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BANK CAPITAL AND PORTFOLIO MANAGEMENT: THE 1930'S "CAPITAL CRUNCH" AND SCRAMBLE TO SHED RISK

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ABSTRACT

Recent models of banking under asymmetric information argue that depositors penalize banks that offer high-risk deposits. Focusing on New York City banks in the 1920's and 1930's, this study examines how banks manage risk during normal times and in response to severe shocks.

We develop and apply a simple framework that identifies the tradeoffs among alternative means of satisfying depositors' preferences for low-risk deposits (i.e. low asset risk versus high capital).

During the 1920's profitable lending opportunities and low costs of raising capital prompted banks to increase their asset risk, while increasing capital to maintain low default risks on deposits. Cross-sectional differences in the cost of raising equity explain differences in banks' choices of asset risk and capital ratios.

In the wake of the loan losses produced by the Depression, high default risk was penalized with deposit withdrawals. To reduce deposit risk, banks increased their riskless assets and cut dividends, but avoided costly equity issues. Banks with high default risk or with high costs of raising equity contracted dividends the most during the 1930's.

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I. Introduction

Focusing on New York City banks in the 1920s and 1930s, this study examines how banks manage risk during normal times, and in response to severe shocks. Recent models of banking under asymmetric information argue that bank capital can be costly to raise and that depositors penalize banks that offer high-risk deposits. We develop and apply a simple framework that identifies the tradeoffs among the alternative means of satisfying depositors' preferences for low-risk deposits (i.e., low asset risk versus high capital). That framework also illustrates how bank "capital crunches" can arise – contractions in lending that result from losses in bank capital.

In our empirical work, we examine how banks simultaneously targeted their asset risk and capital ratios to achieve low deposit risk in the interwar period, and how banks responded to large adverse shocks to their capital during the Depression, which temporarily raised the default risk of their deposits.

We focus on the behavior of New York City banks during the interwar period for two reasons. First, our choice of sample reflects an historical interest in the role of bank credit during the Great Depression. Second, data on the behavior of historical banks (banks that existed prior to regulatory standards that now constrain capital and portfolio choices) is uniquely valuable for testing theories of bank portfolio and capital choices under asymmetric information.

We find that during the 1920s profitable lending opportunities and low costs of raising capital prompted banks to accumulate capital and increase their asset risk, while still maintaining low default risk on deposits. In response to loan losses in the early 1930s, and high costs of raising new capital, banks faced significant pressure from depositors to reduce deposit risk. Banks cut dividends but avoided new offerings of stock and thus allowed capital to remain low.

The primary means to reduce depositor risk, and thus prevent deposit withdrawals, was the contraction of the supply of loans. Banks substituted from loans into riskless assets. This was a gradual process that took place over several years, owing to large adjustment costs of loan liquidation. Cross-sectional differences in the cost of issuing new equity (which we identify using secondary market bid-ask spreads) explain differences in banks' choices of asset risk and capital ratios.

These results provide evidence consistent with the view that the contraction in bank credit during the Depression was largely a result of a "capital crunch" that forced banks to limit their loan portfolio risk. Our results also provide an explanation for the decline in bank capital and the increase in bank reserves during the 1930s. Previous work has viewed capital and liquid assets of banks in isolation and has produced opposing claims about changes in the risk-preferences of bankers during the interwar period. Friedman and Schwartz (1963) – focusing on liquid assets – argue that banks became more risk-averse in the 1930s, while Berger, Herring, and Szego (1995) – focusing on book capital measures – reach the opposite conclusion. We find that bank risk aversion (measured as the targeted level of deposit risk) did not change from the 1920s to the 1930s; the difference between the 1920s and the 1930s was the relative importance of capital and liquid assets as mechanisms for insulating depositors from loan risk.

Our discussion divides into six sections. Section II reviews the theoretical literature on bank portfolio and financing choice, and its relationship to the debate over the role of bank credit contraction during the Great Depression. Section III develops a simple model that provides the basis for our empirical work. Section IV contains the empirical analysis of individual New York City banks' behavior from 1920 to 1940. Section V discusses our contribution to the question of whether banks became more or less risk-averse in the wake of the Great Depression. Section VI concludes.

II. Portfolio Risk and Financing Choices under Asymmetric Information

What is the optimal risk structure of a bank's portfolio? How is that portfolio risk distributed between bank debt and capital – in other words, what is the optimal leverage of a bank? Recent models in corporate finance – especially those that analyze the financing problem of banks – argue that there is a connection between these two questions. In particular, this new literature implies that the "debt capacity" of a firm (the maximum economical amount of debt it can issue) is a decreasing function of its asset risk.

The frameworks of Leland and Pyle (1977), Campbell and Kracaw (1980), and Myers and Majluf (1984) derive the more general point that the riskier the claims offered to outsiders, the more costly it will be to raise funds from outsiders. Those models imply that it is always desirable (if possible) for informed "insiders" to hold equity and for outsiders to hold low-risk debt. If firms are driven to issue risky claims to outsiders, doing so is highly costly, since outsiders have to be convinced of the quality of the firm's assets. Indeed, the difficulty of raising funds from outsiders in the form of junior claims explains why underwriting costs for equity offerings are often very high, particularly for "information-problematic" firms (Calomiris and Himmelberg 1997).

An implication of the asymmetric-information models of corporate finance is that firms can reduce the "lemons cost" of raising funds by reducing (in an observable way) the riskiness of their portfolios. If a firm shifts toward more cash assets, its asset risk declines, and the lemons premium on its outside claims also falls. Lower asset risk raises the firm's capacity to issue low-risk debt.

In banking, there are special problems that tend to reinforce the incentives to issue low-risk debt to outsiders, and thus banks face special incentives to manipulate the composition of their assets (the ratio of cash to total assets) to limit the riskiness of their debt. Models of banks tend to emphasize two special aspects of the banking firm: the potential conflict of interest between bankers and depositors (first emphasized by Diamond 1984), and banks' role as issuers of transactable media. Both of these problems banks face encourage banks to offer extremely short-term (typically demandable), low-risk debt. That is, banks efficiently segment their risk, concentrating most risk in the equity and debt holdings of insiders, and thus insulating outsiders from bearing risk.

The agency argument for this risk segmentation begins by assuming that because banks are information specialists who are given control over financial assets agency problems in banking are likely to be especially pronounced. In Calomiris and Kahn (1991) or Calomiris, Kahn, and Krasa (1992), limiting depositors' risks by offering them demandable debt helps to resolve agency problems between the banker and the depositors either by limiting the bank's propensity to take on excessive risk or by preventing the bank from absconding with depositors funds.

The role of banks as suppliers of transacting media is modeled by Gorton and Pennacchi (1990). They stress that it is difficult for outsiders to value bank portfolios, and that this can make it hard to transact in bank claims. Low-risk debt claims on the bank (deposits) will be more easily traded among uninformed third parties because the unknown risk of the bank's portfolio has little effect on their value. Because depositors value the liquidity of their claims, banks will find it advantageous to offer low-risk debt to finance themselves.

These models of banking under asymmetric information imply that banks will face strong market pressure to offer low-risk debt to outsiders, both because such debt protects depositors from inappropriate bank behavior, and because it enhances the liquidity of bank claims. Banks that try to raise funds from outsiders by offering riskier claims will suffer cost penalties (or, as in Calomiris and Kahn 1991, may not be able to raise external funds at all).

Bank "Capital Crunches"

These models also offer insights on how banks are likely to respond to shocks. If a bank experiences loan losses (which reduce the bank's capital in market value terms, and raise both the asset risk and leverage of the bank), the riskiness of bank debt will consequently rise. For example, even if depositors cannot observe the precise characteristics of the bank's portfolio, they can observe economic downturns and make projections about the consequent average loan losses experienced by banks. Depositors that were previously content with the low riskiness of their claims will respond to the increased risk of bank debt by penalizing their banks – either by demanding a penalty interest rate (a rate that contains a "lemons premium") or by withdrawing their funds and placing them in other banks, in postal savings accounts (popular during the interwar period), or under the proverbial mattress.

In this environment, banks face strong incentives to limit deposit risk. It will be difficult for a bank to reduce its portfolio risk by selling risky assets – after all, the function of the bank is to hold loans that are not readily marketable (Froot and Stein 1997). The two practical means of reducing deposit risk are (1) to liquidate loans as quickly as possible as they mature and replace issuing new capital. None of these alternatives is costless, especially during a recession.

In a recession, attempts to liquidate loans as they mature may force borrowers into financial distress, and thus reduce the value of bank loans. Furthermore, banks build valuable customer relationships over time through their investments in information (for theory, see Rajan 1992, Calomiris 1995; for empirical evidence, see Slovin, Sushka, and Polonchek 1993, Petersen and Rajan 1994). Abandoning a loan customer means shedding an asset that earns positive quasi-rents for the bank (profits in excess of the risk-adjusted return on marketable assets, which reward banks for ex ante investment in information). Thus loan liquidation is costly, and the loan liquidation process may be very protracted (we will argue below that during the Great Depression the process took years to complete).

Accumulating additional bank capital is also expensive. Issuing new equity in the midst of a recession is costly because the costs of adverse selection (lemons premia) are countercyclical. Potential purchasers of bank equity are aware of a significant increase in downside risk within the banking system, and face high costs of distinguishing good from bad bank loan portfolios. Cutting dividends provides only limited amounts of new capital to the bank (particularly when earnings are low), and reduces stockholder liquidity at an inopportune time (which can backfire on the bank by reducing the value of bank stock).

Thus during recessions banks seeking to avoid deposit outflows are caught between the Scylla of loan disposal costs and the Charybdis of high adverse selection costs of raising equity. This costly adjustment process – where banks trade off the costs of losing deposits against the costs of losing loan value and the costs of raising equity – is often referred to as a "bank capital crunch" (Bernanke and Lown 1991).

Macroeconomists (including Fisher 1933 and Bernanke 1983) emphasize that bank capital crunches entail severe contractions in the supply of bank credit, and that these magnify recessionary contractions of economic activity. There is a growing micro-econometric literature tracing the effects of bank capital losses on the supply of credit, and a related macro-econometric literature examining the links between bank credit supply and the level of economic activity (Baer and McElravey 1993, Peek and Rosengren 1997, Kashyap and Stein 1995).

