, views of financial crises in the literature have split into two polar camps, those associated with monetarists versus a more eclectic view put forward by Charles Kindleberger and Hyman Minsky. Monetarists beginning with Friedman and Schwartz (1963) have linked financial crises with banking panics. They stress the importance of banking panics because they view them as a major source of contractions in the money supply which, in turn, have lead to severe contractions in aggregate economic activity in the United States. Monetarists do not view as real financial crises events in which, despite a sharp decline in asset prices and a rise in business failures, there is no potential for a banking panic and a resulting sharp decline in the money supply. Indeed, Schwartz (1986) characterizes these situations as "pseudo-financial crises". Government intervention in a pseudo-financial crisis is unnecessary and can indeed be harmful since it leads to a decrease in economic efficiency because firms that deserve to fail are bailed out or because it results in excessive money growth that stimulates inflation.

An opposite view of financial crises is outlined by Kindleberger (1978) and Minsky (1972) who have a much broader definition of what constitutes a real financial crisis than monetarists. In their view, financial crises either involve sharp declines in asset prices, failures of both large financial and nonfinancial firms, deflations or disinflations, disruptions in foreign exchange markets, or some combination of all of these. Since they perceive any of these disturbances as having potential serious consequences for the aggregate economy, they advocate

a much expanded role for government intervention when a financial crisis, broadly defined, occurs.

One problem with the Kindleberger-Minsky view of financial crises is that it does not supply a rigorous theory of what characterizes a financial crisis, and it thus lends itself to being used too broadly as a justification for government interventions that might not be beneficial for the economy. Indeed, this is the basis of Schwartz's (1986) attack on the Kindleberger-Minsky view. On the other hand, the monetarist view of financial crises is extremely narrow because it only focuses on bank panics and their affect on the money supply.

Asymmetric Information and Financial Markets

The recent literature on asymmetric information and financial markets, which has been excellently surveyed recently by Gertler (1988a), on the other hand does provide a broader view of the nature of financial crises. However it supplies a theory which does not automatically justify government interventions when there is a sharp change in asset prices as the Kindleberger-Minsky view might.

Transactions that take place in financial markets are subject to asymmetric information in which one party often does not know all that he or she needs to know about the other party to make correct decisions. For example, a borrower who takes out a loan usually has better information about the potential returns and risk associated with the investment projects he plans to undertake than does the lender. Asymmetric information creates problems in the financial system in two basic ways: before the transaction is entered into (adverse selection) and after the transaction is entered into (moral hazard).

Adverse selection in financial markets occurs when the potential borrowers who are the most likely to produce an undesirable (adverse) outcome -- the bad credit risks -- are the ones most likely to be selected. Since adverse selection makes it more likely that loans might be made to bad credit risks, lenders may decide not to make any loans even though there are good credit risks in the marketplace. This outcome is a feature of the classic "lemons problem" analysis first described by Akerlof (1970). As pointed out by Myers and Majluf (1984)

and Greenwald, Stiglitz and Weiss (1984), a lemons problem occurs in the debt and equity markets when lenders have trouble determining whether a lender is a good risk (he has good investment opportunities with low risk) or, alternatively, is a bad risk (he has poorer investment projects with high risk). In this situation, a lender will only be willing to pay a price for a security that reflects the average quality of firms issuing the securities -- a price below fair market value (the net present value of the expected income streams) for high-quality firms, but above fair market value for low-quality firms. The owners or managers of a high-quality firm that know their quality then also know that their securities are undervalued and will not want to sell them in the market. On the other hand, the firms willing to sell their securities will be low-quality firms because they know that the price of their securities is greater than their value. Since asymmetric information prevents investors from determining whether some firms are high quality, these high quality firms will issue few securities and credit markets will not work well since many projects with a positive net present value will not be undertaken.

Moral hazard in financial markets occurs after a loan is extended when the lender is subjected to the hazard that the borrower might engage in activities that are undesirable (immoral) from the lender's point of view, because they increase the probability of default. Moral hazard arises as a result of asymmetric information since the lender's lack of knowledge about the borrower's activities enables the borrower to engage in moral hazard. However, asymmetric information is not the only source of the moral hazard problem. Moral hazard can also occur because high enforcement costs might make it too costly for the lender to prevent moral hazard even when the lender is fully informed about the borrower's activities.

Moral hazard occurs because the borrower has incentives to invest in projects with high risk in which the borrower does well if the project succeeds but the lender bears most of the loss if the project fails. Also the borrower has incentives to misallocate funds for his own personal use, to shirk and just not work very hard, or to undertake investment in unprofitable projects that increase his power or stature. The conflict of interest between the borrower and lender stemming from moral hazard (the agency problem) implies that many lenders will decide that

they would rather not make loans, so that lending and investment will be at suboptimal levels.

One of the reasons that using asymmetric information theory to understand financial crises is so attractive, is that this theory is also able to explain the basic facts about our financial structure. Clearly, a theory that explains a wide range of phenomena has a higher probability of being correct and this is the case for asymmetric information theory. The basic facts about our financial structure are as follows:

1. Issuing marketable securities is not the primary way businesses finance their operations.
2. Only large, well-established corporations issue securities to finance their activities.
3. The financial system is among the most heavily regulated sectors of the economy.
4. Financial intermediation is the primary way that funds are channeled to those with productive investment opportunities.
5. Banks are the most important source of external funds for businesses.
6. Debt contracts are used more extensively than are equity contracts.
7. Collateral is a prevalent feature of debt contracts.
8. Debt contracts are extremely complicated legal documents that place substantial restrictions on the borrower.

Asymmetric information theory explains the first fact, why marketable securities are not used more extensively, by pointing out that a lemons problem exists in which low quality firms will be more eager to issue securities. Private production and sale of information, which does occur, can help reduce the asymmetric information that leads to the lemons problem for securities. However, the free-rider problem described below, in which people who do not pay for information can take advantage (free-ride off) of the information that others pay for, suggests that the private sale of information will only be a partial solution to the adverse selection and moral hazard problems in securities markets.

If some investors acquire information that tells them which securities are

undervalued and therefore buy their securities, other investors who have not paid for this information may be able to buy right along with the well-informed investors. If enough free-riding investors can do this, the increased demand for the undervalued securities will cause their low price to be bid up to reflect the securities' full net present value given this information. As a result of all these free riders, investors who have acquired information will no longer be able to earn the entire increase in the value of the security arising from this additional information. The weakened ability of private firms to profit from producing information will mean that less information is produced in securities markets, so that the adverse selection problem might continue to be an impediment to a well-functioning securities market. However, the free-rider problem with regard to adverse selection may not always be that severe if those who have acquired information can keep their purchases of securities secret so that less free-riding occurs.

More importantly, the free-rider problem makes it less likely that securities markets will act to reduce incentives to commit moral hazard. Monitoring and enforcement of restrictive covenants (provisions in debt contracts that restrict and specify certain activities of the borrower) are necessary to reduce moral hazard. By monitoring a borrower's activities to see whether he is complying with the restrictive covenants and enforcing the covenants if he is not, lenders can prevent borrowers from taking on risk at their expense. However, because monitoring and enforcement of restrictive covenants are costly, the free-rider problem discourages this kind of activity in securities markets. If some investors know that other securities holders are monitoring and enforcing the restrictive covenants, then they can free ride on the other securities holders' monitoring and enforcement. Once these other securities holders realize that they can do the same thing, they also may stop their monitoring and enforcement activities, with the result that not enough resources are devoted to monitoring and enforcement. The outcome is that moral hazard continues to be a severe problem for marketable securities.

Asymmetric information theory thus explain why securities are not the way most businesses finance their activities. It also explains the second fact that only large, well-established firms can issue securities. These firms are the ones for whom information is easiest to collect and so adverse selection and moral hazard

problems are less of a hindrance to their issuing securities. Adverse selection (lemons) and moral hazard problems also explain the third fact that government regulation of financial markets is so pervasive. One way to reduce adverse selection and moral hazard problems is for the government to require that firms issuing securities supply information to the marketplace that reduces asymmetric information.

The fourth fact that financial intermediaries are crucial to the channeling of funds to those with productive investment opportunities is explained by the existence of both adverse selection and moral hazard problems in financial markets. Financial intermediaries are especially suited to solving adverse selection problems because they become experts at screening out good from bad credit risks and monitoring borrowers to make sure that they do not engage in risky activities that would increase the probability of default. Financial intermediaries profit from the information they produce because they avoid the free-rider problem by making private loans that are not traded. As a result, other investors cannot free ride off the financial intermediary and bid up the loan's price which would prevent the intermediary from profiting from their information production activities. Similarly, no one else can free ride off financial intermediaries' monitoring activities when they make private loans. Financial intermediaries thus receive the benefits of monitoring and so are better equipped to prevent moral hazard on the part of borrowers.

The fifth fact that banks are the most important player in channeling credit to borrowers is explained by their advantages in making private loans as a financial intermediary and the fact that they have particular advantages over other financial intermediaries in solving adverse selection and moral hazard problems. Banks' advantages in information collection activities are enhanced by their ability to engage in long-term customer relationships and issue loans using lines of credit arrangements. In addition their ability to scrutinize the checking account balances of their borrowers provides them with an additional advantage in monitoring the borrowers behavior. Banks also have advantages in reducing moral hazard because, as demonstrated by Diamond (1984), they can engage in lower cost monitoring than individuals, and because, as pointed out by Stiglitz and Weiss (1983), they have advantages in preventing risk taking by borrowers since they can

use the threat of cutting off lending in the future to improve borrower's behavior. Banks' natural advantages in collecting information and reducing moral hazard explain why banks have such an important role in financial markets.

A particular form of moral hazard, the principal-agent problem, explains the sixth fact why debt contracts are used more extensively than equity contracts. When managers (the agents) own only a small percentage of the equity in a firm, they have an incentive to commit moral hazard against equity holders (the principals) by either hiding profits or by engaging in activities that increase the their well-being but do not benefit the equity holders. To prevent this moral hazard from occurring equity holders have to engage in monitoring, referred to as costly state verification. Costly state verification can be avoided if it only occurs in bad states of the world, as is the case for debt contracts where this verification only takes place when the debt contract is in default. The advantage of a less frequent need to monitor the firm explains why debt contracts are used more frequently than equity contracts.

The seventh fact that collateral is a prevalent feature of debt contracts is explained by the adverse selection problem. With sufficient collateral, a lender can worry less about the adverse selection problem: if a borrower is a bad credit risk and then defaults, the lender will not have substantial losses if there is collateral because he can take possession of the collateral, sell it, and thereby offset the loss from the default. The need to minimize moral hazard explains the eighth fact that debt contracts are typically extremely complicated legal documents that place substantial restrictions on the borrower. These restrictions, called restrictive covenants, are necessary because they enable the lender to prevent the borrower from engaging in risky activities that make it less likely that the loan will be paid off in full.

As this brief review of the literature on asymmetric information and financial structure indicates, asymmetric information theory has proved to be extremely valuable in understanding the basic facts about financial structure. The success of this theory for explaining financial structure suggests that it may also be successful at explaining and understanding the facts about financial crises.

