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Abhandlungen

Too Big to Fail?

The Newfoundland Bank Crash of 1894

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I. Introduction

As Allen/Gale ((2000a), p. 268) correctly point out, "the relationship between banking stability and competition has not been studied as extensively as one might expect". A main purpose of this paper is to study the relationship between banking stability and (imperfect) competition with reference to a dramatic systemic banking crisis in Newfoundland, commonly known as the Bank Crash, or simply the Crash among Newfoundlanders, which took place in 1894 when two commercial banks went bankrupt simultaneously. The Crash is a landmark in the history of Newfoundland because it is the region's worst banking crisis ever. Except a handful of scholars in the history of Newfoundland (e.g., Rowe (1971)), the Crash has drawn little, if any at all, attention from mainstream economists and economic historians. For example, it was not mentioned in the classic work of Kindleberger (1989). For several reasons, the Crash deserves an investigation in its own right and, more important, the episode provides insightful lessons for monetary economists, bankers, and regulators.

The main reasons why the Crash is relevant, important and interesting are interwoven, and they are partly because of certain salient features of

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the Newfoundland banking system then and the Crash itself. First of all, the Crash is a rare, though not necessarily unique, case in which an economy experienced a systemic banking crisis of such a relatively enormous scale. The US banking panic during the Great Depression is widely known to be disastrous, as 9,765 banks failed or were suspended during 1929–1933 and total deposits dropped by 35 % over this period (see Friedman/Schwartz (1963) for details, among many others).[1] By contrast, two out of the only three depository institutions failed in the Newfoundland Bank Crash, involving more than 60 % of total deposits.[2] More important, the entire commercial loan market was suffocated because the two failed banks were the sole credit providers to the economy. The Crash serves as a "natural experiment" for studying the too-big-to-fail doctrine and its implications.[3]

Second, the Crash sheds light on the relationship between banking stability and market structure. The "conventional wisdom" has that free or competitive banking is inherently unstable because of market failure (e. g., Goodhart (1988), among many others), although a recent strand of literature argues in favour of *laissez-faire* in money and banking (see the survey by Selgin/White (1994)). Even with government regulation, banks are commonly believed to be prone to failure under competition, as Allen/Gale assert ((2000a), p. 268): "Casual empiricism supports the notion that a more 'competitive' banking sector, with large numbers of relatively small banks, may be more prone to financial instability than a concentrated banking sector with a few large banks". Indeed, most studies support the charter-value hypothesis by Keeley (1990) and find competition

[1] The total number of bank failures serves only as one of the many indicators reflecting the extent of bank failures due to the Great Depression, because there were still bank failures in the next ten years after the FDIC was set up in 1933 even though the number was less than one hundred each year. For details, see *Annual Report of the Comptroller of the Currency,* Washington, D.C.: Office of the Comptroller of Currency, US Department of the Treasury.

[2] Although there were more bank failures in the US and the total value of the failed banks' deposits, at US$7.06 billion for the years 1929–1933, was higher, the impact of the Newfoundland Bank Crash relative to the economy might be larger after adjusting for the scale of the economy. In the US case, at the peak of the crisis in 1933, total deposits of the failed banks amounted to US$3.596 billion or 6.5 % of GNP (data from *Historical Statistics of the United States*). The historical data for Newfoundland are scanty. According to *Alexander* (1976), Newfoundland's total national income in 1884 was estimated at $11.6 million. The two commercial banks' total deposits in that year were approximately 25 % of total national income.

[3] For the history, theory and evidence of the too-big-to-fail doctrine, see *Kaufman* (1990, 2002).

induces instability (see Carletti/Hartmann (2003) for a survey). By contrast, using data on 70 countries from 1980 to 1997, Beck/Demirgu-Kunt/Levine (2003) recently find that banking crises are less likely to occur in banking systems that encourage competition and have fewer regulatory restrictions on banking competition and activities, but stability is also positively associated with concentration.[4] Their latter finding is consistent with the concentration-stability hypothesis, although they do note that the stabilizing effect of banking concentration is weaker at higher levels of concentration. Therefore, the concentration-fragility hypothesis cannot be completely ruled out.[5] By examining the Crash, we may gain a better understanding of stability in a highly concentrated banking system – in fact a polar case of duopoly.

In addition to the concentration-stability nexus, financial consolidation has raised concerns that bank failures in an oligopolistic market, even if they may be less frequent and if contagions are absent,[6] can be more devastating than in a competitive market simply because failed banks are more likely to be relatively larger in size in the former cases. Regulators are more likely to treat large troubled banks as too big to fail, thus aggravating the moral hazard problem by inducing large banks towards excessive risk-taking (Mishkin (1999)). Besides an empirical assessment of the economic impact of a systemic crisis in a highly concentrated banking system, this study provides experiences and lessons on how to resolve an economy-wide banking crisis and how to lower the probability of its recurrence.

Apart from the too-big-to-fail doctrine, the Newfoundland banking system before the Crash serves as a natural laboratory for examining bank behaviour in a duopolistic setting. Despite the rapid advancement over the last two decades or so in applying game theory to model bank behaviour (e. g., Dermine (1986), Chiappori et al. (1995), Matutes/Vives

[4] A possible explanation for these seemingly contradictory results is that competition may be better proxied by entry and activity regulations than by concentration; higher concentration may mean greater diversification, which is conducive to stability.

[5] Based on US data for the period 1988–1999, *De Nicolo/Kwast* (2002) find that consolidation and systemic risk are positively related, although other factors also contributed to the increased risk.

[6] In theory, an imperfectly competitive banking system can be less vulnerable to contagion (*Allen/Gale* (2004)), whereas a small shock can cause all banks to go bankrupt in a perfectly competitive system (*Allen/Gale* (2000b)). Despite earlier research has shown that contagion may be theoretically possible but is highly unlikely in practice (*Kaufman* (1994)), the controversies on bank contagion remain.

(2000)), empirical studies remain relatively scant. Although constrained by data availability, this study attempts to fill this gap by providing empirical evidence of a price leader-follower relationship that captures the two Newfoundland banks' lending behaviour.

Last but not least, the Crash has been also of interest and relevance to the revived interests in free banking since the mid-1970s. The Newfoundland banking system was a "free" or "quasi-free" banking system as there were no central bank, lender of last resort, deposit insurance, barriers to entry and exit, etc.[7] From this perspective, this study is an addition to the empirical literature of free-banking (in)stability (see, e.g., Dowd (1992) for historical cases of free banking stability and Neldner (2003) for instability).

This paper is organized as follows. The next section describes briefly the historical and institutional background of the Crash. Section III and the Appendix derive a simple duopoly model of price leader-follower to explain the two commercial banks' lending behaviour. Empirical results lend support to the model for the years prior to 1887. The details are reported in Section IV, followed by an intervention analysis to assess the impact of the Crash on exports of dried cod, the main output of the Newfoundland economy. Counter-intuitively, the empirical results do not indicate a significant adverse impact, if any at all. The penultimate section discusses some of the lessons and implications of the Crash for banking regulation and supervision today before the paper summaries and concludes.

II. Historical and Institutional Background

As the Crash is not as widely known as other banking panics like the US Great Depression, the objective of this section is to describe briefly the historical and institutional background to facilitate readers' assess-

[7] Whether the Newfoundland banking system during the period under study was entirely free from government regulations and interventions is controversial. For example, while there was no deposit insurance on deposits held at the private commercial banks, deposits held at the government-owned Newfoundland Savings Bank were guaranteed by the Newfoundland Government. See the next section for more details about the institutional background. Nonetheless, the banking system was highly unregulated and there were no central bank and comprehensive financial safety net. In this sense, I use the term "free banking" rather loosely to describe the then banking structure, which was apparently not the same as the modern free banking system advocated by *Selgin/White* (1994), the Black-Fama-Hall system by *Greenfield/Yeager* (1983), or currency competition by *Hayek* (1978).

ment of the theoretical model and the empirical evidence in the subsequent sections.[8]

The first financial institution in Newfoundland is the Newfoundland Savings Bank, chartered in June 1834, owned and managed by the Newfoundland Government to "serve" the poor working class. It did not accept any deposit less than a shilling sterling or more than £50. A 3 % interest was paid on deposits except those less than a pound or with maturities less than six months. The deposits and the interest thereon were guaranteed by the government. While the Savings Bank's role was to provide a safe and secure place for savings of the working class, another key function was to raise money to redeem Newfoundland's debt by circulating Treasury Notes.

