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IS THE DISCOUNT WINDOW NECESSARY?
A PENN-CENTRAL PERSPECTIVE

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ABSTRACT

The discount window has been under attack recently as a costly and unnecessary tool of policy. This paper argues that the primary role of the discount window should be to provide occasional, temporary support to particular financial markets during localized financial crises. The benefits of the discount window revolve around information externalities across firms resulting from confusion over the incidence of bad news, or reductions in the net worth of market intermediaries. The history of the Penn Central commercial paper crisis of 1970, and the Fed's use of the discount window to combat that crisis, are reviewed. The crisis is visible in a pronounced decline in outstanding commercial paper, an increase in the interest rate spreads for commercial paper and for long-term debt, and declines in stock prices. Cross-sectional variation in abnormal stock returns indicates that, controlling for other factors, firms that were likely to have had outstanding debt in the form of commercial paper suffered larger negative returns during the onset of the crisis, and larger positive returns after the Fed intervened to lower the cost of commercial paper rollover. Implications of the 1970 crisis for current financial markets, and for discount window policy, are considered in light of this evidence.

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I. INTRODUCTION: SUFFICIENT CONDITIONS FOR A BENEFICIAL DISCOUNT WINDOW

In recent years economists have come to question the desirability of granting banks the option to borrow from the Federal Reserve's discount window. The discount window's detractors cite several disadvantages. First, the Fed's control over high-powered money can be hampered. If bank borrowing behavior is hard to predict (or to observe instantaneously) then open market operations cannot perfectly peg high-powered money, which some economists believe the Fed should do. Second, there are microeconomic concerns about potential abuse of the discount window (Schwartz, 1992). Critics argue that the discount window has been misused as a transfer scheme to bail-out (or postpone the failure of) troubled or insolvent financial institutions that should be closed quickly to prevent desperate acts of fraud or excess risk taking by bank management. In response to growing criticism of Fed lending to prop up failing banks, Congress mandated limits on discount lending to distressed banks, which were implemented by the Fed in August 1993.

Some economists (notably, Goodfriend and King, 1988, Bordo, 1990, Kaufman, 1991, 1992, and Schwartz, 1992) have argued that there is no gain from allowing the Fed to lend through the discount window. These critics argue that open market operations can accomplish all legitimate policy goals without resort to Federal Reserve lending to banks. Clearly, if the only policy goal is to peg the supply of high-powered money, open market operations are a sufficient tool. Similarly, the Fed could peg interest rates on traded securities by purchasing or selling them. Any argument for a possible role for the discount window must demonstrate that pegging the aggregate level of reserves in the economy, or controlling the riskless interest rate on traded securities, is insufficient to accomplish a legitimate policy objective that can be accomplished through Fed discounting.

In this article, I examine theoretical assumptions that may justify the existence of the discount window. I argue that there is little current role for the discount window to protect against bank panics. The main role of the discount window is in defusing disruptive liquidity crises that occur in particular non-bank financial markets. I discuss evidence from the Penn Central crisis of 1970 that

seems consistent with that view and conclude by considering whether this evidence is relevant for today's relatively sophisticated financial environment. Backup protection for financial markets through the discount window could be achieved at little cost if access to the discount window were confined to periods of financial disruption. During normal times open market operations and interbank lending would be sufficient for determining the aggregate amount of reserves in the banking system and their allocation among banks.

A first step toward envisioning a role for any financial institution, including the discount window, must be the relaxation of the assumptions of zero physical costs of transacting and/or symmetric information. The discount window's benefit, if any, must be related to its role in helping to economize on costs in capital markets, which themselves are a function of physical or informational "imperfections." I divide the discussion of potential justifications for the discount window into two parts -- assistance to financial intermediaries, and assistance to particular financial markets.

II. THE DISCOUNT WINDOW AND BANKING PANICS

The Federal Reserve System was created in 1913 with three primary objectives: to eliminate the "pyramiding" of reserves in New York City and replace it with a polycentric system of twelve reserve banks, to create a more seasonally elastic supply of bank credit, and to reduce the propensity for banking panics. The discount window was the primary mechanism for achieving each of these goals. By offering an alternative to the interbank deposit market, the architects of the Fed expected to eliminate reserve pyramiding (White, 1983). Interbank lending was viewed by some as a problem because it encouraged dependency of the nation's banks on New York bankers and placed funds into the hands of securities market speculators. Interbank deposits at New York increased during seasons of weak loan demand outside New York and were used in the call loan market to support securities underwriting and brokerage activities.

The discount window also promised to reduce the seasonal volatility of interest rates and increase the seasonal elasticity of bank lending by providing an elastic supply of reserves, allowing bank balance sheets to expand seasonally without increasing the loan-to-asset ratio. Prior to the creation of the Fed bank expansion of loans in peak seasons led to costly increases in portfolio risk (a higher loan-to-asset ratio), or costly seasonal importation of specie. This implied an upward sloping loan supply function with large interest rate variation over the seasonal cycle (Miron, 1986, Calomiris and Hubbard, 1989, Calomiris and Gorton, 1991).

Finally, the availability of the discount window was also expected to reduce the risk of bank panics in two ways. First, by increasing the availability of reserves the discount window limited seasonal increases in portfolio risk and reductions in bank liquidity during high-lending months, thus reducing the risk of panics. Second, the discount window would provide a source of liquidity to banks in case a shortage of reserves due to unpredictable increases in withdrawal demand threatened the liquidity of the banking system (as in Diamond and Dybvig, 1983).¹ But the discount window offered limited protection to banks from a panic induced by adverse economic news. Because access to the discount window was limited by strict collateral requirements, bank borrowing was limited to the amount of near-riskless collateral (commercial paper and government bonds) the bank possessed.² Thus Federal Reserve Banks could not use the discount window to shore up banks if its depositors lost confidence in the quality of the bank's illiquid loan portfolio.

The history of the pre-Fed era suggests that this limitation on discount window lending was important. Gorton (1989), Calomiris and Gorton (1991), and Calomiris and Schweikart (1991) have argued that sudden withdrawals from the banking system occurred when depositors received sufficiently bad news about the state of the economy, but were uninformed about the incidence of this disturbance across individual banks because of depositors' limited information about bank portfolios. Under these circumstances depositors chose to withdraw funds from all banks until they could better

ascertain the risks of individual banks. Thus relatively small aggregate insolvency risk could have large costs through disintermediation from banks.

Costs associated with banking panics can motivate a more aggressive policy than one requiring riskless collateral for all central bank lending. The central bank could provide loans to the banking system on illiquid collateral to offset the temporary withdrawal of depositors' funds. The rationale for this intervention lies in informational externalities caused by panics. Banking panics create negative externalities among banks and their customers. Banks whose assets have not declined in value, and their borrowers and depositors, suffer because of the confusion over whether they are among the banks holding low-value assets. The banks lose business, the borrowers lose access to credit, and the depositors lose interest and pay transaction costs of transferring funds out of the banking system. Banks and their borrowers benefit by keeping the banking system from shrinking.

The discount window can be thought of as a way to enforce a mutually beneficial agreement among depositors not to reduce their deposits during panics. While private deposits fall, public "deposits" made through the discount window (the indirect assets of the public) rise to compensate. Open market operations would not be an adequate substitute policy. Open market operations would simply insulate the money supply from the reduction in the money multiplier as bank deposits and bank credit fell; they would not reduce withdrawals from banks. If bank credit plays a special role in financing some activities in the economy, then contractions in the supply of bank credit will be costly.

Thus one could argue for central bank adoption of the rule for use of a "backup" discount window: Under normal circumstances (when there is no general systemic banking panic reducing private deposits in banks), the central provides no loans to banks. During a systemic crisis the central bank agrees to provide loans to banks up to the amount of depositor withdrawals (now at an interest rate that fairly compensates the government for the default risk of the average bank). Such crisis loans must be short-term and must be paid in full after the crisis passes (which, if history is any

guide, should be no longer than two months). The government might increase the interest rate it charges on loans to banks over time to encourage them to assist in resolving the information asymmetry more quickly (e.g., by sharing information about themselves and one another). The central bank might even charge a fee to banks ex post as a function of actual losses, to further encourage good banks to bring the crisis to a speedy conclusion. As deposits return to the banks, they must use them to repay the government loans. Banks that fail to attract depositors (relative to other banks) as the crisis draws to a close would be denied continuing access to credit and be allowed to fail.³

The absence of an effective market for interbank lending is required to justify the government's role in assisting banks. If the banking system were able to allocate funds to insure against banking panics by agreeing to treat deposits as a collective liability of all banks during a systemic crisis (as some groups of banks did historically), then so long as the public were confident of the aggregate solvency of the banking system there would be no threat of systemic bank runs and no need for a government-run discount window to reduce the costs of banking panics.⁴ Kaufman (1991) argues that interbank markets did not operate effectively historically, but that this is no longer the case. He claims that the existence of the modern federal funds market obviates the need for the discount window during crises because open market operations, combined with interbank transfers, can funnel cash to whichever groups of solvent banks experience large withdrawals. If banks as a group are willing to pool their government security holdings during a crisis, then Fed purchases of securities combined with interbank transfers to banks that lack sufficient government securities can keep the banking system afloat, and possibly prevent a run from starting (if interbank insurance is credible ex ante).

