BANK OF CANADA

Financial System Review

December 2002

Members of the Editorial Committee

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Foreword

The financial system, which consists of financial institutions, financial markets, and clearing and settlement systems, plays an important role in a nation's economy. Sound and efficient financial systems can make a significant contribution to economic growth. But as we have seen in many countries in recent years, a financial system that is not soundly based can make problems that originate elsewhere in the economy much worse and can even be the source of problems itself.

The Bank of Canada is one of several federal and provincial agencies and organizations in Canada that promote the safety and efficiency of our financial system. Each one brings a specialized expertise to this activity. The Bank contributes a broad perspective that reflects the major activities in which it is engaged. As the monetary authority, the Bank brings a macroeconomic or systemwide point of view to issues concerning the financial sector, as well as extensive knowledge of financial markets. As the source of ultimate liquidity to the financial system (and, thus, the lender of last resort) the Bank is acutely aware of stresses that can develop in the system during times of financial turbulence. And, as the overseer of clearing and settlement systems that could pose significant risk to the financial system, the Bank has developed expertise in the design and operation of arrangements to control this risk. Finally, as fiscal agent for the Government of Canada, the Bank has a particular interest in well-functioning government debt markets.

The Bank devotes considerable resources to assessing developments and trends in both domestic and international financial systems. As the oversight agency for key clearing and settlement systems and as a participant in interagency committees, the Bank is also very involved in the policy and infrastructure developments that affect the financial system. Bank staff conduct extensive research in these areas, which enables us to better understand ongoing developments and to contribute to good policy-making. The goal of the *Financial System Review* (*FSR*), which will be issued semi-annually by the Bank, is to share with financial system participants and the Canadian public the Bank's research, analyses, and judgments on various issues and developments concerning the financial system. Our hope is that through this publication, the Bank will contribute to greater understanding of such issues and promote a more informed discussion of policy and developments in Canada and abroad.

With the publication of the *FSR*, the Bank of Canada is taking another step towards increased openness and transparency. Indeed, a number of central banks and the IMF already issue similar reports, which have proven useful to those with an interest in the financial sector in their countries and around the world, and have improved awareness and discussion of developments in the financial system. We hope that the *FSR* will contribute to such a dialogue in Canada and that, working together, the public and private sectors can enhance the efficiency and stability of the Canadian financial system.

Charles Freedman
Deputy Governor and Chair
of the Editorial Committee of the
Financial System Review

Developments and Trends

Notes

The material in this document is based on information available to 4 December unless otherwise indicated.

The phrase “major banks” in Canada refers to the six largest Canadian commercial banks by asset size: the Bank of Montreal, CIBC, National Bank of Canada, RBC Financial Group, Scotiabank, and TD Bank Financial Group.

Introduction

This section of the Financial System Review *examines the recent performance of the Canadian financial system and the factors, both domestic and international, that are influencing it. Related topics of particular interest are discussed under "Highlighted Issues."*

Key Points

- The Canadian financial system has demonstrated impressive resilience in the face of a significant degree of global financial stress.
- Revelations of corporate malfeasance have prompted worldwide efforts to improve transparency and buttress confidence in corporate accounting and governance.
- An important degree of uncertainty persists within the global economic and financial system, indicating a continuing need to closely monitor and analyze financial developments.

The Canadian financial system has coped well during the recent period of increased financial stress. Over the past two years, the global financial system has been affected by a number of shocks in conjunction with a weakening economic environment in the industrialized economies. The Canadian financial system has not been unaffected. It has faced a period of slower domestic economic growth, a deterioration in the quality of corporate credit, and substantial losses by investors (including losses on investments made by financial institutions). Revelations concerning corporate malfeasance (primarily in the United States) also shook market confidence. Together, these factors have contributed to heightened uncertainty and, at times, have been reflected in above-average levels of volatility in financial markets.

