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Are Capital Requirements Effective? A Cautionary Tale from Pre-Depression Texas

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Mexican Payments System Reforms

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Capital requirements are now a primary ingredient in efforts to supervise and regulate the banking industry. Their main purpose is to protect the deposit insurance fund and to minimize taxpayer exposure should financial difficulties occur. Capital requirements are not new, however. Texas was one of the first states to institute formal capital requirements when it introduced a deposit insurance program early in the century. But this early attempt at capital regulation proved ineffective in preventing a complete breakdown of the deposit insurance system it was meant to protect. Using recently discovered examination data for Texas banks operating in the troubled 1920s, we show that the capital requirements were unsuccessful largely due to a reliance on book-value capital measures that overstated the true financial condition of banks. As some researchers have shown recently, the same types of problems confront current efforts to rely on measures of capital as the focus of banking supervision. This has led to recent proposals to restructure bank capital regulation, such as the pre-commitment approach.

Mexican Payments System Reforms

Sujit "Bob" Chakravorti

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This article investigates the ongoing payments system reforms begun by the Bank of Mexico in 1994. The goals of these reforms are to reduce the amount of uncollateralized intraday credit extended by the Bank of Mexico (previously unlimited), to promote a market-based allocation of intraday credit for interbank payments, and to move large-value paper-based payments to electronic form. The Bank of Mexico has been successful in achieving all of these goals to some extent. But despite this progress, like other central banks around the world, the Bank of Mexico still faces the possibility that government guarantees may weaken market discipline in the payments system.

Are Capital Requirements Effective? A Cautionary Tale from Pre-Depression Texas

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In this article, we explore how this early attempt at capital regulation operated and why it ultimately proved unsatisfactory.

Capital regulation is now the cornerstone of efforts to regulate bank risk taking. In 1988, the Basle Accord was adopted by bank regulators in the United States, as well as in Japan, Europe, and Canada. Under this agreement, banks' minimum capital requirements depend on the perceived credit risk exposure of their assets and off-balance-sheet items. In the United States, capital regulation was taken a step further when Congress enacted the Federal Deposit Insurance Corporation Improvement Act of 1991 (FDICIA). Under this legislation, with its provisions for prompt corrective action and early closure, banks face increasingly stringent supervision and regulation as their capital levels decline, including the usual requirement that regulators close the institution if the capital-to-asset ratio reaches 2 percent.

According to many accounts, it was the continued and relatively unfettered operation of capital-impaired financial institutions that exacerbated both the bank and thrift failures of the past decade and the associated losses to the federal deposit insurance funds.[1] Conceptually speaking, the owners of thinly capitalized banks may have the incentive to take on especially risky ventures, as they have relatively little to lose if the ventures should fail, but much to gain if the ventures prosper. And with the federal government guaranteeing the safety of most deposits, depositors would have little incentive to discipline bank owners against such risk taking.[2] Similarly, the owners of thinly capitalized banks may find it more profitable to loot their institutions than to manage them as going concerns. Again, with the safety of deposits guaranteed, only bank regulators could stand in the way of such deceitful strategies.[3]

These factors may have played a significant role in the banking and thrift crises of the 1980s, as risky financial strategies turned out poorly or fraudulent dealings created financial losses. The goal of the new capital-based supervision is to protect the deposit insurance fund (and ultimately the taxpayer) from the types of risk taking, looting schemes, and financial losses experienced during the banking and thrift difficulties of the 1980s. This is accomplished by preventing regulators from allowing capital-impaired banks to continue to operate without compensating restrictions on their financial behavior and by not permitting insolvent banks to remain open.

While the adoption of risk-based capital requirements, prompt corrective action, and early closure represent significant steps in the implementation of capital regulation, they are

We are particularly grateful to Alan Barr at the Texas Department of Banking for providing data on failures of state chartered banks.

[1] See Kane (1989) and Short and Gunther (1988).

[2] See Merton (1977) and Marcus (1984).

[3] Akerlof and Romer (1993) describe in detail how such looting can take place.

not the first attempts by federal regulators to focus on capital as a key component of efforts to regulate insured financial institutions. In December 1981, the federal bank regulatory agencies first jointly announced specific capital requirements applicable to insured commercial banks. Initially, these requirements were based on the size of the institution, with larger organizations required to hold a smaller percentage of their assets as capital. In 1985, bank regulators decided to impose uniform capital-to-asset requirements on all banks, regardless of size.[4]

Long before these requirements were implemented at the federal level, several states had experimented with capital requirements for state-chartered banks. Texas was one of the first states to establish formal capital requirements. The Texas capital requirements were part of an overall package of increased regulation for state-chartered banks that accompanied the state deposit insurance system introduced in the early part of the century. Similar to later capital regulations at the federal level, Texas instituted capital requirements in an effort to protect its deposit insurance fund from financial losses. However, in the 1920s, little more than one decade after the capital requirements were introduced, bank failures mounted and the state-run deposit insurance program suffered increasing losses—losses that proved severe enough to cause the insurance program to close down.

In this article, we explore how this early attempt at capital regulation operated and why it ultimately proved unsatisfactory. Using recently discovered examination data available for a sample of state banks operating in Texas in the 1920s, we are able to determine that the book-value measures of capital applied to individual banks were often grossly inflated. Judging from entries on the examination records, regulators recognized the shortcomings in the reported financial data and initiated attempts to adjust reported capital levels downward to reflect estimates of the expected losses embedded in bank loan portfolios. When estimated losses began to reduce the amount of a bank's paid-in capital, regulators would then classify its capital position as impaired. However, these adjustments were not included as part of the banks' balance sheets that were published by the state banking authorities. And the formal capital requirements instituted in Texas were based on reported capital, rather than capital adjusted for loan losses. As a result, it was possible for banks to satisfy the capital requirements, even as losses in their loan portfolios were propelling them toward insolvency.

We can find no indication, though, that banks were allowed to operate for any length of time after they were classified by regulators as insolvent. Still, while forbearance is not indicated in our examination data, we do find evidence that regulators allowed banks to operate for several years after their adjusted capital was designated as impaired.

We conclude that this early attempt at capital regulation proved unsuccessful largely because the capital requirements were based on book-value measures that did not adequately reflect the true financial strength of individual banks, thereby allowing capital-impaired banks to continue operating without fully compensating restrictions on their financial behavior.

The failure of capital regulation in pre-Depression Texas offers some parallels to the financial-sector difficulties of the 1980s. The capital regulations in place during the 1980s did not prevent either the severe deterioration that occurred in the financial strength of the Federal Deposit Insurance Corporation or the meltdown of the Federal Savings and Loan Insurance Corporation. In these relatively recent episodes of financial failure, as in the collapse of the Texas deposit insurance system in the 1920s, book-value accounting practices had the effect of artificially boosting reported capital levels, and capital-impaired institutions were allowed to continue operating without fully compensating restrictions on their financial behavior.

The Texas experience with capital regulation during the 1920s also has possible implications for the efficacy of capital regulation today, even under the relatively rigorous capital-based supervision implemented under Basle and FDICIA. In the pre-Depression Texas experience, faulty book-value capital measures made capital regulation ineffective. Similarly, the effectiveness of today's capital-based supervision depends critically on the accuracy of regulatory accounting procedures. Prompt corrective action and early closure are at the heart of the new supervisory approach, but both are based on book-value capital. To the extent that book values overstate capital levels relative to the risk of bank activities, the new capital-based supervision is subject to the same criticisms that have plagued capital regulation in the past. And the task of assessing capital adequacy is becoming more rather than less difficult as the complexity of bank activities, including derivatives trading, continues to grow. Hence, the same types of problems that beset this early

[4] See Keeley (1988).

attempt at capital regulation in pre-Depression Texas persist even today as a major challenge to effective capital regulation.

Capital requirements in pre-Depression Texas

Texas was one of the first states to experiment with formal capital regulations. These capital regulations were part of a broader package of increased supervision and regulation for state-chartered banks that was implemented to accompany the introduction of state deposit insurance. Legislation that ushered in the Texas deposit insurance system passed the state legislature in its second session in May 1909. The law was referred to as Senate Bill 4 and became effective January 1, 1910. All state-chartered banks were required to join the system under one of two plans—the depositors guaranty fund or the depositors bond security system.

The most popular of the two plans was the depositors guaranty fund.[5] The guaranty fund covered only noninterest bearing deposits payable on demand, although there was no limit on the amount of these deposits that was covered by insurance. When banks joined the system, they were required to pay a premium of 1 percent of their average daily deposits for the previous year. Thereafter, each bank was assessed one-fourth of 1 percent of its daily average deposits annually until the fund reached $2 million, after which additional regular assessments were not required. However, if the guaranty fund fell below $2 million, or in an emergency, banks would be subject to a special assessment that was not to exceed more than 2 percent of average daily deposits for any one year.[6]

Recognizing that the existence of deposit insurance might lead insured banks to increase their risk profiles, more stringent regulations on state-chartered banks accompanied the implementation of the guaranty fund. Senate Bill 4 specified that no state bank could own more than 10 percent of the capital stock of another bank; it instituted additional penalties for fraud; and limits were placed on the indebtedness to a bank of its directors and officers.[7]

Probably the most important regulatory change accompanying the introduction of deposit insurance was the implementation of capital requirements.[8] In his classic on the history of deposit guarantees, Robb (1921, 151) points out that

> Texas is credited with making the first attempt in American history to establish an arithmetical relationship between the deposits and the capital of a bank. With a capital of $10,000, the deposits of a bank are restricted to five times its capital and surplus; from $10,000 to $20,000 to six times its capital and surplus; from $20,000 to $40,000 to seven times; from $40,000 to $75,000 to eight times; from $75,000 to $100,000, nine times; and if capital is over $100,000, to ten times its capital and surplus.[9]

Unlike modern capital requirements, this early attempt at capital regulation based its requirements not on assets, but deposits. Moreover, the bill was quite specific regarding how banks were to rectify any shortcoming in their capital. Banks were required to file a sworn statement of their average daily deposits for the year ending on the first day of November. If average daily deposits for the year amounted to more than the relevant multiple of capital and surplus,

> ...then in any such case it shall be the duty of the State Banking Board to require that such state bank shall within sixty days thereafter increase its capital by 25 per cent thereof, and it shall be the duty of the commissioner to immediately furnish such state bank with a certified copy of the order making such requirement, and upon receipt of such requisition the directors of such State Bank shall, within the time required, cause such increase to be made in its capital stock, and if the same is not done within such time, it shall be unlawful for such bank to thereafter receive any deposits at any time when its total demand and time deposits shall in the aggregate amount to more than the limitation herein placed upon deposits.[10]

Concerns about the propensity for insurance to increase bank risk, with potentially adverse consequences for the guaranty fund, seemed to be a motivating factor behind these requirements. As Robb (1921, 151) points out, "By these additional regulations the law attempts to counteract any tendencies toward reckless banking that the guaranty system may engender." These capital requirements are summarized in Table 1.