Lending among banks during a crisis, however, may not occur due to asymmetric information. If banks are unable to regulate and credibly monitor each other's portfolios and

behavior, they will be reluctant to insure one another during a banking panic. Even though the interbank market operates quite well during normal times among most banks, it cannot necessarily be relied upon to protect the banking system from panics.

The interbank loan market can operate effectively so long as banks have adequate information about and control over each other's actions. Lending banks must be confident that borrowers are not abusing the interbank market to subsidize excessive risks or provide a bail out to insider depositors of a failed bank. While this "incentive compatibility" requirement may be difficult to satisfy, there are many examples that show it is possible to do so. Gorton (1985, 1989), Calomiris (1989a), Calomiris and Kahn (1990, 1991), and Calomiris and Schweikart (1991) argue that information asymmetry about bank borrowers and the consequent risk of panics prompted cooperative behavior among banks historically. Coordination among banks in response to panics characterized many countries' banking systems (notably England's during the Baring Crisis of 1890, and Canada's during the national banking era). But in the United States laws limiting bank branching and consolidation effectively limited interbank cooperation. As the number of banks and their geographical isolation from one another increase, the feasibility of cooperation is undermined. Each bank's cost of monitoring and enforcing cooperative behavior rises with fragmentation, while the benefit to any bank from monitoring and enforcing declines with the number of members in the coalition (the benefit is shared by all).

Thus the need for "aggressive" discount window assistance to banks arises largely from unit banking laws that make private interbank cooperation, lending, and mutual insurance infeasible. Absent such regulations it would be difficult to argue for the necessity of the discount window as a means of reducing the costs of bank panics (see the related discussion of other countries' experiences in Bordo, 1990, and Calomiris, 1992a).

In closing, four points are worth noting. First, in arguing for a beneficial "aggressive"

discount window, I have not assumed that the government has superior information regarding individual bank solvency (an alternative justification for government lending to banks even in non-crisis states). While such an argument can be made (based on the government's access to information by virtue of its supervisory role) the recent history of bank failures and losses, and of regulatory agencies' inabilities to anticipate, observe, or prevent widespread abuse seem to argue against such a presumption. Kane (1988) argues that regulators face distorted incentives to collect and report information about banks. These incentive problems may outweigh regulators' special channels of information due to supervisory authority.

Second, discount lending can be beneficial if physical transactions costs limit interbank lending. Such physical costs mean that open market operations will have uneven effects on the supply of reserves available to different banks if the market for reserves is segmented. Although this may have been a legitimate motivation for the discount window historically, as Kaufman (1991) argues, current interbank reserve transfers are accomplished at little cost.

Third, I have not addressed the possible role of the discount window in bailing out a banking system that is insolvent as a whole. Even in a concentrated banking system, interbank insurance and lending could never deal with enormous adverse asset shocks (those larger than aggregate bank capital). Elsewhere I have argued that partial government deposit insurance (with large deductibles) for mutually insuring groups of banks can protect against this unlikely event (Calomiris, 1992b).

Fourth, under the current deposit insurance system, "aggressive" discount window intervention would be largely redundant as protection against systemic risk.⁵ It is beyond our scope to examine all of the relative advantages of government deposit insurance or discount lending for stabilizing a fragmented (uncoordinated) banking system. Perhaps the most obvious potential advantage of discount window lending is that government intervention can be state-contingent. If a bank fails when there is no systemic panic, the bank's depositors will not be bailed out by

government insurance. This reduces the moral-hazard costs of the government's "safety net."⁶

III. NON-BANK LENDING AND THE ROLE OF THE DISCOUNT WINDOW

In an economy where physical costs of interbank transfers are small, and where interbank coordination and mutual insurance, or government deposit insurance, protects the banking system from the risk of panic there is no additional need for the discount window to facilitate the operation of the banking system. But even in such an environment problems that arise outside the banking system may motivate central bank lending through the discount window. In particular, other securities markets may be vulnerable to externalities arising from asymmetric information. I will argue that there is evidence for information externalities outside of the banking system, and reason to believe these problems can be addressed most effectively by channeling funds through banks which borrow from the window, rather than through direct lending from the central bank to non-bank firms.⁷ The example I will focus on is the commercial paper market "run" that followed Penn Central's 1970 Bankruptcy.

As many researchers have stressed, the banking system is particularly vulnerable to confusion about the incidence of disturbances for two reasons. First, its assets (bank loans) typically are not traded in centralized markets. Thus it is difficult for an uninformed depositor of a bank to keep abreast of the effect of a given news item on his bank's assets' value. Second, the fact that banks finance through large quantities of demandable debt allows nervous depositors to withdraw from the bank rather than wait to see whether their bank will survive or fail.

While these two attributes that make banking panics possible -- non-traded assets and demandable debt -- seem to set the banking system apart from other markets, the banking system is just an extreme case of a much more general phenomenon. The condition necessary to generate a costly panic in a debt market is that the time horizon for rolling over debt can be less than the time it

takes to make accurate reappraisals of firm-specific risk when general bad news occurs. Lenders' lack of information about specific firms' attributes may result in the pooling of borrowers with common observable characteristics. In such circumstances, firms will face temporarily high "lemons premia" in debt and equity markets, which will increase the cost of finance and reduce investment, even for firms whose true "fundamentals" are unaffected by the bad news. Firms with short-term debts (which must be rolled over regularly) can be particularly vulnerable to systemic risk and the possibility of a run.

Furthermore, if intermediaries for particular markets (e.g., commercial paper dealers) suffers losses from one firm's issues, they may be less able to deal in other firms' paper. This, too, can force firms to pay higher costs for funds temporarily in the affected market, or switch to new, higher-cost sources of funds.

Firms that face such problems in debt markets may be able to obtain assistance from bankers. To the extent that banks have special information about borrowers' attributes, due to their past involvement with firms and their ongoing monitoring of firm compliance with lending covenants, banks may be able to assist firms when their costs of funds rise in other credit markets. But for firms that moved away from reliance on bank credit, there may be no strong banking relationship to fall back upon. Assistance from banks for these firms would be forthcoming only at higher interest rates, which would compensate banks for the transactions and information costs of drafting emergency lending arrangements. In particular, if the bank expects only a temporary relationship with the firm in need (for the duration of the "emergency"), the bank will have to charge higher interest rates to recoup its fixed costs over a shorter lending period.

New financial markets may be particularly vulnerable to these negative externalities among firms or temporary disruptions to market dealers. The lack of data on the risks and liquidity of new products, and their relatively thin markets increase the likelihood of systemic risk in new markets.

In what follows, I will consider whether the commercial paper market experienced such a financial crisis in mid-1970, and whether that crisis warranted discount window intervention. The commercial paper market at that time is an especially interesting case to examine for five reasons. First, most commercial paper matures quickly – with an average maturity of under 30 days (Stigum, 1983, p. 632). This means that a sudden disinclination by investors to hold commercial paper would entail substantial problems for firms trying to rollover their commercial paper debt. Second, commercial paper was a new and growing method of finance during the 1960s. Institutional arrangements for rating and supporting commercial paper issues were virtually non-existent; thus information imperfections were potentially important. Third, commercial paper finance originated as a substitute for bank credit. Many firms that had moved to this market in the 1960s may have curtailed or terminated their relationships with commercial banks (making the disruption in the supply of paper more costly). Fourth, during the early years of rapid growth in this market, there was a major shock to the commercial paper market, namely the failure of Penn Central in 1970, which was associated with substantial contraction of outstanding paper (a "run"). Finally, the Fed intervened during this crisis largely by encouraging banks to come to the discount window to finance the rollover of commercial paper. Evidence from the Penn Central commercial paper crisis of 1970 allows a detailed case study of "information externalities," the potential for a "run" in markets for traded short-term debt, and an evaluation of Fed intervention in response to such a crisis.

Penn Central's Failure and the Liquidity Crisis of Mid-1970

The facts surrounding the commercial paper run following the Penn Central failure are commonly known (see Schadrack and Breimyer, 1970, Maisel, 1973, Timlen, 1977, Brimmer, 1989, and Mishkin, 1991a), but some important details are worth reviewing. Along with many other firms, during the recession of 1969-1970 Penn Central's financial condition deteriorated. Penn Central was

a major issuer of commercial paper, with more than \$84 million outstanding, much of which was coming due in June, July and August of 1970. Initially, as Penn Central's cash flow declined, its debt holders and their agents appealed to the federal government for financial assistance, which the Nixon Administration supported.

The Administration proposed a \$200 million loan guarantee to a syndicate of some 70 banks, which were to provide a two-year loan in that amount. The loan guarantee would be authorized through a loose interpretation of the Defense Production Act. While there was increasing Congressional opposition to this plan, as late as Friday, June 19, the Wall Street Journal reported that "the opposition doesn't yet appear strong enough to halt the \$200 million loan guarantee." That same article also reported the possible existence of a secret memorandum from the New York Federal Reserve Bank recommending "that the loan be granted on the basis of an investigation that bank is believed to have conducted into the credit-worthiness of Penn Central." That same Friday, contrary to the Wall Street Journal report, no such memorandum existed, and the Penn Central plan was rejected by Congress. The Nixon Administration then asked the Federal Reserve Board (through the New York Fed) to make a loan to Penn Central to help it meet immediate obligations. The New York Fed recommended against the loan, and it was denied. This news forced Penn Central's bankruptcy on Sunday, June 21.

