REGRESSION EVIDENCE OF SAFETY-NET SUPPORT
IN CANADA AND THE U.S., 1893-1992*

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Abstract
Using annual deviations between the stock-market and accounting valuations of major banks, this paper constructs synthetic century-long time series for the intangible safety-net capital generated by reporting and supervisory policies in Canada and the U.S. The credibility of the modeling exercise that produces these synthetic time series is supported by evidence that, in each country, all sustained surges in the value of estimated safety-net capital correlate in appropriate ways with regulatory events and crisis pressures. We invite others to test the qualitative usefulness of our framework by applying the method to data from other countries.

Modern contracting theory stresses the importance of resolving incentive conflicts created by asymmetric information (e.g., Hart and Moore, 1999). For bank creditors, every contracting solution has two dimensions: a capacity to sense adverse bank behavior (transparency) and a capacity to influence bank incentives (deterrent rights). In banking, governments have traditionally regulated the transparency of reporting protocols and assigned rights to counterparties and supervisors sufficient to modify bank risk-taking incentives.

Depositors and government authorities typically intertwine transparency and incentive protocols. Both across countries and across time, disclosure requirements interact with the strength and credibility of bailout commitments, the closure pressure and deterrent rights authorities and depositors can and do bring to bear, and contractual rules for reporting and assigning losses experienced by insolvent banks.

This paper analyzes a century of annual deviations between the market value and book value of major Canadian and U.S. banks. These deviations help to measure variation in the transparency of the reporting protocols that these countries used as they passed through various stages of financial and economic evolution. The innovation in this paper is to show that we can estimate from these data the wealth transfers bank shareholders

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received in years when stockholder-contributed capital could not adequately support bank liabilities.

Financial safety nets comprise three related area of policy: procedures for enhancing a troubled institution’s liquidity, procedures for delaying the recognition and resolution of on-balance-sheet insolvencies, and procedures for bringing additional parties into the loss-absorption process. Our analysis begins by assembling and testing regression estimates of the value that the stock market attached to booked and unbooked (i.e., “off balance sheet”) sources of individual-bank capital and goes on to separate estimates of safety-net support from other sources of off-balance-sheet capital. Our methods show that, even in the absence of formal government guarantees, country safety nets sometimes enhanced substantially the value of each country’s major banks. This occurred even though stockholders in Canadian and U.S. commercial banks were subject to supplemental personal liability for bank losses until a phaseout of this obligation began in the mid-1930s. (Friedman and Schwartz, 1963; Holladay, 1938; Klebaner, 1990). In the U.S., the effective phaseout period lasted only two years. In Canada, it extended until 1950. We conjecture that, for closely held banks in developing countries today, contractual and regulatory solutions to risk-shifting problems that combine extended liability for stockholders with other safety-net policies might offer better protection to taxpayers than government deposit insurance.

In Section 1, we develop a model that extracts measures of nontransparency and safety-net support from data on the stock-market performance of individual banks. Section 2 focuses on the extent and character of the nontransparency observed in each country. Sections 3, 4, and 5 develop, test, and interpret year-by-year evidence of the value that sample banks derived from implicit and explicit outside support. Section 6 summarizes our findings and sketches an agenda for future research.

1. **Statistical Modelling**

The opportunity for bankers to shift uncompensated risks onto unwary counterparties is an intangible real option. This option's prospective benefits vary with the fatness of the lefthand tail of a bank’s return distribution. A fat tail indicates that the probability of a deep insolvency is small, but non-negligible.

The value of risk-shifting options is impounded at any time into the aggregate market value (MV) of a bank’s stock (Buser, Chen, and Kane, 1981). In years when rules for liquidating banks imposed double liability on bank stockholders, delays in recognizing
and resolving insolvencies encouraged wealthy and better-informed stockholders to sell stock to parties for whom the double-liability obligation would be more difficult to enforce. Opportunities to exploit such delays increase with the dispersion of bank ownership (Kane and Wilson, 1998). We term the portion of a bank’s MV that derives from existing shareholders’ opportunities to shift losses onto government and industry rescue programs and to weasel out of stockholder obligations to creditors under double liability as “safety-net capital” ($S_N$).

Taking account of differences in market structure, the value of outside contributions to safety-net capital ought generally be greater in the U.S. when many banks fall into distress at the same time and in Canada whenever one or more of its largest banks do. We envision safety-net capital as generated by too-many-to-fail (TMTF) policy pressures in the early years of our samples and by too-big-too-fail-and-unwind (TBTFU) policy strategies throughout.

To test these contentions, models of stock-market value (“market capitalization”) are estimated for the five largest banks in Canada and for the ten largest banks in the U.S. While sample coverage varies somewhat from year to year, the banks sampled usually include the 11 money-center institutions listed in Table 1. Then, intercepts, slopes and residuals of three-year rolling-regression market-capitalization models are inserted into a nonlinear model designed to separate intangible safety-net capital from stockholder-contributed capital at individual banks.