Given the objective and nature of the Savings Bank, the role of providing credit to the domestic economy was taken up by two private commercial banks, namely the Union Bank of Newfoundland and the Commercial Bank of Newfoundland (hereafter the Union Bank and Commercial Bank respectively for brevity). The Union Bank was founded in 1853 with support from the government and the merchant class out of their growing dissatisfaction with the St. John's branch of the Bank of British North America, which was English in origin and had been the sole commercial bank carrying on business in St. John's since 1836.[9] Similar to the kinship-based commercial banks in New England in the early 19th century (Lamoreaux (1986)), the formation of the Union Bank was a means for merchants to overcome the difficulty in obtaining financial accommodation from the Bank of British North America for their dealings with an unstable business like the fishery.[10] The Bank of British North America eventually withdrew its business out of Newfoundland in 1857.

The success of the Union Bank encouraged some merchants who were not its directors and could not benefit from the financial accommodation

[8] For more details, the interested readers can consult *Hiller* (1971), *Rowe* (1971, 1987), *Sparkes* (1962), and *Smallwood* (1998), among others.

[9] The government's dissatisfaction with the Bank of British North America was due to the latter's refusal to circulate Treasury Notes issued to redeem the debt of Newfoundland; all the Treasury Notes received by the bank were immediately redeemed in specie (see *Rowe* (1971)).

[10] There should be little doubt that the Union Bank was formed primarily for this purpose, as a St. John's newspaper said at the time of its founding: "Its mission is to provide that enlarged accommodation: the want of which has sometimes imperilled the integrity of the trade in those times of pressure which the proceedings of the Bank of British North America brought about" (quoted from *Sparkes* (1962), p. 25).

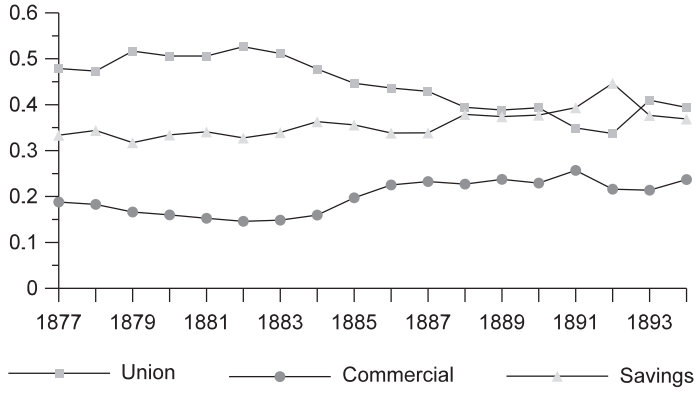

Figure 1: Deposit Market Shares (1877–1894)

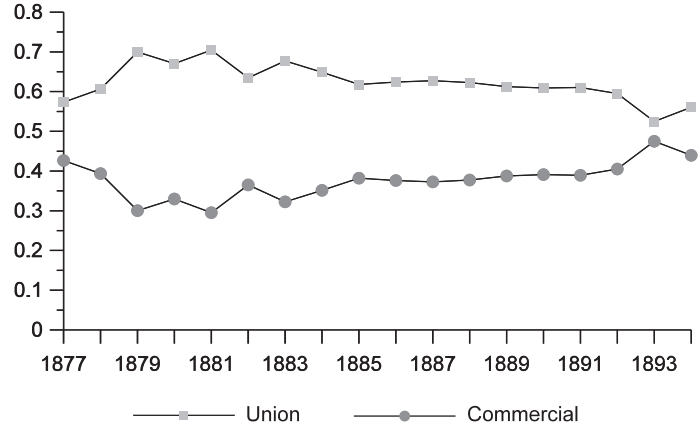

Figure 2: Loan Market Shares (1877–1894)

necessary for their dealings with the fishery to form the Commercial Bank in 1858 to serve their own interests. The Commercial Bank had been dominated by the Union Bank in both deposits and loans, although the latter was losing its market shares over time (see Figures 1 and 2). The asymmetry in market shares together with the merchants' business relations with each other suggests the lack of a strong basis for collusion or cooperation. The size asymmetry was also a factor affecting the two banks' strategies, as will be seen from the theoretical model and the empirical evidence in the following sections.

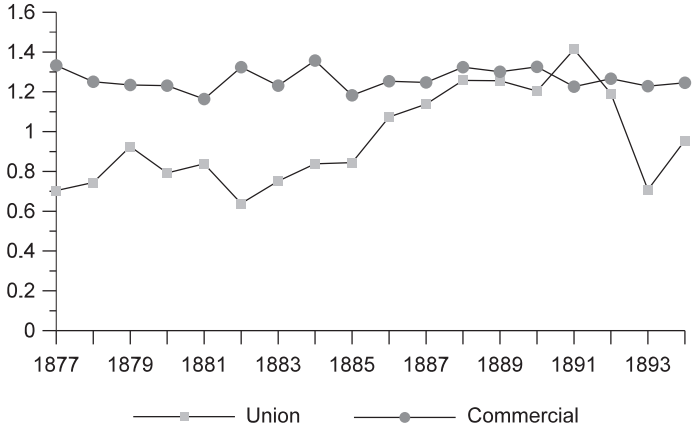

Figure 3: Loan-Deposit Ratios (1877–1894)

Not only their market shares, the two banks' lending policies were also apparently different during the years before 1887. Commercial Bank's loan-deposit ratio was always higher than unity throughout the years for which data are available, suggesting an aggressive, if not overly imprudent and risky, credit policy. By contrast, Union Bank's corresponding ratio was less than unity and consistently lower than Commercial's in the initial years, reflecting a more conservative and prudent lending policy. However, the ratio exceeded unity for the first time in 1885 and followed a rising trend thereafter, indicating an apparent change in Union Bank's policy stance (see Figure 3). As will be seen in Section IV, there was, econometrically speaking, a structural change in 1887 when exports of dried cod fell sharply by 22 % from a year earlier and remained at low levels in subsequent years (Figure 4).[11]

Traditionally the fishery was the major, if not the sole, industry in Newfoundland.[12] The economy was virtually a single-resource export

[11] The decline can be attributed to population growth and increased competition from France and Norway. Population growth partly contributed to the depletion of an over-harvested resource. The average annual population growth rate went up from 1.8 % for the years 1869–1874 to 2.1 % for the decade 1874–1884 (the data are drawn from the Chapter on Economy in the *Encyclopedia of Newfoundland and Labrador*). At the same time, Newfoundland-cured fish often competed unsuccessfully with French and Norwegian cures in the European markets because the former were reportedly badly culled and inferior (see the Chapter on Bank Crash in the *Encyclopedia of Newfoundland and Labrador*).

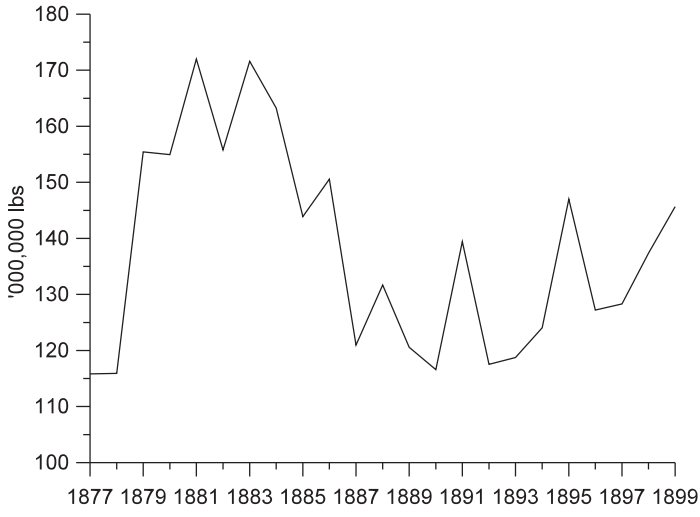

Figure 4: Exports of Dried Cod (1877–1899)

economy in the 1800's, with almost all exports being fish and fish products, and the export sector accounting for 87 % of the labour force (Alexander (1976)). Under the truck credit system, merchants extended credit to fishermen in spring and were repaid at the end of the season in fish.[13] If a fisherman's catch in a particular year was not sufficient to cover his debt, the merchant would carry the debt over until the next successful season. On the other hand, the merchants borrowed money from the two commercial banks as working capital. Besides their customer deposits, the banks borrowed from the Savings Bank and wrote bills of exchange on their customers' agents in England so as to obtain credit from London banks, especially in their final years of operation when they needed a large amount of money to maintain the declining fishery afloat.