The 1920s: A bad time for Texas banks

The early years of the Texas depositors guaranty fund were relatively uneventful. By 1920, the fund had reached its required maxi-

[5] Under the second plan, known as the depositors bond security system, a bank filed annually with the Commissioner of Insurance and Banking a private bond, or policy of insurance or indemnity, equal to the amount of its capital. This latter plan was not popular with the banks, as evidenced by the fact that less than 10 percent of banks chose to be insured under this type of plan when the deposit insurance system began operations. Moreover, until very late in the operating life of the deposit insurance system, banks were not allowed to switch between the two deposit insurance plans.

[6] In response to mounting banking difficulties, the minimum amount required in the guaranty fund was increased to $5 million in 1921.

[7] For some evidence that risk taking at insured banks in Texas during the 1920s was greater than at uninsured banks, see Hooks and Robinson (1996).

[8] Section 27 of Senate Bill 4 contains the capital requirements on Texas state-chartered banks.

[9] Robb points out that the Kansas deposit insurance system, which passed the state legislature on March 6, 1909, established a relationship between deposits and capital. The Kansas law stated, "It shall be unlawful for any bank guaranteed under the provisions of this act to receive deposits continuously for six months in excess of ten times its paid-up capital and surplus..." (State of Kansas, 1909, 103). Unlike Texas, participation in the Kansas system was voluntary.

[10] See *General Laws of Texas* (1909, 423).

Table 1
Capital Requirements on Texas State-Chartered Banks

Capital	Limit on deposits
$10,000 or less	≤ 5 × (capital + surplus)
over $10,000 but less than $20,000	≤ 6 × (capital + surplus)
$20,000 but less than $40,000	≤ 7 × (capital + surplus)
$40,000 but less than $75,000	≤ 8 × (capital + surplus)
$75,000 but less than $100,000	≤ 9 × (capital + surplus)
$100,000 or more	≤ 10 × (capital + surplus)

NOTE: Deposits are based on average daily deposits for the year ended November 1.

SOURCE: *General Laws of Texas, Thirty-first Legislature, Regular, First, and Second Called Sessions, 1909*, 423.

mum of $2 million. From 1910 through 1920, only twenty-four state banks failed in Texas, compared with the more than 1,000 left operating at the period's end. According to Grant and Crum (1978, 103), fifteen banks were closed due to fraud, one bank was closed due to losses on loans, one bank closed due to its inability to meet a large withdrawal, and no information is available about why the other seven banks were closed. Only small disbursements from the guaranty fund were needed to resolve these closed banks, and the withdrawals were covered easily by special assessments that returned the fund to its legislated minimum. After allowing for recovery on the assets of the failed banks, the special assessments averaged about three-hundredths of 1 percent of the deposits of participating banks.[11]

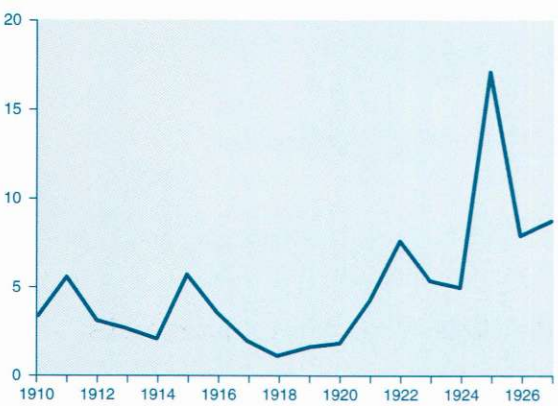
Beginning with a severe recession in 1920, however, the Texas economy suffered a series of setbacks that led to banking difficulties throughout the decade. Cotton was king in Texas, accounting for 70 percent of total crop acreage and about the same percentage of farm cash income. Texas produced about one-third of the U.S. cotton crop and about one-fifth of world output. It is no surprise then that the sharp drop in cotton prices that occurred in the early 1920s produced a severe regional recession. Cotton prices reached a high in March 1920 before falling almost 75 percent by April 1921. The index of prices received by Texas farmers for all crops fell 71.4 percent over this period. The economy recovered in 1922 and into 1923, only to experience the effects of another sharp decline in cotton prices from 1923 through 1926.[12]

These difficult economic times produced a severe financial impact on Texas state banks, most of which were located in rural areas. As shown in Chart 1, the liquidation rate of state-chartered banks in Texas rose sharply in the 1920s, peaking at 17 percent in 1925.[13]

Failure of the guaranty fund

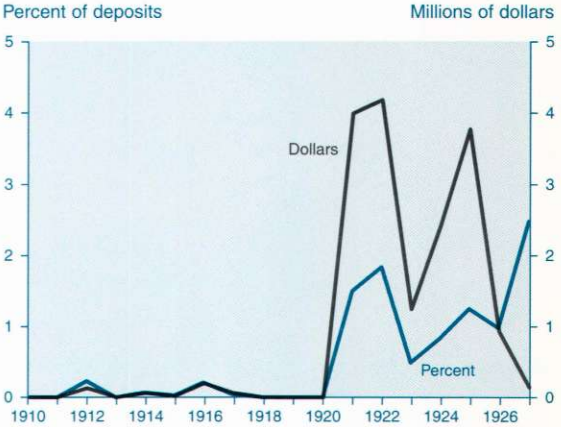
As bank failures mounted, special assessments on state banks were necessary to maintain the guaranty fund's designated balance. Chart 2 shows how these special assessments increased sharply in the early to mid-1920s, both in dollar amounts and as a percent of total deposits. In the early 1920s, these assessments amounted to about 2 percent of banks' total deposits. By 1927, assessments reached almost 2.5 percent of deposits.[14] A total of $17 million was raised through special assessments from 1910 through early 1927. Of course, recoveries were made from the liquidations of the failed banks. But, as shown in Chart 3, payments to depositors far exceeded initial liquidation values and subsequent recoveries from the failed banks, resulting in large losses to the insurance

Chart 1
Liquidation Rate of Texas State Banks, 1910–27



SOURCE: Grant and Crum (1978).

Chart 2
Special Assessments on Texas State Banks, 1910–27



SOURCES: Warburton (1959); FDIC (1956).

[11] See Warburton (1959).

[12] See Grant and Crum (1978, 125–26).

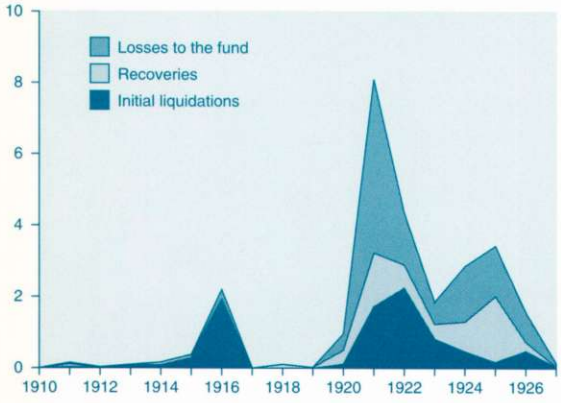
[13] The liquidation rate includes both involuntary and voluntary liquidations. A portion of the voluntary liquidations involved banks switching to a national charter to avoid the increasing costs associated with membership in the depositors guaranty fund. Also, Grant and Crum (1978, 155) point out that the voluntary category included liquidations undertaken in response to considerable pressure from bank regulators for financially impaired banks to surrender their charters: "...(M)ost of the banks that entered 'voluntary' liquidation, except for those that were nationalized, did so because of financial difficulty."

[14] As noted below, membership in the guaranty fund dropped considerably after 1925. Thus, even though the dollar amount of assessments had begun to decline, the burden was spread over a smaller number of banks. These calculations are based on total deposits as recorded in Warburton (1959) rather than on average daily deposits as stipulated in the law because data for this latter deposit category were not available. Therefore, they should be considered an approximation of the actual assessment burden. For comparison, the maximum effective assessment rate charged by the FDIC on insured banks during the banking difficulties of the 1980s and early 1990s was one-fourth of 1 percent of total deposits.

Chart 3

Disposition of Insured Deposits at Failed Texas State Banks, 1910–27

Millions of dollars



SOURCES: Warburton (1959); FDIC (1956).

fund. Over the entire life of the guaranty fund, accumulated losses totaled $11.6 million.[15]

As the assessment burden on banks began to increase, state bankers began to question the wisdom of membership in the guaranty fund. But short of switching to a national charter, they were not allowed to leave the plan.[16] In response to increased demands from bankers, the state legislature in 1925 revised the original legislation to allow banks to leave the guaranty fund and join the depositors bond security system.[17] Within the first three months of this change in the law, more than 300 of the approximately 900 state banks in existence switched to the bond system. By the end of 1926, approximately 800 state banks were in the bond system, while only 75 banks remained in the guaranty fund. The percentage of eligible banks participating in the guaranty fund fell from 96 percent in 1924 to 9 percent in 1926.[18] Those banks that remained in the guaranty fund faced increasingly heavy assessment burdens. By August 1, 1926, the maximum 2-percent assessment had already been levied, collected, and paid out, amounting to 8.5 percent of the capital of the remaining 127 banks in the guaranty fund. State bankers, the Texas Bankers Association, and the state Department of Banking all favored repeal of the guaranty fund. On February 11, 1927, legislation was signed that repealed both the depositors guaranty fund and the depositors bond security system. Liquidation of the guaranty fund required another four years.[19]

Why was capital regulation ineffective?