Defining a Financial Crisis

The asymmetric information theory outlined above provides a framework for understanding how a disruption in financial markets can cause a downturn in aggregate economic activity. It also provides the following more precise definition of what a financial crisis is.

> **A financial crisis is a disruption to financial markets in which adverse selection and moral hazard problems become much worse, so that financial markets are unable to efficiently channel funds to those who have the most productive investment opportunities.**

A financial crisis thus results in the inability of financial markets to function efficiently, which leads to a sharp contraction in economic activity. This definition of a financial crisis is more precise than the Kindleberger-Minsky view, but it still so general that it does not help identify when a financial crisis is occurring or is imminent. To identify a financial crisis, we need easily identifiable signals that indicate whether adverse selection and moral hazard problems are worsening in financial markets. Fortunately, asymmetric information theory does suggest what these signals might be by suggesting what easily identifiable factors can promote financial crises.

Factors Promoting Financial Crises

Five primary factors in the economic environment can lead to substantial worsening of adverse selection and moral hazard in financial markets, which then cause a financial crisis and shift the economy from an equilibrium with high output to one with low output because the financial system is unable to channel funds to those with the best investment opportunities. The factors causing financial crises are: (1) increases in interest rates, (2) stock market declines, (3) increases in uncertainty, (4) bank panics, and (5) an unanticipated decline in inflation.

Increases in Interest Rates. As demonstrated by Stiglitz and Weiss (1981), asymmetric information and the resulting adverse selection problem can lead to credit rationing in which some borrowers are denied loans even when they are willing to pay a higher interest rate. This occurs because individuals and firms with the riskiest investment projects are exactly those who are willing to pay the highest interest rates since if the high-risk investment succeeds, they will be the main beneficiaries. Thus a higher interest rate leads to even greater adverse selection; that is, it increases the likelihood that the lender is lending to a bad credit risk. If the lender cannot discriminate who are the borrowers with the riskier investment projects, it may want to cut down the number of loans it makes, which causes the supply of loans to decrease with the higher interest rate rather than increase. Thus, even if there is an excess demand for loans, a higher interest rate will not be able to equilibrate the market because additional increases in the interest rate will only decrease the supply of loans and make the excess demand for loans increase even further.[1]

The theory behind credit rationing can be used to show that increases in interest rates can be one factor that helps precipitate a financial crisis. If market interest rates are driven up sufficiently, because of increased demand for credit or because of a decline in the money supply, there is a higher probability that lenders will lend to bad credit risks, those with the riskiest investment projects, because good credit risks are less likely to want to borrow while bad credit risks are still willing to borrow. Because of the resulting increase in adverse selection, lenders will want to make fewer loans, possibly leading to a steep decline in lending which will lead to a substantial decline in investment and aggregate economic activity. Indeed, as Mankiw (1986) has demonstrated, a small rise in the riskless interest rate can sometimes lead to a very large decrease in lending and even a possible collapse in the loan market.

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[1]Jaffee and Russell (1976) have demonstrated a second type of credit rationing in which lenders make loans but limit their size to less than the borrower may want. This occurs because the larger the loan, the greater are moral hazard incentives for the borrower to engage in activities that make it less likely that the loan will be repaid.

Stock Market Declines. An important way that financial markets can solve the problems created by asymmetric information is the use of collateral. Collateral reduces the consequences of adverse selection or moral hazard because it reduces the lender's losses in the case of a default. If a borrower defaults on a loan, the lender can take title to the collateral and sell it to make up for the losses on the loan. Thus if the collateral is of good enough quality, then the fact that there is asymmetric information between borrower and lender is no longer as important since the loss incurred by the lender if the loan defaults is substantially reduced.

Net worth performs a similar role to collateral since if a firm has high net worth, then even if it defaults on its debt payments as a result of poor investments, the lender can take title to the firm's net worth, sell it off, and use the proceeds to recoup some of the losses from the loan. (Note that in a multi-period context, Gertler (1988b) shows that the concept of a borrower's net worth can be broadened to include the discounted value of future profits which is reflected in the market value of the borrowing firm.) In addition, the more net worth a firm has in the first place, the less likely it is to default because the firm has a cushion of assets that it can use to pay off its loans. High net worth also directly decreases the incentives for borrowers to commit moral hazard because they now have more at stake, and thus more to lose, if they default on their loans. Hence, when firms seeking credit have high net worth, the consequences of adverse selection and moral hazard are less important and lenders will be more willing to make loans.

The importance of net worth for reducing adverse selection and moral hazard problems provides a rationale for why stock market declines can help cause a financial crisis. As emphasized by Greenwald and Stiglitz (1988), Bernanke and Gertler (1989), and Calomiris and Hubbard (1990), a sharp decline in the stock market, as in a stock market crash, can increase adverse selection and moral hazard problems in financial markets because it leads to a large decline in the market value of firms' net worth. (Note that this decline in asset values could either occur because of expectations of lower future income streams from these assets or because of a rise in market interest rates which lowers the present discounted value of future income streams.) The decline in net worth as a result of a stock market decline makes lenders less willing to lend because, as we have seen, the net worth of firms has a similar role to collateral, and when the value of

collateral declines, it provides less protection to lenders so that losses from loans are likely to be more severe. In addition, the decline in corporate net worth as a result of a stock market decline increases moral hazard incentives for borrowing firms to make risky investments because these firms now have less to lose if their investments go sour. Because borrowers have increased incentives to engage in moral hazard and because lenders are now less protected against the consequences of adverse selection, the stock market decline leads to decreased lending and a decline economic activity.

Increases in Uncertainty. A dramatic increase in uncertainty in financial markets, due perhaps to the failure of a prominent financial or non-financial institution, a recession, or a stock market crash, makes it harder for lenders to screen out good from bad credit risks. The increase in uncertainty therefore makes information in the financial markets even more asymmetric and makes the adverse selection problem worse. The resulting inability of lenders to solve the adverse selection problem, renders them less willing to lend, leading to a decline in lending, investment and aggregate activity.

Bank Panics. As we have seen, banks have a very important role in financial markets since they are well suited to engage in information-producing activities that facilitate productive investment for the economy. Thus as described by Bernanke (1983), a financial crisis which results in a bank panic, the simultaneous failure of many banks, reduces the amount of financial intermediation undertaken by banks, and will thus lead to a decline in investment and aggregate economic activity.

As indicated by Gorton and Calomiris (1991), the source of a bank panic is again asymmetric information. In a panic depositors, fearing the safety of their deposits, withdraw them from the banking system, causing a contraction in loans and a multiple contraction in deposits, which then causes banks to fail. Asymmetric information is critical to this process because depositors rush to make withdrawals from solvent as well as insolvent banks since they cannot distinguish between them. Furthermore, banks' desire to protect themselves from possible

deposit outflows leads them to increase their reserves relative to deposits, which also produces a contraction in loans and deposits and promotes other bank failures. The net result is that a bank panic reduces the funds available to banks to make loans and the cost of financial intermediation rises, causing a reduction in investment and a decline in aggregate economic activity.

A bank panic also can lead to higher interest rates because the panic results in decreasing liquidity since the supply of funds to borrowers has been curtailed. As we have seen, this rise in interest rates directly increases adverse selection problems in credit markets and also can reduce the value of firms' net worth, which also increases adverse selection as well as moral hazard problems. Thus, since bank panics have the secondary effect of increasing adverse selection and moral hazard problems in financial markets, bank panics lead to economic contraction through these channels as well.

Unanticipated Decline in Inflation An unanticipated decline in inflation also decreases the net worth of firms. Interest rate payments on debt are contractually fixed in nominal terms and allow for expected inflation. When inflation turns out to be less than anticipated, which can either occur because of an unanticipated disinflation as occurred in the 1980s or by an outright deflation as frequently occurred before World War II, the value of firms' liabilities in real terms rises so that there is an increased burden of the debt, but there is no corresponding rise in the real value of firms' assets. The result is that net worth in real terms declines. A sharp unanticipated disinflation or deflation, therefore causes a substantial decline in real net worth and an increase in adverse selection and moral hazard problems facing lenders. The resulting increase in adverse selection and moral hazard problems (of the same type that were discussed in assessing the effect of stock market declines earlier) will thus also work to cause a decline in investment and economic activity.[2]

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[2]Calomiris and Hubbard (1989) emphasize this mechanism in their econometric analysis of the 1894-1909 period. A related mechanism that would cause a decline in aggregate demand works through an anticipated deflation which then raises real interest rates and causes a decline in investment. Recent work by Cecchetti (1992), Hamilton (1992), and Evans and Wachtel (1993) has focused on whether the deflation during the Great Depression was anticipated, coming

An Additional Signal of a Financial Crisis

To identify a financial crisis, the analysis above suggests that we should look for sharp declines in stock prices, increases in interest rates, major failures of financial and nonfinancial institutions, bank panics and unanticipated declines in inflation. Our analysis of the impact of asymmetric information on financial markets suggests an additional piece of information that helps signal a financial crisis: the spread between interest rates on low and high-quality bonds. When adverse selection increases in financial markets during a financial crisis there should be a large rise in interest rates to borrowers for which there is substantial difficulty in obtaining reliable information about their characteristics, that is, for which there is a serious asymmetric information problem. On the other hand, there would be a much smaller effect on interest rates to borrowers for which there is almost no asymmetric information problem because it is easy to obtain information about their characteristics. Since low-quality borrowers are more likely to be firms for which information about their characteristics is difficult to obtain, while high-quality borrowers are more likely to be ones for which the asymmetric information problem is least severe, a rise in the spread between interest rates for low and high-quality borrowers can provide information on when the adverse selection problem becomes more severe in debt markets.

The spread between interest rates for low and high-quality borrowers can also provide information about whether moral hazard problems in financial markets are increasing during a financial crisis. High-quality borrowers with initially high net worth are much less likely to engage in moral hazard when a stock market crash or a deflationary shock occurs because they still will have sufficient net worth so that they continue to have much to lose if they default on their debts. On

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to somewhat mixed conclusions. It is important to recognize that the mechanism described in the text in which unanticipated deflation causes a decline in investment suggests that the distinction between anticipated and unanticipated deflations may not be all that crucial in understanding why the Great Depression occurred. Both mechanisms suggest that the sharp deflation in the 1930-33 period in the United States was an important factor causing the Great Depression, whether the deflation was anticipated or not.

the other hand, when a stock market crash or a deflationary shock occurs, low-quality borrowers with initially low net worth will now have so little net worth left that their incentives to commit moral hazard will be greatly increased. The outcome is that a deflationary shock or a stock market crash which increases moral hazard problems in debt markets should result in a greater increase in interest rates for low-quality borrowers than for high-quality borrowers. An increase in the interest rate spread for low versus high-quality borrowers thus suggests that moral hazard as well as adverse selection problems are increasing in financial markets.

The Sequence of Events in Past Financial Crises

To provide evidence on whether our asymmetric information view of financial crises, we can see whether the sequence of events in past financial crises conform to what our theory predicts.