In the face of these global developments, the Canadian financial system has been resilient. Aided by strong financial foundations and improved diversification relative to previous periods of increased stress, Canadian financial institutions as a group remain in a sound position. Financial markets, despite periods of increased volatility relative to historical norms, functioned relatively well while maintaining reasonably good levels of liquidity. In addition, efforts are underway by both public and private sector entities, in North America and elsewhere, to improve transparency and rebuild confidence in corporate accounting standards and governance practices.

A key element going forward is the increased uncertainty that continues to persist within the global economic and financial system. Past shocks will continue to affect the financial system, and global economic, financial, and geopolitical uncertainties remain. In this environment, it will be important to closely monitor and analyze developments within the financial system as well as its overall performance. To improve understanding of how the financial system operates during periods of above-average stress, it is also important to encourage discussion and analysis of ongoing financial innovation (e.g., the steadily broadening array of financial instruments), both in Canada and globally.

Highlighted Issues

Issues discussed in this section include the impressive resilience of the Canadian financial system in the face of increased global economic and financial stress, and the ongoing international and Canadian response to concerns over corporate accounting and governance standards.

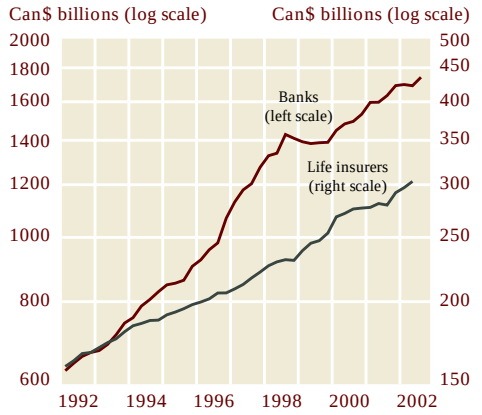
The Resilience of the Canadian Financial System

The Canadian financial system, including financial institutions, has expanded significantly over the past decade (Chart 1). During the past two years, however, the global financial system has experienced an unusual series of adverse shocks, placing strains on national financial systems around the world. In the face of elevated levels of financial stress, the Canadian financial system as a whole has shown itself capable of effectively meeting the current challenges. Canadian financial institutions entered the recent period of economic slowing in a much-improved position compared with earlier stressful episodes, owing partly to strong profitability and improved capital positions within the banking sector. Nevertheless, heightened levels of pressure on the financial system are likely to continue over the immediate future.

The recent adverse economic and financial shocks not only directly contributed to losses for investors and profit declines for financial institutions generally, but also contributed to a weaker global economic climate (Chart 2). Among these shocks was the bursting of the so-called "tech bubble," which began in 2000. Prospects for telecommunications and Internet-related companies deteriorated dramatically and, as is evident in the NASDAQ index, were reflected in their falling equity valuations (Chart 3). This has led to significant sectoral losses for bank lenders and unusually high losses for bond and equity holders.

In addition, the 11 September 2001 terrorist attacks in the United States affected more than short-term prospects for economic growth. They also led to substantial global claims on insurance companies and created difficulties and uncertainty for specific industries (e.g., airlines and tourism). Geopolitical concerns have persisted, with a heightened level of tension in

Chart 1 Total Assets: Canadian Financial Institutions



Source: Bank of Canada

Chart 2 Real GDP Growth

Year-over-year percentage change

* Member economies of the OECD
Source: Thompson Financial Datastream and Statistics Canada

Chart 3 Tech Bubble

Indexed to 2 January 1998 = 100

Source: Thompson Financial Datastream

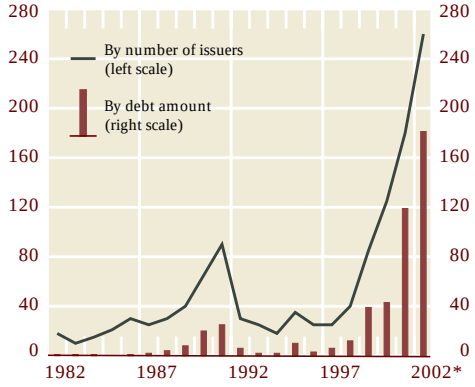
Chart 4 Bond Spread (EMBI+)