The Crash took place on December 10, 1894, when the Commercial Bank failed to open its doors. Its collapse was due to an interruption in the creation of bills of exchange on December 6 when a partner in a London firm passed away and the firm declined to meet further bills of ex-

[12] The economy gradually diversified from a single-resource export (fish) into three – fish, forest, and mineral products – over the period 1890–1930.

[13] During the summer the fisherman bought all his family needs at the merchant's stores on credit.

change until an investigation of its affairs had been made (Rowe (1971)). As a result, the British banks made demands on the Commercial Bank, which in turn called upon the merchants, who failed to respond either. The closure of the Commercial Bank triggered runs on the other two depository institutions. Having first lien on the specie held by the Union Bank, the Savings Bank withdrew large amounts of specie to meet its own obligations. With little specie or cash on hand, the Union Bank was reportedly forced to close its door on the same day, also known as "Black Monday".[14]

The above paragraphs chronologically recapitulate the major developments in the Newfoundland banking system up to the Crash. More details and resolution of the Crash will be discussed in the sections to follow.

III. An Illustrative Model of Duopolistic Loan Market

This section develops a simple duopoly model of "free" banking to study the two Newfoundland banks' lending behaviour. The model also serves as a theoretical basis for the empirical study in Section IV. With reference to the episode, the questions we address in this paper are: How do banks of different size compete with each other in a duopolistic loan market? Is a duopolistic free banking system inherently unstable? What is the impact, if any, of a systemic banking crisis like the Crash on an economy, particularly an economy, like Newfoundland, that relies heavily on a single or a few sectors for its output?

In the duopoly model of bank loans, the Union Bank, the dominant bank, acts as the price leader. For a couple of reasons, a non-collusive model is more appropriate than a collusive model to capture the two banks' behaviour.[15] First, as already mentioned in the previous section, the two banks' asymmetric initial sizes could be a barrier to collusion. In

[14] The closure of the Union Bank has been widely attributed to the bank run on Black Monday (e. g. *Rowe* (1971)). I shall analyse and argue in Section VI below that the run was only a proximate cause for its closure and the root cause was insolvency.

[15] There are many approaches to modelling banking firm. See, for example, *Freixas/Rochet* (1997). My modelling strategy here is to develop an empirically verifiable model given the limited available data. Because of the constraint, the model developed here is kept to as simple as possible. It is by no means the only theory that can explain the two banks' behaviour. Nonetheless, it is a first approximation to the episode until the development of a more sophisticated and realistic model that offers an alternative explanation and is empirically supported by the available data.

1877, the Union Bank accounted for 48 % of total deposits and 57 % of total loans, considerably higher than the Commercial Bank's corresponding figures of 19 % and 43 %. The size asymmetry could have contributed to the price leader-follower behaviour when the Union Bank could take advantage of economies of scope and produced loans and deposits at lower costs than the Commercial Bank could.[16] This was particularly the case if the output levels of loans and deposits were to a large extent jointly determined. Second, collusion was difficult to sustain in the absence of effective punishments on a disobedient member. Theoretically, banks may establish a cartel by forming a bankers' association or clearinghouse to impose regulations and punishments on members (e. g., Dowd (1994), Gorton/Mullineaux (1987)). However, such an organization or similar establishment was absent in Newfoundland. Besides these theoretical arguments, the hypothesis of collusion can be empirically rejected by Union Bank's losses of market shares to the other two banks over the years.

For simplicity, the two banks are assumed to finance their assets with bank capital and deposits only because an active interbank market was absent.[17] For analytical tractability, we abstract from capital decision and simply assume bank capital (K) to be exogenously given. The supply of deposits (D) is assumed to be an upward-sloping function of the deposit rate (r_d).

On the asset side of the balance sheet, reserves (R) and loans (L) are assumed to be the only two bank assets. Without legal reserve require-

[16] The empirical evidence of economies of scale and scope in banking remains mixed and controversial. Based on recent empirical studies, most economists tend to agree that economies of scale may exist for banks with assets ranging from US$100 million to US$5 billion. For a review of the literature see, for example, *Berger/Hunter/Timme* (1993).

[17] The two banks also issued notes with denominations ranging from $2 to $50. The final series of notes issued by the Commercial Bank was on January 3, 1888. Unfortunately, time series data on banknotes issued or in circulation are unavailable. Available balance sheets for 1894 indicate that banknotes accounted for 14 % of Union Bank's total assets and 19 % for the Commercial Bank. According to *Alexander* (1976), the per capita income of Newfoundland was about $60 a year in 1884. So even a $2 note was unlikely to be widely circulated, and all notes with denominations above $5 were possibly held as stores of value rather than as media of account. Anyhow, paper money was never popular in Newfoundland. Business transactions were mainly carried out on credit, by barter, or using "Newfoundland currency" (i. e., dried cod fish), copper coins and tokens brought over from foreign places, as media of exchange (see e. g., *Sparkes* (1962), and *Rowe* (1971, 1987) for details). Hence, banknotes can be theoretically considered as a kind of (demand) deposits in our model here.

ments, the banks are assumed to hold reserves (R) to meet deposit withdrawals (W). The latter is assumed to be directly proportional to the bank's volume of deposits, i. e., $W = \tilde{w}D$, where $\tilde{w}$ is a random variable with possible values between 0 and 1 and an expected value $\ddot{w}$. The cost of illiquidity is simply assumed to be a penalty rate (r_p) exogenously determined.

With these simplifying assumptions, we focus on the banks' lending strategies.[18] Resembling a standard money demand function, the aggregate demand for bank loans (L) is assumed to be a positive function of a scale variable and a negative function of a cost variable, in our case exports of dried cod (EX) and the lending rate (r_L) respectively. Mathematically,

$$L = a_0 + a_1 EX - a_2 r_L. \tag{1}$$

where a_0, a_1 and a_2 are parameters. By definition of duopoly, we have $L = L_1 + L_2$, where L_1 and L_2 are loans extended by the Union Bank and Commercial Bank respectively.

First consider the price leader's optimal lending strategy. Its loan growth rate in period t depends on the growth rate of exports of dried cod for the same period (see the Appendix for the derivation):

$$d\log(L_{1,t}) \doteq \alpha_0 + \alpha_1 \, d\log(EX_t) + \tilde{\mu}_{1,t}. \tag{2}$$

where $\tilde{\mu}_{1,t}$ is a random disturbance term. More specifically, our theory predicts that $\alpha_1 = 1$. As will be seen in the empirical section, the Union Bank, however, seemed to have abandoned this strategy afer 1887 and hence (2) is no longer applicable in capturing its behaviour in subsequent years.

Next consider the dominated bank's optimal lending strategy. The Commercial Bank is assumed to act as a price taker to avoid a price war, taking up the remaining loans demanded by the market at the lending rate r_L set by the Union Bank. To derive Commercial Bank's lending function, we use the balance-sheet constraint and apply the analysis of sources and applications of funds (see the Appendix). In traditional com-

[18] As can be seen in the Appendix, the first-order conditions for the profit maximization problem show that, as in many classic theories of the banking firm such as *Klein* (1971) and *Monti* (1972), the optimal deposit and credit decisions are independent of each other. This separability or independence property allows suppression of the deposit market for analytical tractability and for model verification with the limited available data.

mercial banking, loans are the major application of funds, whereas deposits are the major source. This is particularly applicable in our case since other major sources of funds, such as borrowing from the interbank market and the central bank,[19] and major applications of funds, such as investment in short-term securities, were either absent or unpopular. Therefore, the following specification is estimated:

$$d\log(L_{2,t}) = \beta_0 + \beta_1 d\log(D_{2,t}) + \beta_2 \frac{L_{2,t-1}}{D_{2,t-1}} + \tilde{\mu}_{2,t}\,. \tag{3}$$

where $\tilde{\mu}_{2,t}$ is a random disturbance term and the other variables are as previously defined. Under profit maximization, the bank would extend at the margin all its available new deposits into loans after allowing for the optimal amount of reserves. The coefficient of the deposit growth rate, β_1, is thus expected to be positive and close to unity in absolute value.[20] On the other hand, the loan-deposit ratio reflects the bank's intertemporal portfolio adjustments. The bank's lending decision is related to its reserve holding, which is to some extent beyond its complete control because of random deposit withdrawals. If the bank's loan-deposit ratio at the end of last period is lower than the expected normal level, the bank thus holds "excess" reserves that can be used to extend loans in the current period, and vice versa. Hence, the coefficient β_2 is expected to be negative.

IV. Empirical Evidence

The objective of this section is to empirically test the hypotheses according to Equations (2) and (3) above with annual data on the two banks for the years 1877–1894 drawn from Hiller (1971) and annual data (series N129) on the exports of dried cod for the same period from *Historical Statistic of Canada*.