Macroeconomists (see Calomiris 1993 for a review) have emphasized the potential importance of the bank capital-crunch (and consequent bank credit-supply contraction) during the Great Depression. As Table 1 shows, the decline in bank lending by New York City banks during the 1930s was impressive. Furthermore, evidence that bank credit contraction was correlated with economic contraction can be found in Bernanke (1983) and Ramos (1995). But these papers do not convincingly identify a contraction in bank loan *supply,* induced by the capital crunch. Critics of the Fisher-Bernanke view might argue that the correlation between bank credit and economic activity reflects expectations of poor economic conditions that depressed the *demand* for loans. Thus an important missing link in the existing literature is the one that connects banking distress to the decline in bank lending. In the discussion and evidence that follow, we argue that analysis of individual banks can help to identify the sources of credit contraction.

In addition to contributing to the understanding of the Great Depression, an examination of the behavior of New York City banks in the 1920s and 1930s provides a useful and somewhat unique testing ground for theories of capital crunches induced by asymmetric information problems in banking. Previous empirical work on bank capital crunches has examined recent bank behavior, but such behavior may be an artifact of capital regulation rather than an equilibrium outcome chosen by banks in response to asymmetric-information problems. Currently, banks' capital ratios are regulated as part of the government's safety net and accompanying prudential regulation. Those regulations – particularly, the Basle capital standards and their incarnation in the United States through the FIRREA (1989) and FDICIA (1991) statutes – have created a regulatory link between capital ratios and portfolio risk. Insured banks may face strong incentives to raise their leverage and expand their lending without concern over depositor discipline (since depositors are now insured by the government). To the extent that banks operate on a "regulatory margin" (rather than setting capital and portfolio risk to satisfy their uninsured providers of funds) capital crunches may simply indicate that regulators are enforcing risk-based capital standards – which are designed to force banks to link their capital ratios and their loan ratios.

An examination of the 1920s and 1930s affords a unique opportunity to test theories of bank portfolio and capital structure under asymmetric information in an environment where capital and portfolio risk are not constrained by regulatory capital standards. New York City banks during the 1920s and 1930s are an ideal sample for our purposes. Because these banks were large, publicly traded institutions, their balance sheet data and stock prices (which we use to infer market values of capital, bank asset risk, and deposit default risk) are readily available throughout the interwar period. Furthermore, the choices of publicly traded New York City banks were not significantly influenced by the passage of deposit insurance in 1933 because large New York City banks' deposits were typically too large to be covered by deposit insurance in the 1930s (Saunders and Wilson 1995).

III. Theoretical Framework

We develop and apply a simple model, which combines Black-Scholes (1973) contingent-claims pricing of deposits with information asymmetry between bankers and outside funding sources, and identifies the tradeoffs among the alternative means of satisfying the depositor low-default-risk constraint. The equilibrium choice of capital and portfolio structure reflects the opposing influences of the cost of raising bank capital from outsiders and the quasi-rents from lending that are foregone when banks contract portfolio risk.

The macroeconomic process giving rise to capital shocks is not modeled explicitly. The comparative statics of the model, however, provide some insight about the long-run adjustment to recessionary shocks. Adverse economic shocks will reduce bank capital, raise adverse-selection costs of issuing equity, and reduce quasi rents from lending. The model predicts that such exogenous changes will produce no long-run change in the riskiness of deposits, but will result in persistent reductions in capital, and substitution into riskless assets and away from loans. The costs to the bank of liquidating loans (quasi rents foregone and counterproductive financial distress of clients) may make the reduction of deposit risk and asset risk a gradual and protracted process.

The (Long-Run) Model

The scale of the bank (A) is assumed to be predetermined. Assume that a bank can hold two kinds of assets, risky loans (L) and riskless "reserves" (R).

(1) $A = L + R$

Asset risk is defined as the standard deviation of log asset value (s_A). From (1) we know that:

(2) $s_A = (L/A)\, s_L$,

where s_L is the exogenously given riskiness of loans (the standard deviation of the log value of the loan portfolio). For convenience, we adopt the other assumptions of Black and Scholes (1973) regarding the evolution of asset returns over time and the log normality of s_A. (The role of the Black-Scholes model in our framework and empirical work is to provide a concrete shape to the isorisk map for deposits – a set of lines shown in Figure 1 – not to test alternative frameworks for pricing deposit risk, of which the Black-Scholes model is one). Given the exogeneity of loan portfolio risk, the choice variable of the bank for setting asset risk is (L/A).

Banks earn quasi rents from lending (as in Rajan 1992). That is, banks possess private information, and hence valuable client relationships, that make the risk-adjusted profits from lending positive. Thus banks are not indifferent to the relative size of their loan and riskless asset portfolios; in our model, if external finance were not costly due to asymmetric information, banks would choose to hold all their assets in loans (because we abstract from physical transaction demand for reserves unrelated to the risk of bank assets). We assume for simplicity that total quasi rents (r) are a fixed proportion (a) of loans made by the bank. (Our results would be qualitatively unchanged if, more realistically, we specified a as a declining function of L.):

(3) $r = a\,L$.

Equations (2) and (3) imply:

(4) $r = a\,A\,s_A / s_L$.

We assume (for simplicity) that bankers raise all equity externally and face adverse-selection costs when issuing equity. According to Calomiris and Raff (1995), during the 1920s and 1930s fees paid by stock issuers to underwriters typically exceeded 10 percent of the value of the equity being sold. Additionally, the negative signaling effect of a stock issue imposes costs on insiders, who must sell shares to outsiders at a low price. Rights offerings (transferable subscription rights) were the dominant form of bank stock issues during our period (Wilson and Kane 1997), and price reductions were the primary component of issuing costs. Low offering prices ensured full subscription by outsiders but diluted insider claims on rents.

The deadweight cost (C) borne by insiders for issuing equity is assumed proportional to the amount offered (see Altmkilic and Hansen 1997 and Calomiris and Himmelberg 1997 for supporting evidence), and the riskiness of assets (s_A) magnifies adverse-selection cost. That is:

(5) $C = b(s_A)\,E$,

where E is the amount of equity issued by the bank. Thus the market capital-to-asset ratio of the bank is E/A. For simplicity, we assume that the b function is linear in s_A.

The riskiness of bank debt is measured using Black and Scholes (1973). Bank deposits are assumed to have a one-year maturity – a convenient way of allowing deposits to be risky without sacrificing the continuity assumptions of Black-Scholes (a one-day maturity, given the continuous price movements of Black-Scholes, would render deposits virtually riskless). We recognize that the Black-Scholes model assumes costless information, and is thus not strictly consistent with our other assumptions of bank quasi-rents and adverse-selection costs. We emphasize that our goal in using Black-Scholes is to measure differences in deposit risk over time and across banks, rather than to price deposit risk in an absolute sense.

The Black-Scholes model solves simultaneously for three variables: (1) the riskiness of bank deposits (P) – defined as the credit risk spread (basis points of annual return) that would fairly compensate depositors for the default risk on deposits – as a function of the maturity of debt (assumed here to equal 1), (2) the capital ratio of the bank in market value terms (E/A), and (3) the riskiness of bank assets (s_A). The specific functional form is illustrated in Figures 1 and 2. For our purposes, it is sufficient to point out here that a general form of the equation is:

(6) $P = f(s_A , E/A)$, where $f_1 > 0$ and $f_2 < 0$.

We incorporate the notion of a depositor preference for low risk (from Gorton and Pennacchi 1990, and Calomiris and Kahn 1991) by assuming a penalty paid by the bank (a lemons premium paid on deposits) if it tries to raise the value of p above a given low level (P_M). For simplicity, we assume that the penalty is prohibitively large, and thus that banks will always target a long-run equilibrium combination of E/A and L/A that offers depositors deposits with risk equal to P_M. The assumed nonlinearity of the penalty is consistent with several theoretical interpretations. For example, in the context of the Gorton-Pennacchi model, a bank's failure to keep its deposit risk sufficiently low may result in the bank's being excluded from the payments system (e.g., being ejected from the clearing house). Alternatively, in the context of the Calomiris-Kahn model, banks offering high-risk debt may simply be unable to attract depositors at any price.

The banker's objective is to maximize his profit, which equal the difference between quasi rents earned from lending and the physical costs of placing equity. In other words, we assume that the outside depositors and stockholders of the bank receive a fair expected compensation (commensurate with the true asset risk of the bank), and thus that the banker merely retains the rents from lending net of the costs of issuing equity. One way to enforce this arrangement would be to tie the banker's compensation to the bank's performance.

Assuming the banker maximizes profits (J), he maximizes the value of the following expression, choosing E/A and s_A (which is the same as choosing E/A and L/A), and subject to the constraint of equation (6) and the constraint that $P = P_M$:

(7) $$J = (a\, s_A\, A / s_L) - b\, s_A\, E$$

Assuming $P = P_M$ this expression can be rewritten as equation (8), using equation (6) to express E/A as a function $g(s_A)$:

(8) $$J/A = a\, s_A / s_L - b\, s_A\, g(s_A).$$

Recall that A is predetermined. Differentiating with respect to s_A, the first-order condition for profit maximization is given by:

(9) $a/bs_L = g(s_A) + s_A g'(s_A)$,

where g' is the first derivative of g.

The solution to equation (9) can be illustrated diagramatically. Figure 1 describes deposit isorisk curves for a one basis point deposit risk premium and a 50 basis point risk premium, drawn in the space defined by s_A and E/A. Figure 2 graphs the two sides of equation (9), assuming that p = 1 basis point. In Figure 2, we define $Q = g(s_A) + s_A g'(s_A)$. The equilibrium value of s_A is determined by the intersection of Q and a/bs_L. For example, whether the bank chooses to locate at point X or point Z depends on s_L and the relative sizes of a and b. The larger is a (or the smaller is b), the more the banker will prefer to satisfy depositor risk preferences by choosing a combination of higher E/A and higher s_A. The functional form of the Black-Scholes model (which determines g, and hence the shape of Q) guarantees an interior solution for profit maximization (because Q cuts a/bs_L from below). Stated differently, the second-order conditions for profit maximization are satisfied because the Black-Scholes model implies that $2g' > -g''s_A$.