The surprising news of the unwillingness of Congress and the Fed to prop up Penn Central created widespread concern over the weekend that the Penn Central failure would have reverberations elsewhere in the economy, particularly for firms, like Penn Central, that had large outstanding commercial paper issues. It is not easy to explain this concern without invoking an "information externality" of some form. That is, one needs to explain why the bad news about Penn Central would raise doubts about other firms.

The bad news about Penn Central on June 19 had two parts. First, prior to Friday the Wall

Street Journal reported that the New York Fed had made a favorable audit of Penn Central's underlying financial strength. After Friday, quite the opposite was known. The reaction of the market, as reported in the press, was that if Penn Central's financial state could so rapidly and unexpectedly have turned sour in the previous year, what other "blue chip" commercial paper issuers might be in the same position? This concern was fueled by the fact that the income reductions during the recession of 1969-1970, which potentially affected many firms, were not known at the firm level with any precision at the time. Those concerns about other firms began to be voiced even before the revelation of the New York Fed's audit. For example, a lead article in the Journal on June 12 queried: "How many other U.S. corporations are so short of cash that they may soon find themselves similarly unable to pay their bills?" Until the marketplace could assess the extent to which Penn Central's financial position was the result of idiosyncratic shocks and mismanagement, as opposed to a signal of a common problem likely to be faced by many firms, Penn Central's failure would cast doubt on the financial position of other firms.

The second element of general bad news revolved around the fate of Penn Central and its creditors. It became clear that, whatever its underlying condition, the government would not guarantee Penn Central's debt, and that therefore, Penn Central's creditors faced the possibility of substantial losses. The incidence of the losses on the commercial paper were unknown, but it was rumored that ownership was quite concentrated. For example, on June 15 the Journal reported that Morgan Guaranty owned or acted as "agent" for \$84 million in commercial paper. According to Federal Reserve data on holdings of commercial paper, in early 1970 nonfinancial corporations owned 74 percent of outstanding paper.⁸ The June 12 Journal article cited above also asked: "If even one major corporation should become insolvent, would its failure bring down other cash-short companies because the failing company couldn't pay its bills? Could that, in turn, intensify the present severe strain on the cash reserves of banks and corporations into a liquidity crisis, draining the flow of

money and credit and plunging the nation into a depression?" While this "domino" scenario of economy-wide depression may seem a bit far-fetched, it would have been less far-fetched to imagine that one or two major commercial paper issuers (who may have been creditors of Penn Central) might also find it hard to repay their debts.

Thus lack of information about the effects of the recession on other firms (which Penn Central's failure indicated might be large), and about the identities of Penn Central's creditors and their creditors in turn, could have produced legitimate, rational concern about rolling over the commercial paper of other firms at pre-existing terms. The commercial paper market was especially vulnerable to these sorts of doubts because at the time it was a fast-growing new financial experiment of the 1960s, as shown in Figure 1. From 1956 to 1966 the amount of non-bank commercial paper issuers rose 16 percent per year. From 1966 to 1970 it rose 30 percent per year. The number of companies issuing paper rose from 335 in 1965 to 575 in April 1970. In the later period, growth was especially concentrated in dealer-placed paper (which includes all non-financial commercial paper), which grew from 1966 to 1970 at an annual rate of 57 percent. Rising interest rates and regulatory restrictions on banks (especially Regulation Q ceilings) are widely cited as the cause of this boom in the commercial paper market.

The market pricing and rating of paper issues on a large scale was in its infancy (Stigum, 1983, p. 635, Standard and Poor's, 1979, p. 1), and the recession of 1969-1970 was the first downturn to test the burgeoning commercial paper market. It would not be far-fetched to argue that learning was occurring "in real time" and that the first time a recession occurred, and a commercial paper issuer failed, the market might find it difficult to assess the ramifications for others with any great confidence. Indeed, it may have been necessary for the market to reevaluate its methods for pricing paper generally in light of this surprising event. Professor Roger Murray of Columbia University argued that commercial paper market pricing had been excessively sanguine in the 1960s.

His (post-crisis) study of Penn Central's financial position in the 1960s concluded that there was much to be learned from the Penn Central collapse about the need for greater caution in valuing commercial paper: "a careful financial analyst might well have recommended...against the purchase of Penn Central commercial paper a year or more before the events of May and June 1970."⁹ Murray accounted for the poor ex ante evaluation of risk by the fact that so "many new faces appeared in that market for large sums at the time and Penn Central was hardly noticed as an unusual case."

Schadrack and Breimyer (1970) provide a similar perspective. They claim that before the Penn Central failure "the confusion of corporate size with liquidity tended to mask some deterioration during [the late 1960s] of the quality of commercial paper outstanding...the fact that a number of firms in the market by 1970 had very high debt to equity ratios and/or income flows of dubious quality (some conglomerate, franchising, and equipment leasing companies, for example) suggests such a deterioration in the quality of commercial paper" (p. 289). They also argue that, in addition to the concern about other commercial paper borrowers brought on by the failure of Penn Central, Penn Central's failure raised concern about some of the major brokerage houses, which acted as dealers and purchasers in the market. Commercial paper dealers maintain open positions in the paper they sell either as part of an underwriting arrangement, or through a commitment to maintain a secondary market in the paper (Stigum, 1983, p. 640). The threat of a liquidity crisis for firms and their dealers led to a collapse of demand for the debt instruments of others. These fears fueled the flight to cash.

Schadrack and Breimyer (1970) also argue that the crisis led to refined methods of pricing commercial paper, which is consistent with Murray's view that there was room for improvement. In particular, after the Penn Central crisis they found a wider dispersion of rates for dealer-placed paper, which they interpreted as the result of "greater investor selectivity." Also they noted a persistent shift toward bank CDs and Treasury bills.

As Mishkin (1991a) and Schadrack and Breimyer point out, the spread between commercial

paper and Treasury bills widened during and after the crisis. This widening seems to reflect a persistent revision in the evaluation of commercial paper risk. Schadrack and Breimyer report that in November 1970 the dealer paper rate averaged 103 basis points above the Treasury bill rate, compared to previous spreads of roughly half that amount. A similar pattern is visible in Table 1, which reports interest rates and yields on federal funds, three-month Treasury bills, and prime 4-6 month commercial paper before, during, and after the crisis.

The "flight to quality" visible in the declining yields of Treasury bills and rising short-term spreads is also visible in long-term yields and spreads, shown in Table 2. From June 20 to June 27 Treasury bond yields fall as corporate bond yields rise. The spread between the Treasury bonds and the Aaa corporates reaches a peak on July 11. Interestingly the spread between Aaa and Baa rated bonds is essentially constant during the crisis, but rises afterwards. This is consistent with the view that during the crisis increased riskiness was attributed to all securities, but that after the crisis investors were better able to sort firms into risk categories.

Concerns about the existing financial conditions of commercial paper issuers and dealers proved unwarranted ex post (no other commercial paper issuers defaulted), but seem to have been important ex ante, as evidenced by movements in the stock market and commercial paper market. Firms, especially those with large outstanding debt, saw large stock price declines in the first three days of the crisis. During that time the Dow Jones Industrial Average lost 28 points (a fall of roughly 4 percent). Chrysler, General Motors, and IBM all saw large losses as rumors circulated that they faced risks of being unable to meet their debts (Wall Street Journal, June 23-25, 1970, "Abreast of the Market"). Business Week quoted one stock market analyst saying that "investors think that any company ... with ... debt is going bankrupt" (June 27, p. 42).

Perhaps the best indicator of the extent of these fears was the contraction in the volume of commercial paper outstanding from late June to mid-July. Total outstanding non-bank commercial

paper fell from \$32 billion on June 24 to \$29 billion on July 15. \$2.3 billion of that decline happened in the first week of the crisis (see Figure 2).

Interestingly, commercial paper rates showed little change during the crisis, despite the decline in outstanding paper. The reason for this was the speedy reaction of the Federal Reserve to the failure of Penn Central. Luckily, it occurred over a weekend, which gave the Fed time to prepare for the opening of financial markets on Monday. The Fed pursued four courses of action.

First, the Fed contacted member banks and notified them that "as they made loans to enable their customers to pay off maturing commercial paper and thus needed more reserves, the Federal Reserve discount window would be available."¹⁰ The meaning of "available" is of paramount importance. The Federal Reserve let member banks know that if they borrowed at the discount window for purposes of "pass through" loans to commercial paper issuers, they would be able to do so without incurring any costs other than the discount rate. The Fed was informed by banks when their discount borrowing resulted from financing commercial paper rollovers, and the total amount of such discount borrowing totaled some \$500 million in the weeks immediately following Penn Central (Melton, 1985, p. 158). Beyond the amount lent through the discount window, access to the window for commercial paper rollovers gave "assurance to the financial markets that the liquidity essential to their operation would be preserved. If panicky investors refused to renew their holdings of commercial paper, preferring Treasury bills, bank deposits -- anything! -- instead, their extreme preference for safety would not be allowed to contribute to widespread insolvency. Once everyone understood that, there was little reason for panic" (Melton, 1985, p. 158).

Fed encouragement to use the discount window to finance commercial paper rollover was associated with reduced costs of borrowing from the Fed, even though the discount rate remained unchanged. Normally, the costs of borrowing from the discount window include the discount rate and a non-pecuniary "hassle" cost. That is, the Fed does not want to encourage abuse of the privilege

of borrowing from the discount window, so normally it uses the threat of bank examination or some other non-pecuniary penalty to discourage borrowing. This penalty explains the positive difference between the fed funds rate and the discount rate. If there were no penalty, banks would be indifferent between borrowing from other banks and the Fed's discount window. In this case, the two rates would be identical. In the presence of a non-pecuniary cost of borrowing from the Fed, the fed funds rate will be higher than the discount rate, since on the margin banks will be indifferent between paying the fed funds rate in the interbank market and borrowing from the fed (which entails a discount rate cost and a "hassle" cost).