Our regressions combine two models into a single reduced-form equation:

1. Kane and Unal’s (1990) statistical market-value accounting model (SMVAM), which assumes that stock markets are efficient enough to provide unbiased estimates of the changing opportunity-cost value of a bank’s on-balance-sheet net worth ($BV$) and off-balance-sheet intangible net worth ($U$) over time;


Figure 1 summarizes the input data and Figures 2 and 3 present the end-results of the exercise. For each of the years 1893-1992, Figure 1 plots the mean ratio ($m$) of market capitalization (MV) to $BV$ at major banks in each country. The Figure shows a positive mean amount of “hidden capital” in major U.S. banks until the recession of 1937-38, although individual institutions showed negative amounts in 1893-95, 1906-1917, and
1928-1954. Subsequently, the mean ratio proved negative during most of 1937-1950 and again from 1977-1988. In Canada, the mean value of hidden capital was negative during 1915-1923, 1931-1945, and much of the 1980s. The Figure also shows that market-to-book ratios followed similar cycles in both countries. Although large differences in volatility are observed prior to WWII, volatility differences are milder thereafter.

Given the existence of positive intangible “franchise” values, negative hidden capital indicates the existence of substantial off-balance-sheet obligations and/or unbooked losses. Because several Canadian banks remained thinly capitalized until after WWII, the negativity is consistent with likely fluctuations in the size of the off-balance-sheet put option on stockholders’ personal assets that double-liability bank stock conveyed to creditors before it was eliminated.

Figures 2 and 3 plot year by year at large Canadian and U.S. banks, respectively: (a) the minimum market-to-book ratio found and (b) our estimates of the ratio of aggregate safety net support ($S_N$) to the aggregate market capitalization (MV). Consistent with the assumption that bank returns have fat tails, in most years mean $S_N$ is negligible; but in some eras its value surges. In most cases, these are eras in which the weakest bank’s market-to-book ratio is below one or in the process of moving toward that condition. In section 5, we argue that sustained surges in the importance of $S_N$ correlate with regulatory events and crisis pressures observed within or across countries. These measurements provide a foundation for inferring whether and how capitalized costs of mitigating stockholder losses in banking crises responded to variation in economic, financial and regulatory environments.

a. The Linear SMVAM

The Kane-Unal model undertakes a statistical market-value accounting of a bank’s on-balance-sheet and off-balance-sheet sources of value:

\[ MV_{it} = U_t + k_t BV_{it} + e_{it}, \quad 1 \]

**Definitions**

- $MV_{it} = $ Bank i’s market capitalization at time t (i.e., its stock price times the number of shares outstanding)
- $BV_{it} = $ Bank i’s “bookable” net worth under accounting principles applicable at time t
- $U_t = $ Net value of unbookable intangible assets and liabilities at time t

\[ \text{The full model contains equations explaining how parameters } k_t \text{ and } U_t \text{ change over full time.} \]
k_t = Ratio of the market value to the book value of components of bookable net worth at time t

\( e_\beta \) = a well-behaved error term.

As specified in (1), the SMVAM embodies the testable restriction that the slope coefficients applicable to tangible assets (A_{it}) and tangible liabilities (L_{it}) be equal and opposite in sign. This restriction simplifies the model, but is not necessary for identification. The restriction that identifies U_t and k_t is that each is the same for all banks whose observations are pooled in any given time interval. This restriction presupposes that banks are pooled into homogenous subsamples before the equation is fitted. This restriction too is testable. In principle, pooling may be tested across subsets of individual banks in any year as well as across longer periods of time.

b. Modelling the Value of Safety-Net Capital

The market value of safety-net support to bank stockholders (S_N) is an intangible asset imbedded along with the net value of other intangible assets and liabilities (U-S_N) in a bank’s market capitalization. By definition, stockholder-contributed net worth (NV) is the difference: MV - S_N.

Demirgüç-Kunt (1990) gives intuitive content to safety-net support by conceiving of S_N as a credit enhancement whose incremental contribution to the market value of a financial institution’s NV becomes important only when NV deteriorates (cf. Calomiris, 1997; Hovakimian and Kane, 2000). At high levels of NV, the value of the credit enhancement is negligible. As NV falls toward and through zero, S_N increases at an increasing rate. Eventually, as NV becomes more and more negative, the rate of increase slows, and the slope flattens out at unity. Demirgüç-Kunt flexibly approximates the nonlinear relationship between MV and NV as the hyperbolic function (2):

\[
MV = 0.5NV + \sqrt{0.25NV^2 + c^2}.
\]  