[19] As already mentioned, although a formal interbank market did not exist in Newfoundland, the two commercial banks borrowed from the Savings Bank and also obtained credit from London banks by writing bills of exchange upon their agents in England, especially in the few years prior to their bankruptcies.

[20] A coefficient estimate close to unity can be compatible with both profit maximization and maximization of loan market share (subject to a certain required profit level). The two cases are observational equivalent and require further information for model discrimination. If the coefficient estimate is substantially lower than one, it suggests that the bank held substantial amount of reserves. Such a finding should cast doubt on the validity of maximizing loan market share; the bank was more likely to restrict loan output than to maximize its profits.

The small sample size of the empirical study in this section is easily subject to criticism because at best only annual observations from 1877 to 1894 are available.[21] However, it is well known in time series econometrics that the span of data rather than the number of observations is more important in capturing long-run relationships among variables. Put differently, a minimum of 10 or 15 annual data may be preferred to a shorter span, say, two years, of monthly data, although the latter case has more observations. On the other hand, when the OLS estimator meets practically the "classical" assumptions its desirable properties, say, unbiasedness, do not depend on the sample size at hand; i.e., it is unbiased in both small and large samples. When estimators with attractive small-sample properties cannot be found, the econometrician may justify the use of an estimator based on its asymptotic properties (see Kennedy (2003), pp. 19–22 for details of this argument). From another perspective, the small sample size may not necessarily be a vice because it is immune from the too-large sample size problem – almost any parameter can be found to be significantly different from zero when the sample size is sufficiently large (McCloskey/Ziliak (1996)). The empirical procedures and results of this study are perhaps best defended by this quotation from two statisticians: "… you should not decry the use of small samples, nor following a related argument, the use of relatively unsophisticated tests. Remember that a significant result using a small sample and/or an unsophisticated test will, far more often than not, indicate a more important difference from H_o than a result of the same significance using a larger sample and/or more sophisticated test!" (Neave/Worthington (1988), p. 61).

The variables used in the regressions are all stationary and results of the Dickey-Fuller (1979) test are reported in Table 1. Recursive OLS is initially applied to Equation (2), and a one-period ahead forecast test suggests structural changes in 1887 and 1893; which are also weakly supported by the log-likelihood and Chow tests.[22] The first structural change in 1887 coincided with the drastic fall in exports of dried cod, causing a considerable impact on the loan market. The second structural change in 1893 was plausibly due to the bank's financial stress before

[21] By contrast, the sample size for the intervention analysis in Section V is "reasonably large," with about 90 annual observations from 1806 to 1899.

[22] For 1887, the Chow test and log-likelihood test statistics are 2.41 and 5.36, marginally above the 10% and 5% levels of significance. For 1893, the two statistics are respectively 1.92 and 4.40.

Table 1

Results of Dickey-Fuller Test for Unit Roots

Maintained Regression Model: $\Delta Y_t = \mu + \gamma\, Y_{t-1} + \beta\, t + \varepsilon_t$							
Variable	Test Statistics					Properties of Residuals	
	Φ_3 H_0: $\gamma = \beta = 0$	Φ_2 H_0: $\mu = \gamma = \beta = 0$	τ_μ H_0: $\mu = 0$	τ_β H_0: $\beta = 0$	τ_γ H_0: $\gamma = 0$	Ljung-Box Q-Stat. (12)	Jarque-Bera
Growth Rate of Union Bank's Loans, $d\log(L_{1,t})$	15.219***	10.164***	2.263**	–1.599	–5.498***	11.447	0.565
Growth Rate of Commercial Bank's Loans, $d\log(L_{2,t})$	8.169***	5.478**	1.042	0.247	–3.990***	15.955	1.004
Growth Rate of Commercial Bank's Deposits, $d\log(D_{2,t})$	8.379***	5.591**	0.985	0.336	–4.070***	9.296	0.839
Commercial Bank's Loan-Deposit Ratio, $L_{2,t}/D_{2,t}$	13.733***	9.208***	5.151***	0.647	–5.222***	18.397	0.467
Growth Rate in Exports of Dried Cod, $d\log(EX_t)$	65.194***	43.470***	0.485	–0.234	–11.42***	13.166	0.151

Note: 1. *, ** and *** denote respectively significance at the 10 %, 5 % and 1 % levels.

their collapse a year later.[23] We shall elaborate these phenomena in more detail below.

Because of the structural changes, the first column of Table 2 reports the results for 1877–1886 only. The DW statistic, the Breusch-Godfrey Lagrange-Multiplier test and Ljung-Box Q-statistics all suggest no autocorrelation in the residuals, whereas heteroscedasticity and ARCH effects are not detected either.[24] Nonetheless, the t-statistics based on Newey-West's (1987) heteroscedastic-consistent variance-covariance matrix are also reported for hypothesis testing. As predicted by the theory, the coefficient of the growth rate in exports of dried cod is statistically significant, has the correct positive sign, and its value is statistically not different from one as indicated by a Wald test.[25] Though parsimonious, the model captures most of the variations in loan growth as reflected by the R^2, and the RESET results do not reject the null hypothesis of no misspecification. Overall, these empirical results support our theory that the Union Bank acted as a profit-maximizing price leader in a duopolistic loan market during these years.

For Commercial Bank's lending function, structural changes are not statistically detected. The empirical results for Equation (3) for the entire period 1878–1894 are therefore reported in the second column of Table 2. The coefficients are all statistically significant and have the correct signs as predicted. More interestingly, the coefficient of deposit growth suggests that a one-percent increase in deposit would approximately lead to a 0.9 % increase in loans.[26] Although no structural change is statistically detected, Commercial Bank's lending strategies had plausibly changed

[23] In 1893 there was a financial panic in the US related to the Sherman Silver Act and an economic downturn in Canada. However these two events are unlikely to be the reason for the structural change as no historical evidence indicates that the two banks had close ties with the USA and Canada. The structural change in 1893 was most likely due to the payments of insurance claims following the Great Fire of 1892 in St. John's. Some of the funds went to the two commercial banks, enabling them to extend their credit substantially before they went under a year later. At the end of 1893, deposits held at the Union Bank grew dramatically by 45.7 % from a year earlier, whereas the Commercial Bank also registered a considerable growth rate of 18.6 %.

[24] Although the value of the DW statistic is somewhat low, it is still higher than the upper bound value of 0.998 at the 0.01 level of significance. Thus, there is no evidence of positive first-order autocorrelation. For brevity, the other test results for higher order autocorrelation and heteroscedasticity are not reported here.

[25] At 0.087, the Wald test statistic is statistically insignificant.

[26] At 0.3897, the Wald test statistic suggests that the coefficient is not statistically different from unity.

Table 2

Regression Results for Growth in Bank Loans

Dependent Variables: Loan Growth Rates of the Banks				
Method	OLS		SURE	
Equation	Union	Commercial	Union	Commercial
Intercept	0.061 (1.58) [1.19]	1.2041 (4.78)*** [5.16]***	0.0592 (1.75)*	1.4228 (5.29)***
$d\log(EX)$	1.0921 (3.49)*** [5.40]***	–	1.1509 (4.23)***	–
$d\log(D_t)$	–	0.93 (8.29)*** [9.27]***	–	0.9696 (6.91)***
L_{t-1}/D_{t-1}	–	–0.9525 (–4.74)*** [–5.08]***	–	–1.136 (–5.28)***
Sample	1877–1886	1877–1894	1877–1886	1877–1886
$R^2(\ddot{R}^2)$	0.6358	0.8182	0.634	0.878
F-statistic	12.22***	37.0043***	–	–
S.E.E.	0.1121	0.0421	0.1124	0.0503
DW	1.079	1.8806	0.9548	1.9506
RESET	0.3741	0.7185	–	–

Notes:

1. Figures in parentheses are t-statistics based on OLS standard errors whereas those in brackets are Newey-West's (1987) heteroscedastic-consistent standard errors.
2. *, ** and *** denote respectively significance at the 10%, 5% and 1% levels.

over the period under study without affecting the magnitude of the coefficient. Prior to 1887, Commercial Bank's loan growth was probably constrained by its small depository base, and the bank had to channel all its marginal increases in deposits, after making allocation for reserves, into loans in order to maximize its profits. After 1887 deposits probably remained a constraint to the bank's loan growth, but the bank had probably no longer acted as a price follower. This will be explained in more detail in the paragraphs below about the loan market developments after 1887.