Figure 3 provides a simple illustration of the simultaneous determination of the federal funds rate and borrowed reserves, which is helpful in analysing the effect of discount window lending during the Penn Central crisis. Reserve demand is shown as a negative function of the federal funds rate. The position of the demand schedule varies with loan demand, reserve requirements, and the demand for excess reserves. The Fed determines the amount of non-borrowed reserves through its open market operations. Borrowed reserve costs are given by an upward sloping schedule, which sums a constant pecuniary cost (the discount rate) with an increasing non-pecuniary "hassle" cost. The more reserves are borrowed, the more the Fed is liable to penalize borrowing. Figure 3 illustrates equilibrium in the reserve market for June 17 and July 15, 1970, using actual data on the discount rate, non-borrowed reserves, borrowed reserves, and the federal funds rate. Assuming equilibrium in the reserve market, we can identify shifts between these two days in reserve demand (as bank loans rose to compensate for the contraction in commercial paper) and in reserve supply. The reserve supply function shifted in slightly (unborrowed reserves fell due to increased currency demand, which was only partly offset by open market operations) and rotated downward as the Fed reduced its non-pecuniary penalty for borrowing.

The downward rotation of the borrowed reserve supply function is evidence that the Federal

Reserve lowered the non-pecuniary cost of borrowing from the discount window during the crisis. Other evidence on the composition of bank lending, bank borrowing from the Fed, and the different rates charged to different types of bank customers suggests that the reductions in non-pecuniary costs were linked (as the quotation above suggests it was) to "pass-throughs" to commercial paper rollovers. That is, it seems that loans to member banks for this purpose were granted a special "subsidy" by the Fed (in the form of lower, or possibly zero, non-pecuniary costs).

Consistent with this account, the composition of member bank borrowing changed during the crisis. As of June 24 large commercial banks (primarily money-center banks) accounted for only 75 percent of borrowing from the Fed. The trebling of member bank borrowing from June 24 to July 15 was due to an increase in money-center borrowing, as one would expect if it was earmarked for commercial paper "pass-throughs." As shown in Table 3, total borrowed reserves rose by \$1.196 billion, while borrowed reserves of large commercial banks rose \$1.224 billion. This same group of banks were the only ones who saw a large growth in loans to businesses and finance companies during the crisis. Loans increased by \$2.3 billion from June 24 to July 15, almost an exact offset of the amount by which commercial paper was reduced during this period. This rise of 2.6 percent in total loans for this group of banks was highly unusual. The average rate of increase for the preceding four years during this period had been 0.03 percent, and the highest rate of growth in the preceding four years had been 0.25 percent in 1968.

Finally, there is weak evidence that large borrowers from money-center banks received loans on the best terms during the crisis. Quarterly data on average loan interest rates by size of borrower, type of loan, and region for February and August quarters show that large, short-term borrowers in Northeastern financial centers showed the least increase in lending rates (although differences are small). As Table 4 shows, the largest classes of borrowers in New York City actually saw slight reductions in average loan interest rates.

The discount window "pass through" announcement was only the first of the Fed's four policy responses to the crisis. On Tuesday June 23 the Fed suspended regulation Q ceilings on large-denomination bank CDs. This allowed a flood of money into the commercial banks, so that maturing commercial paper could be directly recycled through CDs, which financed bank loans to former issuers. As shown in Table 3, from June 24 to July 15 large negotiable CDs at large commercial banks increased from \$14 billion to \$16 billion, and the growth continued, with CDs of large banks in excess of \$26 billion by the year's end."

The third policy intervention by the Fed was open market operations. From June 17 to July 15 total U.S. government securities held by the Fed increased from \$57.8 billion to \$58.8 billion. As noted above, however, open market operations were not sufficient even to maintain the stock of non-borrowed reserves, given the increased demand for currency by the public. Thus borrowed reserves were relied upon as the primary vehicle for expanding the banking system during the crisis.

The final policy intervention was the Fed's preparation of "standby procedures" so that, if necessary, it could make loans, directly or indirectly, to "worthy" borrowers who were otherwise unable to secure credit. The Fed never made such loans available because its other policies proved sufficient to contain the run on commercial paper, but it is clear that the Fed was willing to provide direct lending if banks had been unwilling to make appropriate loans for commercial paper rollovers. In his statement to Congress on July 23, then Chairman of the Board of Governors, Arthur Burns, made this commitment clear. He viewed the discount window as the key to preventing a liquidity crisis, and saw the Fed's commitment to explicit direct "pass-through" lending, if necessary, as an appropriate failsafe measure.

Credit demands on the banking system at large can be accommodated by open market operations, while the needs of individual banks can be met through the discount window...We have found, also, that minor adaptations of conventional monetary tools can provide solutions to special financial problems...it was made clear that the discount window would be made available to assist banks in meeting the needs of businesses unable to roll over maturing commercial paper, and member bank borrowings for this purpose subsequently have risen...These conventional tools are buttressed with

standby procedures to permit the Federal Reserve to make funds available to creditworthy borrowers facing unusual liquidity needs through "conduit loans" -- that is, loans to a member bank to provide funds needed for lending to a qualified borrower...Furthermore, the Federal Reserve could -- under unusual circumstances -- utilize the limited power granted it by the Federal Reserve Act to make direct loans to business firms on the security of Government obligations or other eligible paper, provided the borrower is creditworthy but unable to secure credit from other sources.¹²

Here Burns explicitly allows for Fed loans backed by commercial paper, or other eligible collateral.

In dealing with the Penn Central crisis, the Fed did not simply focus on controlling the money supply or an interest rate, which it could have done easily through open market operations. Rather the Fed coaxed deposits into banks by relaxing Regulation Q ceilings, and used the discount window to encourage banks to make loans to customers experiencing distress -- especially commercial paper issuers. The logic of the Fed's combined approach was that monetary aggregates, bank credit, and assistance to the commercial paper market could be targeted independently by using three instruments. Relaxation of Regulation Q rather than expansionary open market operations allowed bank credit growth without (narrow) money growth. The discount window was directed toward the special difficulties in the commercial paper market. The Fed left open the possibility of lending directly to firms in need if they were turned down by bankers.

It is not self evident that the Fed's policy response was correct. Schwartz (1992) has argued that the Penn Central crisis was not a "real" financial crisis and that discount lending served no useful purpose. Of course, the absence of financial collapse in mid-1970 may have been attributable to Fed intervention itself, a possibility Schwartz does not take into account. But even if Schwartz is too quick to dismiss the potential seriousness of the Penn Central crisis -- particularly given the evidence on yield spread movements and the contraction of the volume of commercial paper -- that does not prove that the discount window was a necessary instrument for dealing with the crisis. If the failure of Penn Central raised increased doubts about the solvency of all firms in the economy, then a temporary expansion of open market operations or Regulation Q relaxation -- to increase the supply of credit available to all borrowers through relatively informed financial intermediaries -- would have

been a desirable response to an economy-wide need for liquidity, and there would have been no need to use the discount window.

On the other hand, if the crisis involved a special reappraisal of the creditworthiness of commercial paper issuers and commercial paper dealers in particular, and a reassessment of the desirability of lending through the commercial paper market, then targeting temporary pass-through assistance (a short-run subsidy for bank loans to commercial paper issuers) using the discount window might have been desirable as a means to smooth issuers' costs of rollover.¹³ In this case, open market operations would have been a blunt instrument for dealing with a run on commercial paper, while discount window pass-throughs would have provided direct assistance without affecting monetary aggregates or interest rates on all traded assets. If some combination of an economy-wide reassessment of firms and a commercial paper run characterized the crisis, then policy could have combined an aggregate increase in open market operations or Regulation Q relaxation with targeted assistance to commercial paper issuers.

Thus to assess the desirability of the use of the reliance on the discount window during the crisis one must examine the incidence of the crisis. Was it purely an economy-wide phenomenon, or did it pose a special threat to commercial paper issuers?

An Event Study of the Penn Central Crisis

To investigate the extent to which the Penn Central crisis posed a special threat to commercial paper issuers I examine data on firms' abnormal stock returns during the crisis. Did firms with outstanding commercial paper suffer abnormal negative returns relative to other firms during the onset of the crisis, and were those negative returns reversed by Fed intervention? To answer this question I combine CRSP data on daily stock returns with Compustat data on annual income and balance sheet variables for non-financial corporations to measure cross-sectional differences in abnormal returns

over various dates, and to link them to firm financial characteristics measured at the beginning of 1970. I employ standard measures of abnormal returns, using residuals from forecasts of market returns based on estimates of firms' betas (from a 100-day pre-sample period) and the aggregate contemporaneous movements in the market. Abnormal returns are standardized to adjust for the fact that abnormal returns are derived from estimated values of betas (as in Wall and Peterson, 1990).