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This approximation exhibits the qualitative behavior specified in Demirgüç-Kunt’s intuition. Its usefulness is that it provides a way to separate safety-net capital from a bank’s other sources of intangible value. Equation (2) implies that:

\[
(S_N)_{it} = MV_{it} - NV_{it} = -0.5NV_{it} + \sqrt{0.25NV_{it}^2 + c_{it}^2}.
\]  

This value is always non-negative. As NV moves toward higher values or parameter c approaches zero, the square root term approaches 0.5NV and S_N vanishes. As NV moves toward lower values, the square root term continues to increase, but at a decreasing rate, until it flattens out at unity.
becomes more and more negative, $S_N$ approaches the positive value $-NV$, but exceeds it by an amount related to $|c|$.

c. **The Nonlinear SMVAM**

By imbedding (2) in (1), Demirgüç-Kunt devised the following nonlinear SMVAM:

$$MV_{i,t} = c_t + b_t(BV_{i,t} - a_t) + d_t + e_{i,t},$$  \hspace{1cm} (3)

where $U_t = c_t - b_t a_t$ and $d_t$ measures the contribution of the nonlinear factor the Kane-Unal SMVAM omits. Equation (3) reduces to (1) (with $k_t = b_t$) if $a_t$ and $d_t$ both equal zero.

Suppressing bank subscripts, the $d_t$ term takes the form:

$$d_t = \sqrt{0.25b_t^2(BV_t - a_t)^2 + c_t^2} - \left[c_t + 0.5b_t(BV_t - a_t)\right]$$  \hspace{1cm} (4)

To estimate equations (1) or (3) and test the significance of parameter estimates, it is necessary to impose identifying restrictions that hold the coefficients constant either across particular intervals of time (“eras”) or across subsets of similarly operating individual banks. We assume that investors in very large banks use one and the same valuation model and investigate whether and how model parameters vary over time. To do this, we blend historical and institutional analysis into a type of switching-regression test.

Policy inferences focus on how parameter values evolve within and across countries. Because $d_t$ approaches zero when $c_t$ does, finding a statistically significant value for $c_t$ is a sufficient condition for $d_t$ and surges in $S_N$ to attain significance. Figure 4 shows that, in Canada, throughout the pre-WWII era, surges in $S_N$ are associated with values of $c_t$ that are significant at 5 percent.\(^2\) In the U.S., Figure 5 indicates that $c_t$ proves significant during the prewar surges in $S_N$ and also in 1970s, but fails to attain significance during the 1950s spike. Because the joint effects on $S_N$ of individually insignificant values of $a_t$ and $d_t$ may be significant, the surges in which $d_t$ is insignificant may still have generated significant safety-net support. After estimating the value of safety-net benefits in each country in Section 3, we endeavor in Sections 4 and 5 to link estimated surges in $S_N$ to specific regulatory policies and to the frequency and severity of banking crises.

2. **Evidence of Nontransparency in Bank Accounting Reports**

Data sources used in estimating various versions of the SMVAM are described in Table 2. For any partition of banks or years, the SMVAM is a regression model that sizes
the intangible capital inherent in stock-market value (MV). The stock market decodes three conceptually distinct types of hidden capital. These nontransparencies are described by SMVAM intercepts, slopes, and residuals. Taken together, the residual and intercept measure “unbooked idiosyncratic value” (UIV) that stock markets assign to a bank’s tangible and intangible assets and liabilities. The intercept represents the mean amount of intangible value expected to be found at individual members of the particular subsample analyzed, while the sum of squared residuals (or 1-$R^2$) summarizes the variability of idiosyncratic values across that subsample. Finally, the extent to which the slope exceeds or falls below unity (i.e., the value k-1) expresses the stock market’s estimate of the average extent to which the opportunity-cost value of individual positions booked at subsample banks have been misstated in calculating accounting net worth.

Heteroskedasticity typically arises when model (1) is fitted to samples of banks whose members differ greatly in asset size. One way to guard against this is to deflate equation (1) by $BV_it$ to produce:

$$\frac{MV_{it}}{BV_{it}} = U_i\left(\frac{1}{BV_{it}}\right) + k_i + \frac{e_{it}}{BV_{it}}. \quad (1')$$

Estimating the deflated form (1’) has the ancillary advantage of making it easier to allocate percentage changes in the market-to-book ratio ($m$) across the three categories of nontransparency.³

By defining the deflated residual in (1’) as $e_{it}^m$, we may write the regression equation more compactly as:

$$m_{it} = U_i\left(\frac{1}{BV_{it}}\right) + k_i + e_{it}^m. \quad (1'')$$

Our first line of analysis is to estimate model (1’’) separately for samples of banks in each country in each year and to investigate whether the evidence supports the perfect-transparency hypothesis: that on average stock-market participants could safely accept accounting reports at face value. If further analysis could not improve upon the disclosures conveyed by accounting net worth, $MV_{it}$ would collapse to $BV_{it} + e_{it}$. Perfect accounting transparency implies not only that:

$$m_{it} = 1 + e_{it}^m, \quad (5)$$

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² The significance of the late 1960s surge in $S_N$ is also supported by event-study evidence on the progress of deposit-insurance legislation compiled by Wagster (2001).