Table 3

Correlations between the Growth Rates, 1877–1886

	Union's Loans	Union's Deposits	Commercial's Loans	Commercial's Deposits	Exports of Dried Cod
Union's Loans	1				
Union's Deposits	0.3042	1			
Commercial's Loans	–0.1367	–0.0089	1		
Commercial's Deposits	–0.0057	–0.1248	0.6874**	1	
Exports of Dried Cod	0.7964**	0.3914	–0.6142*	–0.5598	1

Note: * and ** denote respectively significance at the 10 % and 5 % levels.

To allow for the possibility of some common random factors affecting both banks' loan decisions, seemingly unrelated regression estimation (SURE) technique is applied. The SURE results for a balanced sample for 1877–1886 are also reported in Table 2 for comparison. As can be seen, they are both qualitatively and quantitatively similar to the OLS results.

As already mentioned, our theoretical model does not explain Union Bank's lending behaviour after the substantial decline in exports of dried cod in 1887. Similarly Commercial Bank's lending strategy had probably changed too. Unfortunately, estimation of Union Bank's lending function for 1887–1894 is not possible because of the frequent structural changes and limited data availability. Nonetheless, a comparison of the correlations between the relevant variables for 1877–1886 and 1887–1892 sheds some light on the banks' lending policies. Table 3 shows the correlations between the growth rates in deposits, loans and exports of dried cod for 1877–1886. The positive and significant correlation between Union Bank's loan growth and growth in exports of dried cod and that between Commercial Bank's loan and deposit growth need no explanation because they have already been captured by our regression results. What needs an explanation is the significant negative correlation between Commercial Bank's loan growth and the growth in exports of dried cod. The correlation is theoretically inconsistent with Cournot's and Stackelberg's duopoly models but consistent with a price leader-follower model

Table 4

Correlations between the Growth Rates, 1887–1892

	Union's Loans	Union's Deposits	Commercial's Loans	Commercial's Deposits	Exports of Dried Cod
Union's Loans	1				
Union's Deposits	0.0617	1			
Commercial's Loans	0.9496***	0.2425	1		
Commercial's Deposits	0.9109**	0.1475	0.9311***	1	
Exports of Dried Cod	0.1034	–0.8091*	–0.0002	0.1526	1

Note: *, ** and *** denote respectively significance at the 10 %, 5 % and 1 % levels.

(see the Appendix for details). Furthermore, the weak correlation between Union Bank's loan growth and Commercial Bank's suggests that collusion of market sharing or quantity competition was unlikely during these years.[27] In a conjectural variations framework, a negative relationship between two firms' output suggests that an increase in the first firm's output is compensated by a decline in the other firm's output, leaving the price unchanged (e. g., Vives (1999), Ch. 7). The negative correlation is thus consistent with the price leader-follower behaviour.[28]

The price leader-follower relationship, however, apparently broke down after 1887 as evidenced by our regression results. An examination of the correlations between the variables for 1887–1892 (Table 4) and a comparison with Table 3 reveal a couple of conspicuous changes. First, growth in exports of dried cod is no longer a significant determinant of Union Bank's loan growth after 1887. This change can be easily detected visually from the two growth rates for the whole sample period as depicted in Figure 5.

[27] For example, in the traditional duopoly model a la' Cournot, a profit-maximizing bank's reaction function takes into consideration of its rival's output. Empirically, Union Bank's loans do not enter Commercial Bank's lending function as a significant explanatory variable.

[28] This prediction assumes that both banks' conjecture was correct and hence their corresponding actions were reflected by the observed data.

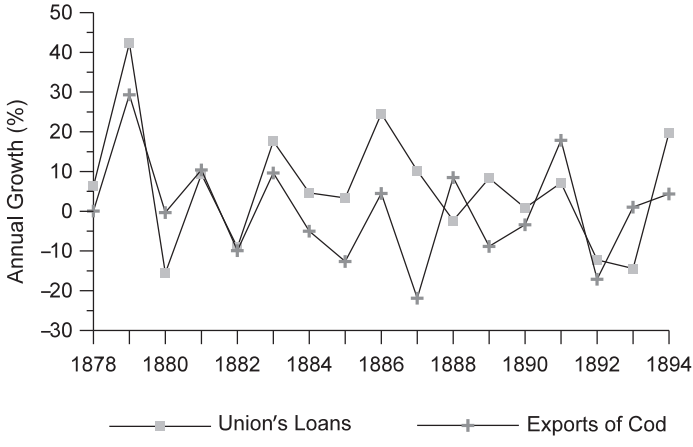

Figure 5: Growth in Loans and Exports (1878–1894)

Second, the weak negative correlation between the two banks' loan growth over the previous years has changed to a strong positive one. This relationship is again highly noticeable, as can be seen from Figure 6, which shows that the two growth rates moved in the same direction and by almost the same magnitude during these years. On the surface, such synchronized quantity expansion could be due to collusion as the loan market shares were also relatively stable during these years (see Figure 2). However, the continued losses in Union Bank's market shares in deposits over this period (Figure 1) tend to reject collusion in practice. A more plausible explanation is that the Union Bank suffered financial distress as a result of poor performance of exports of dried cod – a sharp decline by 22 % in 1887 and failure to rebound in subsequent years. The economic adversity probably made the leader-follower relationship no longer a profitable strategy. The bank probably extended loans to borrowers who failed to repay their loans and to new borrowers as well, hoping that they would repay their loans later when the exports revived in time. In the latter case, the bank tried to recapture its shrinking market share from the Commercial Bank This also explains why the bank's loan-deposit ratio kept on rising after 1887 (Figure 3).

Like the Union Bank, the Commercial Bank had probably changed its strategy during the period under study, although the changes are not reflected by the econometric results. By 1887, the bank's depository base had already built up to a considerable size comparable to its rival. The

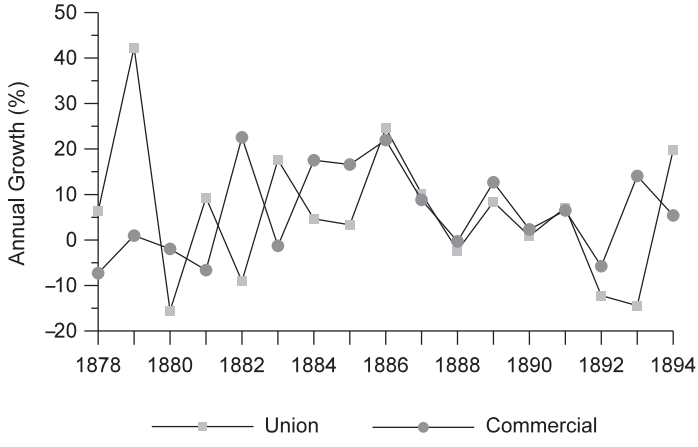

Figure 6: Growth in Bank Loans (1878–1894)

depressed fishery market coupled with the competitive pressure from the Union Bank might have induced the Commercial Bank to turn from a price follower into an aggressive lender, particularly in the last couple of years before it went under. Both banks had plausibly adopted a go-for-broke gambling strategy.[29] For instance, after the substantial increase in its deposits in 1893 as a result of the payments of insurance claims for the Great Fire in St. John's a year earlier, the Commercial Bank expanded its loans two years in a row by a total of 19 % to a record high of $2.3 million before its collapse in 1894, whereas the Union Bank's loans grew by 20 % in its last year of operation when exports of dried cod remained at low levels.[30] In all the above scenarios, the Commercial Bank's deposit growth remained a constraint on loan growth, as reflected by its loan-deposit ratio that exceeded unity throughout the years. This also explains why we observe a positive and almost unitary relationship between these two variables in our regressions.

[29] Admittedly, this is only one of the many possible explanations. A game-theoretic model to explain the post-1887 bank behaviour and modelling the deposit market (i. e., including the Savings Bank) are left for future research.

[30] As shall be explained in the next section, a main reason for both banks' closures is insolvency, not illiquidity.

V. The Impact of the Bank Crash on the Economy

In this section, we apply intervention analysis to assess the impact of the systemic bank failures on the Newfoundland economy. Following Box/Tiao (1975), we first apply the Box-Jenkins (1976) method to estimate an ARIMA model for exports of dried cod.[31] The sample consists of annual data (series N129) for 1806–1894 from *Historical Statistic of Canada*. The original series become stationary after taking logarithm and first differencing. The identification process suggests a model specification of ARMA(1,1) for the transformed series, and the estimation results are reported in the first column of Table 5.[32] Diagnostic results suggest that the residuals follow a white-noise process because the Q-statistics with lags of 8, 16, and 24 indicate no autocorrelation and the Jarque-Bera test suggests that the residuals are normally distributed.