Isolating the effect of reliance on the commercial paper market on abnormal stock returns is not straightforward, since data on outstanding commercial paper issues of firms are not available for this period. The regular reporting of commercial paper ratings was largely a consequence of the Penn Central crisis. Standard and Poor's began publishing some commercial paper ratings in The Bond Outlook in July 1970, but these ratings were for only a handful of issuers, most of which were financial firms. Moody's Industrial Manual and other similar publications, which today provide some data on commercial paper issues by firms, did not provide such data in 1970. Outstanding commercial paper cannot be inferred by looking at firms' reported balance sheets. Commercial paper is generally included in short-term debt, and cannot be separated from other short-term debt (loans from banks, finance companies, etc.). The Board of Governors of the Federal Reserve System did not collect firm-level data on issuers, only on aggregate amounts of outstanding issues, based on dealers' reports. Despite searches of various publications by the rating agencies, I have been unable to uncover any comprehensive listing of firms which issued commercial paper in 1970.

Given the lack of data identifying issuers, I use bond ratings to sort firms according to whether they were likely to have issued commercial paper in 1970. In the 1970s, commercial paper issuance was usually restricted to the firms with the highest bond ratings (Standard and Poor's, 1979, p. 47). Having a AA or AAA rating in 1970 is likely to be the best proxy for the likelihood of being a commercial paper issuer. Eight of the 11 non-financial firms whose ratings were published in Standard and Poor's Bond Outlook in 1970 and 1971 were rated AA or AAA (the remainder were A-

rated). Also, data from later years indicate a close relationship between high bond ratings and commercial paper access. Standard and Poor's first comprehensive listing of commercial paper issuers, The Commercial Paper Ratings Guide, was published in 1978. Of the 82 non-financial firms that had AA or AAA bond ratings in 1970, 59 were issuing commercial paper in 1978. Of the 146 non-financial firms listed in Compustat with AA or AAA bond ratings in 1978, 93 were commercial paper issuers. In 1978, ninety-four of the 207 A-rated non-financial firms in Compustat were commercial paper issuers, and only 43 firms with bond ratings below A issued commercial paper (all of these were firms with BBB or BB ratings). Using the AA rating as our cutoff, therefore, seems advisable. Based on available data it seems reasonable to assume that a majority of AA or AAA non-financial firms were commercial paper issuers in 1970, and that a much smaller percentage of remaining firms were issuers.¹⁴ The total number of non-financial firms in our sample (those without missing observations, and covered by both CRSP and Compustat in 1970) is 1482. Of these, 82 had bond ratings of AA or AAA.

The use of AA or AAA bond ratings as an indicator of a commercial paper issuer provides a "conservative" measure of the problems in the commercial paper market for two reasons. First, measurement error (the existence of some A-rated commercial paper issues, and of non-issuers with AA or AAA ratings) biases the coefficients on the indicator variables toward zero. Second, the excluded A-rated commercial paper issuers likely would have experienced the largest adverse effects of the crisis, since their debt was riskier to begin with.

The goal of the event study is to examine whether (likely) commercial paper issuers suffered abnormal negative stock returns during the Penn Central crisis, and whether Fed intervention reversed those costs to commercial paper issuers, after controlling for other measures of cross-sectional differences among firms. To control for other influences that would not have been specific to the commercial paper market, I add a variety of balance sheet and income statement variables taken from

the January financial reports of these non-financial firms.

Table 5 reports regression results for standardized abnormal returns for two windows around the Penn Central crisis – June 12 to June 22, and June 22 to July 9. June 22 is chosen as the date after which Fed intervention should have improved the position of commercial paper issuers. Early concerns reported about commercial paper dated from June 12, as discussed above. By the second week in July the contraction in outstanding commercial paper began to be reversed. All firm balance sheet and income data are measured as of the beginning of 1970. The variables included in the regressions are: the ratio of debt to assets, the ratio of short-term debt to assets, the size of the firm (market value of capital), the ratio of net income to market value of capital, the ratio of inventories to sales, the squares of each of these variables, and the indicator variable for whether the firm's bond rating was AA or AAA. Table 6 reports the means and standard deviations for each regressor, and the correlations among these variables.

It is important to emphasize three points when reviewing Table 5. First, these are "reduced-form" regressions, and must be interpreted cautiously. For example, while relatively high leverage ratios may have created problems for firms during the crisis, high debt ratios may themselves have been associated with firm attributes (like creditworthiness) that helped firms weather the crisis better (and led to relatively higher stock values). Thus it is not possible to infer "structural" relationships from these cross-sectional findings. Second, the abnormal returns measures are purged of cross-sectional differences in firms' betas that might be correlated with the various regressors. For example, higher debt ratios might be associated with lower returns cross-sectionally because leverage increases a firm's beta. But by construction the abnormal returns used in Table 5 are uncorrelated with the firm's beta. Third, squared terms were added for all regressors, but they do not affect the direction of the results. In no case does a squared term more than offset the linear effect of the same variable when both coefficients are evaluated at the mean of the regressor (given in Table 6). The

direction of association between SCAR and any regressor is that of the linear effect.

The results reported in Table 5 indicate that the ratio of debt to assets and the ratio of income to net worth (both measured at the beginning of the year) were associated with more negative returns cross-sectionally during the onset of the crisis. Firm size, per se, had no effect on returns in the presence of squared terms for debt ratios. For the period after June 22, the total debt ratio and the profit ratio are associated with a positive effect on returns, indicating a reversal of the stock price movements during the period prior to Fed intervention. The inventory-to-sales ratio and the short-term debt-to-assets ratio are both negatively associated with abnormal returns after June 22. Firms with AA or AAA bond ratings experienced significant negative abnormal returns during the onset of the crisis, and significant positive returns after Fed intervention. The addition of this indicator variable increases the adjusted R-squared in both regressions.

This evidence is broadly consistent with two statements about the Penn Central crisis. (1) The Penn Central crisis was a liquidity crisis affecting all firms in the economy. During both windows examined in Table 5, variables associated with greater exposure to a liquidity crisis -- ratios of debt or short-term debt to assets, and a high inventory-to-sales ratio -- are significantly associated with negative abnormal returns. (2) The crisis affected commercial paper borrowers more adversely than other firms prior to intervention by the Fed, and less than non-issuers after intervention by the Fed. The selective nature of Fed intervention through the discount window accounts for this. Indeed, it is possible to argue that the conservative approach toward the aggregate supply of money and credit combined with favoritism toward commercial paper issuers may have led to crowding out of credit supply for non-issuers after June 22. Non-issuers with interest-sensitive costs of operations -- those with high inventory-to-sales ratios or with greater needs for rolling over existing short-term debt -- saw greater declines in their stock value after June 22 than before. Moreover, firms with bond ratings of AA or better had lower ratios of short-term debt, higher profit ratios, and lower inventory-

to-sales ratios (the three variables significantly associated with abnormal returns from June 22 to July 9). Thus the average differences between the stock returns of (likely) issuers and non-issuers after June 22 are larger than indicated by the coefficient on the indicator variable.¹⁵

The evidence provides support for the notion that, in addition to the economy-wide liquidity crisis during the Penn Central crisis, big commercial paper issuers faced a special problem. This in turn lends support to the argument that discount window lending may have been useful in targeting assistance to the commercial paper market. Thus the Fed may have been correct to divide policy into two components: regulation Q relaxation to provide liquidity to all firms through banks, and discount window lending to target special assistance to commercial paper issuers to offset the special disorder in that market. That is not to say Fed policy achieved the right mix. Negative returns for (likely) non-issuers post-June 22 may indicate that credit supply was too tight overall.

Changes in the Commercial Paper Market after the Crisis

The commercial paper market changed as a result of the Penn Central crisis. In addition to increased diligence in evaluating credit risk noted above, two other important changes have reduced the possibility of a similar calamity in the future. First, in August of 1970 the Fed passed a regulation to restrict the growth of bank commercial paper. Bank paper would be treated, for reserve requirement purposes, the same way as demand or time deposits, depending on the maturity of the paper. This eliminated the advantages of off-balance sheet financing through bank commercial paper and led to the contraction of bank paper. This had little effect on banks or on growth in the commercial paper market, which has been robust (Post, 1992). It simply propelled banks toward relying on negotiable CDs (virtually identical to commercial paper) as an alternative source of funds.

Of more lasting importance were the institutional changes in the way commercial paper was marketed. First, rating agencies made finer distinctions in their ratings of commercial paper issues

(Stigum, 1983, p. 637). An important element in the rating became evidence of commercial bank backup arrangements behind commercial paper programs. Commercial bank support for commercial paper programs was a private innovation sanctioned by the Federal Reserve. After, and largely as a result of, Penn Central, commercial paper issuers increasingly sought "hurricane insurance" in the form of backup loan commitments (Stigum, 1983, p. 633-34, Standard and Poor's, 1979, p. 47). Most of these loan commitments (roughly 85 percent in 1989) were not credit guarantees to commercial paper holders, but rather promises for assistance during a general liquidity crisis if the borrower remained creditworthy (see Calomiris, 1989b). Within a few years of the Penn Central crisis backup lines were almost always 100 percent of outstanding issues, except for large, top-rated, highly liquid issuers like GMAC or large commercial banks. These loan commitments were issued by banks for the same reason bank assistance had been relied on during the Penn Central crisis: Banks have access to the discount window, and can rely on the Fed temporarily to shift the borrowing supply curve to grant specifically targeted "pass throughs" during times of emergency. Institutionalizing Fed pass-through protection through bank loan commitments, one could argue, reduces the time to process credit rollover during a crisis. Furthermore, the existence of clear commitments to lend during a crisis may itself reduce the threat of a general liquidity squeeze, and thus make crises less likely.