Given that the primary goal of the capital regulations accompanying the introduction of deposit insurance in Texas was to protect the solvency of the guaranty fund, the failure of the fund in the mid-1920s suggests that the capital regulations may have been seriously flawed. Of course, other factors also contributed to the fund's failure, such as the severity of the economic shocks that precipitated the crisis and incompetent and dishonest bank management. Nevertheless, an apparent paradox of the Texas banking crisis of the 1920s is that reported capital levels remained fairly high, even though banks were failing in increasing numbers.[20] As shown in Chart 4, although the aggregate capital-to-asset ratio for Texas state-chartered banks fell during the 1910–27 period, even its lowest point of 17 percent is remarkably high by today's standards.[21]

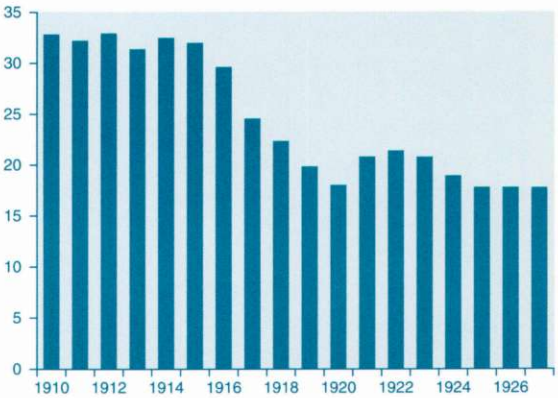
Similar findings hold as well for individual banks. The *Annual Reports of the Commissioner of Insurance and Banking* are an important source of information on the condition of state banks in Texas. We were able to obtain some of the reports that were produced from 1910 to 1922. Unfortunately, after 1922, with the creation of a separate Department of Banking, no annual reports were published. However, during the 1910–22 period, the reports that we obtained contained financial information on fifty-eight failed banks at the time of their closure.[22] The reported capital-to-asset ratios of these failed banks range from 7.1 percent to 37 percent, with an average of 20 percent, which, by today's standards, is a remarkably high capital position for failed banks.[23]

Given these findings, the experience with capital regulation in pre-Depression Texas poses several interrelated questions. Why did banks fail when their reported capital levels were so high? And how could the insurance

Chart 4

Capital Ratios at Texas State Banks, 1910–27

Percent of assets



SOURCE: *All-Bank Statistics, United States 1896–1955*, Board of Governors of the Federal Reserve System (1959).

[15] See Warburton (1959) and FDIC (1956).

[16] According to Grant and Crum (1978, 188), during the last five years of the existence of the guaranty fund, 126 state banks obtained national charters, an average of twenty-five per year. Prior to 1922, conversions averaged three per year.

[17] For a description of the depositors bond security system, see footnote 5.

[18] See Grant and Crum (1978, 185). Not only did the legislation allow banks to switch insurance plans, but it also significantly watered down the requirements of the bond security system. Henceforth, banks would be allowed to count certain bonds already on their books as sufficient to meet the requirements of the bond plan.

[19] See Grant and Crum (1978, 186, 189).

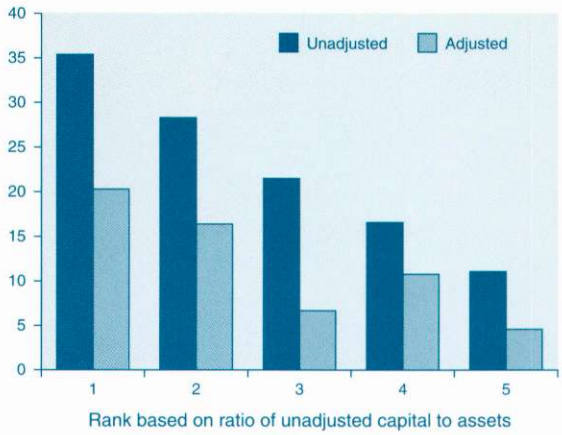
[20] As we discuss in a later section, it appears likely that liquidity pressures often were the factor that led bank supervisors to close these institutions.

[21] Capital is defined as the sum of paid-in capital, surplus, and other capital accounts.

[22] These closures represent true failures in the sense that they do not include any banks that liquidated solely to convert to a national charter.

[23] In an effort to ensure consistency with the capital measures reported in Chart 4, capital is defined from the items in the *Annual Reports* as the sum of paid-in capital, surplus, and undivided profits. Surplus represents the part of bank capital that was accumulated from net earnings to serve as an additional safeguard against losses. Texas state banks were required to set aside 10 percent of net earnings to surplus until the surplus account equaled 50 percent of paid-in capital. Undivided profits are, in today's terminology, retained earnings.

Chart 5
Distribution of Capital Ratios of Texas State Banks at Failure



NOTE: Bars represent the mean values for each group.

SOURCE: *Examiner's Report of Condition*, Federal Reserve Bank of Dallas.

fund have suffered such large losses, given that banks failed with such high levels of capital remaining on their books? An alternative source of data regarding the financial condition of the banks at their time of failure might help answer these questions.

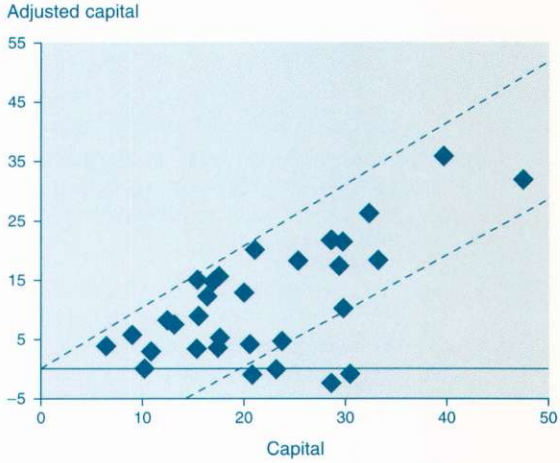
Book-value capital overstated. In the Federal Reserve Bank of Dallas' archives are examination records on almost two hundred state-chartered banks in Texas from 1919–27, which coincides with the turbulence of the state banking system and its deposit insurance fund. These records contain bank balance-sheet information, including the capital positions of the banks. Further, these examination records also include estimates of the losses likely to be incurred by individual banks. These losses are mostly from the banks' loan portfolios but could also include estimated losses on securities, real estate, and cash items. Judging from handwritten entries in these examination reports, bank examiners would deduct the amount of these estimated losses from bank capital. This adjustment would result in the examiner indicating on the reports for a number of banks that their capital was "impaired."[24]

By investigating those examination records that are available for banks close to the time of their failure, and by deducting from capital the losses estimated by examiners, we are able to obtain somewhat more meaningful measures of the financial condition of failed banks. To accomplish this, we pool together the data on all the banks for which we have an examination report dated one year or less before the time of failure.[25] This procedure results in a sample of thirty-two banks.[26]

To gauge the extent of the losses estimated by examiners, we compare the reported or unadjusted capital-to-asset ratios for our sample of failed banks, as recorded in their examination records, with what we call adjusted capital-to-asset ratios that incorporate the losses estimated by examiners. We divide the banks into five groups of nearly equal size based on their unadjusted capital-to-asset ratios. Chart 5 shows the average unadjusted and adjusted capital-to-asset ratio for each of the five groups. Consistent with the data found in the various *Annual Reports of the Commissioner of Insurance and Banking*, these banks reported high levels of capital relative to total assets, even near the time of their failure. The group of banks with the highest capital reported an average capital-to-asset ratio of 35 percent, while the group with the lowest capital had an average capital ratio of 11 percent. However, once the estimated losses are deducted, the average capital ratio for each of the groups falls considerably, often to about half its unadjusted level. These findings indicate that the book-value capital ratios reported by the Texas banks were grossly overstated and thereby help to explain the apparent paradox of how the banks could have failed even as their reported capital levels remained fairly high.

The relationship between the unadjusted and adjusted capital-to-asset ratios for our bank sample is shown in Chart 6. For most levels of

Chart 6
Capital Versus Adjusted Capital at Failed Texas Banks
(Percent of assets)



SOURCE: *Examiner's Report of Condition*, Federal Reserve Bank of Dallas.

[24] There is no indication in the examination records of what is entailed in classifying a bank's capital as impaired. However, in most cases this occurred when the potential losses estimated during the examination process exceeded the level of surplus plus undivided profits, so that the potential losses began to erode the amount of paid-in capital contributed to a bank.

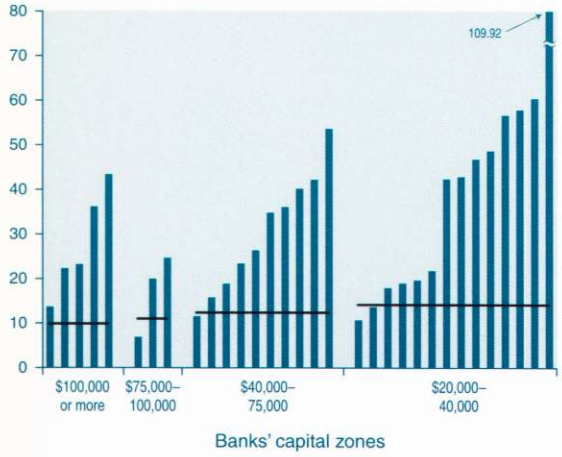
[25] We use as our definition of failure those banks whose charter surrender was characterized as either "involuntary" or "voluntary" because, as noted in footnote 13, this distinction was largely meaningless. We do not include those voluntary surrenders for purposes of switching to a national charter, though, since this would not represent closure due to financial difficulties. We also exclude two banks that were sold voluntarily and were not in financial difficulty.

[26] These failures occurred between 1924 and 1928.

Chart 7

Capital Levels of Texas Banks at Time of Failure

Capital-to-deposit ratio



NOTE: The horizontal lines represent the inverse of the limit on deposits found in Table 1. The requirement for banks with capital of $100,000 or more is 10 percent; with capital of $75,000–100,000, 11.1 percent; with capital of $40,000–75,000, 12.5 percent; with capital of $20,000–40,000, 14.3 percent.

SOURCE: *Examiner's Report of Condition*, Federal Reserve Bank of Dallas.

adjusted capital, reported or unadjusted capital ratios tend to fall in a fairly wide range of about 20 percentage points, as indicated by the dashed lines.[27] Of particular note is how wide the range of reported capital becomes for banks approaching insolvency on an adjusted-capital basis, with reported capital ratios reaching as high as 30 percent.