Assuming the above time-series structure to remain intact during the out-of-sample years 1895–1899, an intervention analysis is then applied to assess the impact of the Crash in the subsequent five years after the Crash. Based on our ARIMA results, export growth of dried cod is hence modelled and estimated as follows:

$$d\log(EX_t) = b_0 + b_1 \log(EX_{t-1}) + b_2 CRASH_t + b_3 \epsilon_{t-1} + \epsilon_t . \tag{4}$$

where CRASH is a dummy variable to capture the impact of the Crash on exports of dried cod. Here we allow for two possible ways the Crash exerted its impact on exports of dried cod. First, the intervention or impact was a single impulse and lasted temporarily for only one year. In this case, the variable CRASH has a value of one for the year 1895 only and a value of zero for all other years. Second, the impact could be a prolonged impulse function that was permanent and long-lasting. In this case, the variable CRASH takes a value of one for the years 1895–1899 and zero for all previous years. In both cases, the sign of the dummy variable is expected to be negative and statistically significant if the Crash had an adverse impact on exports of dried cod. As there is no *a*

[31] For details of both the theory and applications of intervention analysis, see *Box/Tiao* (1975).

[32] A few specifications, e.g. ARMA(0,2), also fit the data satisfactorily. Based on the principles of parsimony and goodness-of-fit, we choose ARMA(1,1) as the representative model. More importantly, the intervention analysis results and conclusion remain qualitatively intact regardless of the model specifications, indicating the robustness of our finding.

Table 5

Results of ARIMA and Intervention Analysis

Dependent Variable: Growth Rate in the Exports of Dried Cod			
	Model		
	Original	Temporary Impulse	Prolonged Impulse
Intercept	0.0048 (3.76)***	0.0046 (3.12)***	0.0049 (3.71)***
AR(1)	0.6058 (6.46)***	0.6099 (7.17)***	0.5938 (6.95)***
MA(1)	–0.9899 (–41.97)***	–0.9899 (–5615.73)***	–0.9899 (–5496.92)***
Crash	–	0.0657 (0.61)	0.0054 (0.17)
Sample	1806–1894	1806–1899	1806–1899
$\ddot{R}^2$	0.1694	0.1732	0.1701
S.E.E.	0.1244	0.1228	0.123
AIC	–1.2961	–1.3142	–1.3104
Q-Stat(8)	3.5675	4.0476	4.3764
Q-stat(16)	12.99	13.959	13.872
Q-stat(24)	19.91	22.024	22.137
Jarque-Bera	0.9635	–0.6097	0.8317

Notes:
1. Figures in parentheses are *t*-statistics.
2. *** denotes significance at the 1% level.

priori reason to determine whether the impact is transitory or prolonged, both cases are estimated.

Results of the intervention analysis are reported in the second and third columns of Table 5. Surprisingly the Crash did not have any significant, both statistically and in terms of its magnitude, adverse impact on exports of dried cod, as reflected by the statistically insignificant and positive sign of the coefficient of the CRASH variable. Traditionally the Crash is commonly described as disastrous, but our empirical findings suggest that it may be somewhat exaggerated, at least as far as its impact

on the fishery is concerned.[33] In fact, exports of dried cod after the Crash went up, which is verified by both our intervention analysis results and reported trade statistics (Figure 4). The Crash could have had a significant adverse impact on the economy if there was a credit crunch. Fortunately, the liquidity problem of the fishing industry, and the whole economy as well, was effectively relieved by entries of Canadian banks shortly after the Crash – the Bank of Nova Scotia opened for business in Newfoundland on 21 December 1894, followed by the Bank of Montreal on 8 January 1895 and the Merchant's Bank of Halifax (now known as the Royal Bank of Canada) on 16 January 1895.[34] In the same month the Canadian currency also became legal tender in Newfoundland.[35]

VI. Banking Stability and Policy Implications

Although the Newfoundland Bank Crash occurred more than a century ago, it sheds light on banking theory and practice and provides many lessons of relevance to modern banking. An important issue of concern is banking stability under imperfect competition. As the Newfoundland episode shows, a "free" or highly unregulated banking system is not necessarily inherently unstable under imperfect competition, as the two commercial banks had at least coexisted for three decades without any apparent signs of "disequilibrium" or instability until 1887. As our model and empirical evidence suggest, a price leader-follower relationship can be one of the many possible mechanisms to maintain stability in

[33] This is not to claim that the Crash was not costly and had no adverse impact at all on the economy. Shareholders, banknote-holders, depositors and other creditors of the two banks definitely suffered losses. We shall return to a more detailed discussion on this issue in the next section.

[34] Thereafter the Newfoundland banking system remained stable, thanks to the stability of the Canadian banking system. Even the Great Depression did not cause any reported bank runs and failures. As its profit opportunities were limited by its status as a saving rather than lending institution, the Savings Bank was ultimately sold to the Bank of Montreal in 1962.

[35] As Newfoundland did not join the Canadian Confederation until 1949, this is an example of "dollarization" in which one country's currency circulates in another country as legal tender. However, the positive impact, if any, of using the Canadian currency on the Newfoundland economy was probably less important than that of Canadian banks' provision of loans and hence should not be exaggerated at this moment. This is because, at various times in the 19th and early 20th centuries, many of the large commercial enterprises in Newfoundland paid their employees' wages by issuing token or private money redeemable for merchandise at their stores. Some of these private monies remained in circulation well into the 20th century.

a duopolistic banking system. Whether such an equilibrium is stable and sustainable in the long run, however, can be controversial as the price leader-follower relationship may break down for one reason or another. In our case, the "equilibrium" was fragile and unstable following a phenomenal adverse shock to the economy. Signs of instability and "disequilibrium", notably the upward trend in Union Bank's loan-deposit ratio, emerged after the sharp decline in the catch of fish in 1887. More important, no mechanism seemed to have existed or emerged to restore stability and to avert the Crash.

Therefore, one may be tempted to interpret the highly synchronized loan expansion of the two commercial banks in the few years immediately after 1887 as evidence of the celebrated "in-concert" overexpansion hypothesis in work, a traditional argument for free banking instability (see, e.g., Goodhart 1988). While the simultaneous overexpansion due to "competitive" pressure cannot be ruled out, it should be pointed out that Newfoundland's banking system was duopolistic, structurally different from the *laissez-faire* system generally referred to in the free-banking literature (see Selgin/White (1994) for a survey). Theoretically, Selgin (2001) argues that "in-concert" overexpansion is implausible because, given a fixed supply of reserves, individual banks would avoid the increasing risk of reserve losses from overexpansion. Empirically, Chu (2002) rejects the "in-concert" overexpansion hypothesis based on the highly unregulated Hong Kong banking system before 1965. Unfortunately, the Newfoundland banking system lacked an effective self-adjusting mechanism, such as adverse clearings, to check overexpansion.

While the inherent instability of a highly unregulated banking system under imperfect competition remains unresolved, our study lends support to the business-cycle view of banking panics (e.g., Gorton (1988)) as the Crash was driven by business-cycle fundamentals, namely the decline of the fishery sector in 1887, rather than any random sunspot event. Business cycles alone, of course, might not have been able to precipitate the Crash had there not been weak corporate governance of banks. As the majority of the two commercial banks' directors were also their borrowers, impartial checks on credit policy were absent.[36] After the Crash,

[36] Of course, this does not imply that directors who are also borrowers will always cheat and default on their banks. For example, the kinship-based banks played a crucial role in promoting economic development in New England (1986). However, it should be pointed out that while the New England and Newfoundland banks were similar in organizational structure (namely, directors were also borrowers), they were so different in capital structure that there should be different

the directors and managers of both banks were charged with publishing false statements to defraud their shareholders although they were not found guilty.[37] Even if their operations were not fraudulent, the two banks could have been restrained from excessive expansion and prevented from a crash had there been a separation between bank management and clients or a governance structure that could have solved or mitigated the conflict of interests.[38]

Does this mean that the Crash could have been prevented by government regulations or the existence of a financial safety net? Yes and no. A banking law or regulation stipulating the separation of bank management and clients could have strengthened the corporate governance of banks.[39] Unfortunately such a law was never enacted. Instead of acting as an impartial regulator or law enforcer, the Newfoundland Government facilitated the establishment of the Union Bank out of its dissatisfaction with the Bank of British North America.[40] To some extent, the withdrawal of the Bank of British North America from Newfoundland in 1857 is an example of Gresham's Law in banking, i.e., "bad" banks drive out "good".[41] It is also an example of government failures in banking that distort incentives or the trade-off between risk and return.[42]

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implications for bank governance. In the case of New England, deposits accounted for only 21% of total liabilities, substantially lower than the 55% for capital. By contrast, the Newfoundland banks were closer to modern banks in terms of leverage: available balance sheets show that deposits and capital accounted for approximately 16% and 66% of total liabilities.