Currently, the use of backup lines of bank credit, "backed" by access to the discount window, has virtually eliminated risk of another Penn Central crisis in the commercial paper market. But this does not imply an end to the role played by the discount window. The protection offered through backup lines of credit depends on banks' potential access to funds through the discount window.

IV. EVALUATING OTHER POSSIBLE FED INTERVENTIONS

Thus far I have argued that both economy-wide policy (open market operations and regulation

Q relaxation) and targeted discount lending may have been desirable interventions during the Penn Central crisis. But the Fed was willing to go beyond these interventions, if necessary, as Chairman Burns' comments cited above indicate. Was the Fed right to have provided for the possibility of direct lending to firms, or should it have been willing to rely only on the discount window and open market operations? Was the Fed right to have allowed Penn Central to fail in the first place?

The Fed's decision not to prevent the failure of Penn Central is easy to defend. The success of the capitalist system requires that firms face "hard" budget constraints. As reformers in Eastern Europe and the Soviet Union have been saying for years, protecting large corporations from bankruptcy through assistance from the state imposes large costs on more successful growing enterprises. More fundamentally, allowing corporations to fail is what encourages them to succeed. It is worth emphasizing that the public policy rationale for insulating financial markets from temporary information externalities during panics does not in any way justify bailing out discernably insolvent institutions.

With regard to the other question -- whether direct Fed lending to corporations is ever justifiable -- it is much harder to justify intervention. As Mishkin (1991b) notes, it is better to decentralize the decision over who receives how much, and place it in the hands of relatively informed bankers who have incentives to avoid making bad loans. If banks had been unwilling to finance the rollover of the commercial paper of certain firms, even on highly subsidized terms, that would have indicated the likely insolvency of those individual issuers.¹⁶ Discount window protection should not be used to save individual firms who are viewed as insolvent by their creditors. Of course creditors are not always right, but part of the rationale for corporate reorganization under bankruptcy law (increasingly popular since the 1978 changes in the bankruptcy code) is to minimize unnecessary costs of liquidating defaulting firms who turn out to be solvent. Given the availability of the reorganization option, it may be best for the government to allow private markets to decide whether

individual corporate borrowers are viable.

V. COULD A SIMILAR CRISIS HAPPEN TODAY?

While I have argued that the possibility of another Penn Central crisis today in the commercial paper market is remote, in other new and growing financial markets the potential for a crisis similar to Penn Central may loom larger.¹⁷ In the swap market, for example, under extreme circumstances default risk may become hard to measure, and the efficacy of private means for managing default risk have not yet been tested by adversity. It is conceivable that a reversal in market opinion about the riskiness of swaps could suddenly affect the market's perception of firms with large swap positions. In this case, temporary disruptions to the supply of credit to certain classes of firms could conceivably result, and these could conceivably motivate discount window "pass throughs" as in the Penn Central crisis. The lesson in this dismal scenario is not that swaps are a bad idea. They offer real long-run systemic risk reduction as a low-cost vehicle to hedge interest rate risk. But reaping the advantages of this and other financial innovations requires a period of learning about how to measure and control the risks created by new financial instruments. The existence of the discount window provides a safety valve to protect the financial system from growing pains like the ones it suffered in 1970. Recent financial innovations in derivatives and asset securitization may have increased the need for the discount window as an instrument of public policy. Its role is not just to protect the banking system from systemic runs on commercial banks (indeed, it has little importance here in the presence of deposit insurance); rather, its role is to effect occasional, contingent, and focused credit subsidies to particular markets through banks during moments of temporary disruption, like that of the Penn Central crisis.

Another example of a potential application of the discount window is a run on a futures clearing house. Individual clearing members stand between all contracting parties, and the clearing

house provides mutual insurance among all members against default. To limit the risk of default by clearing members clearing houses impose reserve requirements in the form of cash or Treasury bills on open positions and frequently monitor those positions. Still, it is conceivable that a very large sudden price drop (say, in the stock market) might bankrupt a clearing member with a large open position, and conceivably threaten the clearing house. This could cause a run on the futures market as holders of contracts wary of the credibility of the clearing house's solvency try to sell their contracts. This could amplify the losses to the clearing house and legitimize the initial concerns that prompted the run, leading to further cashing-in of positions. If the clearing house were to fail, many hedges would disappear with its demise, increasing the risk of many financial claims and causing confusion about the incidence of the increased risk in ways that might provoke a general liquidity crisis.

The Fed could reduce the chance of a run on a futures clearing house by agreeing temporarily to lend at the discount window without penalty to banks making loans to clearing house members, and could even lower the discount rate if necessary to encourage such "pass throughs." Indeed, this seems a reasonable characterization of the Fed's response to concerns about futures markets posed by the stock market collapse of October 1987.

There is a more difficult policy question, however, that so far has not been addressed. If banks are unwilling to lend to a clearing house -- even on highly-subsidized terms -- should the Fed let the clearing house fail? On one hand, ad hoc direct lending by the Fed runs the risk of encouraging lax self-regulation within the clearing house. On the other hand, the financial disruption from a clearing house failure might generate substantial negative externalities in the financial system. The Fed already has had to come to grips with this problem in establishing fees and limits on overdrafts of bank accounts with the Fed. It might be worthwhile for the Fed to decide explicitly whether it would stand behind the liabilities of failed private clearing houses. If protection is deemed

necessary, the next step would be to design an insurance arrangement that appropriately combines deductibles, margins, and premia to minimize incentive problems and pay for itself (Calomiris, 1992b). As the volume of transactions in financial derivatives expands, so does the need to develop consistent policies for dealing with possible systemic risks related to these markets.

In conclusion, it is important to emphasize that identifying a potential benefit from a "backup" discount window does not justify the current form of the discount window. There may be no benefit to allowing the Fed to lend to banks during normal times, and as Schwartz and others have argued, such lending may be highly costly. There is always a risk that government agencies will abuse even a "reformed" discount window by defining non-crises as crises in order to make loans to favored parties. One possible solution to this problem, following the recent guidelines for bank bailouts established in FDICIA, would be for Congress to require that a supermajority of the Federal Reserve Board and members of the Administration must agree that a crisis is under way before the discount window could be used.

NOTES

1. If money-demand disturbances were the cause of banking panics, as envisioned in Diamond and Dybvig (1983), then open market operations, as normally defined, would be a sufficient tool for policy if the central bank were permitted to purchase bank loans. Since bank loans are not "special" in that framework (i.e., there is no delegated control and monitoring function performed by the banker, and hence no potential for adverse selection or moral hazard), it is natural to think of standard open market operations as including purchases of bank debt in the context of that model. If, however, banking panics are produced by confusion over the incidence of shocks to the value of bank assets, as argued in Calomiris and Gorton (1991), and if banks have special information about their portfolios, then a government policy of purchasing bank loans during a crisis at pre-panic prices would have the same costs and benefits as allowing banks access to the discount window.
2. These limitations were eliminated in the 1930s. For a discussion of changing collateral requirements on Fed lending, see Friedman and Schwartz (1963, 190-195). For a discussion of the near-riskless quality of commercial paper, see Calomiris (1992a). Note that lending from the Fed on riskless collateral can provide special assistance to banks (up to the amount of their riskless collateral) only because the Fed enjoys a special right to "jump the queue" of debt seniority. By taking the best assets of the bank as collateral the Fed effectively subordinates existing debt claims. Private creditors would not be able to do so, and thus would not be able to lend to the bank on the riskless collateral.
3. To have any effect in stopping a panic, lending by the Fed must shift bank-specific asset risk to the Fed. This proposed rule is different from "Bagehot's rule" – lend freely at a "penalty" rate. There must be an implied subsidy relative to the terms on which private lenders would be willing to lend to the bank, or else government lending cannot prevent runs.
4. Calomiris (1990, 1992c) argues that a nationwide branch banking system would not have experienced aggregate insolvency risk even during the worst episodes of bank failure and bank panic.
5. Under current law, deposits of greater than \$100,000 are not protected (de jure) by government deposit insurance, although larger deposits would be covered if a general run on the banking system ensued. FDICIA establishes a formula for determining whether a systemic threat warrants the coverage of larger-denomination deposits.
6. This argument for the relative desirability of the discount window as a means to insure against panics presumes that the central bank will not cave in to the political pressures of special interests to bail out banks in non-crisis times. Recent accusations by the House Banking Committee of inappropriate lending by the Federal Reserve to insolvent banks cast some doubt on the ability of current institutions to make and enforce appropriate distinctions regarding when banks should have access to the discount window (see Business Week, July 15, 1991, pp. 122-3). Schwartz (1992) argues that the history of the discount window is replete with such examples. Still, in principle, a properly administered discount window would be superior to deposit insurance. Congress has mandated, and the Fed has implemented, specific new guidelines that limit Fed lending to distressed banks (American Banker, August 12, 1993, pp. 1-2).
7. Mishkin (1991a) also argues that asymmetric information is relevant outside the banking sector. He uses data on interest rate spreads between risky and riskless debt instruments to support this view. He finds evidence of an increase in these spreads (which he interprets as reflecting an increased inability to

sort borrowers according to risk) coinciding with or prior to the Penn Central crisis of 1970 and the stock market crash of 1987.