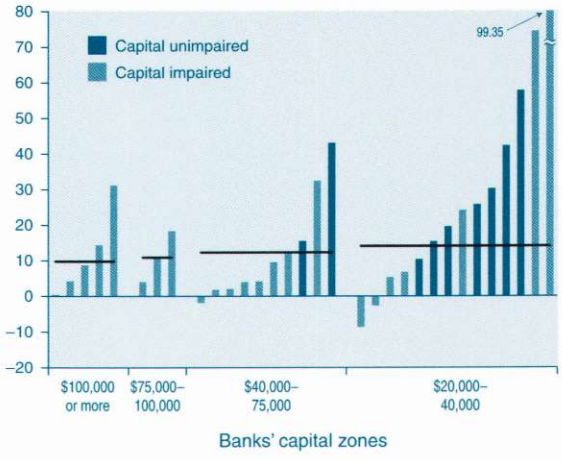
Because the formal capital requirements instituted in Texas were based on reported book-value capital, and given the abundance of evidence presented above indicating that reported capital was grossly overstated, it is difficult to see how the capital regulations in place could have been effective in their intended purpose of preventing "reckless" banking and protecting the guaranty fund. In Chart 7, the statutory required minimum amount of capital relative to deposits, which, as shown in Table 1, is based on banks' capital zones, is depicted by the horizontal lines, while each of our thirty-two individual banks' reported or unadjusted capital-to-deposit ratio, as stated in the last examination report available prior to failure, is shown by the vertical bars.[28] Reported capital fell short of its statutory level relative to deposits for only four of the thirty-two banks, even near the time of failure, suggesting that the capital requirements probably had little constraining effect on bank behavior. In contrast, in Chart 8, when each bank's adjusted capital is compared with its level of deposits, now seventeen banks are in violation of the capital requirement, and three of these are insolvent. These results indicate that the adjustments by examiners to bank capital to reflect likely losses give a more accurate picture of the financial health of individual banks. Chart 8 also shows which of these banks were classified as capital-impaired by examiners.[29] Interestingly, of the thirty-two failed banks, twenty-four were deemed either to be capital impaired, as assessed by examiners, or to have had adjusted capital ratios below the statutory minimum. While the capital regulations themselves were largely ineffective, regulators did attempt to take into account the prevalent overstatement of book-value capital levels by forming their own estimate of potential losses. However, given that (1) almost half of the banks in our sample were not in violation of capital requirements near the time of their failure, even after adjusting for estimated losses, (2) only three out of the thirty-two banks' capital fell below zero after accounting for estimated losses, and (3) the depositors guaranty fund suffered large losses that ultimately resulted in its liquidation, even the regulatory adjustments to bank capital contained in the examination reports did not provide a very accurate picture of the economic value of Texas state banks.[30]

Was forbearance a problem? One reason why these adjustments to capital, while an improvement, are still suspect is that regulators may have delayed recognition of problems in

Chart 8

Adjusted Capital Levels of Texas Banks at Time of Failure

Adjusted capital-to-deposit ratio



NOTE: See note to Chart 7.

SOURCE: *Examiner's Report of Condition*, Federal Reserve Bank of Dallas.

[27] The correlation between these two measures of capital is 63 percent.

[28] We convert the representation of capital requirements from a deposits-to-capital to a capital-to-deposits ratio for ease of exposition. The capital-to-deposit ratios shown here are calculated as paid-in capital and capital surplus relative to total deposits. These calculations are based on total deposits from bank examination records rather than on average daily deposits as stipulated in the law because data for this latter deposit category were not available.

[29] We should note that it is possible for a bank to be designated as capital impaired, as judged by examiners, even when its capital is fairly high relative to deposits, if the bank had suffered a large decline in deposits. See footnote 24.

[30] It is possible that losses incurred by the insurance fund in resolving failed banks might overstate the extent of the banks' insolvency if the banks possessed a value as a going concern that was lost in the resolution process. But it is unlikely that such factors can account for the large losses suffered by the insurance fund.

Table 2
Measures of Bank Financial Distress Prior to Failure

Years before failure	Percentage of banks that: Are capital impaired	Do not meet capital requirement (adjusted)	Do not meet capital requirement (book value)
0–1	72	53	12
1–2	59	19	7
2–3	46	15	4
3–4	27	9	4

SOURCE: *Examiner's Report of Condition*, Federal Reserve Bank of Dallas.

the hopes that banks' financial health would recover. Grant and Crum (1978, 157) report several cases in which insolvent banks were allowed to continue operating.[31] They quote Banking Commissioner Charles Austin in 1925

> Most of these failures were banks known to this department to be absolutely insolvent for a long time, but which appear to have been kept open with the hope that they might work out their own salvation. Bank failures do not develop overnight, but are usually the result of conditions well known and fully recognized for a long time before the crisis develops. None of the failures which have occurred so far this year should have been any surprise to any person having access to the bank examiner's reports, and most of them should have been no surprise to the public at large for the reason that the banks have been notoriously insolvent and generally discussed in the communities where they existed for many months prior to their closing.

These words highlight the important distinction between bank insolvency and bank failure or closure. Banks are insolvent when the market value of their assets is less than the market value of their liabilities. Here, failure or closure refers to a decision by the chartering authority that effectively terminates the operations of the bank. We do not have a definitive answer as to what ultimately triggered closures of Texas banks during the 1920s. It appears likely, however, that regulatory assessments of capital strength were not the primary factor in determining when a failing bank was ultimately closed. Warburton (1959, Table 10, 46) provides evidence that incompetent management and associated heavy depositor withdrawals were the primary causes of Texas bank failures over the period 1921–30. Liquidity pressures on banks, then, may have forced the regulators' hand in triggering the decision to close a failing bank.[32]

However, even though our limited data, represented by examination reports on thirty-two state bank failures, do not allow us to determine definitively whether or to what extent forbearance was widespread, we can use the available examination reports to at least shed some light on this issue. Most of the records contain a question that asks if the examiner considers the bank to be solvent. Of the thirty-two failures, only four examination reports indicated that the bank was not solvent when close to failure. Several more banks were classified as either questionably solvent or "barely" solvent when approaching failure. In only one case was a bank classified as insolvent more than one year prior to failure. However, as stated earlier, the data on the increasing assessment burdens and ultimate depletion of the deposit insurance fund are consistent with the view that the condition of troubled banks was substantially worse than examiners' assessments would indicate. In this sense, forbearance was still practiced, though unintentionally.

In almost every case, however, while the majority of banks were classified as solvent at or before failure, most of the descriptions of their financial condition indicated serious financial difficulties occurring several years prior to failure. The extent of banks' financial weakness in the years prior to failure depends on the particular measure of capital difficulties, as shown in Table 2. The least restrictive measure is the reported, or book-value capital ratio. By this measure, only 12 percent of the banks in our sample did not meet the minimum capital-to-deposit requirement when close to failure, compared with 53 percent of banks when using the adjusted-capital measure. Almost three-fourths of the banks that failed were classified as capital impaired one year or less prior to failure. The proportion of banks operating in financial difficulty trails off as the failure date recedes. In every case, the least restrictive measure is the reported book-value capital ratio, while the designation of capital impairment captures the largest percentage of subsequent failures.[33] If restraints had been set in place for capital-impaired banks similar to those legislated for banks not meeting the formal capital requirements, then perhaps the regulatory apparatus would have been more successful in limiting losses to the insurance fund.

Assessment. Overall, the available evidence indicates that this early attempt to imple-

[31] Warburton (1959) also cites forbearance as a problem in Texas during the 1920s.

[32] Weaver (1926, 62) points out that the commissioner had the authority to close institutions where "the interests of the depositors are jeopardized" by fraud or heavy deposit withdrawals. Friedman and Schwartz (1963, Chapter 7) also note the importance of liquidity pressures on bank failures during the 1930s.

[33] Data for all thirty-two bank failures are not available for up to four years prior to failure. The number of banks for which we have examination data in the years before failure are as follows: twenty-seven banks one to two years before failure, twenty-six banks two to three years before failure, and twenty-two banks three to four years before failure.

ment capital standards on banks produced mixed results, at best. Unlike seven other state deposit insurance systems in place at the time, no insured depositor suffered any losses under the Texas system.[34] However, though reported capital levels were quite high, even at the time of failure, they were largely fictitious, and the depositors guaranty fund suffered such heavy losses that its cost proved too great for its members. We surmise that a primary reason for the failure of capital regulation in pre-Depression Texas was that the capital requirements were based on book-value measures that did not adequately reflect the true financial strength of individual banks. As a result, capital-impaired banks were allowed to continue operating without fully compensating restrictions on their behavior, since specific restrictions were legislated only for banks that failed the capital requirement on a book-value basis.[35] The lesson we take from this early attempt at capital regulation is: Without meaningful measures of capitalization that provide at least a close approximation of the net economic value of an institution relative to the size and risk of its activities, together with appropriate compensating restrictions on the financial behavior of capital-impaired institutions, capital regulation will tend not to provide an adequate level of protection to the deposit insurance fund.

What about today?

Capital regulation is probably more important today than it was in pre-Depression Texas. This reflects the aftermath of the bank and thrift difficulties of the 1980s and early 1990s. The collapse of many savings and loans has been estimated to have cost taxpayers between $150 billion and $175 billion.[36] Banking difficulties of the 1980s and early 1990s were not as severe, but did result in the Federal Deposit Insurance Corporation reporting a negative balance of $7 billion for the first time in 1991.[37] Despite a system of formal capital requirements in place, bank failures generated substantial losses, as indicated in Table 3. The more recent Basle risk-based capital requirements, along with the prompt corrective action and early closure features of FDICIA, were implemented to avoid a replay of these difficulties. And the prompt corrective action and early closure provisions of FDICIA are specifically designed to prevent banks from pursuing any risk-taking or looting incentives that may arise if their capital should become impaired.

However, immediately related to the above analysis is whether the current regulatory accounting standards supporting Basle and FDICIA provide an adequate measure of bank capital relative to the size and riskiness of bank activities. Several recent analyses have questioned whether the current capital-based supervisory system in place will make a difference, should banking difficulties develop in the future. Jones and King (1995) estimate that most of the banks exhibiting a high risk of insolvency from 1984 to 1989 would not have been classified as undercapitalized had the FDICIA guidelines been in place. In fact, more than one-third of the banks would have been classified as well capitalized. Interestingly, Jones and King suggest a modification to the calculation of loan loss reserves based on examination results as one possible adjustment to the risk-based capital requirements. It was also an adjustment to capital based primarily on estimated loan losses that Texas examiners in the 1920s used in an apparent attempt to derive more meaningful capital measures. Along these same lines, Peek and Rosengren (1996) question whether the prompt corrective action provisions of FDICIA would have made a difference during recent banking difficulties in New England.

This evidence from the past decade, plus our analysis of the Texas banking difficulties of the 1920s, highlights how problematic book-value accounting measures can be. Market-value accounting was part of the original proposal that eventually became FDICIA, but the objections of regulators and bankers caused it to be dropped from the final bill.[38] It should be emphasized that the estimation of the economic or market value of banks' assets and liabilities, many of which are not publicly traded, presents a number of formidable difficulties.[39] As a result, the same types of measurement problems that have plagued traditional forms of capital regula-

Table 3
Losses to Bank Insurance Fund from Bank Failures, 1985–94

Year	Number of failed banks	Estimated loss (in millions)
1985	120	$1,008
1986	145	1,725
1987	203	2,021
1988	221	6,872
1989	207	6,123
1990	169	2,813
1991	127	6,269
1992	122	3,960
1993	41	584
1994	13	139

SOURCE: United States General Accounting Office (1996).

[34] Seven other states experimented with deposit insurance systems around this time, including Oklahoma, Kansas, Nebraska, Mississippi, South Dakota, North Dakota, and Washington. All of these state-run plans experienced financial difficulties and ultimately collapsed. See FDIC (1956), American Bankers Association (1933), and Calomiris (1989) for descriptions of these various deposit insurance systems. While no insured depositors suffered any losses in Texas, in the other states losses on insured deposits ranged from $1.2 million to $33.7 million.