As documented in Mishkin (1991), most financial crises in the U.S. have indeed begun with a sharp rise in interest rates, a stock market crash and an increase in uncertainty arising after the start of a recession and from a failure of major financial or non-financial firms (the Ohio Life Insurance & Trust Co. in 1857, the Northern Pacific Railroad and Jay Cooke & Co. in 1873, Grant & Ward in 1884, the National Cordage Co. in 1893, the Knickerbocker Trust Company in 1907, and the Bank of United States in 1930.) During these crises the increase in uncertainty, the rise in interest rates and the stock market crash increased the severity of adverse selection problems in credit markets, while the decline in net worth stemming from the stock market crash also increased moral hazard problems. As the theory predicts, the spread between interest rates on low and high-quality bonds rose when these events occurred, indicating the worsening adverse selection and moral hazard problems in financial markets. The increase in adverse selection and moral hazard problems made it less attractive for lenders to lend and led to a decline in investment and aggregate economic activity.

Because of the worsening business conditions and uncertainty about their bank's health, depositors now began to withdraw their funds from banks because they worried that the banks might become insolvent. The resulting bank panic, in

which the number of banks declined, raised interest rates even further and decreased the amount of financial intermediation by banks. With the bank panic, the spread between interest rates on low and high quality bonds jumped even further, indicating a further worsening of the problems created by adverse selection and moral hazard, which, in turn, led to further economic contraction.

In many of the episodes, such as the panics of 1857, 1884, 1890, 1893, and 1907, there now would be a sorting out of insolvent firms from healthy firms by bankruptcy proceedings and the same process would occur for banks, often with the help of public and private authorities. Once this sorting out was complete, uncertainty in financial markets would decline, the stock market would undergo a recovery, and interest rates would fall. The result would then be a diminution in adverse selection and moral hazard problems, the spread between interest rates on low and high quality bonds would decline, and the financial crisis would subside. With the financial markets able to operate well again, the stage would be set for the recovery of the economy.

However, in other episodes, such as the 1873 panic and the Great Depression, the economic downturn and contraction of the money supply resulting from the bank panic led to a sharp decline in prices. With the unanticipated deflation, the recovery process might get short-circuited. In this situation described by Irving Fisher (1933) as a debt-deflation, the unanticipated deflation led to a further deterioration in firms' net worth because of the increased burden of indebtedness. When debt-deflation set in the adverse selection and moral hazard problems continue to increase, so that the spread between interest rates on low and high quality bonds keeps on rising. As a result, investment spending and aggregate economic activity remain depressed for a long time.

There are several conclusions that can be drawn from studying the U.S. episodes. The timing and the pattern of the data in the episodes seem to fit an asymmetric information interpretation of financial crises. Rather than starting with bank panics, as the monetarist view of financial crises contends, most of the financial crises began with a rise in interest rates, a stock market crash and the widening of the interest rate spread. Furthermore, a financial panic frequently was immediately preceded by a major failure of a financial firm and the beginning of the recession which increased uncertainty in the marketplace. The increase in

uncertainty and the rise in interest rates magnified the adverse selection problem in the credit markets, while the decline in the stock market increased adverse selection and moral hazard problems, both of which were reflected in the rise in the spread between interest rates for low and high-quality borrowers. The increase in adverse selection and moral hazard problems then led to a decline in investment activity and aggregate economic activity.

Only after these problems have manifested themselves in financial markets do we find that a bank panic occurs. The monetarist explanation of financial crises does not explain the timing of banking panics, that is, why they occurred when they did. Asymmetric information analysis, on the other hand, sees bank panics as a consequence of high interest rates, a major failure of a corporation or a nonbank financial institution, or weak business conditions stemming from a recession which makes depositors nervous about the health of banks that hold their deposits. Since depositors cannot easily screen out good from bad banks, when this adverse aggregate information appears, they worry about potential losses on their deposits and withdraw funds from the banking system, precipitating a panic. The facts about the crisis episodes discussed in Mishkin (1991) are thus entirely consistent with Gorton's (1987) view that bank panics are predictable.

Once a bank panic sets in, the resulting loss of liquidity causes interest rates to rise further, the stock market to decline even more and the adverse selection and moral hazard to worsen, as manifested by a further widening of the spread between interest rates for low versus high-quality borrowers. Finally, the sorting out of solvent from insolvent firms and banks occurs, the crisis then subsides, the stock market undergoes a recovery, interest rates fall, and if economic uncertainty and unanticipated deflation were not too severe, adverse selection and moral hazard problems would diminish, leading to a decline in the interest rate spread between low and high-quality borrowers. In episodes in which a substantial deflation does not occur we then expect and do see a rapid decline in the spread between interest rates for low versus high-quality borrowers.

However, in episodes in which a substantial deflation sets in, we see evidence of a debt-deflation process in which there is a prolonged continuation of a large spread between interest rates for low and high-quality borrowers. It is exactly in these episodes that we see aggregate economic activity depressed for a

prolonged period of time.

Pseudo-Financial Crises

Our analysis of what constitutes a financial crisis also distinguishes between financial crises which severely damage the economy by interfering with the smooth functioning of financial market and other financial market disturbances which, although very dramatic, are not damaging to the economy in themselves. Sharp changes in asset prices, such as those occurring during a stock market crash or in a foreign exchange crisis often are viewed as financial crises. However, the asymmetric information view suggests that such financial disturbances may not qualify for the financial crisis label unless they are combined with other events which lead to the full-blown financial crisis we described in the previous section. These financial disturbances which do not lead to increases in asymmetric information problems in the financial markets will not seriously damage the economy and thus qualify for Schwartz's (1986) designation as "pseudo-financial crises".

For example, there are many instances of stock market crashes, which show no manifestation of an increase in asymmetric information problems in financial markets. For example, one of the most severe stock market crashes in U.S. history occurred in May of 1940 in the aftermath of Dunkirk. Indeed, the monthly decline in May 1940 was the third largest negative monthly return in the 1834-1988 period examined by Wilson, Sylla and Jones (1990). However, this crash occurred at a time when the U.S. economy was booming and interest rates were low, so that other conditions were very unfavorable to worsening of adverse selection and moral hazard problems in financial markets. Not surprisingly, as pointed out in Mishkin (1991), the spread between interest rates on low and high quality bonds rose hardly at all and the U.S. economy kept on booming.

Even more striking is the behavior of the interest rate spread in the aftermath of the October 1929 stock market crash, which is viewed by many laymen as the cause of the Great Depression. Although there was some rise in the

spread after the crash, for a year following it remained at remarkably low levels, especially considering the decline in the stock market and the fall in industrial production in this period documented by Friedman and Schwartz (1963). It was not until the first bank panic in October 1930, that asymmetric information problems in financial markets substantially worsened and the interest rate began to rise, eventually to unprecedentedly high levels by 1933. Thus, consistent with Friedman and Schwartz's view, the stock market crash was not a full-fledged financial crisis and did not cause of the Great Depression.

The fact that the 1929 stock market crash did not lead to a deterioration in the smooth functioning of financial markets was not happenstance. The credit for averting a financial crisis in this episode goes to the prompt action by the Federal Reserve Bank of New York to provide reserves to the New York banks. During the panic period, banks and lenders outside of New York rushed to liquidate their call loans to brokers. In order to keep market conditions from getting more unsettled, the Federal Reserve Bank of New York, as described by its president, George L. Harrison, kept its "discount window wide open and let it be known that member banks might borrow freely to establish the reserve required against the large increase in deposits resulting from the taking over of loans called by others."[3] In addition, the New York Fed made open market purchases of $160 million during this period, even though this amount was far in excess of what was authorized by the Federal Reserve System's Open Market Investment Committee. In the aftermath of the New York Fed's action to provide sufficient liquidity for the economy there was a decline of the interest rate spread to levels below those before the stock market crash and a continuing low level up until October 1930.

Armored with the asymmetric information definition of financial crises, it also should be obvious that foreign exchange crises, which are often labeled as international financial crises, are likely to fit into the category of a "pseudo-financial crisis". Foreign exchange crises like the one that almost brought down the European Monetary System in September 1992 involve a speculative attack on currencies in a fixed exchange rate system, a key feature of which is that in effect central banks have established a one-sided bet for speculators by standing ready

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[3]Friedman and Schwartz (1963), page 339.

to intervene to prop up weak currencies. In this situation private firms and banks in the aggregate are not exposed to large losses of wealth because a change in the exchange rate leads both to winners and losers. Furthermore, private firms and banks actually tend to benefit during these "crises" because the one-sided intervention on the part of central bank results in huge profits for the speculators at the expense of the central banks. During the September 1992 exchange rate crisis, reports in the press indicated that intervention by the central banks resulted in their losing from 4 to 6 billion dollars.

Indeed, the only danger of financial crisis might come from central bank attempts to prop up their domestic currency by raising interest rates to extremely high levels, as occurred in Sweden when the interbank rate went to 500%. If such tight money policies are continued for very long, then there is a potential for the high interest rates to lead to increased asymmetric information problems in the financial markets. One of the reasons that central banks often are forced to give up on pegging the value of their currency during a speculative attack is that they sensibly have concluded that attempts to keep the exchange rate fixed will have costly effects on the economy.

Recent Potential Financial Crises

Since the Great Depression, severe financial crises have not been a feature of the world economy. However, there have been several episodes in which the potential for a severe financial crisis existed, but timely intervention by a central bank prevented the financial crisis from occurring. Two examples in the United States illustrate that the potential for financial crises are still substantial: the Penn Central bankruptcy in June 1970 and the stock market crash in October 1987.

Prior to 1970, commercial paper was considered one of the safest money market instruments because only corporations with very high credit ratings issued it. It was common practice for corporations to continually roll over their commercial paper, that is, issue new commercial paper to pay off the old. Penn Central Railroad was a major issuer of commercial paper, with more than $200

million outstanding, but by May 1970 it was on the verge of bankruptcy and it requested federal government assistance from the Nixon administration.[4] Despite administration support for a bailout of Penn Central, after six weeks of debate Congress decided not to pass bailout legislation. Meanwhile, the Nixon administration asked the Board of Governors to authorize a direct loan from the Federal Reserve Bank of New York Fed to Penn Central. However, on Thursday, June 18, the New York Fed informed the Board of Governors that its staff studies indicated that Penn Central would not be able to repay the loan, and as a result the Board decided not to authorize the loan. Without this loan, Penn Central was forced to declare bankruptcy on Sunday, June 21.

Once the Federal Reserve made the decision to let Penn Central go into bankruptcy, it was concerned that Penn Central's default on its commercial paper would, as Brimmer (1989) puts it, have had a "chilling effect on the commercial paper market" (p. 6), making it impossible for other corporations to roll over their commercial paper. The Penn Central bankruptcy, then, had the potential for sending other companies into bankruptcy which, in turn, might have triggered further bankruptcies---leading to a full-scale financial panic. To avoid this scenario, the New York Fed got in touch with a number of large money center banks on Saturday and Sunday, June 20 and 21, alerted them to the impending Penn Central bankruptcy on June 22, encouraged them to lend to their customers who were unable to roll over their commercial paper, and indicated that the discount window would be made available to the banks so that they could make these loans.[5] Indeed, the banks did as they were told and made these loans, receiving as much as $575 million through the discount window for this purpose. In addition, on June 22 the Fed decided to suspend Regulation Q ceilings on deposits of $100,000 and over in order to keep short-term interest rates from rising, and the formal vote was taken the next day to allow the FDIC and the

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[4]See Maisel (1973) and Brimmer (1989) for further discussion of the Penn Central bankruptcy episode.