8. Schadrack and Breimyer (1970), p. 283.

9. Murray (1971), pp. 42-9. David Whitford (1993) applied Altman's (1968) "z-score" model to Penn Central's accounts as of December 1969, and found a remarkably low z-score of 0.135. Altman had found that no healthy firms had z-scores of below 1.81 and no bankrupt firms had a score above 2.99.

10. For this quotation Schadrack and Breimyer (1970, p. 289) refer to Treiber (1970), p. 16.

11. An unintended cost of Regulation Q was that it removed an "automatic stabilizer" from the financial system by making it less attractive for investors to hold bank debt at times of crisis in other markets.

12. Burns (1970), pp. 624-5.

13. The moral hazard costs of government pass throughs were minimal, since the banks and not the government bore the default risk on the loans. This statement requires some qualification. If the pool of borrowers faced large aggregate default risk, then bank failures might have resulted from the loans, in which case the government would have borne some of the losses. Moreover, if some banks had been on the brink of failure, they might have been willing to make subsidized loans to the riskiest firms, thus concentrating overall default risk and making the government's indirect default risk greater. The central assumptions underlying my claim that the government's share of the risk was small are that banks were not on the verge of failure at the time, and that the average quality of the commercial paper borrowers pool was high. The relaxation of regulation Q ceilings on CDs was also helpful in limiting the government's risk, since it limited the amount of borrowing from the Fed. CDs also provided a natural vehicle for financing fixed term commercial paper, and did so without affecting the money supply.

14. It is less clear whether the data on A-rated firms in 1978 is representative of A-rated firms in 1970. From 1970 to 1978, market analysts argue that the growth in commercial paper issuers brought more firms with lower ratings (A or BBB) into the market; thus it might not be appropriate to assume that 1970 saw the same high proportion of A-rated firms issuing paper as in 1978 (45 percent). For purposes of constructing an indicator variable, given the uncertainty about the number of issuers with A ratings in 1970, it is best to exclude A-rated firms from the group of likely issuers because A-rated firms are a small fraction of total firms with ratings below AA, but a large fraction of AA or AAA firms.

15. As shown in Table 6, the correlations are -.07 and -.19, and .07, respectively, between the AA-or-better rating indicator and the short-term debt ratio, inventory-to-sales ratio, and profit ratio. All three of these correlations are highly statistically significant (with p-values of 0.003, 0.0001, and 0.004, respectively).

16. Of course, the Fed could have done even more to encourage banks to make pass throughs than it did during Penn Central by making its subsidy larger. The subsidy the government can grant is potentially very large. By lowering the discount rate to zero and discriminating in imposing non-pecuniary penalties across banks (e.g., charging zero hassle cost to banks borrowing for targeted pass throughs, and a prohibitive rate on other borrowing) the subsidy can be increased to the level of the equilibrium fed funds rate without affecting monetary control.

17. Gorton and Pennacchi (1992) argue that there is no evidence for "contagion" among commercial paper issuers or finance companies. They examined the failures of several issuers and finance companies and found that a failure did not lead investors in securities markets to lower the price of other issuers' or finance companies' securities, *ceteris paribus*. It is premature, however, to interpret this as evidence that issuers or finance companies are now immune to panics, or more broadly, that financial technology has improved so much that intermediaries are not potentially vulnerable to panics. Gorton and Pennacchi's sample of events is small, and the events they examine may simply have been transparently idiosyncratic (unlike, for example, the Penn Central crisis). It is possible that events unlike those in their sample could produce panics.

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Table 1
Selected Yields and Interest Rates

Date ¹	3-month Treasury Bill Yield	Federal Funds Rate	4-6 Month Prime Commercial Paper
<i>1970</i>			
January	7.89	9.04	8.55
February	6.88	8.41	8.50
March	6.16	7.45	8.03
April	6.59	8.43	8.00
May	7.00	7.64	8.13
June (1)	6.82	7.84	8.13
(2)	6.76	7.98	8.15
(3)	6.71	7.80	8.25
(4)	6.51	7.21	8.25
July (1)	6.46	7.23	8.38
(2)	6.62	7.34	8.35
(3)	6.46	7.59	8.25
(4)	6.34	7.16	8.35
August	6.25	6.34	7.70
September	5.80	6.05	7.20
October	5.84	6.11	6.63
November	4.99	5.16	5.75
December	4.83	4.82	5.75

¹Data are all end-of-month, except for June and July, which are reported end-of-week. Treasury bill and commercial paper yields are quoted on June 6, 13, 20, and 27, and July 4, 11, 18, and 25. Federal funds rates are for June 3, 10, 17, and 24, and July 1, 8, 15, and 22.

Source: Board of Governors of the Federal Reserve System (1976), pp. 689-707.

Table 2
Long-Term Yields and Spreads

Date ¹	Long-Term Government Bonds ²	Aaa Corporate Bonds ³	Baa Corporate Bonds ³	Spread Between Aaa and Government Bonds	Spread Between Baa and Aaa Corporate Bonds
1970					
January	6.84	8.29	8.81	1.45	0.52
February	6.25	8.23	8.73	1.98	0.50
March	6.33	8.22	8.66	2.11	0.44
April	6.70	8.21	8.74	1.51	0.53
May	7.21	8.56	9.10	1.35	0.54
June 6	7.00	8.62	9.13	1.62	0.51
13	7.09	8.70	9.18	1.61	0.48
20	7.05	8.80	9.26	1.75	0.46
27	6.89	8.89	9.36	2.00	0.47
July 4	6.73	8.92	9.41	2.19	0.49
11	6.56	8.93	9.44	2.37	0.51
18	6.61	8.88	9.39	2.27	0.51
25	6.54	8.82	9.38	2.28	0.56
August	6.73	8.72	9.47	1.99	0.75
September	6.52	8.66	9.32	2.14	0.66
October	6.65	8.64	9.34	1.99	0.70
November	5.97	8.62	9.37	2.65	0.75
December	6.05	8.23	9.02	2.18	0.79

¹All data are end-of-month, unless otherwise indicated.

²Maturity varies.

³Rated by Moody's.

Source: Board of Governors of the Federal Reserve System (1976), p. 757.

Table 3

Banking System Changes during the Penn Central Crisis

Date	Federal Funds Rate Minus Discount Rate	Total Borrowed Reserves \$million	Borrowed Reserves of Large Commercial Banks \$million	Loans to Business and Finance Companies By Large Commercial Banks, \$million	Large Negotiable CDs at Large Commercial Banks \$million	U.S. Government Securities Held By Federal Reserve Banks \$million
1970						
January	3.04	1,071	807	83,423	10,444	55,568
February	2.41	873	522	83,549	10,839	55,749
March	1.45	1,594	1,334	83,903	11,795	55,621
April	2.43	926	680	84,122	13,022	56,085
May	1.64	979	675	83,265	12,984	57,115
June 3	1.84	1,335	1,063	83,545	12,964	57,698
10	1.98	834	624	83,811	12,956	57,552
17	1.80	459	273	85,785	12,741	57,823
24	1.21	840	613	85,331	12,949	57,005
July 1	1.23	923	671	87,212	14,118	57,714
8	1.34	1,598	1,402	87,161	15,199	57,671
15	1.59	2,036	1,837	87,560	15,980	58,839
22	1.16	1,216	1,044	87,472	16,911	58,138
August	0.34	1,044	941	86,067	20,157	59,618
September	0.05	852	788	88,426	22,227	60,055
October	0.11	418	341	86,514	23,546	59,283
November	-0.59	1,144	1,098	86,385	25,201	61,209
December	-0.68	252	224	89,130	26,075	60,632

¹ All data are end-of-month, unless otherwise shown.

Sources: Table 1 and Board of Governors of the Federal Reserve System (1976), pp. 286-7, 588-9.

Table 4
Average Loan Rates on Short-Term Loans

	New York City		Other Northeastern Financial Centers	
	February	August	February	August
All sizes	8.24	8.24	8.86	8.89
\$ 1,000-\$ 9,000	9.05	9.07	9.23	9.41
\$ 10,000-\$ 99,000	8.91	8.95	9.34	9.42
\$100,000-\$499,000	8.53	8.59	9.01	9.01
\$500,000-\$999,000	8.31	8.23	8.72	8.68
\$1 mil and over	8.13	8.12	8.45	8.49

Source: Board of Governors of the Federal Reserve System (1976), p. 711.