[35] Grant and Crum (1978, 158–59) report that the actions available to regulators included: (1) stockholder assessments to restore capital, which were largely unsuccessful due to the fact that the principle stockholders were often officers of the bank who had depleted their own resources in an attempt to save their business, (2) "overnight reorganizations" with new stockholders and a new charter quickly arranged, and (3) liquidations.

[36] See National Commission on Financial Institution Reform, Recovery and Enforcement (1993).

[37] See FDIC Annual Report (1991). One likely reason why the thrift industry's difficulties were much more severe was the less stringent supervision and regulation of savings and loans. While thrifts were subject to capital requirements in the 1980s administered by the Federal Home Loan Bank Board, the amounts required were substantially reduced throughout the 1980s, while the definition of regulatory capital was watered down. See Barth (1991) and Kane (1989).

[38] See Benston and Kaufman (1994).

[39] See Berger, King, and O'Brien (1991).

tion since the Texas banking crisis of the 1920s are likely to remain a source of concern, even if attempts were made to implement market-value accounting.

In fact, the measurement problems associated with capital regulation may have increased as banks have moved beyond their traditional role of taking deposits and making loans into new forms of financial intermediation. In this regard, many have argued that traditional methods of assessing capital adequacy are not applicable to these new lines of business, particularly the trading of financial derivatives, because measurement of the size and risk potential of derivatives portfolios is exceedingly difficult.

In response to these developments, several new approaches to capital regulation have been advanced.[40] A prominent example is the so-called precommitment approach, whereby banks determine their maximum precommitted trading losses and set aside sufficient capital based on these estimates.[41] Under this approach, penalties would be assessed on banks if their trading losses exceeded their maximum expected losses. This approach addresses the measurement problem squarely, since regulators are required to know only the actual losses, leaving the measurement of the size and riskiness of trading activities to the banks themselves. Unfortunately, to the extent that this approach has merit, its primary application is to portions of a bank's overall activities, rather than the bank as a whole.

As the banking industry continues to evolve in response to market pressures, the implementation of capital regulation most likely will continue to adapt as well. However, despite all this change, measurement problems akin to the inflated book values that plagued an early attempt at capital regulation that occurred some eighty years ago in the state of Texas are likely to remain as a significant challenge to effective capital regulation.

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[40] For more on these approaches to determining capital, as well as some shortcomings, see Bliss (1995).

[41] See Kupiec and O'Brien (1995).

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Mexican Payments System Reforms

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As with the other major financial reforms initiated since the late 1980s, Mexico's recent efforts to enhance the role of market-based decisions in the payments system represent a significant step in the right direction.

Since the late 1980s, Mexico has engaged in a series of far-reaching financial and economic reforms. These reforms include the privatization of its banks and other state-owned enterprises, interest rate deregulation, an easing of reserve requirements, reductions in restrictions on trade and foreign bank entry, and an overhaul of the payments systems.[1] This article investigates the ongoing payments system reforms that Mexico began in 1994.

The safe and efficient transfer of monetary value in exchange for goods, services, and financial assets is vital to any market economy. The apparatus used to transfer monetary value is the payments system. For the purpose of analysis, the payments system as a whole can be divided into large-value and small-value systems. Large-value, or wholesale, payments systems are primarily used to transfer funds between banks, and the average value of each transfer is relatively large. Folkerts-Landau, Garber, and Lane (1994) list the important functions of large-value systems: to provide the necessary infrastructure for the intermediation of household and business payments, to enable more efficient liquidity management by banks, to assist the development of security markets, and to allow for more effective implementation of monetary policy. The primary thrust of payments system reform in Mexico thus far has concentrated on large-value systems.

Small-value, or retail, payments systems process relatively small payments among consumers and businesses. Retail payment instruments include cash, checks, automated clearinghouse payments, credit and debit cards, and, more recently, electronic money.[2] Pingitzer and Summers (1994) state that "the efficient operation of a market economy depends on the availability of a smoothly functioning small-value transfer system that connects all economic agents."

Although financial analysts agree that large-value payments systems should be safe and efficient, there is little consensus on their optimal design and operation. Major differences exist in the types of large-value payments systems employed in developed countries.[3] As a result, developing countries seeking to enhance their integration with international capital markets face difficulty in identifying the most appropriate blueprint for strengthening their own large-value systems.[4] Mexico provides an interesting example of the recent push to enhance the safety and efficiency of large-value payments systems in emerging financial markets.

In early 1994, the Bank of Mexico, the

Most of my understanding of the Mexican payments systems is based on interviews and written correspondence with the major players in the Mexican financial markets. I benefited from conversations with Juan Antonia, Gilberto Calvillo, Abdón Sánchez-Arroyo, and Francisco Solís at the Bank of Mexico, Héctor Pérez Galindo and Carlos H. Garza at INDEVAL, and individuals at other institutions that are major players in the payments systems described. In addition, I would like to thank Alton Gilbert, Jeff Gunther, Genie Short, Ed Stevens, Bruce Summers, and Jim Thomson for comments on previous drafts.

1 For a discussion of Mexican financial system reforms, see Welch and Gruben (1993) and Gruben, Welch, and Gunther (1993).

2 For a description of these systems, see Chakravorti (1997).

3 For a comparison of large-value payments systems, see Horii and Summers (1994) and Bank for International Settlements (1997).

4 For an overview of payments system issues in developing countries, see Listfield and Montes-Negret (1994) and Sato and Humphrey (1995).

central bank of Mexico, proposed reforming its payments system. The goals of these reforms are to decrease the amount of unsecured intraday credit it extends to banks over the large-value interbank payments system, to promote market discipline in the determination of credit exposures related to the payments system, and to move large-value transactions away from checks to electronic systems. The first two goals are designed to reduce payments system risk, while the last one is aimed at increasing efficiency.

Progress has been made on each of these fronts. Except under certain circumstances, the Bank of Mexico no longer extends uncollateralized intraday credit to settle payments on its large-value payments system.[5] Instead, to maintain adequate liquidity while imposing market discipline, the Bank of Mexico implemented a net large-value payments system, in which participants send payments based on intraday lines of credit they extend to one another. In addition, the Bank of Mexico has successfully promoted this system as an alternative to high-value checks. However, some challenges remain for the Bank of Mexico in implementing the desired market discipline in the intraday credit market.

Trade-offs in payments system design

The details of the recent payments system reforms in Mexico are best understood in the context of the policy alternatives facing payments system operators in general. To provide a framework for an analysis of Mexico's reforms, this section discusses some of the major issues associated with the operation of large-value payments systems.

A safe payments system minimizes the risks involved in the transfer of monetary value. From a public policy perspective, a safe payments system can prevent the costly disturbances that result from the stoppage of clearing and settlement caused by a failure of one or more participants to settle. An example of such a stoppage occurred in the Hong Kong futures market during October 1987, when the market was closed for four days to sort out its settlement problems. The Hong Kong government, along with leading banks and brokerage firms, helped the various parties meet their obligations by extending credit totaling HK$2 billion (US$256 million).[6]

The risks that safe payments systems attempt to minimize are often collectively referred to as payments system risk. Payments system risk includes liquidity risk, settlement risk, and systemic risk. (See the box entitled "Glossary of Terms.") Liquidity risk is the risk that a participant does not have good funds at the time of settlement but can provide them at a later time. Settlement risk is the risk that one party to a transaction does not deliver the underlying asset in its entirety at the specified settlement time. This asset could be good funds, another financial asset, or a physical asset.[7] Systemic risk, as defined by the Bank for International Settlements (1992), is "the risk that the inability of one institution to meet its obligations when due will cause other institutions to be unable to meet their obligations when due."[8]

However, safety is not the only factor influencing the economic benefits provided by a payments system. An efficient payments system also promotes an efficient allocation of financial resources. At the level of individual market participants, this efficiency results in lower transactions costs. For example, a comparison of the cost differentials between securities clearing and settlement systems used in emerging markets and the United States illus-

Glossary of Terms

Clearing/Clearance "Clearing is the process of transmitting, reconciling and in some cases confirming payment orders or security transfer instructions prior to settlement, possibly including netting of instructions and the establishment of final positions for settlement" (Bank for International Settlements 1993).

Clearing House for Interbank Payments System (CHIPS) CHIPS is the primary electronic large-value funds transfer system for the dollar component of foreign exchange and cross-border transactions. CHIPS, established in 1970, is operated by the New York Clearing House Association.

Delivery Versus Payment (DVP) DVP describes transactions in which delivery of an asset occurs if and only if payment occurs. Participants need not deliver good funds but only a payment instrument with the underlying value.

Fedwire Fedwire, the U.S. large-value gross settlement system operated by the Federal Reserve, is used for the transfer of funds and government securities.

Liquidity Risk The risk that a participant does not have good funds at the time of settlement, but can provide them at a later time.

Settlement "An act that discharges obligations in respect of funds or securities transfers between two or more parties" (Bank for International Settlements 1993).

Settlement Risk The risk that one party to a transaction does not deliver the underlying asset in its entirety at the specified settlement time. This asset could be good funds, another financial asset, or a physical asset.

Sistema de Atención a Cuentahabientes de Banco de México (SIAC) SIAC is the large-value gross settlement system that transfers funds between reserve accounts at the Bank of Mexico.

Sistema de Información de Depósito de Valores (SIDV) SIDV is the large-value securities transfer system. SIDV is operated by the Instituto de Depósito de Valores (INDEVAL).

Sistema de Pagos Electrónico de Uso Ampliado (SPEUA) SPEUA is the large-value funds transfer system that nets payments and settles over SIAC. SPEUA is operated by the Bank of Mexico.

Systemic Risk "The risk that the inability of one institution to meet its obligations when due will cause other institutions to be unable to meet their obligations when due" (Bank for International Settlements 1992). This definition applies in the context of payments systems.

[5] I discuss these circumstances below.

[6] This conversion is based on the prevailing exchange rate of 7.81 HK dollar–U.S. dollar in October 1987. For a description of this event, see Folkerts-Landau et al. (1995).

[7] When discussing large-value payments systems, good funds are usually reserves held at the central bank by financial institutions.

[8] Bank for International Settlements (1992), A2–7. In the broader banking literature, systemic risk is often defined as the failure of a financial institution leading to the failure of one or more financial institutions, with adverse consequences to both the financial system and the economy as a whole.

trates the potential cost savings to participants. According to Stehm (1996), the average cost to process and settle a securities trade in emerging markets is probably between ten and one hundred times greater than in the United States.