The comparative statics illustrated in Figure 2 are intuitive. When quasi rents from lending are high (for a given cost of issuing capital), bankers prefer to lend more, and issue more capital to insulate depositors from the asset risk implied by greater lending. Higher equity issuing costs (for any given set of lending opportunities) lead bankers to prefer lower equity (and hence they are constrained by depositor preferences to lend less).

Figures 2 and 3 show why it can be difficult to determine whether cross-sectional differences, or differences over time, in banks' chosen combinations of capital and asset risk reflect differences in the marginal cost of raising capital (parameter a) or differences in bank lending opportunities (parameter b). In Figure 2, it is not possible to say whether a bank located at point Z has a high b or a low value of a compared to a bank located at point X.

Figure 3 illustrates how reactions to exogenous shocks that produce capital are similarly hard to trace to changes in a or b. Figure 3 plots points X and Z from Figure 2 in the space defined by E/A and s_A. Suppose that point X in Figure 3 represents a bank's position in 1928, and point Z represents that same bank's position in 1936. According to the Fisher-Bernanke view of the contraction of credit during the Great Depression, the long-run movement from point X to point Z over the 1930s reflects a combination of exogenous capital loss and a high cost of replacing capital. Alternatively, however, one could argue that the Depression reduced the bank's profitability of lending. A decline in quasi rents from lending can provide an alternative explanation for the movement from X to Z.

The goals of our empirical work are, first, to show that the framework described here and illustrated in Figures 1-3 provides a realistic depiction of bank behavior, and second, to distinguish between "loan-supply" and "loan-demand" explanations for the contraction in bank's targeted capital and asset risk which occurred during the 1930s.

IV. Empirical Analysis

Historical Background

The period from 1920 to 1940 witnessed three U.S. business cycle contractions: the recession of 1920-1921, the Great Depression of 1929-1933, and the recession of 1937-1938 (for details, see Balke and Gordon 1989 and Romer 1989). The Depression was unusually severe in magnitude and duration. The departure from gold in March 1933 was associated with rapid economic recovery. Although unemployment remained high throughout the 1930s, and the level of GDP remained below trend until World War II, 1934-1936 was one of the periods of fastest economic growth in American history. A brief recession in 1937-1938 was followed by another period of rapid growth as the United States became an engine of wartime production, first for its allies, and later for itself.

The history of American interwar business cycles is reflected in the balance sheet aggregates of New York City banks in ways that are consistent with our previous theoretical discussion. As shown in Table 1 (which reports data for all New York City Fed member banks), the time of aggressive economic expansion, from 1922 to 1929, was associated with rapid loan growth and reductions in the ratio of liquid assets (cash plus Treasury securities) relative to loans and discounts. Banks saw large quasi rents from lending during the boom, and were willing to undertake massive issues of new equity to support their increased portfolio risk (to offset the effects on deposit default risk from the rise in asset risk).

Tables 2a and 2b report market-based data for publicly traded banks in New York City (the Data Appendix describes variable definitions and sources). As shown in Table 2a (which reports data for a sample of banks that remained in the sample throughout the years 1920-1940) and Table 2b (which reports analogous data allowing for exit and entry of banks) the growth in bank lending during the 1920s was associated with significant increases in the market value of bank stock, and the ratio of capital to assets. The boom of the 1920s also led to increases in bank asset risk. Our measures of bank asset risk (s_A) and deposit default premia (P) are derived from observed stock price variation (using weekly stock prices over the last half of each year) and end-of-year bank balance sheet statistics, using the Black-Scholes formula.

Recessions (1920-1921, 1929-1933, and 1937-1938) are associated with declines in lending activity, increases in the ratio of riskless assets (cash plus government securities) to total assets, and declines in bank capital. Relative to other recessions, the Great Depression saw extreme declines in loan ratios and capital ratios. The recessions of 1920-1921 and 1937-1938 caused a small increase in deposit default risk which banks were able to eliminate within one year. In 1929-1930, bank behavior was similar, but subsequent shocks in 1931, 1932, and 1933 posed an unprecedented challenge to banks, and they were unable to reduce their default risk quickly during those years.

The Great Depression was also unusual in another respect. In other recessions, deposit outflows were minimal, while during the Depression deposit outflows were large. From June 1930 to June 1932, New York City banks' deposits fell more than 30 percent. A possible explanation for the unusual decline in deposits over this period is the reaction of risk-intolerant depositors to the severity of bank capital loss and the slow adjustment back to low risk on deposits.

Clearly, the primary means banks employed for controlling their asset risk was the ratio of risky assets to riskless assets, and this variable declined steadily throughout the 1930s. As shown in Table 1, the ratio of the (book) value of loans to the sum of cash, reserves, and government securities rose from 2.06 in 1922 to 3.33 in 1929, then declined to 1.84 in 1931, and continued to decline, eventually reaching 0.25 in 1940.

Despite bankers' willingness to substitute away from loans into cash, the combination of high adjustment costs to liquidating loans, and the series of closely-timed adverse shocks that buffeted banks in the early 1930s left banks no alternative but to allow deposit risk to rise from its historical levels (the movement from point X to point Y shown in Figure 3). Our measure of depositor risk on average for all banks (Table 2a) rises to a peak of 97 basis points in 1931; the average peak for the stable sample of banks reaches its apex of 41 basis points in

1933. (The difference between the two samples in Tables 2a and 2b reflects the fact that several risky banks exited our sample in the early 1930s.)

The immediate post-Depression years (1934-1936) correspond to the adjustment process back to long-run equilibrium with respect to deposit risk (a movement from point Y to point Z in Figure 3). By 1936, long-run equilibrium has been essentially restored. Deposit risk rose once again during the recession of 1937-1938, but only briefly.

Banks did not replace the capital that was lost during the Depression, and capital ratios fell dramatically from their peak in 1928-1929. Many banks in our sample had issued new stock in the 1920s. Several banks issued equity several times during the 1920s. For our sample of banks, we recorded 95 stock offerings from 1920 to 1930 (see Table 5). But virtually no new stock was issued after 1930 (as shown in Table 5, we identified only four stock offerings for our sample of banks from 1931 to 1940, two of which happened in 1937 – in the aftermath of four years of economic recovery). The change in bank propensity to issue stock is consistent with the view that, in the aftermath of the Depression, as the potential for hidden loan losses loomed large, the cost of new stock issues was prohibitive, and thus banks sought to satisfy the depositor risk constraint through continuing reductions in portfolio risk rather than offerings of new equity.

Banks cut dividends dramatically after 1929 (see Table 8). Clearly, banks were eager to amass capital, but were not willing to pay the costs of accessing equity markets in the 1930s to do so. Of the 21 banks in our 1939 sample, 18 cut (nominal cash) dividends from their 1929 levels, one kept dividends unchanged, and two raised dividends.

Secondary market bid-ask spreads for bank stock provide another window on the costs banks would have faced from raising equity externally. Tables 2a and 2b report data on average bid-ask spreads (as a percentage of share price) for bank stocks. Bid-ask spreads reflect several influences, but an important component of secondary market bid-ask spreads is the adverse-selection premium charged by market makers to compensate for hidden information about the value of equity. Consistent with our argument that banks suffered much larger adverse-selection problems in equity markets during the 1930s than they had previously – due to increases in the potential for hidden asset quality problems in banks – Tables 2a and 2b show that bid-ask spreads for bank stocks in secondary markets widened significantly and remained large during the 1930s. That evidence is consistent with the view that adverse-selection costs limited banks' abilities to offer stock in the 1930s.

Another interpretation of the annual averages of the percentage bid-ask spread is that risk (not adverse-selection costs) were pushing up bid-ask spreads over time. To distinguish between these views, we examine the usefulness of bid-ask spreads as measures of adverse-selection costs further in our panel data analysis.

In summary, the evidence on average bank changes over time is consistent with the theoretical predictions we outlined in sections II and III. Six facts about the changes in bank behavior over time warrant emphasis:

(1) Banks target a low long-run equilibrium default risk on their deposits.

(2) Low deposit default risk is maintained by a combination of sufficient capital and limited asset risk. In the 1920s low default risk was maintained despite higher asset risk because banks increased their capital. In the 1930s low default risk was achieved by lowering asset risk to offset the effect of shrinking capital.

(3) The Great Depression was associated with very large consecutive shocks to capital, which were not offset immediately by reduced asset risk (owing to adjustment costs

associated with large, sudden liquidations of bank loans). Thus there is prima facie evidence that banks may have been facing unprecedented finance constraints limiting their ability to lend (the Bernanke-Fisher hypothesis). Stated differently, the fact that the path from point X to point Z in Figure 3 was via point Y (and not merely along the low-default premium isorisk line) is an indication that the supply of loanable funds was a binding constraint on lending during the Depression. Otherwise – (according to our model) if banks had been able to raise capital at low cost – they would not have permitted their default premia to rise above their low long-run equilibrium value.

(4) Consistent with the assumption that some depositors are risk-intolerant (and thus that allowing default premia to rise temporarily is costly to banks), the high deposit default risk during the early 1930s was associated with contractions in bank deposits, which were reversed as default risk declined. Long-run equilibrium in default risk and deposit flows appears to have been reestablished by 1936.

(5) The shift from a reliance on capital to a reliance on low asset risk as a means to limit default risk on deposits reflected the fact that banks were unwilling to issue new stock in the 1930s. The low incidence of new stock issues during the 1930s was associated with higher bid-ask spreads on bank stock in secondary markets, which may serve as a proxy for the adverse-selection costs of issuing equity.

(6) Banks cut dividends substantially during the 1930s, as a means of preserving internally generated (i.e., cheap) capital to restore default risk to its low long-run value.

Panel Regressions

We turn now to micro-econometric evidence using panel regressions. Our description of banking trends in the 1920s and 1930s focused on variation across time. Here we concentrate on cross-sectional variation, using firm-level data, and controlling for time effects.