[5]It is noteworthy that when the Fed advanced discount loans to banks lending to customers who needed to role over their commercial paper, the banks were told that they would be responsible for the credit risk involved in this lending. See Brimmer (1989), page 6.

FHLBB to take parallel action. The net result was that the Federal Reserve provided liquidity so that the commercial paper market would keep functioning.

The rationale for the Fed's action was that lenders would not be able to screen out good borrowers in this market from bad borrowers. Was this rationale plausible? The data in Figure 1 on the following variables suggest that it was. The STOCK variable is the cumulative geometric sum of the stock market return series in Wilson, Sylla and Jones (1990) and is an end-of-month series and RCP is the 4-6 month commercial paper rate. The SPREADB variable is the spread between Moody's Baa corporate bond rate and the long-term Treasury bond rate averaged over the month, the same spread variable used by Bernanke (1983), while SPREADC is the spread between interest rates on 4-6 month commercial paper and 6-month Treasury bills. (The interest rate data were obtained from various issues of the Federal Reserve Bulletin.) The onset of the recession in January 1970 is marked with an "R", and the Penn Central bankruptcy date is marked by a "P". Panel A contains data on the stock market variable, STOCK, and the commercial paper rate, RCP, and Panel B contains data on the interest rate spread variables, SPREADB and SPREADC.

The data in Panel A display the typical pattern found in pre World War II financial crises. The high level of interest rates reached in late 1969-early 1970 and the increase in uncertainty with the onset of the recession in January 1970 are likely to have increased the adverse selection problem in the credit markets. Furthermore, by May 1970 the stock market had declined over 35% from its peak value in November 1969. This decline in the valuation of firms resulted in a decrease in net worth and further increased moral hazard and adverse selection problems in the credit markets. Consistent with the rise in asymmetric information difficulties for the credit markets we do see in Panel B a rise in both of the interest rate spread variables, SPREADB (for long-term bonds) and SPREADC (for commercial paper). Furthermore, despite the Fed's actions we also see a jump in the interest rate spread variables at the time of the Penn Central bankruptcy in June 1970. The fact that the spread between interest rates on corporate Baa and Treasury bonds, rises along with the commercial paper-Treasury spread variable indicates that the problems in the commercial paper market did have a potential for spreading to other sectors of the capital market. As occurred in earlier episodes

of financial crisis, the interest rate spread does decline after the crisis, and this pattern is especially pronounced for the commercial paper-Treasury spread variable in Panel B, which returns to 1968 levels by the end of 1970. The SPREADB variable, on the other hand, continues to remain high for over two years after the Penn Central bankruptcy. However, the increase in the SPREADB variable resulting from the Penn Central bankruptcy was not large by the standards of earlier financial crises. A major disturbance to the credit markets as a result of increased asymmetric information problems seems to have been avoided by the Fed's willingness to perform its lender-of-last resort function.[6]

The causes of the stock market crash of 1987 are still being hotly debated, but the biggest danger to the economy appears not to have come from the decline in wealth resulting from the crash itself, but rather from the threat to the clearing and settlement system in the stock and futures markets.[7] From the peak on August 25, 1987 until October 16, just prior to the crash, the Dow Jones Industrial Average had declined 17.5%. On Monday, October 19, the market fell by 22.6% (as measured by the DJIA) on record volume of 604 million shares. Although October 19, 1987, dubbed "Black Monday", will go down in history as the largest one-day decline in stock prices to date, it was on Tuesday, October 20, 1987, that financial markets received their worst threat. In order to keep the stock market and the related index futures market functioning in an orderly fashion, brokers needed to extend massive amounts of credit on behalf of their customers for their margin calls. The magnitude of the problem is illustrated by the fact that just two brokerage firms, Kidder, Peabody and Goldman, Sachs, had advanced $1.5 billion in response to margin calls on their customers by noon of October 20. Clearly, brokerage firms as well as specialists were severely in need of additional funds to finance their activities. However, understandably enough, banks were growing very nervous about the financial health of securities firms and so were reluctant to lend to the securities industry at a time when it was most needed.

Upon learning of the plight of the securities industry, Alan Greenspan and

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[6]Further evidence for this view is provided by Calomiris (1993).

[7]See the Wall Street Journal (1987) and Brimmer (1989) for a description of the events surrounding the stock market crash.

E. Gerald Corrigan, the president of the New York Federal Reserve Bank and the Fed official most closely in touch with Wall Street, began to fear a breakdown in the clearing and settlement systems and the collapse of securities firms. To prevent this from occurring, Alan Greenspan announced before the market opened on Tuesday, October 20, the Federal Reserve System's "readiness to serve as a source of liquidity to support the economic and financial system." In addition to this extraordinary announcement, the Fed encouraged key money center banks to lend freely to their brokerage firm customers, and made it clear that it would provide discount loans to banks so that they could make these loans. The banks did as they were told and by October 21 had increased by $7.7 billion their loans to brokers and to individuals to purchase or hold securities. As a result, the markets kept functioning on Tuesday, October 20 and a market rally ensued that day, raising the DJIA by over 100 points (over 5%). This action by the Fed is reminiscent of the actions taken by the Fed during the October 1929 panic period in which it provided liquidity to enable money center banks to take over call loans which had been called by others.

The potential for a serious financial crisis resulting from the stock market crash is evident in the data on stock prices, interest rates and interest rate spreads found in Figure 2 which again display patterns seen in other financial crises. Panels A and B have the same format as those in Figure 1 with the date of the stock market crash marked by a C, while an additional panel, Panel C, has been added which contains weekly data on interest spread variables for the six months surrounding the crash. Panel C plots an additional series, SPREADJ, the spread between interest rates on junk bonds (those with ratings below Baa, obtained from weekly issues of Barrons) and long-term Treasury bonds.

The commercial paper rate had been rising for a year before the stock market crash because of the tight money policy followed by the Fed, while stock prices began a decline over a month earlier. The evidence for increased asymmetric information problems in credit markets before the crash, however, is not particularly strong. The commercial paper-Treasury bill interest rate spread variable, SPREADC, also had been rising for a year before the crash, and yet the junk bond-Treasury and Baa-Treasury spread variables, SPREADJ and SPREADB, did not rise until the stock market crash, when they immediately jumped. Not

surprisingly, given that asymmetric information effects should impact more on low quality borrowers than on high quality borrowers, the junk bond-Treasury spread shows the largest jump. In the week of the stock market crash, it jumped by 130 basis points (1.3 percentage points) and rose another 60 basis points over the next two weeks. However, as usually occurs after a panic, the junk bond-Treasury spread fell quickly thereafter and within two months of the crash was back to pre crash levels. The commercial paper-Treasury spread, SPREADC, followed a similar pattern by returning quickly to its pre crash levels, but the Baa-Treasury spread, SPREADB, declined more slowly and only reached its pre-crash level six months after the crash.

The fact that the spread variables seem to fit a classic pattern for financial crises suggests that the October 1987 stock market crash did have the potential to create major asymmetric information problems in the credit markets. However, the prompt action by the Fed kept the asymmetric information problem from getting out of hand, as is indicated by the moderate increase in the Baa-Treasury spread relative to earlier financial panics. The failure to enter a recession after the stock market crash, despite many forecasters predictions along these lines, is consistent with the view that the Fed's actions prevented the development of serious asymmetric information problems in the credit markets. Furthermore, the fact that the stock market crash in the United States occurred simultaneously with stock market crashes in the rest of the world, suggests that a financial crisis, if it had been allowed to develop, would have been a world-wide phenomenon and would not have been restricted to the United States.

WHY HAS THE INTERNATIONAL FINANCIAL SYSTEM BECOME MORE FRAGILE?

The examples of the Penn Central bankruptcy and the October 1987 stock market crash illustrates that the potential for financial crises is a real one. Here, I want to argue that changes in the international financial system have made the potential for financial crises even greater in recent years, thus requiring vigilance and possible action by policymakers to prevent these crises.

Increased Liquidity of International Financial Markets

The financial innovation process, which has led to such immense changes in the international financial system in recent years, has to a large extent been driven by the desire to increase the liquidity of financial markets. For example contracts in the financial derivatives markets have been specifically designed to improve liquidity. Stock index futures enable institutional investors to in effect trade in large blocks of stock with extremely small transactions costs, as is also the case for Treasury bond and other interest rate futures. Indeed, financial futures markets are so liquid that the most successful options contracts, futures options, are derivatives twice removed. Their underlying instrument is not debt or stock securities, but instead is on the more liquid futures contracts on these debt and stock securities.

Advances in computers and telecommunications have also made financial markets more liquid throughout the world. Technology to transmit share prices and information instantaneously around the world has led to dealers in New York, London, or Tokyo not being constrained by the hours of organized exchanges; they can trade at any time of day or night. The low cost of international communications is also making it easier to invest abroad, and we have moved to a world in which stocks and bonds are traded internationally twenty-four hours a day. A similar phenomenon has been occurring the futures markets, as is evidenced by the development of the Globex electronic trading system by the Chicago Mercantile Exchange, which allows futures trading internationally even when exchanges are not officially open.

The increase in liquidity produced by financial innovation is in general a good thing because it makes the financial markets work more efficiently. However, it does have the side effect that it may accelerate movements in financial markets that could lead to financial crises. For example, many economists view the speed at which the decline in stock prices occurred during the stock market crash of October 1987 to be the result of increased liquidity provided by stock index futures, which in effect, enabled institutional traders to sell large blocks of shares more easily. As a result critics of stock index futures have advocated restrictions on their trading, and stock exchanges, such as the NYSE, have placed

limits on trading when there are large swings in stock prices within a day.

The advances in telecommunications have also resulted in increased global integration of financial markets. The impact of advanced telecommunications on the internationalization of financial markets was most dramatically illustrated by the events during the Crash of 1987. Just before the crash on October 19, 1987, there were substantial declines in foreign stock markets. As a result, there were huge sell orders at the U.S. markets' openings on October 19 and stock prices on the U.S. exchanges plummeted. Then the crash in U.S. stocks was transmitted to foreign markets which experienced declines of similar magnitude. For better or for worse, we now live in a world of highly integrated financial markets in which disturbances in financial markets in one country will quickly be transmitted to markets throughout the world.

The Increase in Corporate Indebtedness

An important development in the 1980s was the explosion of corporate indebtedness in the United States and the resulting increase in leverage. Corporate debt relative to GDP which had been around the 30% level in the early 1980s, climbed to above 40% by the late 1980s, and, although it has declined in recent years still remains at quite high levels. Although there is some evidence that increased corporate indebtedness has improved the incentives for managers and so has improved the efficiency of American business,[8] the asymmetric information analysis of financial crises outlined here suggests that increased indebtedness has the undesirable consequence that it makes financial crises more likely. Unanticipated disinflation will have a greater impact on adverse selection and moral hazard problems in financial markets, the greater is business firms' indebtedness. Furthermore, studies by Bernanke and Campbell (1988) and Bernanke, Campbell and Whited (1990) indicate that a severe recession has the potential to trigger a serious crisis of escalating bankruptcies.