Table 5

Event Study Regression Results for Standardized Abnormal Returns
(Standard Errors in Parentheses)

	<u>6/12/70 - 6/22/70</u>				<u>6/22/70 - 7/9/70</u>			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<u>Intercept</u>	-1.24 (0.23)	-0.59 (1.18)	-0.81 (1.19)	-0.39 (1.20)	-1.99 (0.27)	-1.72 (1.35)	-1.48 (1.34)	-2.24 (1.35)
<u>Debt/Assets</u>	-0.44 (0.18)	-1.06 (0.54)	-0.81 (0.55)	-0.68 (0.55)	0.62 (0.20)	1.13 (0.62)	0.53 (0.62)	0.30 (0.62)
<u>(D/A)-sq.</u>		1.01 (0.72)	0.61 (0.74)	0.50 (0.74)		-0.62 (0.83)	-0.62 (0.84)	-0.42 (0.83)
<u>STD/Assets</u>	0.05 (0.43)	-1.08 (0.96)	-0.71 (0.99)	-0.79 (0.99)	-1.50 (0.49)	-3.36 (1.10)	-1.92 (1.12)	-1.77 (1.11)
<u>(STD/A)-sq.</u>		3.11 (2.28)	2.39 (2.30)	2.50 (2.30)		4.93 (2.62)	4.41 (2.59)	4.21 (2.56)
<u>Size(MVE)</u>	0.13 (0.02)	0.03 (0.21)	0.09 (0.21)	0.01 (0.21)	0.16 (0.02)	0.11 (0.24)	0.10 (0.23)	0.26 (0.24)
<u>(MVE)-sq.</u>		0.004 (0.01)	0.002 (0.009)	0.006 (0.009)		0.002 (0.01)	0.002 (0.01)	-0.006 (0.01)
<u>NI/MVE</u>			-0.86 (0.33)	-0.82 (0.32)		1.72 (0.37)	1.66 (0.37)	
<u>(NI/MVE)-sq.</u>			0.82 (0.43)	0.80 (0.43)		-0.59 (0.49)	-0.56 (0.48)	
<u>INV/SALES</u>			-0.39 (0.40)	-0.52 (0.41)		-2.00 (0.45)	-1.77 (0.45)	
<u>(INV/SALES)-sq.</u>			-0.04 (0.41)	-0.04 (0.41)		0.74 (0.46)	0.59 (0.46)	
<u>AA or AAA</u>				-0.32 (0.15)				0.58 (0.17)
<u>Adj. R-square</u>	0.034	0.036	0.040	0.042	0.046	0.046	0.080	0.087

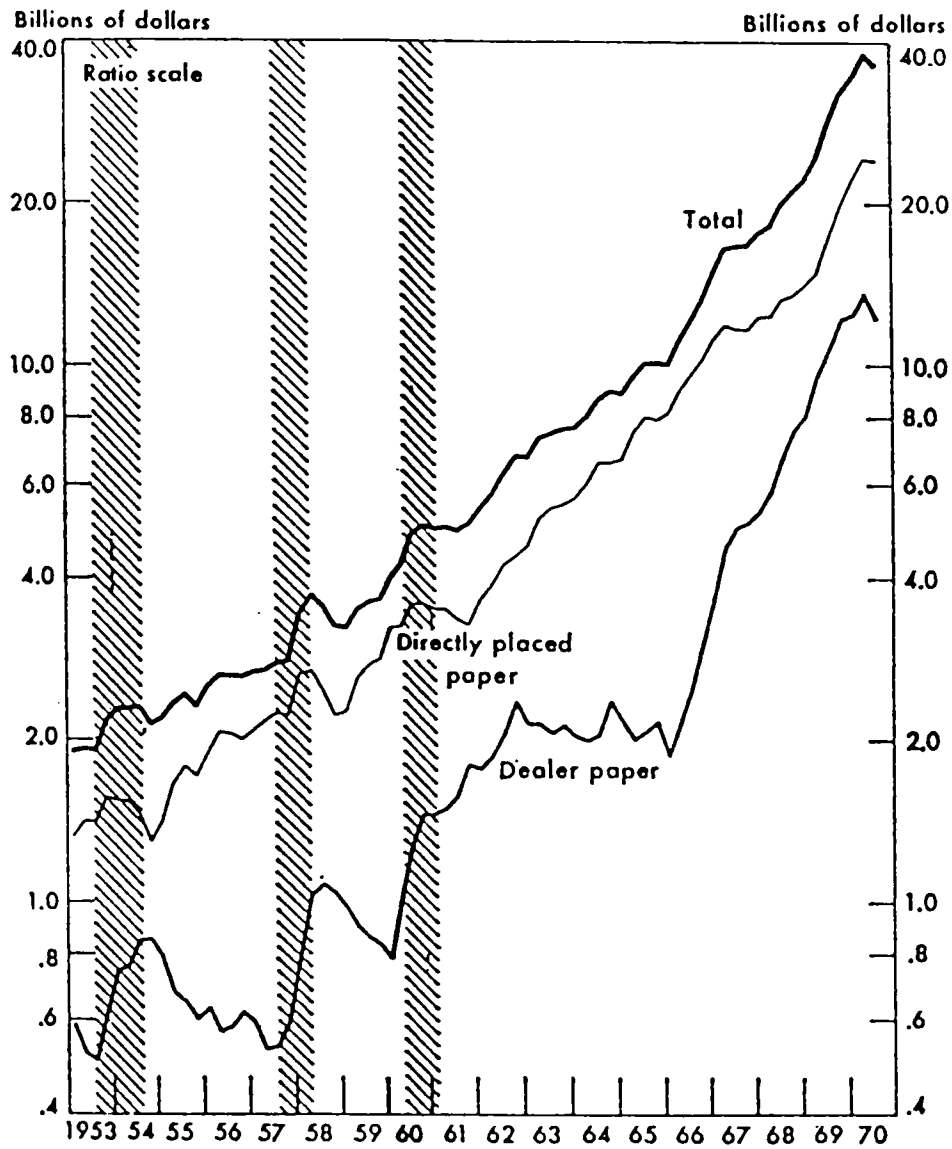
Table 6

Means, Standard Deviations, and Correlations Among Regressors

	Mean	St.Dev.	Correlations (p-values in parentheses)				
			<u>STD/A</u>	<u>MVE</u>	<u>NI/MVE</u>	<u>I/S</u>	<u>AA+</u>
<u>D/A</u>	0.28	0.21	0.52 (0.000)	-0.11 (0.000)	0.28 (0.000)	-0.05 (0.05)	0.11 (0.000)
<u>STD/A</u>	0.07	0.09		-0.28 (0.000)	0.06 (0.03)	0.26 (0.000)	-0.08 (0.003)
<u>MVE</u>	11.2	1.6			-0.03 (0.22)	-0.13 (0.000)	0.32 (0.000)
<u>NI/MVE</u>	0.17	0.13				-0.13 (0.000)	0.07 (0.004)
<u>I/S</u>	0.17	0.13					-0.19 (0.000)
<u>AA+</u>	0.06	0.23					

Figure 1

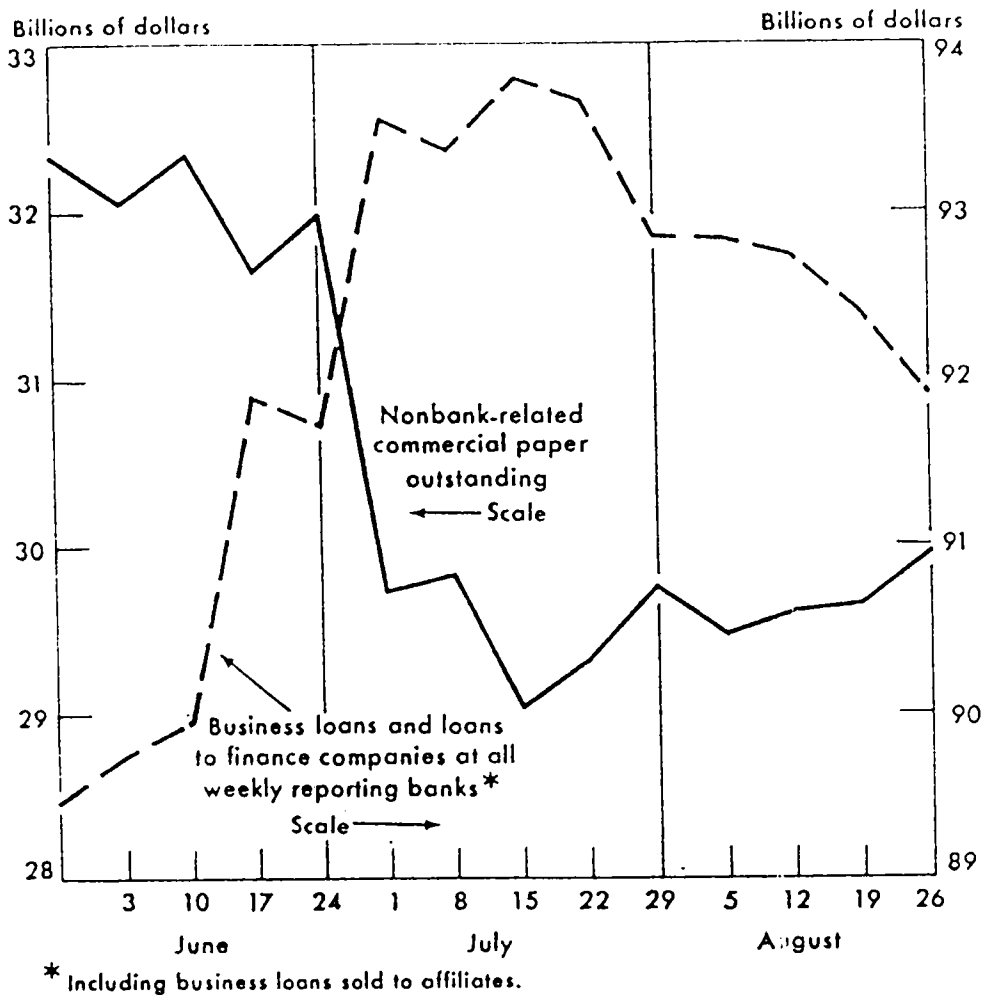
Commercial Paper Outstanding



Source: Schadrack and Breimyer (1970), Chart I.

Figure 2

Commercial Paper and Business Loans
June-August 1970



Source: Schadrack and Breimyer (1970), Chart V.

Figure 3
Shifts in the Reserve Market
June 17-July 15