Basis points (over U.S. Treasury bonds)

Source: J.P. Morgan

Chart 5 Global Corporate Defaults

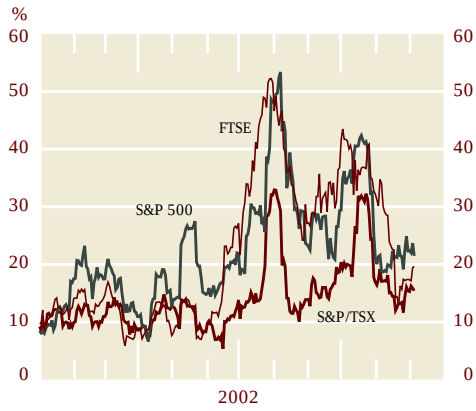
US$ billions



* Annualized figures based on the first three quarters
Source: Standard & Poor's

Chart 6 Volatility of Equity Indexes

10-day annualized historical volatility



Source: Thompson Financial Datastream and Bank of Canada calculations

areas such as the Middle East, the Persian Gulf, and Southeast Asia.

Markets have also been affected by mounting financial difficulties in several Latin American countries, and bond spreads have risen as a result (Chart 4). In January 2002, Argentina effectively defaulted on its sovereign debt. More recently, markets have shown concern over the financial stability of Brazil.

In December 2001, the U.S. energy company Enron declared bankruptcy, an event notable for the surprising rapidity with which it occurred. Subsequent revelations about questionable corporate accounting and governance practices at Enron and at other companies damaged investor confidence in financial statements and led to a reassessment of the financial strength of a number of corporations.

These events, along with the sluggish global economy, contributed to a heightened level of corporate fragility. Defaults on corporate bonds globally rose to unprecedented levels in 2002 (Chart 5). Other sources of concern also emerged, such as the potential need for corporations to make "top-up" contributions to defined benefit pension plans because of diminished (or negative) returns on the plans' equity portfolios.

During the summer of 2002, further dramatic revelations concerning questionable corporate accounting and governance practices again shook market confidence in the quality of financial statements and corporate management. The decline in global equity markets, compounded by a reallocation of investor portfolios towards less-risky assets, contributed to diminishing optimism regarding the economic outlook (particularly in the United States and, more recently, in Europe). Reflecting an elevated level of uncertainty, financial markets, globally and in Canada, were characterized by heightened volatility relative to typical levels (Charts 6 and 7).[1]

In this environment of increased uncertainty, changing perceptions of risk associated with financial assets and declining investor willingness to take on risk (i.e., rising risk aversion) contributed to the movements in equity and bond prices. Spreads on high-yield

1. While the recent observed levels of volatility are unusual, they are not unprecedented.

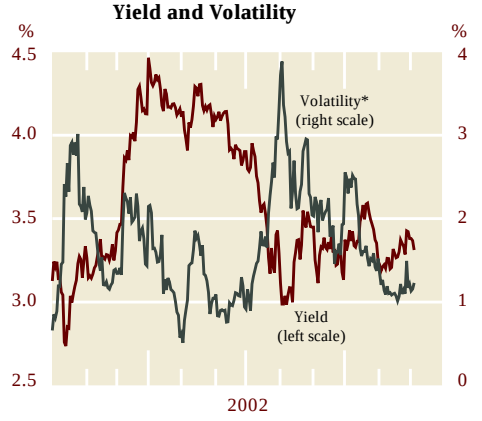
(i.e., relatively risky) bonds rose particularly sharply (Chart 8).