When designing payments systems, operators can choose between gross settlement systems and net settlement systems. In gross settlement systems, each transaction is settled individually; in net settlement systems, participants settle the net of their incoming and outgoing payments at the end of a specified period of time, usually a day. (For a comparison of gross and net settlement systems, see the box entitled "Gross Versus Net Settlement.") Gross settlement offers participants the immediacy of using the underlying funds and reduced settlement risk because each transaction is settled with good funds.[9] However, these systems are more expensive for participants to use than netting systems because of the need for greater quantities of good funds to settle. Operators of payments systems must weigh the safer gross settlement system against the more efficient net settlement system.

Payments system operators often adopt policies to increase the efficiency of gross settlement systems or decrease the settlement risk of netting systems. To decrease cost to participants, gross settlement system operators may extend free intraday credit. To decrease settlement risk to participants, net settlement system operators may impose market-based debit caps and/or loss-sharing arrangements among participants. Market-based debit caps restrict the amount a participant can owe at any time during the day. Loss-sharing rules distribute the losses associated with the failure of one or more participants to settle among the remaining participants.

One area in which central banks' gross settlement systems differ is the quantity of intraday credit they extend. In this context, intraday credit is used to facilitate payment flows during the day. Payments system participants are expected to end the day with a zero balance. At one extreme is Swiss Interbank Clearing, where the Swiss National Bank, the central bank of Switzerland, extends no intraday credit.[10] At the other extreme, until recently some central banks extended unlimited daylight credit. Until the mid-1980s, the Federal Reserve extended nearly unlimited daylight credit to Fedwire participants. Since then, the Federal Reserve has imposed limits on intraday credit and also charges fees based on the quantity of credit extended.[11] The Bank of Mexico also used to extend unlimited and uncollateralized intraday credit to its banks to make payment over its large-value gross settlement system. As part of the recent reforms, however, the Bank of Mexico has replaced most unsecured intraday credit with fully collateralized credit.

Central banks are faced with a trade-off when deciding to extend intraday credit. By not providing intraday credit, they eliminate credit risks associated with direct intraday lending. However, such a policy may result in payment gridlock, especially in financial systems without well-developed interbank funds markets. Payment gridlock occurs when the flow of payments stops because participants are waiting to receive payments before sending them. By providing intraday credit, central banks increase intraday liquidity and prevent payment gridlock. A central bank's major concern about such a policy is the credit risk associated with intraday lending, especially if this credit is not properly priced. In addition, the reliance on central bank credit by payments system participants may distort the market allocation of intraday credit.

Another way to reduce payment gridlock that does not rely on central bank credit is to net payments instead of settling each payment individually. In net settlement systems, participants extend each other credit during the day and settle their positions with good funds at the end of the day. An example of such a system is the Clearing House Interbank Payments System (CHIPS), the large-value payments system used primarily to settle international dollar payments and dollar components of foreign exchange transactions.[12] However, such systems do not usually guarantee the immediacy of funds. In other words, good funds are not usually available until the end of the day for further transactions.

In its reform of the payments systems, the Bank of Mexico reduced its direct exposure to intraday credit risk, while maintaining sufficient liquidity. The Bank of Mexico implemented parallel gross and net settlement systems. The two net settlement systems settle over the gross settlement system at the end of the day. To decrease its exposure to credit risk, the Bank of Mexico eliminated the extension of daylight credit to banks except under certain limited circumstances. Although the Bank of Mexico eliminated direct unsecured intraday credit, it guaranteed payment of end-of-day net clearing balances arising from the two parallel netting systems. However, these guarantees may still expose the Bank of Mexico to undesired levels of credit risks.

[9] Financial institutions usually do not earn interest on these reserves, so they attempt to minimize their reserve holdings.

[10] For a description of Swiss Interbank Clearing, see Vital and Mengle (1988).

[11] For a discussion of these issues, see Hancock and Wilcox (1996) and Richards (1995).

[12] The risk and efficiency trade-offs of payments systems that net are modeled in Chakravorti (1996).

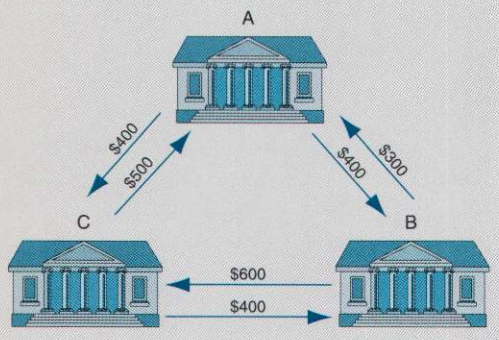
Gross Versus Net Settlement

To illustrate the difference between gross and net settlement systems, consider the following six individual payments between institutions A, B, and C:

A	→	B	$400
A	→	C	$400
B	→	A	$300
B	→	C	$600
C	→	A	$500
C	→	B	$400

In gross settlement systems, each institution settles each payment individually (*Chart 1*). If we assume that the central bank does not grant intraday credit, each participant would either have to wait until it is paid, borrow funds in the interbank funds market, or hold assets in the form of central bank reserves to make payment. If each bank waited until it was paid, there is a possibility that

Chart 1
Gross Settlement

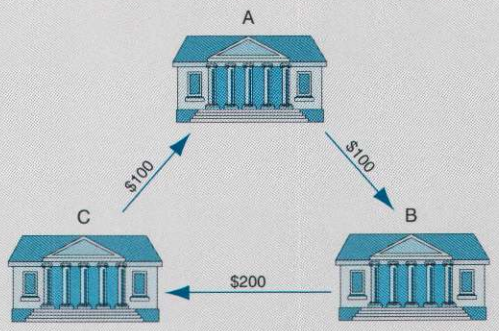


no one would send a payment, resulting in payment gridlock. Let us assume that institutions do not wait for incoming payments before sending an outgoing payment. In such a system, one cost of participation is the cost of holding or borrowing central bank reserves. For illustrative purposes, assume there is a 1 percent cost for holding or borrowing reserves. In this example, institution A uses $800, institution B uses $900, and institution C uses $900. The cost for A would be $8; for B, $9; and for C, $9.

Alternatively, these participants could bilaterally net payments during the day and settle at the end of the day. By bilaterally netting, an institution nets payments between itself and each of the other institutions, resulting in only one transaction with each of the other participants (*Chart 2*). In such a system, institution A only needs $100 of central bank reserves, reduced from $800; institution B only needs $200, reduced from $900; and institution C only needs $100, reduced from $900. The cost for A is $1, reduced from $8; for B, $2, reduced from $9; and for C, $1, reduced from $9.

Multilateral netting would further reduce holdings of central bank reserves by the institutions

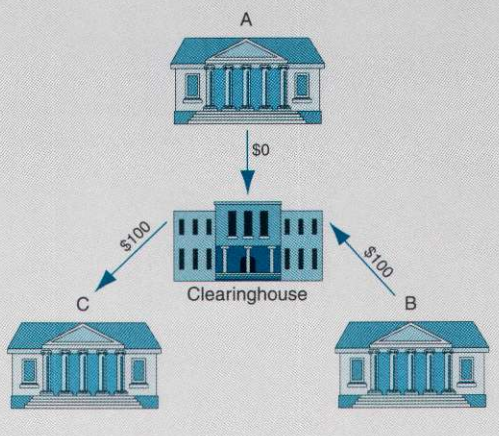
Chart 2
Bilateral Net Settlement



(*Chart 3*). In this case, institution A reduces its holdings of central bank reserves from $100 in the bilateral netting system to $0 in the multilateral netting system; institution B reduces its holdings of central bank reserves from $200 to $100; and institution C reduces its holdings of good funds from $100 to $0. The cost of holding reserves to A and C is zero and to B is $1. Multilateral settlement systems require the least amount of central bank reserves to settle and are also the least costly to participants.

However, settlement of payments is not final in net settlement systems. Settlement only becomes final at the end of the day when good funds are transferred. One way to increase the efficiency of the payments system and to ensure settlement at the time of payment is for the central bank to extend free intraday credit and guarantee payment. In such systems, participants enjoy the benefits of netting, since they settle at the end of the day and also benefit from immediacy of funds due to the guarantee. But by extending free intraday credit, central banks are exposed to settlement risk, and the guarantee distorts the payments system participant's credit assessments of other participants.

Chart 3
Multilateral Net Settlement



The Mexican payments system reforms

Before the proposed reforms in 1994, the Bank of Mexico operated the Sistema de Atención a Cuentahabientes de Banco de México (SIAC-BANXICO, or SIAC), which was Mexico's only electronic large-value interbank payments system.[13] SIAC was introduced in 1986, replacing the electronic system known as Sistema de Información Contable. Participants used SIAC to transfer Mexican pesos, U.S. dollars, and government securities. Each participant had three SIAC accounts: a peso account, a U.S. dollar account, and a securities account. The Bank of Mexico guaranteed every payment and granted free unlimited and unsecured daylight peso overdrafts to banks. However, the Bank of Mexico did charge penalty rates for overnight borrowing resulting from daylight overdraft positions.

As part of the reforms, the Bank of Mexico reorganized SIAC into three linked payments systems: a new SIAC, the Sistema de Pagos Electrónico de Uso Ampliado (SPEUA), and the Sistema de Información de Depósito de Valores (SIDV). SIAC, still operated by the Bank of Mexico, is now used primarily to settle positions from the other two systems. The Bank of Mexico replaced unlimited and unsecured overdrafts with 100 percent collateralized overdrafts. In addition, the Bank of Mexico placed limits on the size of the fully collateralized overdrafts based on bank size. SPEUA, also operated by the Bank of Mexico, is another electronic large-value funds transfer system. Unlike SIAC, SPEUA participants use uncollateralized intraday credit to make payment. However, participants face credit limits based on the credit lines they extend to one another. SIDV, operated by Instituto de Depósito de Valores (INDEVAL), a private firm, clears and settles government- and bank-issued securities and equities. Each of these systems is discussed in more detail below.