We find more direct confirmation for the assumptions of the model, and the Fisher-Bernanke view that banks were finance-constrained in the 1930s. The contraction in bank lending seems to be largely attributable to a contraction in the supply of loans. Bank capital losses created strong incentives for banks to curtail their deposit default risk. Reductions in bank lending were the least-cost response, given the desirability of avoiding both depositor "discipline" and the adverse-selection costs of raising new equity.

The rise in deposit risk after 1928 had clear costs for banks in the form of lost deposits. Risky banks that were unable to cut lending and dividends sufficiently to limit the risk of default on their deposits suffered observable costs from not doing so (i.e., lost deposits).

Banks with high adverse-selection costs tended to choose low-capital, low-asset risk strategies compared to banks with low adverse-selection costs. That evidence lends credence to the view that increases in adverse-selection costs placed binding constraints on banks.

Banks moved aggressively to cut dividends despite the value of dividends for liquidity-constrained stockholders. Banks with high deposit risk and high adverse-selection cost tended to cut dividends more than other banks.

Our discussion divides into four parts. First, we test the central assumption of our model - that banks target low default risk on deposits in the long run - by investigating whether the banks that choose higher asset risk also tend to choose higher capital ratios. Second, we test the hypothesized link between increased depositor risk and deposit outflows.

Did banks that allowed their default premia to rise to relatively high levels also experience relatively large "penalties" in the form of deposit outflows? Third, we test for effects of a financing constraint on bank lending by investigating whether adverse-selection costs explain the differences across banks in their propensity to finance through equity. Finally, we examine cross-sectional variation in changes in dividends to investigate the extent to which banks cut dividends in the 1930s in response to rising costs of funding themselves from outsiders.

Limited versus Extended Liability

Before discussing empirical findings, we briefly digress to consider the appropriateness of our assumption of strictly limited liability for banks, which is one of the underlying assumptions in the Black-Scholes model, which we use to measure asset risk and deposit default risk. Prior to the 1930s double liability was the norm, and the 1930s saw the abolition of double liability and the movement toward strictly limited liability for state and national banks (see Kane and Wilson 1997 and Wilson and Kane 1997). As Kane and Wilson (1997) emphasize, the timing of the change away from double liability effectively occurred much sooner, as the average wealth of bank stockholders fell during the 1920s. The value of double-liability protection depended crucially on stockholders' wealth. According to Kane and Wilson (1997), as stock became widely held in the 1920s, and as wealthy insiders held increasingly smaller proportions of bank stock during the late 1920s, de facto double liability protection fell to insignificance.

Kane and Wilson's (1997) findings suggest that our assumption of strictly limited liability is a reasonable approximation of reality. The influence of double liability on our estimates of deposit default risk and asset risk only would be conceivably important during the post-1928 period (when bank capital was low and deposit risk was high), and by that date double liability had ceased to be important de facto. As a robustness check, however, we developed an alternative double-liability version of the contingent claims pricing model and ran all of our empirical tests under the assumption of complete double liability protection. The results were quite similar to those that we report here under the assumption of strictly limited liability.

Asset Risk and Bank Capital

If, as we have argued, banks try to maintain low default risk on deposits, then asset risk and capital ratios are not determined independently. For example, bank portfolio risk should increase endogenously in response to exogenous increases in bank capital. Similarly, when capital falls exogenously, banks should reduce their asset risk exposures (or increase their capital) to limit the increases in their deposit default risk. Table 3 provides some simple tests of this proposition using data from individual banks.

The regressions reported in Table 3 relate changes in bank asset risk to changes in the ratio of the market value of capital to the market value of assets. Our sample includes all available banks (not just the stable sample) for the years 1921 through 1940. We report both ordinary least squares (OLS) results and two-stage least squares (2SLS) regressions (which use predicted rather than actual changes in capital, to control for endogenous capital change). The two-stage least squares estimates use lagged bank-specific variables, and bank type and year indicator variables as instruments. Bank-specific instruments include the bank's lagged capital ratio, the square of the lagged capital ratio, and lagged asset volatility. Bank type indicator variables identify whether banks are state trusts, state banks, or national banks.

Our OLS and 2SLS regressions reported in Table 3 are similar across the various specifications (functional forms differ depending on the inclusion of $(E/A)^2$). They reveal a positive relationship between bank capital and bank asset risk. We report several alternative specifications. Our specifications include, in addition to the capital ratio and the square of the capital ratio, bank type indicator variables (to indicate whether the bank is a trust company or whether it is a national bank), year indicator variables (to control for year-specific effects), and the lags of the capital ratio and asset volatility. These lagged variables are included to allow for gradual adjustment of asset risk to capital changes.

The regressions uniformly show a large and statistically significant positive relationship between capital and asset risk. The bank type indicator variables are also significant in the absence of lagged endogenous variables, indicating that national banks and state-chartered trusts targeted lower deposit default risk than state banks. As one would expect, the presence of the lagged dependent variable (which is correlated with the bank-specific mean) reduces the significance of the bank type effect in specification (5). Lagged volatility enters positively and significantly, supporting the view that adjustment to shocks was gradual. No 2SLS results are reported for the final specification, since all the variables used as instruments in the other specifications are included as regressors in the last OLS regression (specification 5).

The high default risk on deposits shown in Tables 2a and 2b during the early 1930s is apparent in the significant positive coefficients on year effects in those years. That is, asset risk was higher in those years (after controlling for capital) than in other years because default risk was higher in those years.

Deposit Risk, Deposit Outflows, and the Fisher-Bernanke View

A key feature of bank behavior during the Depression was the willingness to allow deposit default risk to rise temporarily, rather than suffer the costs from either rapidly liquidating loans or issuing capital (actions necessary to maintain deposit risk at its low long-run level). In the regressions in Table 4, we examine the relationship between individual bank deposit outflows and deposit default premia for New York City banks. We report OLS results, as well as two-stage least squares results (using year and type indicators, and lags of the default premium, equity volatility, capital ratio, and percentage bid-ask spread as instruments).

We find a large and statistically significant positive relationship between deposit default risk (P) and deposit outflows. The inclusion of year effects has little effect on the size and significance of the coefficient on deposit risk. Instrumenting strengthens the effect. One interpretation of the larger negative coefficients for the 2SLS results is that deposit contractions promote (or are associated with) endogenous behavior by banks that reduce deposit risk. Consistent with the results in Table 3, which indicated that national banks and state trusts targeted lower deposit default risk, those two groups also suffered lower deposit outflows on average (indicated by the positive coefficients on the two indicator variables).

These results provide evidence that depositors were able, in some degree, to identify weak banks and penalize them for undesirable increases in default risk. These results do not necessarily imply that depositors "knew" the Black-Scholes model; more likely, depositors were able to observe the decline in bank stock values easily and make roughly accurate appraisals of the changing risk of deposits by observing changes in market prices (and associated changes in bank leverage). Similar evidence that depositors were able to discriminate across banks during the Depression in their withdrawals is provided in Calomiris and Mason (1997) for Chicago banks, who use interest costs of debt (rather than implied default premia) to measure cross-sectional differences in bank default risk.

The evidence thus far indicates that our theoretical framework fits the facts of bank behavior during the 1920s and 1930s well. During the 1920s, increases in bank lending opportunities prompted banks to accumulate capital and increase asset risk. Asset risk and capital were maintained such that deposit risk remained small. In response to the adverse shocks to bank capital experienced during the 1930s, banks allowed capital to remain low and reduced asset risk by substituting into riskless assets and limiting the riskiness of their loan portfolios.

What do our results have to say about the question of whether the decline in bank lending was induced by weak loan demand (falling quasi rents from lending) as opposed to high costs of supplying loans (the Fisher-Bernanke view, which requires both a high lemons premium on new equity and the constraint requiring low risk on deposits)? The fact that increases in the risk of bank deposits was costly for banks – in the form of deposit withdrawals – suggests that the cost of supplying loans was a binding constraint for many banks. Obviously, banks experiencing large deposit outflows faced a strong supply-side incentive to cut lending. Thus the evidence that default risk on deposits rose, and that rises in default risk gave banks a strong incentive to cut lending (to preserve deposits), provide support for the Fisher-Bernanke view that the bank capital crunch contracted the supply of lending and thus worsened the severity of the Depression.

Dividend Payments, Bid-Ask Spreads and the Cost of Bank Capital

Another approach to testing the Fisher-Bernanke view is to investigate how deposit risk and adverse-selection costs affected bank capital accumulation decisions. Were deposit risk and adverse-selection costs binding constraints on dividend payments and bank stock issues? If banks could have raised stock easily in the 1930s, they could thereby have reduced leverage and the risk of default on their deposits. Doing so would have avoided the binding constraint of depositor discipline, and the need to curtail their supply of loans and payments of dividends.

Our model predicts that banks with higher adverse-selection costs will choose lower capital and lower asset risk (point X rather than point Z in Figure 2). Here we examine the links between adverse-selection costs and decisions to raise capital and pay dividends.

Table 5 presents data on the timing of stock issues for our sample of banks. Table 6 reports logit results predicting the decision to issue stock. We define the event of a stock issue in two ways: narrowly (issuing stock unrelated to an acquisition of another bank), and broadly (including stock swaps associated with bank acquisitions). We include the lagged bid-ask spread and year indicators in our logit regressions for the period 1921-1930. The paucity of stock issues after 1930 makes it impossible to extend our logit sample period beyond 1930.

We find that the lagged bid-ask spread is useful as a predictor of stock issues, even after controlling for time effects. Banks with lower bid-ask spreads were more likely to issue stock than other banks (irrespective of whether the issuing event is defined narrowly or broadly).

While these results do not provide direct evidence on the 1930s, they do show that the bid-ask spread is a useful measure of the adverse-selection costs of issuing equity. The link between bid-ask spreads and issuing costs during the 1920s lends plausibility to the view that the increase in adverse-selection costs during the 1930s – apparent in the doubling of bid-ask spreads – can explain the absence of stock offerings during that period. Stated differently, from the perspective of the panel findings of Table 6, and the growth in bid-ask spreads shown in Tables 2a and 2b, it is plausible to argue that banks faced much higher costs of issuing equity in the 1930s than in the 1920s, and that this can explain the absence of equity offerings (Table 5).