Inevitably, all of these developments have adversely affected the revenues and profitability of Canadian financial institutions. More generally, losses have been widely distributed among holders of financial assets. For example, the downward trend in equity values has directly affected merchant banking portfolios, the investment portfolios of insurance companies and pension funds, and the wealth of individual investors. The deterioration in credit quality has most directly affected banks through increased loan losses, but non-financial companies have also experienced losses on vendor financing. Bondholders have also faced higher default levels (although declining medium- and long-term interest rates for higher-grade bonds have provided an offset in the form of higher prices over the recent period).

Overall, the Canadian financial system has coped well with the events and related pressures of the past two years. Banks, which account for over one-half of the assets held in Canada by the financial services sector, have responded to the corporate sector difficulties arising from these shocks by adding significantly to their loan-loss provisions (Chart 9). Insurance companies have also provisioned against losses on their portfolio investments. This has been accomplished without significant impact on the capital base of Canadian financial institutions as a whole. Banks have also sought to manage their exposure to credit risk in the current climate, and some major banks have announced longer-term plans to reduce the proportion of capital allocated to corporate lending. Despite heightened levels of volatility relative to historical norms, financial markets continued to function relatively well, setting prices of financial assets while maintaining reasonably liquid markets.

The resilience of the Canadian banking system is especially welcome when compared with the difficulties that the sector faced during earlier cyclical downturns (e.g., in the early 1990s, which included the associated downturn in the commercial real estate sector). Several factors have contributed to this. Various measures have enhanced the banks' overall robustness (e.g., loan-loss provisioning practices have been adjusted to improve their timeliness and include the use of general provisions), and banks now

Chart 7 2-year Government of Canada Bonds: Yield and Volatility

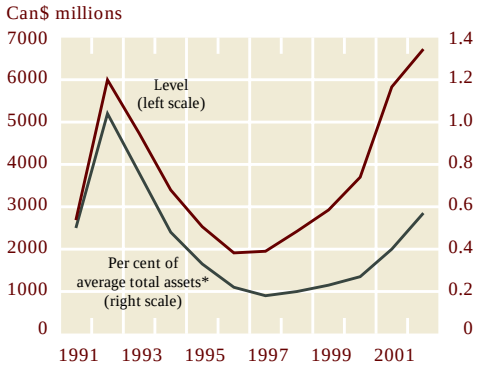


* 10-day historical volatility
Source: Thompson Financial Datastream and Bank of Canada calculations

Chart 8 Spreads Between Canadian Corporate and Government Bonds

* Large changes can occur owing to compositional shifts
Source: Scotia Capital

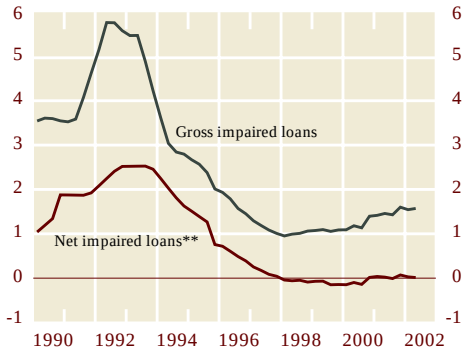
Chart 9 Provision for Credit Losses: Major Canadian Banks



* Assets on a taxable equivalent basis
Note: Figures for 2002 are based on the first three quarters.
Source: Canadian Bankers Association and Bank of Canada

Chart 10 Non-Performing Loans: Major Banks

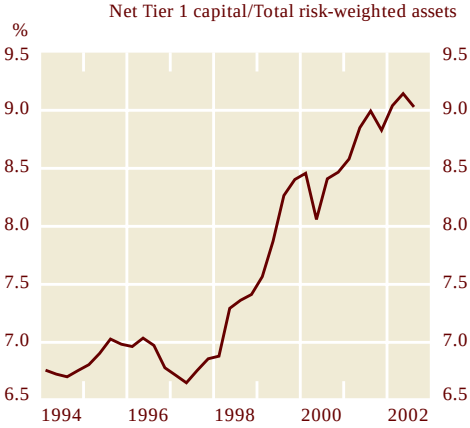
As a percentage of total loans*



* Net of loan-loss allowances
** Impaired loans less allowances
Source: Office of the Superintendent of Financial Institutions