SIAC. Currently, SIAC participants hold only peso accounts at the Bank of Mexico, and payments are irrevocable. As mentioned above, most payments over SIAC must be collateralized or made with good funds, which limits the Bank of Mexico's exposure to unlimited and uncollateralized intraday credit. Most analysts agree that this policy has reduced the Bank of Mexico's risk because the value of unsecured intraday credit extended by the Bank of Mexico has decreased. SIAC's major function is to settle payments resulting from end-of-day positions from the other systems.[14] These types of SIAC payments are called nonrejectable payments. In addition, some individual payments continue to be processed over SIAC. Brokers, for example, send payments via SIAC since they are not allowed to participate in SPEUA directly.[15]

If a SIAC participant does not have adequate collateral for a payment and the payment is used to settle an end-of-day clearing obligation from another system, such as SPEUA, the Bank of Mexico will extend unsecured credit to the bank to allow the payment to be made. Although the Bank of Mexico thus extends unsecured credit, it charges penalty rates on such overdrafts and strongly encourages participants to avoid them. In addition to penalties for each unsecured overdraft, the Bank of Mexico imposes sanctions based on a participant's unsecured overdrafts during a given month. The Bank of Mexico may also increase collateral requirements for a participant that sends uncollateralized nonrejectable payments too often. Because the Bank of Mexico is willing to allow such payments, the receiving participant of a SPEUA payment bears no same-day liquidity risk. However, that participant does face credit risk based on its share of the loss-sharing arrangement should the sending participant be unable to meet its obligation after three days.[16]

After these changes were implemented in March 1995, SIAC participants learned to manage their SIAC accounts better and reduce their reliance on Bank of Mexico unsecured intraday and overnight credit. SIAC participants significantly reduced their reliance on Bank of Mexico unsecured credit after the first three months following the adoption of these policies. Of the penalties imposed for SIAC unsecured overdrafts in the first nine months after the adoption of these policies, 92 percent occurred in the first three months, whereas only 8 percent of the penalties occurred in the next six months.[17] Thus, early indications suggest that the Bank of Mexico has been successful in reducing the amount of uncollateralized credit it grants to SIAC participants.[18]

SPEUA. SPEUA was developed to increase intraday liquidity and to decrease the risk absorbed by the Bank of Mexico. Unlike SIAC, SPEUA participants are limited to banks. In SPEUA, the participants determine the levels of intraday credit through bilateral credit lines that they extend to each other. Further, each bank has an aggregate credit limit that is the sum of the bilateral credit limits. Like SIAC payments, SPEUA payments are irrevocable, except if payments are queued.

For example, if a sending bank exceeds its credit limit, payment messages are placed in a

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[13] For a description of the Mexican payments systems prior to 1994, see Sánchez-Arroyo (1996).

[14] In addition to SPEUA and SIDV end-of-day positions, SIAC also settles positions from the check clearinghouses.

[15] The Bank of Mexico does not regulate or supervise brokers.

[16] A bank that has defaulted on settlement has three days to meet its shortage of funds and faces penalties for the length of time it takes to settle. If the bank cannot settle at the end of three days, the loss-sharing arrangements are used. At this point, the banks that granted the defaulting bank credit share in the loss. This loss-sharing arrangement is described in the box entitled "SPEUA Loss-Sharing Arrangements." Failure to meet its overdraft within the three-day time frame is not sufficient for the Bank of Mexico to close the bank.

[17] Díaz (1996).

[18] A full assessment of the Bank of Mexico's success in reducing the level of intraday credit would require a comparison of the aggregate bilateral SPEUA credit granted as a percentage of the total value of payments to the aggregate overdrafts on SIAC as a percentage of total value of payments before the reforms.

SPEUA Loss-Sharing Arrangement

These loss-sharing arrangements are used after a bank has failed to settle its SPEUA obligations for three consecutive days. The additional settlement obligation (obligación adicional de liquidación—OAL) for institutions that grant credit to the defaulting institution is[1]

(B.1) $$OAL_{ij1} = C_{j1}\left[\frac{LER_{ij1}}{\sum_{k=1}^{n} LER_{kj1}}\right],$$

(B.2) $$OAL_{ij2} = C_{j2}\left[\frac{LER_{ij2} - OAL_{ij1}}{\sum_{k=1}^{n}(LER_{kj2} - OAL_{kj1})}\right],$$

(B.3) $$OAL_{ij3} = C_{j3}\left[\frac{LER_{ij3} - OAL_{ij2} - OAL_{ij1}}{\sum_{k=1}^{n}(LER_{kj3} - OAL_{kj2} - OAL_{kj1})}\right]$$

where:

OAL_{ijt} = The additional settlement obligation of participant i as a result of the default of participant j on day t. Equation B.1 calculates the additional settlement obligation for day 1, equation B.2 for day 2, and equation B.3 for day 3.

C_{jt} = The overdraft of defaulting bank j at day t. For days 2 and 3, C_{jt} measures the difference between the overdraft position on day t and the overdraft position from the preceding day, or day $t - 1$. If the difference is negative, the overdraft position for the preceding day will be recalculated.

LER_{ijt} = The amount of the credit line extended to participant j by participant i at day t.

LER_{kjt} = The amount of the credit line extended to participant j by participant k at day t.

i = The bank for which the additional settlement obligation is being calculated.

j = The overdraft bank.

k = All banks except overdraft bank j.

n = The total number of SPEUA participants.

In period 1, the additional settlement obligation of a participant is equal to the product of the participant's share of the total credit extended to the overdraft participant and the total amount of the overdraft.[2] In periods 2 and 3, the calculation of the additional settlement obligation is similar, except that it is based on any additional credit extended to the overdraft bank. The total additional settlement obligation of a participant is equal to the sum of the obligations in days 1 through 3. If there is a shortfall between the defaulting participant's overdraft and the sum of the additional settlement obligations of the remaining participants, the Bank of Mexico absorbs the loss.

[1] Bank of Mexico (1997). The description of loss-sharing arrangement did not appear in the original version but appeared as an update.

[2] Loss-sharing rules are often based on the credit line and not the actual credit extended. For example, CHIPS' loss-sharing arrangements are also based on credit lines extended (see New York Clearing House Association 1996).

queue. Payments that are queued can be canceled before they are sent. When the participant is again sufficiently below the credit limit, the queued payment message is sent if it has not previously been canceled. However, due to the high credit lines extended to participants, few payments are queued. In addition, participants usually stop sending payments when their credit limit is reached. The Bank of Mexico restricts them from reducing credit lines during the day.[19] At the end of the day, each bank must meet any debit positions and send payments via SIAC. As part of the reforms, the Bank of Mexico also established loss-sharing rules to distribute losses in the event of the failure of a SPEUA participant. (For a description of this arrangement, see the box entitled "SPEUA Loss-Sharing Arrangement.") According to these rules, SPEUA participants that grant intraday credit to a failed participant share in the loss based on a loss-sharing formula.[20] In addition, the Bank of Mexico plans to impose collateral requirements in the future.

In reforming its payments systems, the Bank of Mexico also wanted to move high-value payments away from checks to electronic form. Several studies have shown that electronic alternatives are significantly less costly to process and use than checks.[21] This savings increases the efficiency of a country's payments system. To provide an incentive to use SPEUA instead of checks, the Bank of Mexico changed the value

[19] The Bank of Mexico has considered allowing participants to decrease their credit lines during the day. However, such a change would further complicate the loss-sharing rules. The Bank of Mexico is considering the adoption of less complex loss-sharing arrangements in conjunction with the introduction of collateral requirements. If such changes are adopted, the Bank of Mexico may consider allowing participants to decrease their credit lines.

[20] The effectiveness of the loss-sharing provision is critically dependent on how the Bank of Mexico settles insolvent banks. If banks are not allowed to fail, or if interbank placements are not subject to loss even in the event of failure, SPEUA participants extending credit would discount the costs associated with the loss-sharing provision in their interbank lending decisions.

[21] See Robinson and Flatraaker (1995) and Humphrey and Berger (1990) for cost comparisons of electronic forms and checks or paper giros. Giro payments are credit transfers between the payor and the payee that may be used for recurring or nonrecurring payments. The payor instructs the Giro, an organizational structure that receives and makes payment, to debit his or her account and credit the payee's account. Giro payments are a dominant form of payment in many European countries. Giro payments can be either electronic or paper based.

date on checks to next day from same day in January 1996. The Bank of Mexico also reduced the minimum value for SPEUA transactions from 500,000 pesos to 150,000 pesos in December 1995.[22] The Bank of Mexico believes that these policies were responsible for the reduction of the average daily value of checks from 55 billion pesos in 1995 to 6 billion pesos in 1996.[23] Although the value of check transactions decreased significantly, the number of checks processed did not decrease significantly because the number of checks with values of 150,000 pesos and above was and continues to be fairly small. The average daily number of checks decreased from 782,000 in 1995 to 684,000 in 1996.

Most Mexican peso components of large-value foreign exchange transactions are settled via SPEUA. Most foreign exchange peso transactions are for U.S. dollars, and the dollar components of each transaction are settled primarily via New York-based CHIPS. In most cases, if a nondollar–peso foreign exchange transaction is requested by a client, the trader would first make a dollar trade and then trade dollars for the desired currency. Herstatt risk exists for peso–dollar transactions using SPEUA and CHIPS, since the settlement of the dollar and peso components of the transaction may not occur simultaneously, even though SPEUA and CHIPS operate roughly during the same time.[24] For large-bank–to–large-bank transactions, the peso and dollar transactions are not settled in any specific order. However, for transactions involving a small participant and a large bank, the large bank will often require the delivery of one currency before releasing the other.

SIDV. Operated by INDEVAL, SIDV is used to clear and settle bank and government securities, and equities.[25] SIDV participants are required to have two types of SIDV accounts—a funds account and a securities account. All SIDV transactions follow the Bank for International Settlements' Delivery Versus Payment (DVP) model 2.[26] In a DVP transaction, the underlying security and the payment for that security are exchanged at the same time, thereby reducing settlement risk.[27] In October 1994, DVP was implemented for bank securities transactions. In July 1996, the DVP process was extended to government securities, and in April 1997, the DVP process was extended to equities.

For a DVP SIDV settlement to occur, the buyer must have a positive balance in its SIDV funds account or have access to overdraft facilities, and the seller must have the security in its securities account. Once INDEVAL has confirmed the seller's possession of the security and that the buyer has adequate funds or overdraft facilities, the transaction cannot be reversed. If the seller does not have the underlying security or the buyer does not have the funds or sufficient overdraft facilities, the transaction is placed in a queue and settled when each party has the necessary funds and securities to settle. If the queued transaction involves government or bank securities, the trade can be canceled. However, if the transaction is an equity transaction, it cannot be canceled while in the queue because of stock exchange rules regarding trades.[28]

The buyer's overdraft facility is the lesser of the fully collateralized credit line or buyer's bank credit line. Collateral can be in the form of bank or government securities. When used for collateral, government securities receive a lesser discount than bank securities.

In addition to the collateralized credit lines, participants are granted credit lines that are a component of their overdraft facility from banks. Every morning, the Bank of Mexico extends credit lines to banks for the purpose of making SIDV payments. In turn, banks allocate these credit lines to SIDV participants. Although there is not a set policy for the amount of credit each bank is granted by the Bank of Mexico, in most cases banks receive credit lines of around 60 percent of their aggregate SPEUA credit line to allocate to SIDV participants. In addition to the collateralized and bank credit lines, buyers can transfer funds from SPEUA or SIAC to use for payment.[29] However, participants use the overdraft facility most of the time.