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[8]This evidence is however, highly controversial. See Michael Jensen (1988) and the rest of the "Symposium on Takeovers" in which the Jensen paper is published.

The evidence therefore suggests that increased corporate indebtedness has made the American financial system more fragile. Although the explosion of corporate indebtedness was primarily a U.S. phenomenon, instability in U.S. financial markets would surely spread throughout the world given today's integration of international financial markets.

The Decline of the Banking Industry

Financial innovation has caused banks to suffer declines in their cost advantages in acquiring funds, that is, on the liabilities side of their balance sheet, while at the same time, they have lost income advantages on the asset side of their balance sheet. Fundamental forces in the financial system are thus causing a simultaneous decline of cost and income advantages for banks that will cause the banking industry to shrink in the future.

Banks have lost their cost advantages in acquiring funds because banks' monopoly power over bank depositors, frequently granted by government regulation, has been eroding. In 1960, over 60% of bank liabilities in the United States were demand deposits which, by government regulation, paid no interest. Attempts to get around deposit rate ceilings and reserve requirements (that in effect acted as a tax on deposits since no interest is paid on reserves) led to financial innovation which produced money market mutual funds. These helped break the banks' monopoly power over depositors because depositors could now obtain checking-like services while earning high interest rate on their money market mutual fund accounts. A manifestation of these changes in the financial system was the disintermediation process where banks were no longer able to attract funds, particularly low cost funds: checkable deposits declined dramatically in importance for banks, falling from over 60% of bank liabilities to under 20% today, and many of these are NOW accounts which pay interest.

The loss of monopoly power over depositors has not just occurred in the United States, but elsewhere as well. The financial deregulation process which has been occurring world-wide has been opening up new attractive alternatives for where depositors can put their funds. The financial deregulation process in Japan,

for example, has opened a wide array of new financial instruments that are available to the public, causing a similar disintermediation process to the one that has already taken place in the United States.

The loss of cost advantages on the liabilities side of the balance-sheet for is one reason that banks have become less competitive, but they have also been hit by a decline in income advantages on the assets side. In the United States, improvements in information technology have made it easier for business firms to issue securities directly to the public. This has meant that instead of going to banks to finance short-term credit needs, many of the banks' best business customers now find it cheaper to go to the commercial paper market for funds instead. The loss of this competitive advantage for American banks is evident in the fact that before 1970 the amount of nonfinancial commercial paper was less than 5% of commercial and industrial bank loans, while this ratio has grown to over 20% today.

The rise of money market mutual funds has been another factor in the rapid growth in the commercial paper market. Because money market mutual funds need to hold liquid, high-quality, short-term assets such as commercial paper, the growth of assets in these funds to over $500 billion has created a ready market in commercial paper. This growth in the commercial paper market has allowed finance companies, who primarily depend on commercial paper to acquire funds, to greatly expand their operations at the expense of banks. Finance companies who lend to many of the same businesses that borrow from banks have increased their market share relative to banks: Before 1980, finance company loans to business were around 30% of commercial and industrial loans, while currently they are over 60%.

The rise of the junk bond market has also eaten into banks' loan business. Improvements in information technology have made it easier for corporations to sell their bonds to the public directly, thereby bypassing banks. Although Fortune 500 companies started taking this route in the 1970s, now lower quality corporate borrowers are using banks less often because they have access to the junk bond market.

Improvements in computer technology have led to securitization, in which illiquid financial assets like bank loans or mortgages are transformed into

marketable securities. Computers enable other financial institutions besides banks to originate loans because they can now accurately evaluate credit risk with statistical methods, while computers have lowered transactions costs, making it possible to bundle these loans and sell them as securities. As a result, banks no longer have an advantage in making loans when default risk can be easily evaluated with computers. Without their former advantages, banks have lost loan business to other financial institutions even though the banks themselves are involved in the process of securitization. Securitization has been a particular problem for mortgage-issuing institutions such as S&Ls because the bulk of residential mortgages are now securitized.

Because of the squeeze on the banks resulting from the loss of competitive advantages on both the cost side in raising funds and the income side on the use of their funds, the last twenty years have not been good ones for the banking industry. In the United States, commercial banks' importance as a source of funds for borrowers has shrunk dramatically, from around 40% of total credit advanced in the 1960s to below 30% in the early 1990s.[9] Thrifts have also seen a decline in market share from 20% in the 1960s and 70s to around 15% in the early 1990s.

Furthermore, bank profitability has declined as well. Two standard measures of commercial bank profitability, the rate of return on assets and the rate of return on equity indicate a declining trend in bank profits in the 1980s. For example, the rate of return on equity has declined from 13% in the 1970-80 period to 10% in the 1990-92 period. Although bank profits did improve sharply in 1992, many bank analysts believe that profits in that year were temporarily high because of favorable interest rate developments that would not be long lasting. The dismal performance of the banking industry has led to a large number of bank failures in the United States, which have been running at rates more than ten times that of the 1945-81 period, and to a shrinkage of the number of commercial banks

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[9]See Boyd and Gertler (1993), Edwards (1993) and Mishkin (1995, forthcoming) for additional discussion of the forces behind the decline in the banking industry. Note that as Boyd and Gertler have pointed out, looking at the decline in the market share of credit advanced by banks overstates somewhat the decline of the banking industry in credit markets because, as pointed out in the previous chapter, banks have increased their off-balance sheet activities in credit markets.

from around 15,000 in the 1970s to 12,000 today.

The banking industry has not suffered as much in other countries as in the United States because government regulators in these countries have often worked harder to protect the privileged position of banks. However, as noted in the introduction, banks in other countries have also begun to experience difficulties recently. Because the forces driving the decline in the banking industry are so fundamental, no matter how protected banks are in other countries eventually they will have to face the music and cope with a more competitive environment. Thus a major shrinkage of the banking industry will not be restricted to the United States, but will occur throughout the industrialized world.

Normally economists do not lose much sleep over a declining industry. Clearly the buggy whip industry could not survive after automobiles came onto the scene, and the fact that it died a relatively quick death is a good thing because it allowed resources to move to more productive uses. However, the decline of the banking industry is another matter. The decrease of profitability means that less capital will be attracted to the industry and banks would therefore have to shrink, or would disappear entirely. If this is an orderly process, then there is no problem. But the weakening profitability of banks means that bank failures are more likely and, as we have seen, because depositors may not be able to distinguish good banks from bad banks, bank failures have the potential to escalate into bank panics. Then if a bank panic occurs, there will be a loss of information production in financial markets, a resulting increase in adverse selection and moral hazard problems, and therefore a sharp decline in investment and aggregate economic activity. The fundamental forces which have been causing the banking industry to shrink thus provide another reason for increased fragility of the international financial system.

IMPLICATIONS FOR POLICY

By now, I hope that the reader is convinced that the potential for future international financial crises is a real one and, has, if anything, grown in recent

years. Now we can use the asymmetric information framework developed in this lecture to discuss the issues facing policymakers on how to prevent international financial crises.

Lender of Last Resort

The traditional recommendation for prevention of financial crises goes back to Thornton (1802) and Bagehot (1873) who recommend that the central bank be a lender of last resort who will lend freely during a panic at a penalty rate. What does the asymmetric information framework outlined here say about this traditional recommendation? Does it provide further guidance on when the central bank needs to be ready to be a lender of last resort and how it can conduct this role? How would the policy prescription differ from that provided by the earlier literature on financial crises?

A monetarist view of financial disturbances sees them as important only if they produce banking panics which leads to a decline in the money supply. With this view, the lender of last resort role should be very a narrow one: the central bank would only lend freely to banks when there is a sudden desire on the part of depositors to withdraw their funds from banks. To lend freely at other times, during what Anna Scwhartz (1986) calls "pseudo-financial crises", will only lead to inefficiency because firms that deserve to fail are bailed out, or because it results in excessive money growth that stimulates inflation. Indeed, the monetarist position suggests that if the central bank is able to keep monetary aggregates growing at appropriate rates, it is unlikely that a lender of last resort role is even needed to promote the health of the economy.[10]

The asymmetric information framework provides a better explanation of the sequence of events during financial crises than does the monetarist view. An asymmetric information view of financial crises, although it sees an important role for bank panics, does not see them as the only financial disturbances that can have

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[10]For example, McCallum (1988) takes the position that monetary policy only needs to concern itself with adherence to a monetarist-like rule which adjusts monetary base growth for past changes in velocity. In a more recent paper, McCallum (1989) suggests that pursuance of such a rule would have been enough to prevent the Great Depression.

serious adverse effects on the aggregate economy. Financial crises have effects over and above those resulting from banking panics, and analysis of such episodes as the Penn Central Bankruptcy and the stock market crash in October 1987 suggest that a financial crisis which has serious adverse consequences for the economy can develop even if there is no threat to the banking system.

Mishkin (1991) provides evidence that although there was no banking panic in 1937 or 1938, a financial crisis seems to have occurred in the 1937-38 period. From its peak in February 1937 until its trough in March 1938, the stock market declined by 50%, with the stock market return of -23.9% in March 1938 ranking as the second worst monthly return in the 1834-1988 period. (Only the return of -29.3% in September 1931 is worse.) Coming at a time when the economy was already in trouble, adverse selection and moral hazard problems in financial markets appeared to worsen substantially, with the spread between interest rates on low and high quality bonds rising back to the extremely high levels found in 1934. This episode thus also suggests that a financial crisis situation can develop even if a banking panic is not present.

The asymmetric information analysis thus suggests that a lender of last resort role may be necessary to provide liquidity to nonbanking sectors of the financial system in which asymmetric information problems have developed. Furthermore, it suggests that financial disturbances outside of the banking system in the postwar period have had the potential to have serious adverse effects on the aggregate economy and that these adverse consequences have in fact been prevented only by quick actions of the Federal Reserve to pursue an expanded role as a lender of last resort. However, it also provides support for the monetarist position that in order to prevent severe disturbances to the economy, it is important for the central bank to operate as the lender of last resort to prevent banking panics.

Although a central bank's role as a lender of last resort has the benefit of preventing financial crises, it does have a cost. If a bank's depositors expect that the central bank will provide a bank with discount loans when it gets into trouble and come to its rescue, then they have less incentive to monitor the bank and withdraw their deposits if the bank takes on too much risk. Thus the lender of last resort role in itself can produce a moral hazard problem because it can lead to

expectations which encourage banks to take on too much risk. This moral hazard problem is most severe for large banks if they are the beneficiaries of a somewhat misnamed "too big to fail" policy in which depositors at a large bank in trouble are protected from any losses by a lender of last resort policy, such as that used when Continental Illinois failed in 1984 in the United States. (The "too big to fail" policy is somewhat misnamed because although depositors are completely protected from losses, the bank is in fact allowed to fail with losses to the equity holders.) Evidence in Boyd and Gertler (1993) suggests that the cost of the "too big to fail" policy has indeed been quite high in the United States after it was put into force with the failure of Continental Illinois in 1984.