[37] In the trial of the Commercial Bank directorate, the defendants were found not guilty because of the impossibility for the Crown to prove that the bank's debentures and overdrafts were not assets, which the directors claimed they were. Following the result of this trial, the Union Bank case was dropped (see *In the Matter of the Crown versus the Directors and Manager of the Commercial Bank of Newfoundland* (1895) and *In the Matter of the Crown versus the Directors and Manger of the Union Bank of Newfoundland* (1895) for details).

[38] Admittedly, the governance of financial institutions has received little attention from the academic literature until recently. See *Adams/Mehran* (2003) for the systematic differences between the governance of banking and manufacturing firms.

[39] Alternatively, for example, *Macey/O'Hara* (2003) recently propose that, to ensure the safety and soundness of banks, bank directors should face personal liability for failure to fulfill fiduciary duties.

[40] See Footnote 7. Also, the Newfoundland Government granted in 1844 a charter to the Newfoundland Bank, which never opened for business. "This Bank was founded for no other purpose than to prick the Bank of British North America into less illiberal terms. To a point it succeeded and therefore justified its existence." (*Sparkes* (1962), p. 24)

[41] The bank was known for its stringent terms and conservative lending policy. It continued carrying on business in Canada until 1918 when it was absorbed by

Given the closure of the Union Bank following a bank run on Black Monday, could a financial safety net like a deposit insurance scheme abort the Crash? Possibly but highly unlikely. Other countries' experiences indicate that it is highly unlikely, if not impossible, for a run to drive a solvent bank into insolvency (e. g., Kaufman (1990, 1994)). Similarly, illiquidity was unlikely to be the true reason for Union Bank's closure because the bank could have reopened for business after Black Monday when depositors realized it was in a financially sound position. A more plausible reason was insolvency, although some commentators have erroneously denied it.[43] After all, even deposit insurance is not always run-proof, as evidenced by runs on the Savings Bank, whose deposits were guaranteed by the Newfoundland Government, during and after the Crash largely because of doubtfulness about the government's ability to manage the growing public debt.[44] As in the meltdown of the Ohio and Maryland deposit insurance funds in 1985 (see, e. g., Kane (1989) for details), runs cannot be aborted when depositors fear that the insurer cannot cover their losses. Furthermore, the notorious moral-hazard problem associated with deposit insurance might encourage the Union Bank towards even more excessive risk-taking than we have actually observed.[45] Therefore, a deposit insurance scheme might at best postpone rather than avert the failure of the insolvent Union Bank.

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the Bank of Montreal. According to *Jamieson* ((1957), pp. 53–4), the British bank was sound and well managed; and the merger was arranged as a solution to difficulty in administration caused by restrictions on travel and communications during World War I.

[42] For other cases of government failures in money and banking, such as state ownership of banks, see *World Bank* ((2001), Chapter 3).

[43] For example, *Sparkes* wrote ((1962), p. 25), "Why the Union Bank crashed we shall never know. Really it is not true to say that it crashed. On that black Monday, 10 December 1894 when it closed its doors never to reopen them, it was able to pay 92 ½ cents to the dollar. Can this, even by the harshest standards be called insolvency?" However, *Rowe* ((1971), p. 11) had a more accurate assessment: "… The Union Bank Notes were assessed at 80 cents to the dollar whilst the Commercial Bank only amounted to 20 cents to the dollar. The shareholders of course lost everything."

[44] Based on figures from *Sparkes* (1962), deposit withdrawals from the Savings Bank totalled $20,394 in the three weeks following Black Monday and $1,581,576 in 1895 or 56 % of total deposits at the beginning of that year. The massive deposit withdrawals reflected a loss of public confidence in the poor economy and the government, whose debt amounted to over $9 million by 1894.

[45] Using a panel of 61 countries for 1980–1997, *Demirguc-Kunt/Detragiache* (2002) find that deposit insurance tends to induce banking crises, particularly among countries with weak institutional environments.

By the same token, a lender of last resort was unlikely to avert the Crash either, not to mention that a lender of last resort should not lend to an insolvent bank according to the classical Bagehotian principle (Bordo (1992)). In most cases, regulators bail out insolvent banks because of their own career objectives (Kane (1990)) or because of the too-big-to-fail doctrine. Our intervention analysis results, however, suggest that regulators do not have to follow the too-big-to-fail doctrine in resolving banking crises.[46] Almost all works in the existing literature on the Crash have described the Crash as a disaster causing widespread business failures and massive unemployment.[47] The evidence these works have provided, however, is largely anecdotal. Their descriptions of the Crash are inconsistent with our intervention analysis results as well as the statistics of exports of dried cod in the subsequent years after the Crash. In all likelihood, the adverse impact of the Crash has probably been exaggerated or dramatized, just like the US free banking era.[48]

This is by no means to claim that bank failures are not costly, as the two banks' depositors, note-holders and shareholders definitely suffered losses from the Crash. Indeed, systemic banking crises are very costly (see, e.g., Caprio/Kliegebeil (1999), among others). But bygones are bygones. Banks' poor portfolio choices, once made, are difficult, if not impossible, to reverse into profitable investments. Therefore, it is not economically justifiable to allow insolvent banks, no matter how large they are, to stay afloat by regulators' forbearance. Furthermore, there are other feasible means to alleviate the adverse impact of a large bank failure. In the Newfoundland Bank Crash, the short-lived illiquidity problem was alleviated by entries of Canadian banks and adoption of the Canadian dollar as legal tender. From this perspective, free banking – by removing barriers of entry to existing foreign banks and to domestic potential entrants as well, and also by allowing the circulation of foreign currencies – is one of the feasible methods to resolve banking and currency crises. Allowing large banks to fail does not necessarily cause a

[46] *Kaufman* (1990, 2000) has already pointed out that neither theory nor historical record provides strong support for the widespread fears that large bank failures would trigger a domino effect bringing down other banks, and possibly the economy as well, and could reduce substantially the availability of banking services.

[47] Even without the Crash, seasonal unemployment would be high in winter.

[48] The US free banking era had been generally believed to be disastrous until many empirical studies published in the last two decades show that it was exaggerated. See, for example, *Rockoff* (1974) and *Rolnick/Weber* (1983), among many others.

significant adverse impact on the economy or the impact can be substantially lessened when the roles of failed banks are appropriately and promptly taken up by other existing banks or new entrants.

VII. Conclusion

This paper has examined the Newfoundland Bank Crash of 1894 in which the commercial banks in a duopolistic loan market both went under simultaneously. The duopolistic market had maintained banking stability for three decades by a price leader-follower relationship, as reflected by our regression results, until a drastic decline in exports of dried cod in 1887, which triggered a regime change into simultaneous loan expansion that ultimately precipitated a systemic banking failure.

The Crash was the outcome of a combination of factors. In the real sector, the major driving force was the over dependency of the economy on a single resource. A considerable downturn in the business cycle easily raised systemic banking risk because of lack of output diversification. In the banking sector, a main factor causing the Crash was inadequate corporate governance of banks – the overlapped dual role of directors and merchants (bank borrowers), unrestrained excessive loan expansion, and imprudent, if not irregular and fraudulent, banking practice. To some extent, the Newfoundland Government also aided and abetted the "bad" banks to drive out the "good", because of its need of a bank to help circulating its Treasury Notes to finance the public debt.

Although the relatively lax banking regulation and supervision were to blame, a financial safety net such as a deposit insurance scheme or a lender of last resort, even if existed in this "free" or highly unregulated banking system, could in all likelihood only postpone rather than prevent the Crash because the two banks were insolvent. The short-lived liquidity crisis was ultimately alleviated by allowing entries of Canadian banks and the adoption of the Canadian dollar as currency shortly after the Crash. In practice, the *laissez-faire* principle of free entry can be a successful method of resolving banking crises, as both our intervention analysis results and the official export statistics suggest that the Crash did not have any significant adverse impact on the fishery sector. Therefore, regulators should carefully reconsider their too-big-to-fail policy in resolving bank failures – it is not necessary to keep large insolvent banks afloat by regulatory forbearance.