In results not reported here, we checked the robustness of Table 6's results to alternative explanations for the predictive power of the bid-ask spread. For example, we included the bank share price as a regressor to control for the potential influence of minimum price ticks on the percentage bid-ask spread. While this is generally an important determinant of percentage bid-ask spreads in current markets, there was no share price effect on percentage bid-ask spreads in our sample, partly owing to the fact that the price per share tended to be high during our period.

The bid-ask spread is not only negatively associated with the decision of whether to issue stock, it is also negatively associated with the capital ratio chosen by the bank (E/A), as predicted by our model. Table 7 reports reduced-form regression results for the bank capital ratio. Consistent with our view that bid-ask spreads capture adverse-selection costs that discourage a high-risk/high-equity strategy, we find that the bid-ask spread is negatively associated with the capital ratio chosen by the bank. Other exogenous variables included in Table 7 – indicators for charter types and years – are significant and may partly reflect variation in lending opportunities.

While the percentage bid-ask spread is *negatively* associated with the propensity to raise capital by offering shares on the market (and the average capital ratio of banks during our period), our proxy for adverse-selection costs is *positively* associated with the tendency to accumulate capital *internally* during the 1930s – which was accomplished by cutting dividends. Information and agency costs encourage the payment of dividends, and cutting dividends is costly (Miller and Rock 1985, Ofer and Siegel 1987). Indeed, the fact that New York banks were paying dividends while simultaneously raising significant amounts of equity during the 1920s provides prima facie evidence that paying dividends was valuable to our sample firms.

Table 8 reports dividend data retrospectively for 1929 and 1939, for the banks included in our 1939 sample. Dividend reduction was often large during the 1930s, and there is substantial cross-sectional variation in the extent to which banks cut dividends.

In Table 9, we report panel OLS results for the annual percentage growth of nominal dividends for banks over the period 1929-1939 (the period that saw significant reductions in bank dividends). We include the percentage bid-ask spread and the default risk on deposits as regressors. Both are significant negative predictors of dividend growth. Banks experiencing high deposit default risk or a high percentage bid-ask spread were likely to cut dividends more than other banks. During the adjustment process of the 1930s, the more a bank needed to reduce its deposit risk, and the harder it would be for the bank to float equity to reduce deposit risk, the more the bank reduced dividends. Cutting dividends, in other words, was both a way to restore low default risk and to self-insure against the possibility of having to raise (expensive) equity in the future, and the value of that self-insurance was highest for banks that faced the highest costs of accessing equity in the market.

V. Implications for Arguments about Depression-Era Changes in Bank Risk Preferences

One of the lessons of our study is that when examining bank portfolio or financing changes during the Depression it is important to look at both sides of the balance sheet at the same time. Previous analysis of the behavior of banks can be criticized for not having done so. For example, Berger, Herring, and Szego (1995, p. 403) conclude that the precipitous decline in bank (book) capital-to-asset ratios after 1933 reflected the effects of government deposit insurance, which relieved banks from having to satisfy depositor discipline.

Friedman and Schwartz (1963), examining the asset side of the banks' balance sheets, arrive at the opposite conclusion. They argue that banks felt obliged to increase their holdings of cash and Treasury securities because of the *increased* risk faced by banks. Friedman and Schwartz argue that the failure of the Fed to act as a lender of last resort made banks realize that they were more vulnerable than they had previously thought.

An implication of the Friedman and Schwartz view is that bankers and depositors would have targeted lower default risk for any given lending risk than they did prior to the Depression. Berger, Herring and Szego's view implies the opposite - that is, greater tolerance for bank default risk after 1933 than during the 1920s.

Our data do not support either implication. The targeted default risk of deposits in the late 1930s - like that of the 1920s - was very low. Depositors' tolerance for default risk neither rose (as argued by Berger, Herring, and Szego), nor fell (as implied by our interpretation of the Friedman-Schwartz view). Once one considers bank capital ratios and asset risk *together*, New York City banks behaved as if they were responding to the *same* depositor preferences in the 1920s and the 1930s. Lower capital ratios in the 1930s did not reflect an absence of discipline, and neither did lower asset risk reflect an increase in risk aversion. Rather, the level of discipline was unchanged, but banks chose to substitute lower asset risk for lost capital because the cost of issuing new capital had risen.

We also note that the fact that New York City banks reduced their capital during the Depression is prima facie evidence against the view that deposit insurance caused that decline more generally, since New York City banks enjoyed very little benefit from federal deposit insurance owing to the large deposits held in those banks (Saunders and Wilson 1995).

VI. Conclusion

Recent theoretical work in banking and corporate finance under asymmetric information emphasizes that depositors may be intolerant of default risk on their deposits and may reward banks for keeping default risk low. Information problems also make it more costly for banks to issue stock. Other related work on banking sees bankers as information producers and managers who earn quasi rents through risky lending, based on possessing scarce information. Our theoretical framework combines these insights (along with standard contingent claims pricing) to solve for the equilibrium asset risk choices, and financing choices, of banks.

We apply this framework to the experience of New York City banks during the interwar period (1920-1940). Our findings support the key theoretical propositions developed in sections II and III. Capital ratios and asset risk are alternative control variables banks use to limit deposit default risk. Normally, banks strive to keep their default risk low, to avoid withdrawals by risk-intolerant depositors. In response to the capital losses of the Depression, banks substituted into low-risk assets as quickly as possible, and cut dividends. Still, they were forced to let their default risk rise temporarily. Over time, as loan liquidation proceeded, default risk returned to its low long-run equilibrium levels.

Deposit outflows were the inevitable cost of choosing not to liquidate loans faster or issue new capital. Banks that suffered larger increases in default risk during the Depression suffered greater percentage shrinkage in their deposit base and made larger cuts to dividends. The reason banks did not issue new capital in the 1930s was the higher adverse-selection costs (reflected in wider bid-ask spreads) associated with bank stock in the wake of the Depression.

Our findings indicate no long-run change in the tolerance for deposit risk following the Great Depression. We find that banks in the mid-1930s achieved the same level of default risk on deposits via a different combination of capital and asset risk.

Our findings have general implications for the literature on "capital crunches," and for the Fisher-Bernanke interpretation of bank credit reduction during the Depression. We have argued that New York City banks faced binding financing constraints that reduced the supply of bank loans. Loans did not decline solely because of reduced opportunities for profitable lending. Banks scrambled to shed asset risk during this period, to restore their default risk to the low long-run desired level, and to avoid the high cost of issuing capital as an alternative means to reduce default risk. Avoiding the prohibitive cost of issuing capital entailed a costly adjustment process – banks balanced the costs of foregone lending opportunities, disruptive deposit withdrawals, and stockholder displeasure at draconian reductions in dividends.

Despite the support we provide for the Fisher-Bernanke view, our analysis also contains a cautionary note. While we have shown that bank lending was constrained in the early 1930s by the capital losses of the Great Depression, we have *not* shown how much higher bank lending would have been in the absence of those constraints. Our model of bank risk and financing choices (depicted in Figure 2) illustrates why it is difficult to determine the precise extent to which a collapse of lending is caused by lost bank capital. A movement from X to Z in Figure 2 reflects some combination of a higher cost of capital and reduced lending opportunities (lower bank quasi rents from lending). While we have argued that financing constraints were important binding constraints during the 1930s, we cannot address empirically the counterfactual question of how much lending would have declined simply due to the decline in lending opportunities because we lack a good measure of the quasi rents from bank lending.

Finally, our evidence that (1) markets and depositors discriminate across banks when measuring risk, (2) depositors apply market discipline selectively to reward prudence, and (3) the threat of discipline leads banks to reduce asset risk following capital losses suggests potential gains from reintroducing market discipline into banking. Government safety nets can eliminate the incentive to reduce asset risk in the wake of losses. Indeed, protected banks may increase risk after capital losses (to maximize the value of the safety net subsidy). Requiring banks to meet market standards for prudence could mitigate such moral hazard problems and reduce the vulnerability of banking systems to collapse (see also Calomiris 1997).

DATA APPENDIX

The data sample is comprised of annual bank balance sheet, dividend, and stock issuance data and weekly stock price data for a sample of New York City banks whose bid and ask quotes were reported in the *Commercial and Financial Chronicle* and whose stock was actively traded over the period 1920-1939. In 1920 (1939) this sample included approximately 55 (32) banks, with the largest decline in sample bank numbers during the early 1930s. The sample consists of national banks, state banks and trust companies, ranging in size from large money-center banks to smaller borough and suburban banks.

Annual bank-specific balance sheet data, including capital, surplus, deposits, cash, securities, loans and total assets, were collected from *Rand McNally Bankers Directory*. The balance sheet data were also cross-checked for accuracy with *Moody's Manual of Investments*, which began publication in 1928. This latter resource also allowed us to collect detailed historical accounts of bank capital levels, new capital issues, dividends, and stock dividends and splits.

Bid-ask spreads, market values of capital, and equity returns volatility were calculated from stock prices reported weekly in the *Commercial and Financial Chronicle*. Specifically, the average of reported bid and ask quotes was used to develop a weekly stock series for each bank, which was then adjusted for stock splits and stock dividends. The standard deviation of equity returns was then calculated, based on the six months of weekly stock prices preceding the report date for the bank's (year-end) balance sheet data. The Black-Scholes (1973) model was used to derive implied asset volatility s_A (the standard deviation of log asset value) and deposit default premia from our measures of market capital values, book values of debt, and equity returns volatility.