³ The intercept (slope) of the deflated model corresponds to the slope (intercept) of the undeflated model.
but also that the confidence interval around 1 be fairly tight. To test whether the deflated SMVAM (1’’) reduces to (5), it is convenient to subtract 1 from both sides of (1’’):

\[ m_{it} - 1 = U_i \left( \frac{1}{BV_{it}} \right) + (k - 1) + e_{it}^m = \alpha_i \left( \frac{1}{BV_{it}} \right) + \beta_t + e_{it}^m. \]  

(6)

To the extent that \( \alpha_t = U_i \) and \( \beta_t = (k - 1) \) differ significantly from zero or \( \sigma(e_{it}^m) \) and (1-R²) are large, accounting reports on bank net worth in period \( t \) lack transparency.

To study the sources of hidden capital more closely, we estimate and test models (1’’) and (6) for the largest banks operating in each country in each year. In the U.S., we separate out the ten largest banks for which we have stock prices in each year; in the more concentrated market of Canada, we segregate the five largest institutions. Resulting estimates of \( U_i \) and \( k_t \) and corresponding t-values are plotted in Figures 6 and 7. The R²'s of the regressions for each country are graphed in Figure 8.

**Behavior of Estimates of \( U_i \) and \( k_t \)**

In most years, market and supervisory discipline failed to produce a high degree of transparency at either country’s megabanks. On average, positive or negative hidden capital existed in the balance-sheet reports filed by large Canadian banks at least until World War II. For U.S. institutions, the value of net off-balance-sheet assets is negative about 90 percent of the time indicating that the unbooked value of credit enhancements and obligations to fund customer and respondent-bank credit lines often exceeded what the corporate-finance literature calls “growth opportunities.”

For **Canadian megabanks**, the mark-to-market parameter \( k \) usually lies above unity throughout the sample period. With 3 degrees of freedom, the critical value for the t-statistic is 3.182. The departure from unity is significant more than one third of the time. Only about half as many intercepts differ significantly from zero. Still, consistent with the long 1936-50 phaseout of stockholders' personal liability for cumulated losses, intercepts are typically negative until the pressure for federal deposit insurance strengthened in the mid-1960s. Afterwards, the sign fluctuates. Finally, year-to-year volatility in both \( k_t \) and \( U_i \) increases once explicit deposit insurance is formally adopted in 1967.

At **American megabanks**, \( k_t \) hovers above unity (often significantly so) only until the 1930s. After deposit insurance is introduced, \( k_t \) swings above and below unity in a series of long cycles. Although few of the dips in \( k_t \) below unity are significant, during
much of the interval between about 1955 and 1975, $k_t$ lies significantly above unity. The intercept $U_t$ is usually negative, but it is significant in only about 11 years.

Despite the small sample sizes, many $\alpha_t$ and $\beta_t$ prove statistically significant, confirming that gaps in transparency frequently exist. The $R^2$s of the annual regressions indicate that the SMVAM better explains the variation in market caps for Canadian banks than for the less-homogeneous samples of U.S. banks. In both countries, the model’s explanatory performance varies greatly over time.

3. Sporadic Surges in the Extent of Nonlinearity in Bank Valuation

Both to increase degrees of freedom and to stabilize the $R^2$s, in this section the nonlinear model is estimated as a three-year rolling regression.\(^4\)

As before, prior to estimating the equations, we deflate both sides of (3) by the value of $BV_{it}$. For each country, Figures 4 and 5 graph the location of 95-percent confidence intervals for parameter $c$ of the nonlinear SMVAM.\(^5\) The statistical significance of this parameter is a sufficient condition for the statistical significance of implicit safety-net support for bank debt featured in Figures 2 and 3. In each country, the value of $c$ is statistically significant whenever a plotted confidence interval fails to intersect the horizontal axis. In Canada, for example, $c$ is frequently nonzero and often significant prior to 1935, but infrequently so thereafter. Interestingly, $c$ is often nonzero in the era immediately before and after the introduction of deposit insurance in 1967.

For U.S. banks, nonzero $c$ values are more concentrated in time, but only occasionally significant. Significant values for $c$ emerge only in the 1890s, mid-1920s and 1969-72. Significant safety-net support was triggered first by the widespread suspension of convertibility of deposits into currency observed in the banking crisis of 1893 and included the clearinghouse support enjoyed by surviving New York City banks. The second spike occurred during the 1926-27 recession. Kane and Wilson (1998) argue that this recession prompted authorities to soften double liability by expanding opportunities for national banks to split their stocks.