Similarly, the lender of last resort role to prevent a financial crisis arising outside of the banking sector may encourage other financial institutions and borrowers from them to take on too much risk. Knowing that the central bank will prevent a financial crisis if it appears imminent will encourage them to protect themselves less against systemic risks, i.e., those that occur system-wide which will trigger a lender of last resort response. There is thus a tradeoff between the moral hazard cost of the lender of last resort role and its benefits in preventing financial crises.

The asymmetric information view of financial crises thus, like the monetarist view, does see a danger in too liberal a use of the lender of last activities on the part of central banks. Although the asymmetric information view has a broader definition of what constitutes a financial crisis than the monetarist view, it also does not recommend that a central bank be a lender of last resort during a pseudo-crisis. As we have seen, a stock market crash by itself, as in May 1940 in the U.S., does not imply that a financial crisis is imminent. Neither does a foreign exchange crisis or a collapse in other asset values, such as real estate. The asymmetric information framework outlined here does provide clues, however, as to when a lender of last resort role is necessary. A sharp decline in the stock market, when it is accompanied by a sharp rise in the demand for liquidity may signal an imminent financial crisis, as would a failure of a major financial or nonfinancial institution when there already is some evidence of asymmetric information problems financial markets as reflected by an increase in the interest rate spread between low and high quality borrowers.

However, an increase in the interest rate spread by itself does not imply that a central bank should act as a lender of last resort because a natural outcome during a recession is a rise in uncertainty about who will be bad rather than good credit risks and thus a rise in the interest rate spread. Indeed, the increase in asymmetric information problems in financial markets during a recession is a potential propagation mechanism that explains why recessions are prolonged. Although lender of last resort activities which increase liquidity to reduce asymmetric information problems during recessions have benefits, we have also seen that they create moral hazard costs as well. Thus, the need to use the lender of last resort role sparingly in order to keep moral hazard from getting out of hand argues against such intervention unless it is absolutely necessary. The lender of last resort role should therefore occur very infrequently.

One problem with deciding to engage in the lender of last resort role is that for it to be effective it has to be implemented quickly. Less intervention is required the faster the lender of last resort role is implemented because once market participants know that liquidity is being injected into the system, uncertainty in the financial markets will decrease. Thus, the Federal Reserve's actions during the stock market crash of 1987 are a textbook case of how a lender of last resort role can be performed successfully. The Fed's action was immediate, with an announcement that operated to decrease uncertainty in the marketplace. Reserves were injected into the system, but once the crisis was over, they were withdrawn. Not only was a financial crisis averted, but also the inflationary consequences of this exercise of the lender of last resort role were quite small.

However, the need for the lender of last resort action to be quick does mean that central banks may not be able to wait until all the information is in that tells them a financial crisis is about to occur or is occurring. To wait too long to implement a lender of last resort policy could be disastrous. Thus, even though the asymmetric information view of financial crises provides some guidance as to when a lender of last resort role should be implemented, deciding on when to do so will necessarily be an art rather than a science. Central bank "feel" for conditions in financial markets that comes from informal as well as formal signals about developments in these markets is necessary to make the appropriate decision

on when a lender of last resort role is necessary.

Discount Lending

A corollary of the monetarist view is that the operation of central bank discount facilities may be unnecessary. Open market operations are sufficient to keep the money supply on its target path and this is all that is needed to keep the economy functioning well. Using this reasoning, Friedman (1958) advocated abolishment of the Federal Reserve's discounting operation and more recently Goodfriend and King (1988) seem to come to a similar conclusion. Goodfriend and King (1988) dichotomize the activities of the central bank into "monetary policy", i.e., changes in the total volume of high powered money which can be entirely carried out with open market operations, and "banking policy", which involves regular lending and emergency financial assistance to individual banks and institutions along with regulatory and supervisory actions. Because they see financial crises as being essentially monetary in nature, they do not see the need for "banking policy" and discount lending. Since they consider the regulatory and supervisory activities that become necessary when there is discount lending by the central bank to be costly, they lean to elimination of Federal Reserve discount lending.[11]

The asymmetric information interpretation of financial crises, on the other hand, provides a strong rationale for the operation of the central bank discount facilities. As the analysis of the response to the stock market crashes of 1929 and 1987 indicate, a central bank can use the discount facilities to channel liquidity directly to the sector that is most in need of it. Without discount facilities, a central bank can only provide liquidity to a specific sector by providing it to the overall economy using open market operations. Because this provision of liquidity might be very indirect, a larger infusion of liquidity may be needed to prevent the

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[11]They do hedge their position, however, for they "wonder whether discount lending could be rationalized under a different criterion: to prevent the disruption costs of widespread insolvencies associated with temporary interest rate spikes." (Goodfriend and King (1988) p. 18.) The argument in this paper that disruption costs may indeed be high from widespread insolvencies provides a rationale for "banking policy" even in their framework.

financial disturbance from creating severe asymmetric information problems. Consequently, in order for a central bank to achieve its objectives it may have to put so much liquidity into the economy that it would produce substantial inflationary pressure. Having discounting at its disposal provides the central bank with a delicate tool that enables it to cope with financial disturbances without promoting inflationary tendencies.

The operation of discount facilities also provides a central bank with another major advantage in dealing with potential financial crises. Government bailouts of individual firms have the significant disadvantage that it is likely to keep inefficient firms in operation and also encourages excessive risk taking on the part of firms that expect to be bailed out. In essence, the problem is again one of asymmetric information because the government is unlikely to be able to separate out insolvent from temporarily illiquid firms. In addition, political pressures may influence bailout decisions to the detriment of economic efficiency.[12]

On the other hand, discount lending enables the central bank to encourage lending to a sector of the financial system in which asymmetric information has become a serious problem and yet minimizes some of the efficiency losses from this lending. Using discounting enables the central bank to take advantage of the monitoring and information collection expertise inherent in individual banks so that lending is likely to be made only to solvent business enterprises. In other words, the central bank is making use of the banks as delegated monitors on its behalf. In order to do this the central bank must give the appropriate incentives to banks to engage in monitoring and information collection the banks must be responsible for the credit risk involved in lending. The central bank needs to indicate that it will provide liquidity to prevent systemic risk, but would not be responsible for idiosyncratic risk. This is exactly what the Federal Reserve did when it made discount loans to banks during the Penn Central bankruptcy crisis so that banks could in turn lend to borrowers in the commercial paper market and also when the Fed lent to banks during the stock market crash of 1987 so that the banks would

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[12]The cost of politically motivated propping up of insolvent firms is amply demonstrated by what occurred during the 1980s when political forces led to the government allowing insolvent Savings and Loans to stay in business, the result of which was losses to the American taxpayer in excess of $100 billion.

extend additional loans to their brokerage firm customers. It was made clear that these customers would have to be considered creditworthy by the banks. The burden of screening out good from bad borrowers was thus left to individual banks, who have the expertise to do this properly.[13]

The use of banks as delegated monitors for the central bank during a financial crisis suggests that the traditional recommendation that the central bank should lend at a penalty rate when it performs its lender of last resort role might be problematic. In order to provide banks with the incentives to act as the central bank's delegated monitor, banks must be able to profit from this activity. Thus there is a case for subsidizing banks by setting the discount rate below the interest rate they earn on their loans during a financial crisis. Without this subsidy, the banks might not be willing to make the necessary loans. The need for delegated monitors during a financial crisis might thus explain why central banks typically set their discount rate below market interest rates, which requires them to ration discount lending. Although monetary economists have typically criticized central banks for setting the discount rate too low and engaging in rationing of discount loans, there is a partial rationale for this policy. However, it is not clear why central banks would not obtain the full benefits from banks acting as delegated monitors by setting the discount rate below market rates only during a financial crisis and not in more normal times.

The asymmetric information analysis of financial crises also provides a

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[13]The discussion above illustrates why I think that the following statement by Goodfriend and King (1988) is misguided. On page 18 immediately following the quote in footnote 5 they state, "If such aggregate disruption cost were large enough, temporary transfers to the banking system that could avoid such costs might be in society's interest. It should be pointed out, however, that a similar argument could be made for avoiding disruption costs of temporary insolvencies anywhere in the economy. Therefore, acceptance of the criterion for banking policy alone would need to be based on a demonstration that disruption costs are much larger in the banking sector than elsewhere." I disagree particularly with the last sentence. Use of the discount window (banking policy) is especially valuable if disruption costs are larger in the nonbanking sector than in the banking sector. Use of discounting to lend to banks who, in turn, lend to the sector in financial difficulty minimizes the adverse selection problem facing a central bank lending directly to that sector because it delegates information collection and monitoring to individual banks who have incentives to do this effectively. Thus discounting helps the central bank to deal with systemic risks and not idiosyncratic risks. Bernanke and Gertler (1990) also point out that advantages of using financial intermediaries who have information capital to make loans to a troubled sector of the economy.

rationale for discount lending to banks in order to prevent banking panics. Clearly, it provides support for the view that during a financial crisis central banks should lend to illiquid but solvent banks. Lending to insolvent banks, however, creates the moral hazard problem that arises with the "too big to fail" policy: it creates incentives for banks to take on too much risk. The problem facing central banks is that they are unable to use delegated monitors to channel funds to illiquid but solvent banks. Rather they have to make the decision themselves as to whether a bank in trouble deserves to receive an infusion of liquidity. This raises two problems in turn. First, central banks must have sufficient information about banks they may need to lend to in order for them to be able to tell whether a bank needing liquidity is solvent or insolvent. Second, central banks may not have the right incentives to lend to illiquid but insolvent banks rather than insolvent banks. In contrast to private banks, who are subject to a profit motive and thus have the appropriate incentive to lend only to solvent firms, central banks may be influenced by other considerations. They may be too anxious to protect the banks that they are close to and also may be put under intense political pressure to bail out insolvent banks. Indeed, in the United States the Federal Reserve has been accused of causing higher losses to the American taxpayer by propping up insolvent banks through its discount lending, thus allowing them to continue in operation which then resulted in higher losses to the FDIC. As a result, there are provisions in the Federal Deposit Insurance Corporation Improvement Act of 1991 to limit Federal Reserve discounting to insolvent banks.

The asymmetric information framework outlined in this lecture does provide a rationale for a "too big to fail" policy in which a central bank lends to a big, insolvent bank because a failure of a big bank can create uncertainty in the financial markets that make a financial crisis more likely. Because I took the view that the failure of a large bank could have extremely adverse consequences for the economy, in previous writings, Mishkin (1992), I advocated some discretionary use of the "too big to fail" policy. However, research such as Boyd and Gertler (1993) have convinced me that the costs of the "too big to fail" policy may be higher than I originally thought. In addition, further thinking about the Penn Central and the stock market crash of 1987 episodes has led me to realize that there is an alternative way for a central bank to keep a financial crisis from

developing when a large bank becomes insolvent. As in the Penn Central case, the insolvent institution can be allowed to fail with consequent losses to both the equity holders and the debt holders, which in the case of a bank, would include the depositors uninsured by government deposit insurance. However, once the central bank made the decision to let the insolvent bank go under, it would need to make an announcement of its "readiness to serve as a source of liquidity to support the economic and financial system", as on October 20, 1987, and would make it clear that the discount window would be open to banks that needed liquidity. The result is that the large bank would be allowed to fail and produce losses for equityholders and debtholders, such as uninsured depositors, thus creating incentives for these parties to keep large banks from taking on too much risk. However, the lender of last resort role of the central bank would then keep a bank panic from spreading to the rest of the banking system, thereby preventing a financial crisis.