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FIGURE 1: DEPOSITOR INDIFFERENCE CURVES

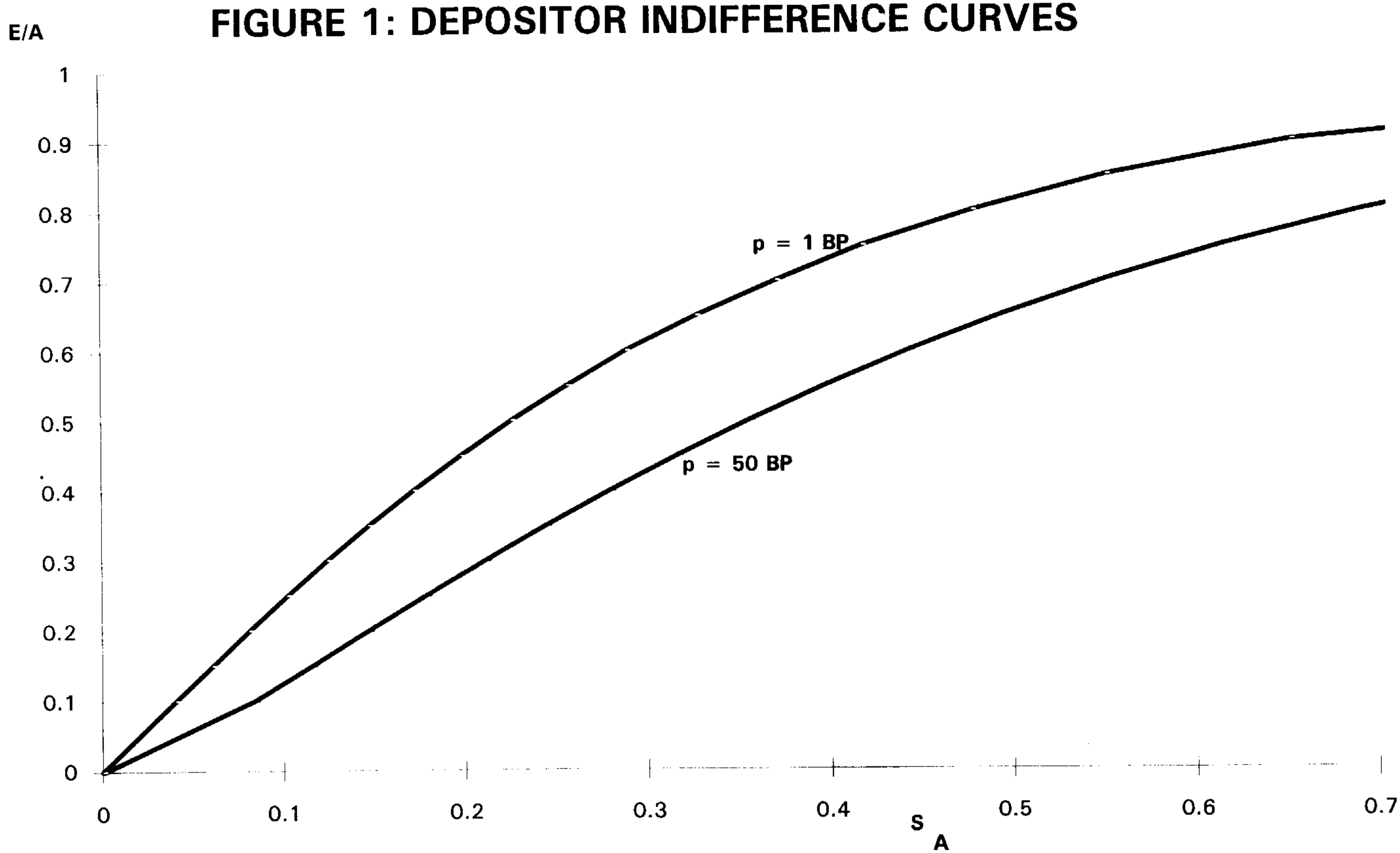

FIGURE 2: LONG-RUN COMPARATIVE STATICS WITH p = 1 BP

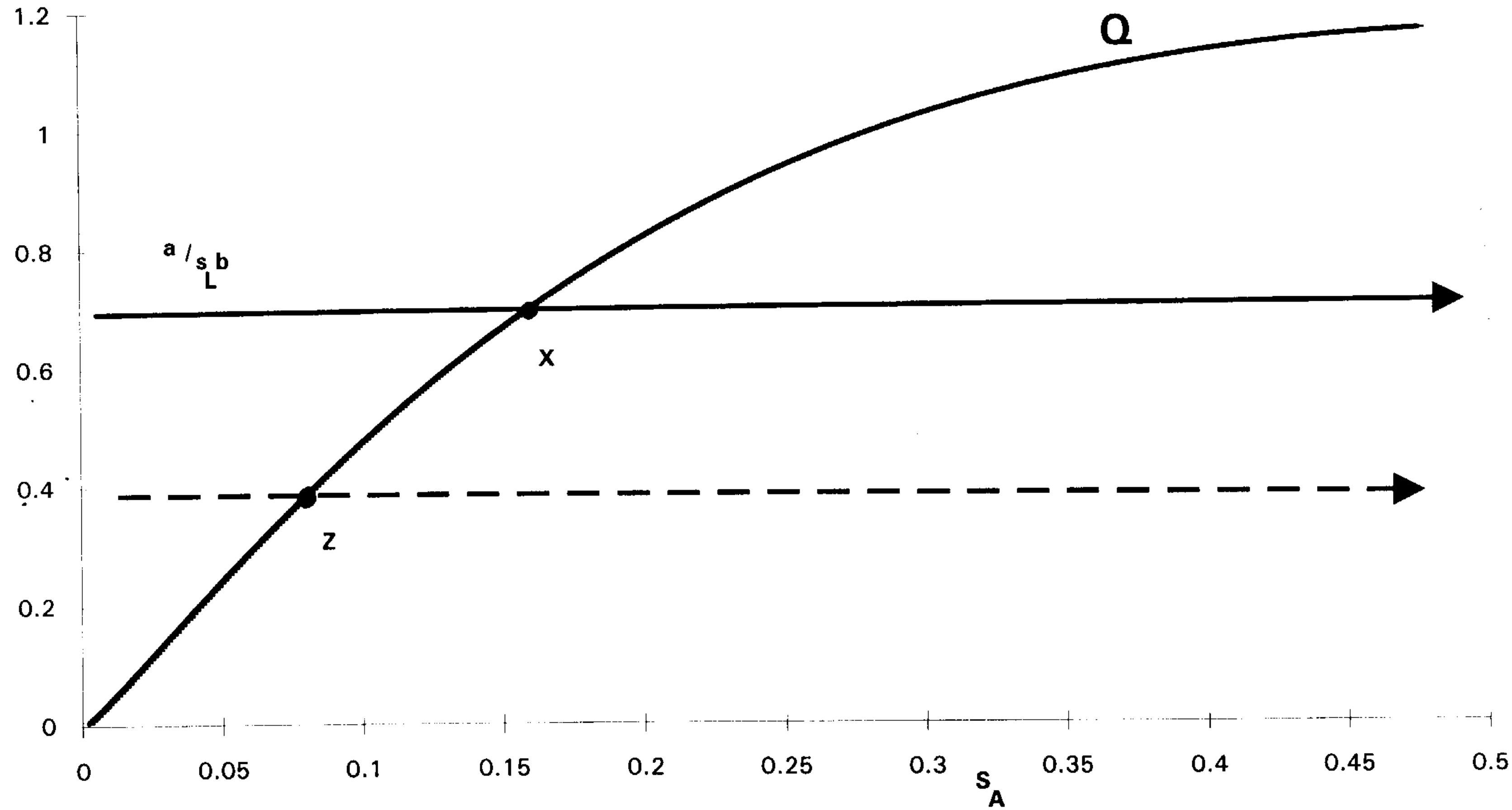

FIGURE 3: IMPACT OF CAPITAL SHOCK

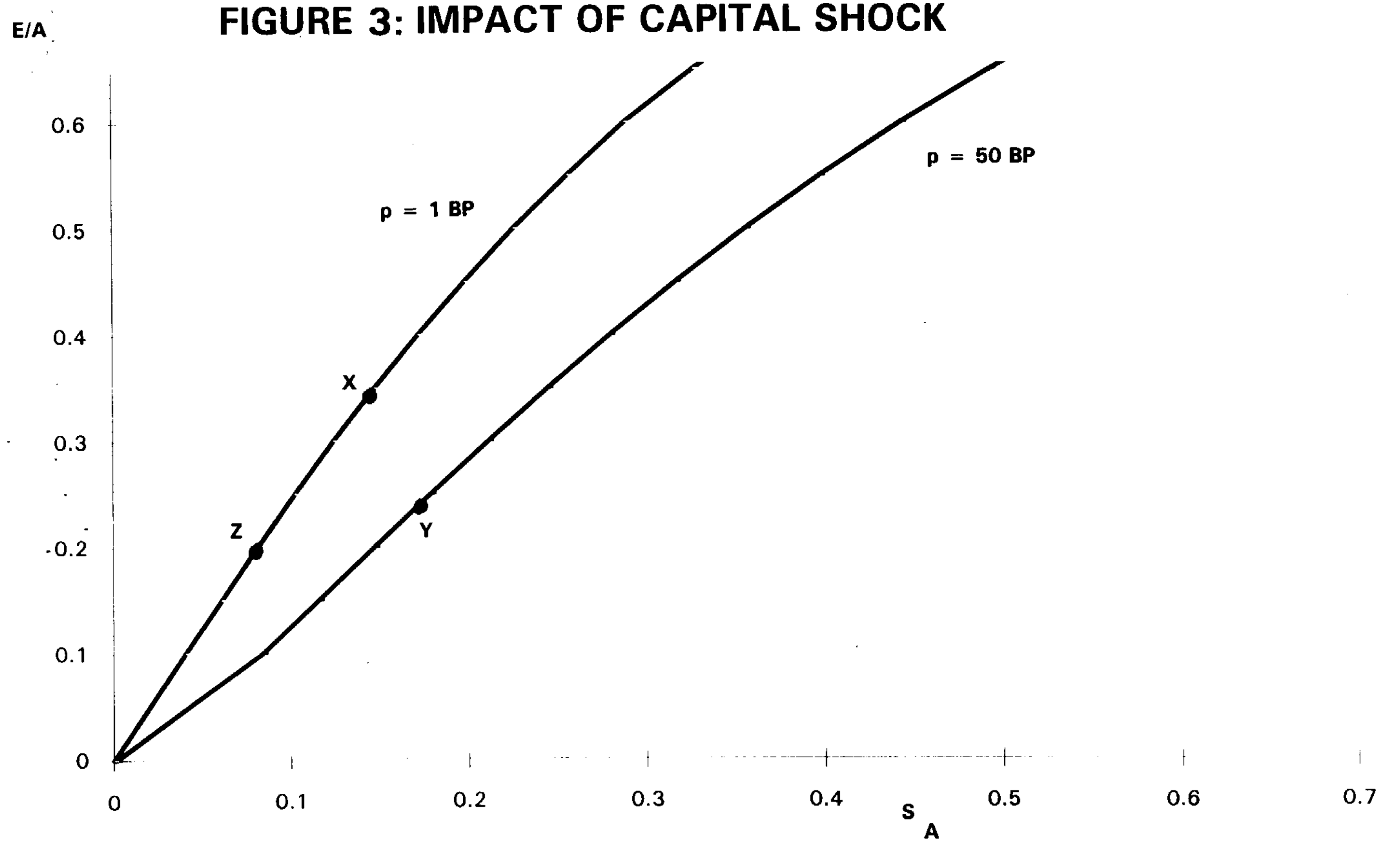

Table 1 AGGREGATE BALANCE SHEET DATA OF NEW YORK CITY FED MEMBER BANKS FOR SELECTED DATES (End-of-Year Data)