In Canada, claims to double liability on deposits were subordinated to claims by the government and by holders of banknotes. We contend that the more frequent

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\(^4\) Although year-to-year fluctuations are smoothed slightly, in the rolling regressions, SMVAM parameter estimates follow the same qualitative patterns that is observed in Figures 6 and 7.

\(^5\) In these graphs, a few intervals are truncated at 1,000 percent. This occurs because the confidence interval increases without limit as the $c$ parameter approaches zero.
appearance of safety-net capital in Canada than in the U.S. prior to 1927 reflects the greater effectiveness of the disincentive to risk shifting that owing unsubordinated double liability on deposits imposed on stockholders of what at the time were closely held U.S. banks. In 1927, restraints on stockholder dispersion were relaxed for national banks, leading to the failure for this system of monitoring and controlling bank loss exposures and its prompt replacement by explicit government deposit insurance during the Great Depression. In Canada, double liability was phased out over 16 years. Deposit insurance was not adopted until much later.

4. Sources of Secular Change in Bank-Customer Contracting Environments

Canada and the U.S. share common cultural and legal origins and substantial trade and financial linkages. Still, their domestic financial and economic environments differ in notable ways: in economic geography, in regulatory architecture, in patterns of interbank competition, and in governmental organization. Although not experimentally controlled, measurable differences within and across countries may be interpreted as treatments applied to “experimental” and “control” groups. In particular, linking parameter variation with changes in the regulatory regime provides a way to "mine" our regressions for evidence about how variations in a country’s competitive and regulatory structure influence bank risk and return.

Historically, the U.S and Canadian banking-policy environments differed in two important ways. First, the U.S. had many more banks and established a strong central bank and federal deposit insurance several decades earlier than Canada did. Also, the Canadian and U.S. banking and regulatory environments divided regulatory jurisdiction between national and subnational (state or provincial) governments in different ways. In particular, restrictions on the geographic location of banking offices were an important dimension of banking regulation in the U.S., but not in Canada.

A country’s evolving bank-customer contracting environment has three principal dimensions: (1) the quality of the information that the counterparties exchange (informational transparency, T); (2) the strength of the deterrent rights counterparties can exercise to protect their stake in individual banking deals (deterrency, D); and (3) the extent to which regulatory arrangements do or do not effectively compensate for weaknesses in T and D.
At the start of our sample century, both countries tried to mitigate information asymmetries facing bank depositors in the same two-tiered way. Governments regulated transparency by requiring banks to publish regular financial statements under penalties for fraud and negligent misrepresentation. To deter risk shifting, bank shareholders were incented to monitor managers by requiring them, if liquidation proceeds could not cover creditor claims in the event of a failure, to supplement the on-balance-sheet capital of the bank from their personal resources. The effectiveness of extended liability as a deterrent is bound to vary across countries and time periods with depositor confidence, operative closure strategies, and the dispersion of bank ownership (Evans and Quigley, 1995; Kane and Wilson, 1998; Wagster, 2001).

Over time, declining costs of communications and transportation improved information flows and gradually turned local banking markets into appendages of regional, national, and global trading and pricing venues. However, the speed and safety-net costs of banking market consolidation varied greatly between countries. During the period we study, authorities in the U.S. restricted office locations. They did so for much the same reason that today authorities in many developing countries restrict international capital movements and limit entry by foreign banks: to mitigate the squeeze that technological trends would otherwise put on the profits of local banking institutions.

In the early years of our sample, no national government had yet explicitly obligated itself to reimburse depositors for losses suffered in bank failures. Bank closures and even banking panics were not uncommon. During the interval from 1893 to 1929, the number of banks fell steadily in Canada. In the U.S., the number expanded until 1920 and then fell sharply; but after World War I, deviations from a common downward trend were negligible.

During the pre-Depression interval, the number of banks in each country in any year \( t (n_{b,t}) \) can be predicted almost exactly \( (R^2 = .997) \) from a double-log linear equation, whose regressors are the natural logs of the four-digit year \( (\ln t) \) and of the number of banks existing in that country in the previous year \( (\ln n_{b,t-1}) \). Regression experiments uncover no significant cross-country differences in intercepts or slopes.

Given this strong trend in bank exits, depositors had reason to monitor their banks and government and industry in each country faced incentives to generate a de facto safety net. The limits of a country’s net are inevitably ad hoc and evolutionary in nature.