Regulation

The discussion of discount lending above indicates that central bank lending to financial institutions can create moral hazard incentives for them to take on too much risk. To prevent this, the central bank needs to restrict its lending to solvent institutions that are not taking on too much risk. Just as private financial institutions need to have access to information about borrowers so that they can screen and monitor them to reduce adverse selection and moral hazard problems, it is also desirable for a central bank to have similar access to information about the financial institutions it lends to. One way for central banks to have this information is for it to have a direct regulatory oversight over these financial institutions, as occurs in the United States where the Federal Reserve conducts periodic examinations of banks. This is one reason why the U.S. Treasury's recommendation in 1991 to take away the Federal Reserve's supervisory role over large national banks that it has through supervision of their bank holding companies was ill founded.[14] Some central banks, such as the Bundesbank,

[14]See Mishkin (1992)

strenuously object to having a direct regulatory role because they believe that it will subject them to political pressures which may interfere with their ability to use monetary policy to combat inflation. Nonetheless, if a central bank is to run its discount operations to minimize moral hazard problems it needs to make sure that it has mechanisms in place that provide it with the required amount of information about its borrowers. Thus even if a central bank does not have a direct regulatory role over the institutions it lends to, it must be a de facto regulator in that it examines the state of these institutions and can deny them discount loans if it believes they are taking on too much risk.

An additional implication of the analysis here is that once a financial institution is given access to the discount facilities of a central bank, the central bank must have access to information on the institution's risk-taking activities. This implication is important because central banks are often required to open their discount facilities to financial institutions other than banks. If these institutions are to receive discount privileges, they must bear the cost of being subjected to some regulatory oversight by the central bank.

Our earlier discussion of the decline of the banking industry suggests that regulation has another important role in preventing financial crises: it needs to promote the orderly decline of the industry. One of the reasons that the decline of the banking industry was so precipitous in the 1980s in the United States is that the regulatory system encouraged risk-taking on the part of banks. Federal deposit insurance, especially combined with the "too big to fail" policy, protected all depositors, including large ones, from any losses when banks failed and so their was little incentives for depositors to monitor banks and withdraw funds if the bank was taking on too much risk. This lack of monitoring by depositors combined with lax regulation by American regulators meant that, when faced with declining profitability, the banks took on even more risk to shore up their profits. For a while, the subsidy to risk-taking created by deposit insurance kept the banking industry from shrinking, but when many of the banks risky bets did not pay off, bank failures resulted. The outcome was then a much sharper drop in the size of the industry than would have occurred otherwise. Although a financial crisis was avoided in the U.S. through actions of the Federal Reserve and the deposit insurance agencies, the cost to the American taxpayer has been high, with

losses to the deposit insurance agencies exceeding $100 billion.

The reason why the American experience is important to policymakers in other countries is that the decline in the banking industry in these countries has not yet progressed as far as it has in the U.S. The decline in the banking industry in these countries thus does have the potential to increase the probability of a financial crisis if it is not managed well. The lesson from the United States, is that bank regulation must not promote risk-taking in an environment where fundamental forces are decreasing the profitability of the industry. The Federal Deposit Insurance Corporation Improvement Act of 1991 has reduced some of the moral hazard incentives in U.S. bank regulation, although more needs to be done.[15] Policymakers in other countries need to examine their bank regulatory system to ensure that they too do not encourage excessive risk-taking, making a precipitous decline in their banking industries more likely and thereby increasing the potential for financial crises.

International Policy Coordination

International policy coordination to manage aggregate economic activity has frequently been criticized in the literature and has given international policy coordination a bad name. However, the analysis in this lecture indicates that international policy coordination to deal with financial crises is imperative. The increased integration of financial markets throughout the industrialized world means that financial market disturbances in one country will be transferred quickly to other countries. Given the linkages between financial institutions in different countries, a failure of a major institution in one country will create uncertainty in financial markets throughout the world. In addition, as we saw in October 1987, a stock market crash in one country may result in a stock market crash in other countries as well. As the Europeans have learned recently, high interest rates in one country, such as Germany, lead to pressures for high interest rates in other countries, particularly if they are trying to fix their exchange rates. Thus financial

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[15]Mishkin (1995, forthcoming) contains a discussion of this legislation and what additional measures can help reduce the moral hazard incentives for too much risk taking.

crises, if they are to occur, are likely to be more of a global phenomenon than they were in the past.

As we have seen, central banks can use their lender of last resort role to prevent financial crises, but in the face of a financial crisis that is world wide, cooperation between central banks could be essential. If a failure of a major financial institution is imminent in one country, not only must the central bank in that country know about it and be ready to engage in a lender of last resort role to make sure that the failure doesn't spread to the rest of the financial system in that country, but it must inform other central banks about the imminent failure and they too must stand ready to perform the lender of last resort role. In addition, if a central bank does not feel that it has the resources to contain a financial crisis in its country, then it needs to be able to solicit the help of other central banks to keep the financial crisis from getting out of hand and spreading to other countries.

Highly integrated global financial markets also requires cooperation between countries on banking regulation. Excessive risk-taking by banks needs to be restricted everywhere, since a banking panic in one country could spread to another. Furthermore, banks must not be able to escape regulatory oversight as a result of their international banking activities. As the 1991 collapse of BCCI indicated, closer cooperation among bank regulatory authorities and standardization of regulatory requirements is necessary in order to make sure that all banks are properly regulated. The world has been moving in this direction through agreements like the Basle accord on capital requirements in 1988 and the new regulatory oversight procedures announced by the Basle Committee in July 1992 to further standardize the regulation of international banks.

CONCLUSION

The view of financial crises outlined in this lecture suggests that the international financial system is more fragile than it has been in the past and so policymakers must be especially vigilant for potential financial crises. The asymmetric information framework developed here provides some guidance for how policymakers can deal with potential financial crises, but it also suggests that

there are elements or art as well as science to coping with financial crises. Furthermore, with the increased global integration of financial markets, the need for international policy coordination between central bankers to prevent financial crises is critical.

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Figure 1: The Penn Central Bankruptcy