Year	L	C + T	L / (C + T)	A	D
1922	3,663	1,778	2.06	7,689	6,374
1925	4,732	1,745	2.71	8,952	7,552
1929	6,683	2,004	3.33	13,583	10,173
1931	4,763	2,592	1.84	10,417	7,781
1933	3,453	3,405	1.01	9,496	7,284
1934	3,159	5,289	0.60	11,372	9,512
1936	3,855	7,061	0.55	13,734	11,824
1940	3,384	13,325	0.25	19,688	17,744

Source: Board of Governors of the Federal Reserve System 1976, pp. 80-82.

Variable Definitions:

L = Bank Loans
C = Cash Assets (cash plus reserves)
T = U.S. Treasury Securities
A = Total Assets (book value)
D = Total Deposits

Table 2a SUMMARY STATISTICS FOR "UNSTABLE SAMPLE" OF NEW YORK BANKS

Year	MVE / BVE	E/A (%)	S_A	BID-ASK	P	St.Dev. P	MVA	#BANKS
1920	1.10	14.05	0.023	2.97	0.49	2.5	227	27
1921	1.25	15.63	0.023	2.58	0.13	0.7	229	28
1922	1.31	14.86	0.043	3.25	40.27	240.1	188	44
1923	1.28	14.95	0.018	2.94	0.19	1.2	203	40
1924	1.56	16.60	0.027	2.85	0.00	0.0	245	41
1925	1.85	18.35	0.050	3.16	9.94	51.4	208	57
1926	1.88	19.12	0.029	2.77	0.01	0.0	233	50
1927	2.27	24.81	0.060	3.21	0.22	1.0	236	52
1928	2.78	27.50	0.076	3.46	0.13	0.5	395	46
1929	2.04	27.02	0.142	4.55	30.33	76.0	420	90
1930	1.38	20.74	0.074	6.40	14.55	68.4	369	44
1931	0.81	14.89	0.088	11.81	97.39	321.8	380	38
1932	1.12	16.80	0.099	8.68	22.95	35.7	498	24
1933	0.73	12.08	0.060	7.25	46.86	136.0	413	23
1934	0.80	11.67	0.030	5.62	5.03	26.5	500	28
1935	1.23	14.26	0.050	4.71	12.23	54.6	609	23
1936	1.18	13.92	0.032	3.86	0.72	3.3	653	22
1937	0.84	10.82	0.028	4.75	0.35	0.8	580	22
1938	0.80	9.96	0.031	6.20	7.23	21.3	591	23
1939	1.03	10.98	0.037	6.36	0.29	1.2	686	24
1940	0.74	7.87	0.022	8.56	10.40	54.1	576	33

Note: The "unstable sample" is defined as the sample of banks that varies over time due to entry and exit. The sample of banks is restricted to banks with available stock prices, as described in the Data Appendix. Data are measured at year end.

Variable Definitions:

MVE	average market value of equity
BE	average book value of equity
E/A	average market capital-to-asset ratio
S_A	average asset volatility (standard deviation of log asset value)
BID-ASK	average bid-ask spread as a percentage of share price
P	average deposit default premium in basis points (1.00 = 1 basis point)
St. Dev. P	standard deviation of P
MVA	average market value of assets ($millions)

Table 2b SUMMARY STATISTICS FOR "STABLE SAMPLE" OF 12 NEW YORK BANKS

Year	MVE / BVE	E/A (%)	S_A	BID-ASK	P	St.Dev. P	MVA
1920	1.23	16.73	0.024	2.53	0.00	0.0	306
1921	1.40	18.03	0.029	2.41	0.30	1.0	317
1922	1.51	18.40	0.045	2.09	7.75	26.5	363
1923	1.54	20.25	0.019	1.73	0.00	0.0	352
1924	1.89	21.70	0.038	1.78	0.00	0.0	434
1925	2.36	24.77	0.056	1.47	0.07	0.2	482
1926	2.27	26.10	0.029	1.26	0.00	0.0	530
1927	2.81	32.16	0.061	1.47	0.00	0.0	573
1928	3.82	34.16	0.084	2.58	0.08	0.2	858
1929	2.80	33.10	0.179	2.74	33.46	71.3	105
1930	2.06	26.86	0.085	2.05	1.24	2.8	998
1931	1.02	18.54	0.085	4.18	9.18	10.4	739
1932	1.16	19.24	0.115	5.64	34.73	46.8	712
1933	0.88	15.02	0.070	5.41	41.69	112.5	641
1934	0.98	13.88	0.038	5.48	11.72	40.5	781
1935	1.34	16.96	0.063	4.41	23.09	75.4	907
1936	1.32	16.74	0.043	3.66	1.32	4.5	976
1937	0.94	12.95	0.037	4.28	0.60	1.0	863
1938	0.91	12.05	0.035	5.49	7.08	19.5	923
1939	1.39	14.70	0.056	5.63	0.50	1.6	113
1940	0.93	9.55	0.020	6.71	2.14	7.4	126

Note: The "stable sample" is defined as the sample of banks that are present in the data base throughout the period. The sample of banks is restricted to banks with available stock prices, as described in the Data Appendix. Data are measured at year end.

Variable Definitions:

MVE =	average market value of equity
BVE =	average book value of equity
E/A =	average market capital-to-asset ratio
S_A =	average asset volatility (standard deviation of log asset value)
BID-ASK =	average bid-ask spread as a percentage of share price
P-VALUE	average deposit default premium in basis points (1.00 = 1 basis point)
St. Dev. P	standard deviation of P
MVA	average market value of assets ($million)

Table 3. ASSET VOLATILITY REGRESSIONS
Dependent Variable: Bank Asset Volatility (Standard Deviation of Log Asset Value, S_A)
Standard Errors in Parentheses

Variable	OLS (1)	2SLS (2)	OLS (3)	2SLS (4)	OLS (5)
Constant	-0.218	0.982	1.033	0.664	0.676
	(0.227)	(0.367)	(0.360)	(0.404)	(0.315)
E/A	0.289	0.230	0.108	0.112	0.197
	(0.012)	(0.019)	(0.035)	(0.048)	(0.034)
$(E/A)^2$			0.0025	0.0012	0.0020
			(0.0006)	(0.0008)	(0.0005)
E/A_{-1}					-0.163
					(0.020)
S_{A-1}					0.276
					(0.031)
Trust Co.			-0.899	-0.179	-0.110
			(0.272)	(0.265)	(0.244)
Nat. Bank			-0.771	-0.332	-0.184
			(0.284)	(0.277)	(0.257)
year1920			-0.109	-0.241	0.048
			(0.626)	(0.586)	(0.540)
year1921			-0.479	-0.299	-0.352
			(0.620)	(0.286)	(0.534)
year1922			1.639	1.144	1.246
			(0.509)	(0.567)	(0.517)
year1923			-0.967	-0.947	-1.243
			(0.528)	(0.527)	(0.4816)
year1924			-0.377	-0.184	-0.202
			(0.525)	(0.509)	(0.464)
year1925			1.576	1.115	0.832
			(0.477)	(0.494)	(0.440)
year1926			-0.689	-0.543	-0.986
			(0.512)	(0.514)	(0.459)
year1927			1.055	1.200	0.765
			(0.516)	(0.530)	(0.465)
year1928			2.153	2.922	2.149
			(0.553)	(0.559)	(0.485)
year1929			8.751	9.630	8.838
			(0.557)	(0.557)	(0.496)
year1930			3.485	4.055	2.214
			(0.535)	(0.537)	(0.561)
year1931			6.187	5.331	5.126
			(0.607)	(0.578)	(0.554)
year1932			6.946	7.150	5.964
			(0.710)	(0.650)	(0.604)
year1933			3.850	3.893	2.601
			(0.669)	(0.600)	(0.588)
year1934			0.916	0.970	0.196
			(0.698)	(0.638)	(0.599)
year1935			2.545	2.656	2.165
			(0.688)	(0.621)	(0.573)
year1936			0.772	0.868	0.298
			(0.697)	(0.620)	(0.574)
year1937			0.973	0.964	1.199
			(0.682)	(0.610)	(0.567)
year1938			1.391	1.391	1.278
			(0.682)	(0.622)	(0.577)
year1939			1.470	1.734	0.975
			(0.667)	(0.599)	(0.557)
Adj. R-Sq.	0.360	0.333	0.580	0.635	0.685

Notes: E/A is the market capital-to-asset ratio. Nat. Bank and Trust Co. are indicator variables for national banks and trust companies. 1940 is the omitted year dummy. See text for instrument list.

Table 4 DEPOSIT GROWTH REGRESSONS
Dependent Variable: Annual Percentage Change in Deposits.
Standard Errors in Parentheses.