Consistent with the Demirgüç-Kunt model, the breadth of the de facto net and the strength
of its putative government backing become observable only during crises when interbank
and political pressure for government support emerges and sets historical precedents.
Over time, successive precedents have tended to reinforce the perception that in future
crises governments and ad hoc industry cross-guarantee schemes will protect major banks
(Pozdena and Hotti, 1985). In the aftermath of notable crises, very large banks became
larger and authorities reshaped the net, usually by strengthening chartering or information-
reporting requirements and by redefining or reinforcing individual banks’ contractual
rights and duties.

Salient information about banks may be defined as knowledge or news about
individual-borrower prospects and broad market forces that would enable us to calculate
accurately the opportunity-cost value of their tangible and intangible assets. The discipline
a bank experiences depends simultaneously on the vision and deterrent rights that its
counterparties and supervisors possess and on these parties’ incentives to exercise their
particular rights promptly. Banks are known to engage in “window-dressing” and
government examiners usually treat adverse examination data as confidential. In the short
run, when banks are weak, authorities often endeavor to put a favorable “spin” on
whatever unpleasant facts that manage to leak out. Still, secular pressure for improved
disclosure to mitigate bank risk-shifting comes from the market and regulatory sectors.

Economic analysis presumes that the desire to preserve one’s wealth would lead
every well-informed counterparty to use its deterrent rights efficiently to protect its stake
in any bank. In principle, a properly incentivized third-party regulator could lower the
costs of monitoring and policing bank risks by eliminating duplication in the tasks of
extracting and analyzing relevant bank and borrower data and by better calibrating actions
intended to curtail bank risk-shifting. However, the extent (R) to which regulation
actually compensates for weaknesses in the bank-customer contracting environment is
reduced when the contractual incentives under which regulatory officials operate are
conflicted by personal and bureaucratic temptations to favor banking interests. Patterns of
regulation that decrease the probability a bank will be liquidated typically lessen private
counterparties’ incentives both to invest time and energy in monitoring and to respond
promptly to evidence of risk-shifting. Because the negative feedback that regulatory
discipline exerts on market discipline offsets some of the benefits that society derives from
enhanced supervisory effectiveness, the displacement of private discipline is an important
issue in assessing regulatory performance.
We hypothesize that how closely the incentives of top regulatory officials are aligned with societal interests depends on officials’ accountability (A) for policy mistakes and ethical lapses: the extent to which officials can be made to answer after the fact both for counterparty losses that regulators failed to recognize or deter in a timely manner and for having accepted ethically questionable benefits from banking interests. Opportunities for a bank to engage in risk-shifting may be said to vary inversely with the quality of its contracting environment (E). At any time, $S_N$ should be a decreasing function of E and E itself should be an increasing function of transparency, deterrency, and regulatory accountability:

$$E = E [T, D; R(A)].$$  \hspace{1cm} (7)

The semicolon in equation (7) expresses the hypothesis that other equations exist in which variation in $R$ both influences and responds to the level of $T$ and $D$. The observed decline in the magnitude and frequency of safety-net support over our sample century indicate that both countries’ contracting environments improved substantially.

5. **Timing of Implicit Government Support for Banks**

Demirgüç-Kunt’s nonlinear representation of the intangible credit enhancement imbedded in bank stock prices can estimate the value of intangible safety-net capital at any date. Equation (2’) indicates that the value of $S_N$ may be calculated for any bank (or set of banks) from $c$ and the bank’s (or banks’) market capitalization, MV. Using regression values for banks in each country in each year. Figures 2 and 3 track the value of $S_N/MV$ that emerges in each country when the (deflated) nonlinear SMVAM equation is fitted to a rolling three-year sample of megabanks.

Table 3 summarizes major changes in the banking environments of Canada and the U.S. observed during our sample period, including the dates of banking crises. In Canada, blips in the value of $S_N/MV$ correspond broadly with crisis dates. $S_N$ emerges in 1896-1899, 1903-1905 (when 3 banks failed), in the mid-1920s (after the failure of the Home Bank), and in the 1960s and early 1970s (when national deposit insurance was first introduced).

In the U.S., spurts in $S_N/MV$ are relatively brief. Lasting movements occur only at the beginning of our sample. The large 1950-53 surge coincides with the Fed’s ending its program for fixing Treasury bond prices and yields. The ensuing decline in bond prices
would have imposed capital losses on any banks that had been holding long bonds to capture the excess holding-period return that the fixed positive yield curve locked into long bonds. Still, this blip in $S_N$ appears to be an artifact of small-sample nonlinear estimation because Figure 5 provides no evidence to support a nonnegligible value for $c$.


6. **Summary and Agenda for Future Research**

In both countries, bank stock prices were buffeted during our sample century by global as well as national economic forces. Our model indicates that large-bank stockholders benefited on occasion from implicit safety-net capital well before explicit deposit insurance was formally established.