Chart 11 Tier 1 Capital Ratio: Major Banks

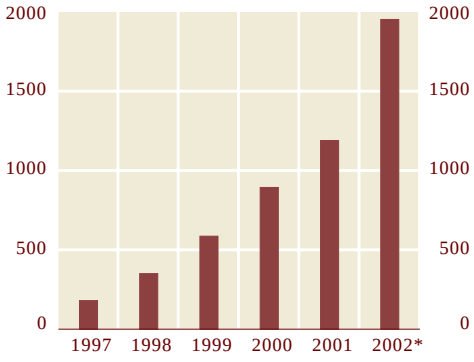
Net Tier 1 capital/Total risk-weighted assets



Source: Office of the Superintendent of Financial Institutions

Chart 12 Size of Global Credit-Risk Transfer Markets

US$ billions



* Figure for 2002 is estimated

have more diversified revenue sources and portfolios. Benefiting from diversification, the level of non-performing loans has risen but remains well below earlier peaks (Chart 10). The average Tier 1 capital ratio of the major banks has moved upwards over the course of the 1990s and remains high despite current pressures (Chart 11).[2]

How financial systems in Canada and elsewhere perform during periods of increased financial stress may be affected by changes brought about by financial innovation.[3] For example, innovative financial instruments involving the transfer of credit risk (Chart 12) have expanded the means available for managing risk exposure. These instruments, which allow credit risk (i.e., the potential for losses when extending credit) to be treated essentially as a tradable commodity, facilitate the adjustment of risk profiles in a way that better reflects institutions' ability to absorb risk.[4] At the same time, markets for some of these instruments are relatively new. Particularly during periods of above-average financial stress, it is important to encourage assessments of the effects of such financial innovations to help in understanding their implications.

Responding to Deficiencies in Corporate Accounting and Governance

A series of revelations last summer increased concerns about the use of improper accounting methods in corporate financial statements. These events also reinforced questions about whether senior corporate executives and board members had acted in the best interests of shareholders. The perception that market confidence in corporate behaviour and financial statements had been severely impaired added a sense of urgency to the efforts within official and private sector bodies to buttress confidence in the standards for corporate accounting and governance. This was particularly important in an environment where other factors were

2. Tier 1 capital represents the highest quality of capital that underpins the banks' activities.
3. For a discussion of innovation among financial-service providers, see the article by Freedman and Goodlet in this *Review* (page 57).
4. See Box 5 on page 20 for a more specific discussion of these financial instruments.

already contributing to increased risk aversion on the part of investors.

The range of international activity in this area has been extensive. In the United States, where much of the corporate malfeasance originally came to light, government legislation in the form of the Sarbanes-Oxley Act (signed into law on 30 July) introduced a broad array of changes designed to improve corporate governance and raise confidence in financial statements. The Act included a new oversight board (the PCAOB) to monitor the U.S. accounting industry. See Box 1 for a list of relevant organizations.

Securities regulators, stock exchanges, and government authorities have also been examining a wide range of business activities with respect to their impact on investor confidence. For example, the combination of investment banking activities and stock research in the same firm, together with the distribution of shares under initial public offerings (IPOs), has come under close scrutiny because of perceived conflicts of interest.

There has also been an increased focus on international co-operation. The IASB and the U.S. FASB recently issued a memorandum describing their joint efforts to bring about greater convergence in global accounting standards. In October, the FASB released a proposal for a new principles-based approach to setting U.S. accounting standards. Also in October, IOSCO released a set of principles designed to guide national securities regulators with respect to company disclosure and auditor independence and oversight. This broad re-examination of corporate governance and accounting has been supported by international bodies such as the FSF and the OECD.

These events have raised a range of issues for both financial and non-financial Canadian companies, and for the relevant oversight bodies in Canada (see Box 2). While efforts to increase financial transparency, allowing investors to better assess risk and financial soundness, will be beneficial, careful evaluation over time will be important to avoid unintended effects from regulatory and related changes.