Panel A: Stock Prices and the Commercial Paper Rate

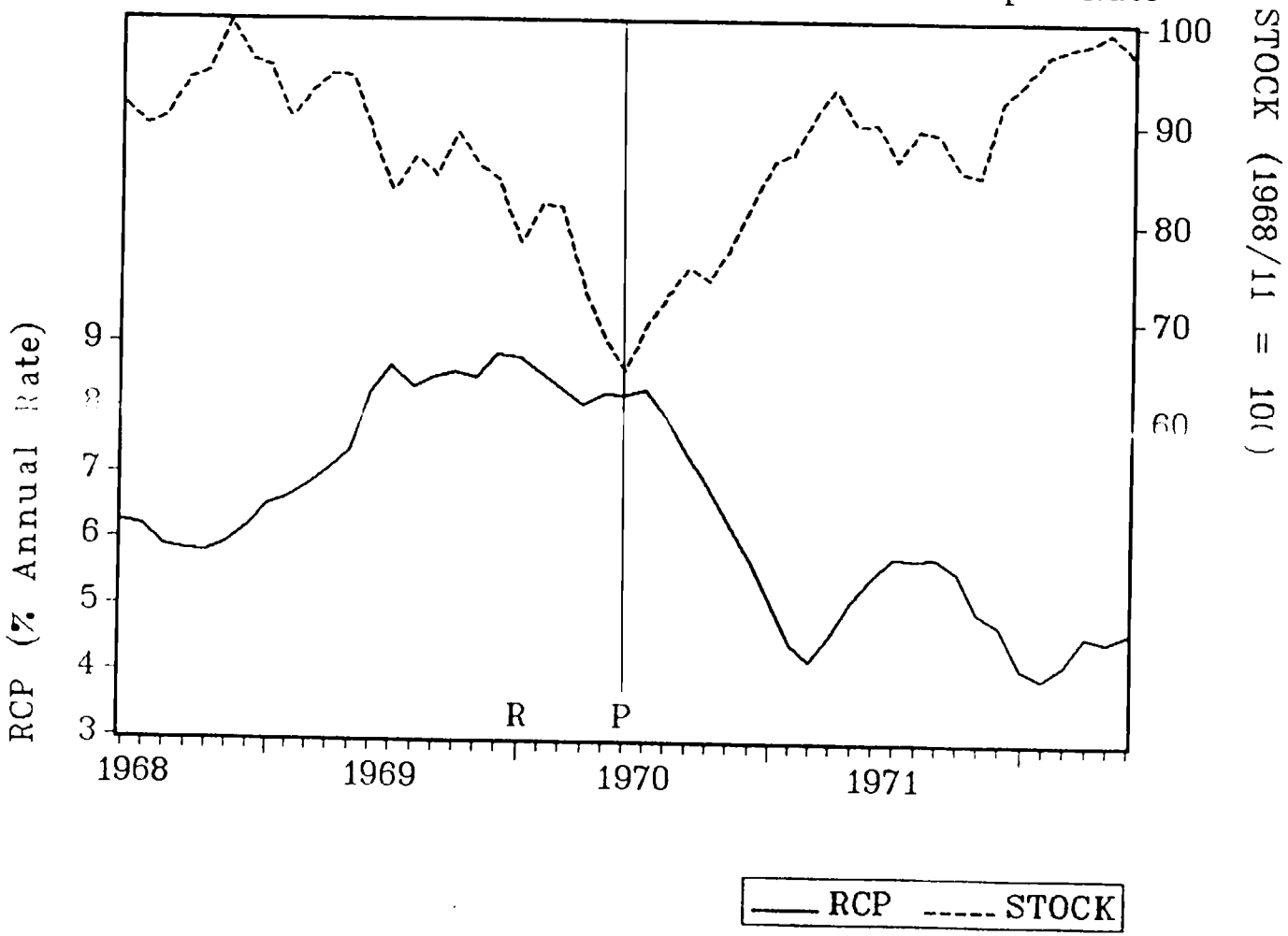


Figure 1: The Penn Central Bankruptcy

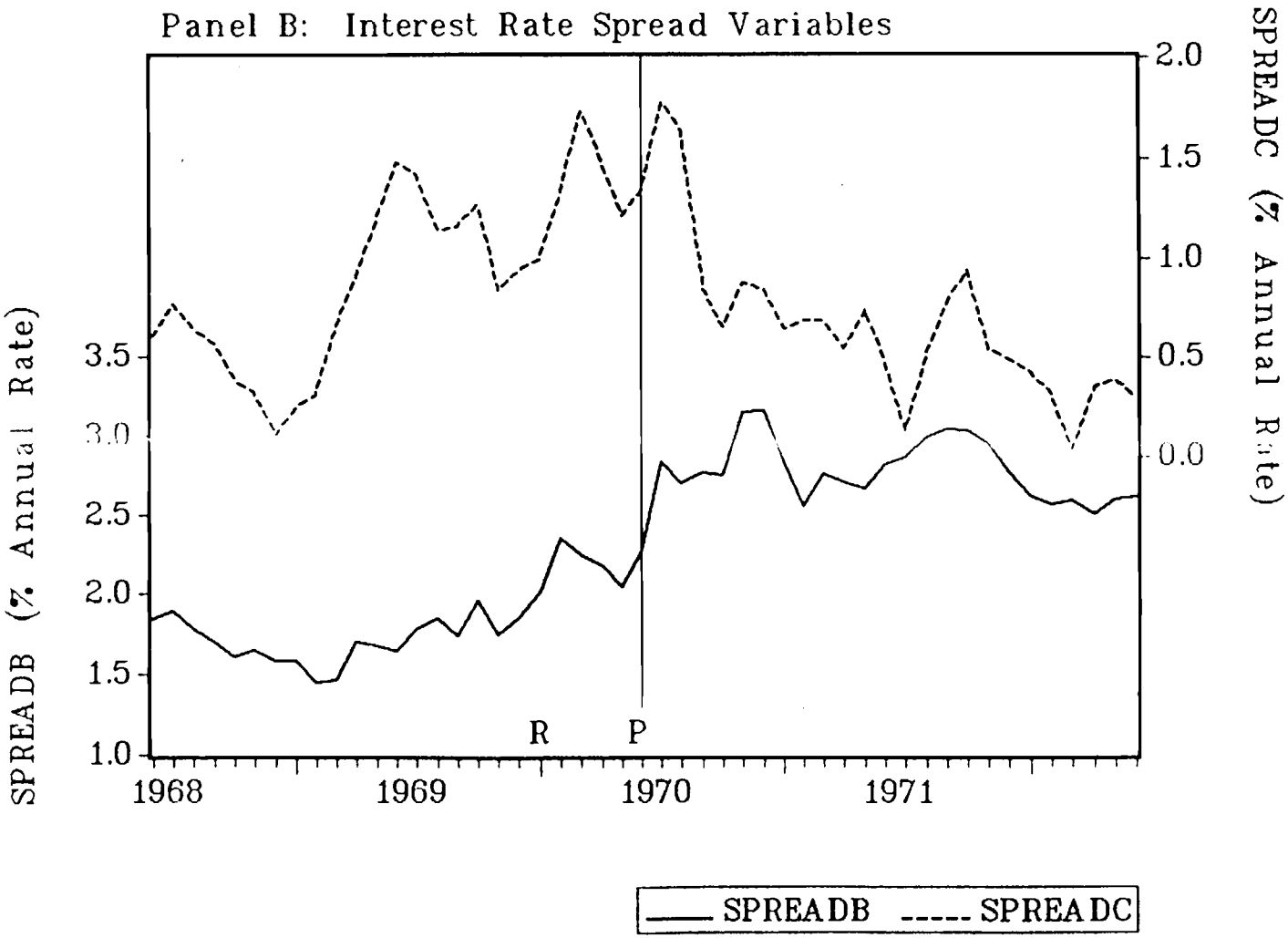
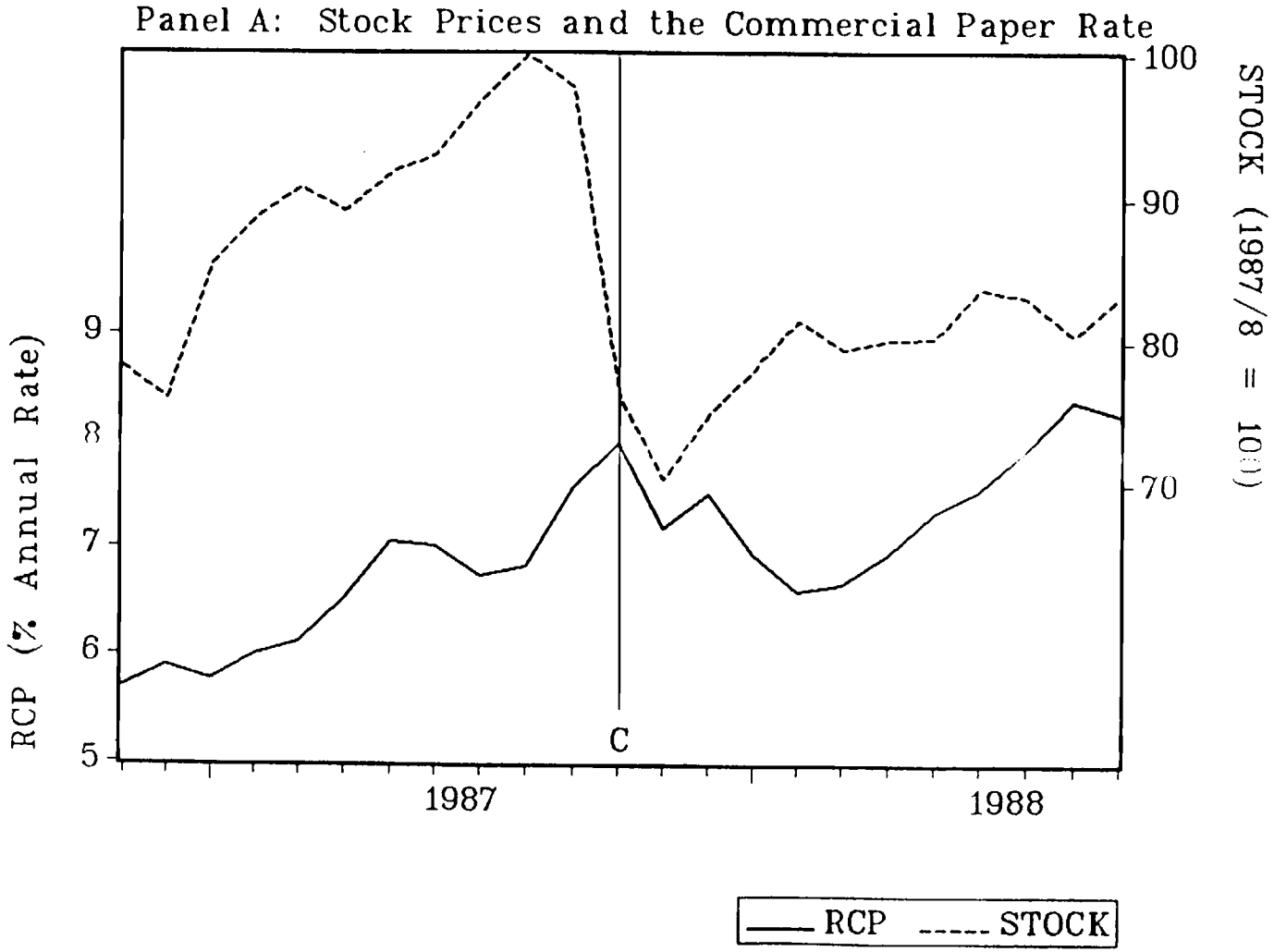


Figure 2: The Stock Market Crash of October 1987



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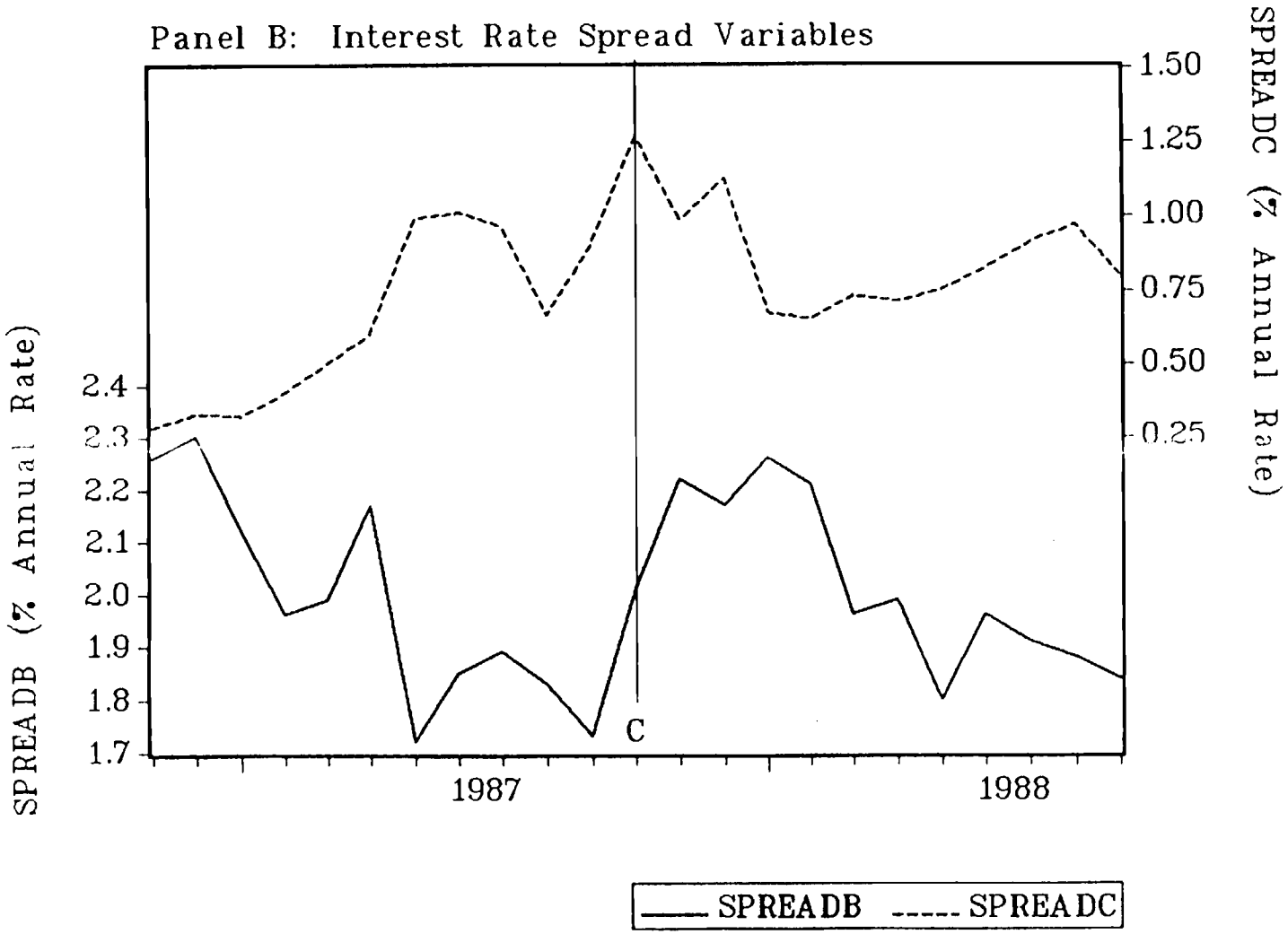

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