Our methods can be used to estimate safety-net capital in any country during any era in which bank stock is actively traded. Combining data on accounting values and bank stock prices allows policymakers to infer whether and how intertemporal differences in safety-net regimes and in off-balance-sheet liability for bank stockholders generate safety-net capital. When applied to multicountry data sets, the model could explore how the value of safety-net capital responds in different environments to disturbances in asset returns and macroeconomic forces. Given the world-wide consolidation the banking industry is experiencing and the universality of both too-big-to-fail and too-many-to-fail concerns, taxpayers everywhere should want financial regulators to do everything they can to measure and control the size and variability of safety-net capital.

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6 See Kryzanowski and Roberts, 1993
REFERENCES


TABLE 1
NAMES OF MONEY-CENTER BANKS IN 1992 FOR WHICH STOCK PRICES ARE AVAILABLE EVERY YEAR EITHER FOR THEMSELVES OR FOR PREDECESSOR FIRMS

<table>
<thead>
<tr>
<th>Canada (CN)</th>
<th>United States (US)</th>
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<tbody>
<tr>
<td>Bank of Montreal</td>
<td>Bankers Trust</td>
</tr>
<tr>
<td>Bank of Nova Scotia</td>
<td>Bank of New York</td>
</tr>
<tr>
<td>Canadian Imperial Bank of Commerce</td>
<td>Chase Manhattan Bank</td>
</tr>
<tr>
<td>National Bank of Canada</td>
<td>Chemical</td>
</tr>
<tr>
<td>Royal Bank of Canada</td>
<td>Citibank</td>
</tr>
<tr>
<td>Toronto Dominion Bank</td>
<td>United States Trust</td>
</tr>
</tbody>
</table>

Note: Our sampling procedure takes the largest banks in each country in each year. Entry, exit, mergers, and variation in individual-bank size rankings prevent us from using panel methods.
TABLE 2
DESCRIPTION OF DATA SOURCES

For Canada, monthly bid-ask quotes for bank stocks were obtained from the monthly Bank and Quotation section of the *Commercial and Financial Chronicle* post-1897, and from the Montreal newspaper *The Gazette* before that date. Balance-sheet data were taken from three sources: Moody's *Investment Manual* which started in 1928; 1906-1927 data from *The Statistical Yearbook of Canada* and earlier data from *The Canada Gazette*. We focus on chartered Canadian banks because of their size, historical prominence and data availability.

For the U.S. the *Commercial and Financial Chronicle* (CFC) reports bid-ask quotes for a large sample of New York City (NYC) banks that cover the period 1893 onwards. The CFC price list varies in number from a low of 77 banks in 1900 to 158 banks in 1969. Balance-sheet data for sample banks were collected from Rand McNally's *Bankers Directory* for the period before 1928. Subsequent data were drawn from Moody's *Investment Manual* through 1972. Later balance-sheet data come from the Compustat Bank Research tapes and price data from the CRSP (Center for Research in Security Prices) tapes.

The CFC sample consists mostly of NYC money-center and metropolitan-area banks and trust companies, although after WW II the sample becomes geographically more diverse.
TABLE 3

Overview of 1893-1992 Canadian Banking Environment

- From 1867 to 1935, each chartered bank reported to the government in a constant format the “true condition of the bank” on the last business day of each month. Individual and consolidated bank balance sheets were published in the Canada Gazette within five weeks of the monthend (Holladay, 1938).
- Number of chartered banks declined from 51 in 1874, to 35 in 1900, and to 11 in 1925. By 1966, the five largest banks held 90 percent of industry assets.
- Between 1893 and 1923, 12 banks failed, but only six of the failures imposed “major” losses on depositors (Carr, Mathewson, and Quigley, 1995). Bank stockholders faced double liability on their banknotes, but not on their deposits.

Intermittent Crises Encountered
- Panic of 1907 (leading to 3 bank failures in 1908)
- August 1923 Failure of the Home Bank
- Great Depression of 1930-33
- 1965: near-failure of British Mortgage & Trust Co.
- 1985: Failures of Canadian Commercial Bank and Northland Bank
- 1992: Failure & Assisted Acquisition of $10.7 Bil. Central Guaranty Trust

Notable Regulatory Events
- 1871 Bank Act: established capital requirements and double liability for bank obligations, but subordinated deposits to banknotes and government claims
- 1891: chartered banks required to support Finance Ministry fund for redeeming banknotes of suspended banks
- 1913 Bank Act: required an independent audit of bank records
- 1914 Finance Act: lender-of-last-resort powers given to Finance Ministry
- 1924 Bank Act revisions: instituted annual government bank solvency examinations*
- 1934 Bank of Canada Act: established a central bank and enacted what became a 16-year phaseout of stockholders’ extended liability by capping it at a secularly declining fraction of the notes each bank had in circulation
- 1944 Bank Act required that all outstanding banknotes in circulation be transferred to the Bank of Canada by January 1, 1950
- 1967 Bank Act revisions: created the Canadian Deposit Insurance Corporation, with the Finance Ministry retaining examination and supervision functions
- 1980 Bank Act revisions: enhanced ability of trust companies and foreign banks to compete with chartered banks
- 1987: Superintendent of Financial Institutions established and CDIC powers extended
- Bank Act of 1992: expanded the powers of the CDIC and chartered banks