Box 1

Selected Organizations

AASOC	Auditing and Assurance Standards Oversight Council (Canada)
AcSB	Accounting Standards Board (Canada)
AcSOC	Accounting Standards Oversight Council (Canada)
CICA	Canadian Institute of Chartered Accountants
CSA	Canadian Securities Administrators
CPAB	Canadian Public Accountability Board
FASB	Financial Accounting Standards Board (United States)
FSF	Financial Stability Forum
IAIS	International Association of Insurance Supervisors
IASB	International Accounting Standards Board
IDA	Investment Dealers Association (Canada)
IOSCO	International Organization of Securities Commissions
OECD	Organisation for Economic Co-operation and Development
OSFI	Office of the Superintendent of Financial Institutions (Canada)
PCAOB	Public Company Accounting Oversight Board (United States)
SEC	Securities and Exchange Commission (United States)
TSX	Toronto Stock Exchange

Box 2

The Regulatory and Accounting Response in Canada

International developments have raised a number of issues for Canadian authorities, regulators, and accounting bodies (among others). In some cases, Canadian firms are directly affected by foreign initiatives. For example, they may have their shares listed on U.S. stock exchanges and are thus affected by some of the measures contained in the Sarbanes-Oxley Act.[1] More fundamentally, in the current environment of diminished investor confidence, it appears unlikely that the status quo is a viable option. In assessing which changes to adopt, however, some provincial regulatory agencies and stock exchanges have argued that caution is necessary, suggesting that not all of the new rules introduced in the United States, for example, may be appropriate in the Canadian context. A sample of recent initiatives in Canada follows.

Auditing Standards

Perhaps the key development in Canada to date has been the announcement by the CSA, OSFI, and CICA of a new oversight board, the CPAB. The Board will oversee the introduction of new rules involving more rigorous inspection of the auditors of public companies, auditor independence, and new quality-control requirements for auditing firms. It will have the ability to impose sanctions against auditors who do not meet the required standards. In September, the CICA proposed new guidelines to assess and buttress auditor independence. These were adapted from international rules, as well as from the new SEC requirements in the United States. The CICA has also announced a new oversight body for the setting of auditing and assurance standards (the AASOC).

Accounting Standards

Specific accounting issues are also being addressed. The CICA has proposed new guidelines on the treatment of financial "special-purpose vehicles" in financial statements. The treatment of stock options has been a particularly contentious issue, both internationally and domestically. The Canadian AcSOC has publicly indicated that it supports in principle companies expensing stock options. More recently, the AcSB has announced that it will draw up explicit proposals to that effect. Indeed, some Canadian firms have already indicated that they will begin to expense stock options on their financial statements.

Governance Issues

Partly at the behest of securities regulators, stock exchanges have been examining their corporate-governance requirements for listed companies. For example, the TSX has announced changes for listed companies with regard to board composition. It has also supported the proposal that CEOs certify the accuracy of their companies' financial disclosures.

A contentious issue has been that of potential conflicts of interest in firms that offer an array of financial services. Some provincial regulators are currently pursuing this issue with the major Canadian securities firms. In April, the IDA proposed a new set of guidelines to address conflicts of interest, but a consensus has not yet developed around these proposals. Some provincial regulators have recently proposed increased penalties for firms and individuals who violate securities regulations.

Finally, in November, the CICA released a new framework for the management discussion and analysis component of corporate reports.

1. While this involves a relatively small number of Canadian publicly listed firms, they nevertheless represent approximately one-half of the market capitalization of Canadian firms. There is ongoing discussion as to whether Canadian companies and their auditors will receive an exemption from some elements of the new U.S. rules.