Variable	OLS (1)	2SLS (2)	OLS (3)	2SLS (4)	OLS (5)	2SLS (6)
Constant	17.741	17.660	17.220	16.997	17.908	17.755
	(0.100)	(0.139)	(0.215)	(0.275)	(0.245)	(1.030)
P	-0.008	-0.037	-0.008	-0.036	-0.008	-0.117
	(0.003)	(0.011)	(0.003)	(0.011)	(0.003)	(0.036)
Trust Co.			0.433	0.618	0.260	0.538
			(0.258)	(0.335)	(0.251)	(0.635)
Nat. Bank			0.976	1.118	1.005	0.990
			(0.275)	(0.349)	(0.265)	(0.660)
year1920					-2.82	-2.80
					(0.81)	(1.89)
year1921					-1.12	-1.01
					(0.81)	(1.89)
year1922					-1.65	-1.57
					(0.54)	(1.43)
year1923					-1.75	-1.68
					(0.64)	(1.57)
year1924					-1.39	-1.36
					(0.51)	(1.37)
year1925					-1.42	-1.30
					(0.44)	(1.28)
year1926					-1.76	-1.50
					(0.43)	(1.27)
year1927					-1.55	-1.63
					(0.42)	(1.24)
year1928					-1.46	-1.42
					(0.44)	(1.27)
year1929					-0.69	1.79
					(0.47)	(1.53)
year1930					-0.97	2.07
					(0.45)	(1.59)
year1931					0.54	1.27
					(0.71)	(1.71)
year1932					-0.84	0.12
					(0.89)	(2.04)
year1933					-0.96	-0.74
					(0.71)	(1.69)
year1934					-0.05	0.55
					(0.54)	(1.49)
year1935					0.07	3.22
					(0.67)	(1.92)
year1936					-0.08	-0.04
					(0.54)	(1.42)
year1937					-0.13	-0.08
					(0.54)	(1.42)
year1938					-0.21	0.20
					(0.54)	(1.45)
year1939					0.53	0.52
					(0.54)	(1.42)
Adj. R-Sq.	0.014	0.048	0.039	0.026	0.134	0.029

Notes: P is the (end-of-year) deposit default premium, derived from the data over the last six months of the year (see Data Appendix). Nat. Bank and Trust Co. are indicator variables for national banks and state trust companies. 1940 is the omitted year dummy. See text for instrument list.

Table 5 NEW YORK CITY BANK STOCK ISSUES AND ACQUISITIONS, 1920-1940

Year	New Offerings unrelated to acquisitions	Acquisitions financed by new stock issues	Acquisitions not financed by new stock issues
1920	5	0	6
1921	5	0	6
1922	5	1	5
1923	2	0	3
1924	7	3	1
1925	10	2	2
1926	6	1	7
1927	15	5	4
1928	16	4	5
1929	22	7	8
1930	2	1	10
1931	1	0	9
1932	0	0	0
1933	0	0	0
1934	1	0	0
1935	0	0	0
1936	0	0	0
1937	2	0	0
1938	0	0	0
1939	0	0	0
1940	0	0	0

Source: *Moody's Manual of Investments: Banks, Insurance Companies, Investment Trusts, Real Estate Finance and Credit Companies,* various years.

Note: The sample of banks is restricted to those included in our data base, as defined in the Data Appendix.

Table 6 LOGIT REGRESSIONS PREDICTING STOCK ISSUES (1921 - 1930)

Variable	Dependent variable is stock offering unrelated to acquisition		Dependent variable is any stock offering, including those related to acquisition	
	(1)	(2)	(3)	(4)
Constant	-2.71 (0.24)	-3.73 (0.75)	-2.71 (0.20)	-2.89 (0.45)
ba_{-1}	-0.180 (0.070)	-0.178 (0.070)	-0.089 (0.048)	-0.095 (0.048)
year1922		0.79 (0.85)		-0.11 (0.59)
year1923		0.55 (0.87)		-0.31 (0.62)
year1924		-0.04 (1.01)		-1.14 (0.82)
year1925		0.87 (0.85)		-0.21 (0.62)
year1926		0.83 (0.85)		-0.08 (0.59)
year1927		0.68 (0.87)		-0.22 (0.62)
year1928		1.03 (0.83)		0.22 (0.55)
year 1929		1.49 (0.79)		0.61 (0.52)
year 1930		2.21 (0.76)		1.47 (0.48)

Notes: ba_{-1} is the bid-ask spread at the end of the previous year. 1921 is the omitted year dummy.

Table 7 REDUCED-FORM REGRESSIONS FOR BANK CAPITAL RATIO
Dependent Variable is Market Capital-to-Asset Ratio (E/A). Standard Errors in Parentheses.

Variable	1920-1940 (1)	1920-1940 (2)	1920-1928 (3)	1920-1928 (3')	1929-1940 (4)	1929-1940 (4')
Constant	0.178	0.075	0.252	0.199	0.087	0.050
	(0.01)	(0.02)	(0.018)	(0.021)	(0.020)	(0.021)
Trust Co.	0.029	0.039	0.057	0.048	0.019	0.024
	(0.010)	(0.018)	(0.012)	(0.013)	(0.012)	(0.013)
Nat. Bank	0.009	0.016	0.022	0.023	0.009	0.027
	(0.010)	(0.009)	(0.012)	(0.013)	(0.014)	(0.014)
ba	-0.005	-0.0022	-0.003	-0.0044	-0.0023	-0.0030
	(0.001)	(0.0009)	(0.002)	(0.0029)	(0.0010)	(0.0011)
E/A_{-1}				0.410		0.249
				(0.052)		(0.046)
year1920		0.049	-0.137	-0.147		
		(0.022)	(0.021)	(0.021)		
year1921		0.063	-0.123	-0.129		
		(0.022)	(0.020)	(0.021)		
year1922		0.058	-0.128	-0.123		
		(0.020)	(0.018)	(0.019)		
year1923		0.060	-0.124	-0.128		
		(0.020)	(0.018)	(0.020)		
year1924		0.074	-0.112	-0.113		
		(0.020)	(0.018)	(0.019)		
year1925		0.099	-0.085	-0.093		
		(0.019)	(0.017)	(0.018)		
year1926		0.103	-0.082	-0.097		
		(0.020)	(0.018)	(0.019)		
year1927		0.161	-0.024	-0.019		
		(0.019)	(0.018)	(0.019)		
year1928		0.186				
		(0.020)				
year1929		0.180			0.181	0.178
		(0.020)			(0.020)	(0.020)
year1930		0.122			0.123	0.119
		(0.020)			(0.019)	(0.020)
year1931		0.069			0.070	0.067
		(0.021)			(0.021)	(0.022)
year1932		0.081			0.826	0.087
		(0.023)			(0.023)	(0.023)
year1933		0.036			0.038	0.037
		(0.023)			(0.022)	(0.022)
year1934		0.028			0.030	0.025
		(0.023)			(0.023)	(0.022)
year1935		0.051			0.053	0.056
		(0.023)			(0.023)	(0.022)
year1936		0.046			0.048	0.043
		(0.023)			(0.023)	(0.022)
year1937		0.017			0.019	0.008
		(0.023)			(0.023)	(0.023)
year1938		0.012			0.014	0.010
		(0.023)			(0.023)	(0.022)
year1939		0.024			0.025	0.018
		(0.023)			(0.022)	(0.022)
Adj. R-Sq.	0.05	0.32	0.26	0.37	0.33	0.38

Notes: ba is the contemporaneous percentage bid-ask spread for bank stock. Nat. Bank and Trust Co. are indicator variables for national banks and state trust companies. 1940 is the omitted year dummy in (2), (4) and (4'). 1928 is the omitted year dummy in (3) and (3)'.

Table 8 NEW YORK CITY BANK DIVIDEND CHANGES, 1929-1939

BANK	DIVIDEND 1929 ($ million)	DIVIDEND 1939 ($ million)
Bankers Trust Co.	30.0	2.0
Bank of New York & Trust	20.0	14.0
Brooklyn Trust Co.	30.0	4.0
Central Trust Co.	3.0	4.0
Chase National Bank	10.5	1.4
Chemical National Bank	12.0	1.8
National City Bank	7.0	4.0
Commercial National Bank & Trust	0.0	8.0
Continental Bank & Trust	8.8	0.8
Corn Exchange Bank & Trust	12.0	3.0
Empire Trust Co.	16.0	0.6
Fifth Avenue Bank	59.0	24.0
First National Bank	20.0	15.0
Guaranty Trust Co.	14.0	7.0
Irving Trust Co.	7.0	3.6
Bank of the Manhattan Co.	16.0	0.9
Manufacturers Trust Co.	5.8	2.0
New York Trust Co.	20.0	4.0
Public Bank of New York	4.0	1.5
Title Guarantee & Trust Co.	36.0	0.0
United States Trust Co.	60.0	60.0

Source: *Moody's Manual of Investments: Banks, Insurance Companies, Investment Trusts, Real Estate Finance and Credit Companies,* various years.

Note: The sample of banks included in this table is restricted to banks in our data base (as defined in the Data Appendix) that were in existence both in 1929 and in 1939.

Table 9 DIVIDEND GROWTH REGRESSIONS (1929-1939)
Dependent Variable is Annual Percentage Change in Dividends.
Standard Errors in Parentheses.

Variable	(1)	(2)	(3)
Constant	3.77	6.75	7.85
	(4.13)	(8.91)	(9.21)
ba	-1.91	-1.78	-1.81
	(0.65)	(0.67)	(0.75)
P	-0.115	-0.131	-0.131
	(0.055)	(0.057)	(0.061)
ba_{-1}			-0.225
			(0.684)
P_{-1}			0.02
			(0.08)
year29		11.31	11.42
		(11.01)	(11.15)
year30		-22.31	-22.38
		(10.75)	(11.00)
year31		-1.16	-1.35
		(11.12)	(11.27)
year32		-9.70.	-9.74
		(11.76)	(11.90)
year33		-11.12	-11.16
		(11.75)	(11.87)
year34		-2.12	-2.55
		(11.81)	(12.00)
year35		-2.86	-3.09
		(11.81)	(11.91)
year36		-0.74	-0.65
		(11.69)	(11.81)
year37		1.89	2.27
		(11.66)	(11.83)
year38		0.36	0.26
		(11.66)	(11.76)
Adj. R-Sq.	0.05	0.06	0.05

Notes: ba and P are the end-of-year bid-ask spread and deposit default premium. 1939 is the omitted year dummy.