* Holladay (1938, p. 183) offers the testable hypothesis that, because the minister of Finance was required to appoint a curator to take charge of any bank his examiners determined to be insolvent, the “man in the street” incorrectly believed that “the government is guaranteeing banks in some peculiar way.”
Long before the 1890s, state-chartered banks were required to file condition reports with the governor or legislature. In New York, regular on-site inspection by state examiners was a long-established tradition. When the Federal Reserve began operations in 1914 and the Federal Deposit Insurance Corporation (FDIC) in 1934, each received authority in cooperation with the chartering authority to examine state banks under their particular jurisdiction. National banks file quarterly condition reports with the Office of the Comptroller of the Currency (OCC) and the OCC conducts on-site examinations. The scope and quality of bank examinations were rudimentary but improving during the first decades of our sample. However, the informativeness of reports of accounting net worth was reduced after 1938 when federal regulators agreed to let banks use “intrinsic value” accounting principles to carry troubled assets at book value as long as payments due do not fall far behind schedule.

The number of commercial banks surged from about 8,000 in 1893 to about 30,000 in 1920. Between then and 1935, the number declined rapidly to just over 15,000. Subsequently, the number declined at a slower rate, reaching about 12,000 in 1992.

Intermittent Crises Encountered

- May-September 1893: 360 banks restrict payments out of deposits (Friedman and Schwartz, 1963, p. 109 fn.)
- October 1907: Beginning with Knickerbocker Trust Co., New York banks restrict payments. J.P. Morgan organizes a lifeboat fund to stop depositor runs.
- December 16, 1930: Bank of the United States suspends and is eventually put into liquidation, paying off about 75 cents on the dollar.
TABLE 3 (continued)

- March 6-9, 1933: Banking Holiday. More than 2,000 banks never reopen (Friedman and Schwartz, 1963, p. 330)
- December 1988-February 1989: Incoming President decides to resolve the longstanding insolvency of Federal Saving and Loan Insurance Corporation (FSLIC).

• Notable Regulatory Events
  - 1913: Federal Reserve is established and foreign branching allowed.
  - 1927: McFadden Act authorizes greater stockholder dispersion and city-wide branching for national banks
  - 1933: Glass-Steagall Act establishes FDIC, separates commercial and investment banking, and begins the phaseout of extended liability for bank stockholders.
  - 1970: Bank Holding Co. Act is extended to one-bank holding companies.
  - 1980: The limit for explicit deposit-insurance coverage was increased from $40,000 to $100,000 per account name.
  - 1991: FDIC Improvement Act improves deposit insurance pricing and loss control
Figure 1 Mean Market-to-Book Ratios at Major Banks in Canada and the U.S., 1893-1992
Figure 2: Variation in Implicit Safety-Net Support at Major Canadian Banks, 1893-1993

Explicit Deposit Insurance
Figure 3: Variation in Implicit Safety-Net Support at Major U.S. Banks, 1893-1992

Aggregate SNN as a percent of aggregate MV

Explicit Deposit Insurance Begins
FIGURE 4: CONFIDENCE INTERVALS ON PARAMETER c IN YEARS IT PROVES NONZERO FOR MAJOR CANADIAN BANKS

Confidence Interval as a percent of mean MV_t
FIGURE 5: CONFIDENCE INTERVALS ON PARAMETER $c$ IN YEARS IT PROVES NONZERO FOR MAJOR U.S. BANKS

Confidence Interval as a percent of mean $MV_t$
FIGURE 6 PANEL A: 
ESTIMATES FOR SMVAM PARAMETERS AT CANADIAN MEGABANCS

Intercept Scale
Signed Ln(Abs(U estimate)))

YEAR


k estimate
FIGURE 6 (continued)

PANEL B: t-STATISTICS FOR TESTING THE HYPOTHESES THAT k=1 AND U=0

t scale for testing U=0

t scale for testing k=1

t scale for testing U=0

YEAR
FIGURE 7 PANEL A: 
ESTIMATES FOR SMVAM PARAMETERS AT UNITED STATES MEGABANKS
FIGURE 7 (continued) PANEL B:
t-STATISTICS FOR TESTING THE HYPOTHESES THAT $k=1$ AND $U=0$
FIGURE 8
R² OF ANNUAL SMVAM REgressions FOR MAJOR CANADIAN, U.K., AND U.S. B