SIDV is linked to SPEUA and SIAC. These links enable participants to transfer funds in real time between these systems either directly, if they are banks, or through their correspondent bank. A participant, for example, can sell a security using SIDV and transfer the funds to SIAC and then use the funds to offset some other obligation, all within minutes.

The Group of Thirty in 1989 made recommendations for the clearance and settlement of securities.[30] (See the box entitled "Group of Thirty Recommendations for Securities Clearing and Settlement" for a complete list.) These recommendations have been accepted as a standard that securities markets around the world should strive to meet, and, in 1992, the Group of Thirty produced status reports on various countries, including Mexico. At that time, Mexico did not satisfy two of the recommendations. First, Mexico did not satisfy recom-

[22] In May 1996, the Bank of Mexico further reduced the minimum value per transaction to 100,000 pesos. However, there was no significant change in the value or volume of check payments.

[23] The figures for check value and volume are from Díaz (1996) and correspondence with Bank of Mexico staff.

[24] Named after the German bank that was closed in 1974 before it could make payment on its dollar obligations, Herstatt risk is the risk in a foreign exchange transaction that one party delivers one currency but the counterparty does not deliver the other. In the case of Herstatt, the time zone difference between Germany and New York was largely to blame for the dollar defaults. Although this type of settlement risk is named Herstatt risk, it is not necessarily eliminated if there is little or no time zone difference between the currencies being settled. The difference in settlement times of the two underlying currencies in a foreign exchange transaction leads to Herstatt risk. For a discussion of foreign exchange settlement risk, see Chakravorti (1995) and Bank for International Settlements (1996).

[25] For a general overview of clearance and settlement of securities in emerging markets, see Stehm (1996).

[26] Based on a survey of various DVP systems, the Bank for International Settlements (1992) categorized DVP systems into three models. Model 2 DVP systems settle the securities part of the transaction on a gross basis during the day and settle the funds side on a net basis at the end of the day. Model 1 DVP systems settle both the securities and funds side on a gross basis. Although model 1 systems have less settlement risk than model 2 systems, such systems require greater amounts of good funds to settle and as a result are more expensive for participants to use. Model 3 DVP systems settle both the securities and funds side on a net basis.

[27] The adoption of delivery-versus-payment arrangements does not eliminate payments system risk completely. There could still be a failure to settle the payment. In non-DVP transactions, there is the potential for one party to never deliver its asset after receiving the counterparty's asset.

[28] Most stock transactions occur on the stock exchange because of tax benefits associated with exchange traded stocks.

[29] For SIAC transfers, nonbank participants may transfer funds themselves if they are SIAC participants. However, for SPEUA transfers, nonbank SIDV participants must have correspondent relationships with a SPEUA participant.

mendation 5, which states that each country should use DVP to settle all securities transactions. Today, all transactions cleared and settled by INDEVAL use DVP.

Second, Mexico did not meet recommendation 9, which states that each country should adopt the international message standard developed by the International Organisation for Standardisation (ISO Standard 7775). Use of one standard for numbering and identifying securities facilitates greater ease in cross-border transactions. In 1993, INDEVAL implemented the International Securities Identification Number (ISIN) code.[31]

Some market participants are concerned about the funds-netting component of SIDV's DVP system, especially if participants are allowed in the future to sell securities short or act as market makers. They fear that the risk of open positions taken by participants may affect end-of-day settlement. In a netting system, the default of one participant may affect others, even if they did not deal directly with the defaulting participant. However, other participants argue that, by allowing participants to make the market or sell short, the liquidity of these markets should improve. Greater liquidity in the market should enable participants to have greater ease in buying and selling securities, thereby reducing the settlement risk associated with open positions in general.

Remaining challenges

As part of its payments system reforms, the Bank of Mexico attempted to implement a market-based allocation of intraday credit. By eliminating unsecured daylight overdrafts on SIAC and simultaneously developing SPEUA, the Bank of Mexico attempted to shift most of the credit risk associated with the extension of intraday credit from itself to payments system participants. Furthermore, by implementing explicit loss-sharing rules for SPEUA settlement failures, the Bank of Mexico attempted to increase market discipline by imposing losses on creditors.

However, concerned about maintaining adequate liquidity to avoid payment gridlock and keeping the cost to participants relatively low, the Bank of Mexico has implemented policies that may have the unintended effect of distorting the market-based allocation of intraday credit. For example, the Bank of Mexico's restriction on participants' decreasing their credit lines during the day may also increase the availability of interbank funds to troubled participants, which, in turn, could increase the risk of financial loss from a settlement default. In addition, the previously mentioned practice of granting immediacy of payment for SIAC transactions used to meet end-of-day settlement may distort the credit assessments made among interbank participants.

Banks evaluate their daily credit line extensions knowing that the Bank of Mexico will make payment at the end of the day. As long as the Bank of Mexico allows nonrejectable payments to exist on SIAC, market-based risk assessments may be distorted by the guaranteed end-of-day extension of liquidity by the central bank. Although the SPEUA loss-sharing rules can allocate losses to SPEUA creditors, even if the defaulting bank is not

Group of Thirty Recommendations for Securities Clearing and Settlement

The recommendations made by the Group of Thirty (1989) are:

Recommendation 1: Trade Comparison
By 1990, all comparisons of trades between direct market participants (that is, brokers, broker/dealers, and other exchange members) should be accomplished by T + 1.

Recommendation 2: Trade Affirmation
Indirect market participants (such as institutional investors, or any trading counterparties which are not broker/dealers) should, by 1992, be members of a trade comparison system which achieves positive affirmation of trade details.

Recommendation 3: Central Securities Depository
Each country should have an effective and fully developed central securities depository, organized and managed to encourage the broadest possible industry participation (directly and indirectly), in place by 1992.

Recommendation 4: Trade Netting System
Each country should study its market volumes and participation to determine whether a trade netting system would be beneficial in terms of reducing risk and promoting efficiency. If a netting system would be appropriate, it should be implemented by 1992.

Recommendation 5: Delivery Versus Payment
Delivery versus payment (DVP) should be employed as the method for settling all securities transactions. A DVP system should be in place by 1992.

Recommendation 6: Same Day Funds
Payments associated with the settlement of securities transactions and the servicing of securities portfolios should be made consistent across all instruments and markets by adopting the "same day" funds convention.

Recommendation 7: T + 3 Settlement
A "Rolling Settlement" system should be adopted by all markets. Final settlement should occur on T + 3 by 1992. As an interim target, final settlement should occur on T + 5 by 1990 at the latest, except where it hinders the achievement of T + 3 by 1992.

Recommendation 8: Securities Lending
Securities lending and borrowing should be encouraged as a method of expediting the settlement of securities transactions. Existing regulatory and taxation barriers that inhibit the practice of lending securities should be removed by 1990.

Recommendation 9: Common Message Standard
Each country should adopt the standard for securities messages developed by the International Organisation for Standardisation [ISO Standard 7775]. In particular, countries should adopt the ISIN [International Securities Identification Number] numbering system for securities issues as defined in the ISO Standard 6166, at least for cross-border transactions. These standards should be universally applied by 1992.

[30] The Group of Thirty, established in 1978, is a private-sector nonprofit organization concerned with the working of international financial markets. In 1989, the Group of Thirty published its recommendations to reduce risk and improve efficiency of securities markets around the world.

[31] S. D. INDEVAL (1995).

declared failed, other considerations might make the Bank of Mexico reluctant to impose these loss-sharing rules as a first step. To the extent that banks feel that the Bank of Mexico will deal with insolvent banks without creditors absorbing losses, its efforts to induce participants to monitor risk and allocate their exposures based on the establishment of interbank SPEUA credit lines with loss-sharing provisions will not impose the degree of market discipline that would exist if market participants anticipated the potential for interbank losses.

In this regard, the Bank of Mexico has revised its policies governing the liquidation of failed banks, with the purpose of promoting market discipline. In 1995, the Bank of Mexico established—through an amendment to Fondo Bancario de Protección al Ahorro (FOBAPROA)[32]—explicit rules identifying categories of bank liabilities that it will not guarantee. The 1995 FOBAPROA amendment states that

> FOBAPROA shall guarantee all liabilities contracted by participating financial institutions, as long as said liabilities stem from their normal business operations, excluding:
>
> 1) subordinated debentures they might issue,
> 2) liabilities resulting from illicit or anomalous acts or acts of bad faith, and
> 3) liabilities stemming from credit contracted between banks in order to guarantee liabilities payable in favor of the Bank of Mexico, provided the said banks participate in the fund transfer systems administered by the central bank.[33]

Exception three of this amendment specifically addresses SPEUA credit lines. However, this amendment applies only when the bank is in the process of being liquidated. To date, none of these exclusions has been imposed.

Conclusion

The 1994 large-value payments system reforms implemented by the Bank of Mexico, including the introduction of parallel intraday large-value payments systems for funds and securities, have reduced payments system risk while keeping transaction costs relatively low. By eliminating free and unsecured daylight overdrafts, the Bank of Mexico has reduced its credit risk associated with direct intraday lending. In addition, with the implementation of DVP for all securities transactions and 100 percent collateral requirements for the funds component of securities transactions, credit risk in securities transactions has been significantly reduced. However, to maintain adequate liquidity at a relatively low cost for participants, the Bank of Mexico established the large-value interbank funds payments system, SPEUA, and the securities clearing and settlement system, SIDV. Participants do not use good funds to settle each SPEUA or SIDV transaction but must settle their net positions at the end of the day. In addition, the Bank of Mexico extends unsecured credit to allow banks lacking reserves to settle over SIAC their end-of-day clearing balances from the other systems, although the Bank of Mexico strongly discourages banks from relying on such credit.

Payments system reforms are still being implemented, and further changes may be necessary for the Bank of Mexico to meet its stated objectives. Market participants seem generally pleased with the payments system reforms implemented to date. However, the Bank of Mexico may find that some of the policies designed to increase liquidity in the payments system, such as the inability of SPEUA participants to decrease their credit lines during the day and the guarantee of payment for nonrejectable SIAC payments, unintentionally work against the goal of promoting market-based intraday credit decisions. The need for some of these policies in Mexico may diminish over time with renewed strength in the banking system and a continued deepening of financial markets.

Finally, the SPEUA loss-sharing rules designed to help promote market discipline in the payments system will not be fully effective if participants feel that the Bank of Mexico will resolve insolvent banks without imposing losses. However, this struggle to offset the possibility that government guarantees may weaken market discipline in the payments system is not unique to Mexico; it is, in fact, common to developing countries in general and even to developed countries. As with the other major financial reforms initiated since the late 1980s, Mexico's recent efforts to enhance the role of market-based decisions in the payments system represent a significant step in the right direction.

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