In brief, this study not only sheds light on our understanding of the working of a duopolistic banking industry but also provides lessons for banking regulation and policies, the too-big-to-fail doctrine in particular. As in most imperfect competition theory, this study, however, has provided only one of the many possible stories. In particular, our study has not analysed the oligopolistic deposit market and how it interacted with the duopolistic loan market, mainly because of the limited availability of data. Despite recent contributions and advancement (e. g., Berger et al. (2004), Allen/Gale (2004), Kahn (2004), Boyd et al. (2004), Thakor (2004)), further research is needed before we have a much better understanding of the relationship between banking stability and imperfect competition.

Appendix: Derivations of the Lending Functions

This appendix derives the specifications of the two banks' lending functions for the regression analysis and also shows the comparative-statics analysis result of the response of Commercial Bank's loans to a change in exports of dried cod.

In our duopoly model, bank I is assumed to maximize its expected profits:

$$E(\Pi_i) = r_L L_i - r_d D_i - r_p(\ddot{w} D_i - R_i) - C_i(L_i,\ D_i). \tag{A1}$$

subject to the balance-sheet constraint:

$$L_i + R_i = D_i + \ddot{K}_i. \tag{A2}$$

In Equation (A1), the real resource cost function $C_i(L_i,\ D_i)$ is assumed to be twice differentiable and separable in L_i and D_i. Assume for simplicity that the marginal cost of making loans is $C_i^{'}(L_i,\ D_i) = c_i L_i$, where c_i is a constant. Assume also $c_2 > c_1$ to reflect the Union Bank's cost advantage over the Commercial Bank. Without loss of generality, we can simplify the algebraic manipulations by normalizing $c_2 = 1$ and $c_1 = 0$.

First consider Commercial Bank's profit maximization problem. Since the bank is a price taker, both the lending and deposit rates are taken as given in its optimization problem. Therefore, the first-order conditions are:

$$r_L - \frac{\partial C_2(\cdot)}{\partial L_2} + \lambda_2 = 0. \tag{A3}$$

$$-r_d - r_p w - \frac{\partial C_2(\cdot)}{\partial L_2} + \lambda_2 = 0. \tag{A4}$$

$$r_p + \lambda_2 = 0. \tag{A5}$$

$$L_2 + R_2 = D_2 + \ddot{K}_2. \tag{A6}$$

where λ_2 is the Langrangean multiplier. From (A3) and (A5), we can solve for the optimal level of loans, which is characterized by equating the marginal real resource cost of loans (since $c_2 = 1$ by normalization) to the differential between the lending rate and the penalty rate:

$$L_2^* = r_L - r_p. \tag{A7}$$

Similarly, the optimal level of deposit is determined by (A4), whereas the optimal level of reserve is determined as the residual asset from the balance-sheet constraint (A6). The model has the well-known property of independence of loan and deposit decisions. Unfortunately, Equation (A7) is not empirically operational as data on marginal costs and the lending and penalty rates are unavailable. Alternatively, one solves for the reduced form of L_2^* in terms of exports of dried cod from (A3), and the loan demand (1). But as will be seen very shortly below, this approach also requires data on the interest elasticity of loan demand unless we assume that the elasticity does not change in response to changes in exports of dried cod. To make model verification empirically operational, we thus make use of the balance-sheet constraint (A6) and apply the applications and sources of funds as described in the text.

Next we turn to derive Union Bank's lending function. After substituting (A7) into (1), the inverse loan demand function can now be written as:

$$r_L = \frac{1}{(a_2 + 1)}\left(a_0 + a_1 EX + r_p - L_1\right). \tag{1'}$$

Whether the bank sets price or output does not affect the solution to its profit maximization problem. Thus, the first-order conditions are:

$$r_L + L_1 \frac{\partial r_L}{\partial L_1} - \frac{\partial C_1(\cdot)}{\partial L_1} + \lambda_1 = 0. \tag{A8}$$

$$-r_d - D_1 \frac{\partial r_d}{\partial D_1} - r_p w - \frac{\partial C_1(\cdot)}{\partial D_1} - \lambda_1 = 0. \tag{A9}$$

(A10) $$r_p + \lambda_1 = 0.$$

(A11) $$L_1 + R_1 = D_1 + \ddot{K}_1.$$

From (1′), (A8) and (A10), the optimal level of loans can be solved as:

(A12) $$L_1^* = \frac{1}{2}\left(a_0 + a_1 EX - a_2 r_p\right).$$

As exports of dried cod are considerably larger in value than the given parameters and the penalty rate, the logarithm of the expression inside the parentheses on the R.H.S. of (A12) can be simply approximated by the logarithm of exports of dried cod. Therefore, taking logarithms and differencing of (A12) yields (2) for our empirical verification. The model also provides a further testable hypothesis: namely a one-percent increase in the exports of cod leads to a one-percent increase in Union Bank's loans. Or in other words, $\alpha_1 = 1$.

Finally, we examine the relationship between the growth in exports of cod and Commercial Bank's loan growth. From (1′), (A7), and (A12), we obtain

(A13) $$L_2^* = \frac{1}{2(1 + a_2)}\left(a_0 + a_1 EX - a_2 r_p\right).$$

Taking logarithm yields

(A14) $$\ln\left(L_2^*\right) = constant + \ln(EX) - \ln(1 + a_2).$$

The parameter a_2 is related to the interest elasticity of aggregate loan demand. If it is a constant, then a one-percent increase in exports of dried cod will lead to a one-percent increase in Commercial Bank's loans. However, it is more likely to be the case that an increase in exports of dried cod will not only shift the position of the aggregate loan demand schedule but also its slope (i. e., a_2). If this is the case, the relationship between the growth in exports of dried cod and Commercial Bank's loan growth will be ambiguous, depending on the magnitude of change in the second term relative to the last term in (A14). This ambiguity, however, can be a virtue rather than a vice because it serves to discriminate the price leader-follower theory from the Cournot's and Stackelberg's duopoly models. The latter theories can be rejected if there is empirically a negative relationship between export growth of dried cod and growth in Commercial Bank's loans.

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Summary

Too Big to Fail?
The Newfoundland Bank Crash of 1894

In the Newfoundland Bank Crash of 1894, the commercial banks in a duopolistic loan market both went under simultaneously. The banking system was "free", as central bank, deposit insurance, and lender of last resort were all absent. The objective of this study is to shed light on our understanding of the working of a duopolistic bank loan market and to provide lessons for banking regulation and policies, the too-big-to-fail doctrine in particular. Our regression results suggest a price leader-follower relationship before 1887, and a drastic decline in exports that year triggered a regime change into simultaneous loan expansion that ultimately precipitated a systemic banking failure. The short-lived liquidity crisis, however, was alleviated by entries of Canadian banks. More important, results of intervention analysis suggest that the Crash did not have any significant adverse impact on the fishery sector, the pillar of the single-resource economy.
(JEL E5, G2, N2)

Zusammenfassung

Zu groß für den Untergang?
Bankenzusammenbruch in Neufundland im Jahr 1894

Bei dem Bankenzusammenbruch in Neufundland im Jahr 1894 war der Markt für das Aktivgeschäft der beiden Geschäftsbanken auf dem duopolistisch strukturierten Markt gleichzeitig weggebrochen. Das Bankensystem war „frei", da es keine Zentralbank, keine Einlagensicherung und keine Refinanzierungsinstitute gab. Ziel dieses Artikels ist es, Licht auf unser Verständnis der Arbeitsweise zu werfen, das wir für einen von einem Duopol gekennzeichneten Markt für das Aktivgeschäft entwickelt haben, und der Politik und den Bankenregulierern Lehren insbesondere in Bezug auf die Doktrin zu erteilen, dass ein Unternehmen zu groß für den Untergang ist. Unsere Regressionsergebnisse lassen erkennen, dass vor 1887 eine Beziehung zwischen Preisführern und -folgern existierte; ein drastischer Rückgang der Ausfuhren in eben diesem Jahr löste einen Systemwechsel hin zu einer gleichzeitigen Expansion des Aktivgeschäfts aus, wodurch letztlich ein systembedingter Bankenzusammenbruch beschleunigt herbeigeführt wurde. Die kurzfristige Liquiditätskrise wurde jedoch dadurch gemildert, dass kanadische Banken sich ebenfalls auf diesem Markt zu betätigen begannen. Wichtiger noch ist die Tatsache, dass die Ergebnisse einer Interventionsanalyse darauf hindeuten, dass der Bankenzusammenbruch auf den Fischereisektor, die einzige Stütze der Volkswirtschaft, keine signifikant nachteiligen Wirkungen gehabt hat.