The Macrofinancial Environment

Global Environment

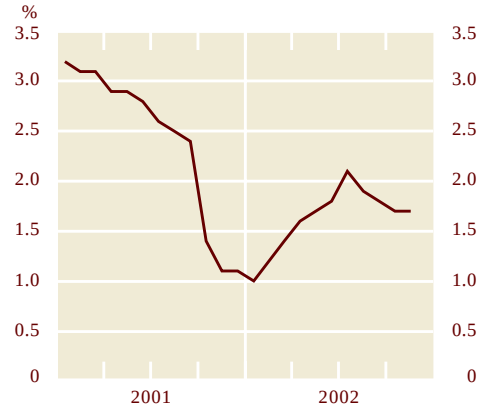
Over the past six months, the global environment has been marked by heightened uncertainty and downward revisions to estimates of the strength of the global recovery. Consensus projections for growth this year in the industrialized economies, after picking up sharply following the surprisingly rapid rebound during the first part of the year, stabilized and then reversed course in the summer (Chart 13).

A number of factors contributed to the pullback in expectations for growth. These included a generally unexpected weakening in U.S. growth in the second quarter, the uncertainty created by revelations (primarily in the United States) concerning deficient corporate accounting and governance, and the downturn in global equity markets.

These developments occurred in an environment where corporations were already under financial pressure. This was exemplified by the increase in credit-rating downgrades relative to upgrades for U.S. and European firms (Chart 14), with elevated levels of downgrades continuing into the third quarter. The telecommunications sector has been responsible for a relatively large proportion of problem issuers. Reflecting the higher level of global financial stress, financial institutions have also accounted for a relatively large proportion of credit downgrades. This is particularly the case for insurance companies which, worldwide, have come under pressure from higher claims and reduced investment income.[5]

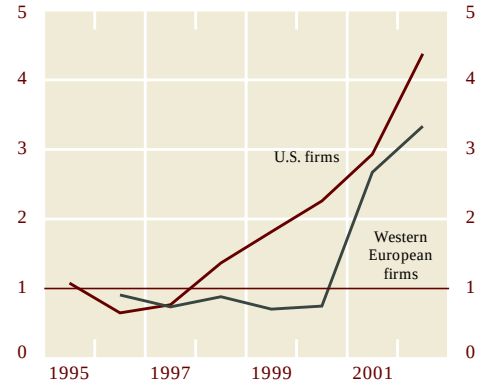
In some foreign economies, prices in the residential real estate market have been rising rapidly (e.g., Australia, the United Kingdom, and, to a lesser extent, the United States). Although this has provided an offset to the decline in household wealth arising from lower equity prices, such increases will eventually slow and may, in some cases, reverse.

Chart 13 Evolution of Consensus Estimates for Annual Growth in 2002



* North America, Western Europe, and Japan
Source: Consensus Economics

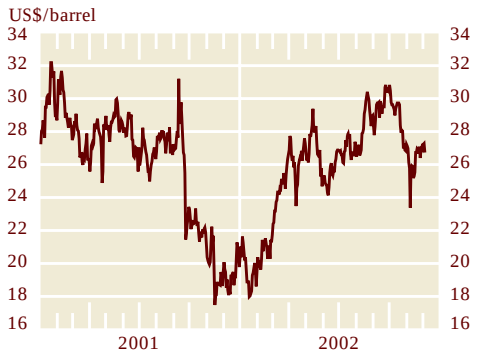
Chart 14 Corporate Downgrade/ Upgrade Ratio



Note: Figures for 2002 are based on the first three quarters.
Source: Moody's

5. Standard & Poor's estimates that the global insurance/reinsurance industry has experienced a net reduction in capital of approximately US$200 billion over the past several years.

Chart 15 Crude Oil Prices



Source: Bank of Canada

Chart 16 Indicators for Brazil

* Increase indicates a depreciation
Source: Thompson Financial Datastream and J.P. Morgan EMBI+

Table 1

Total Canadian Bank Claims on Selected Latin American Countries ($ millions)*

	2002Q2	2001Q2
Mexico	21,465	22,241
Chile	4,947	4,536
Argentina	2,467 **	4,798
Brazil	2,039	2,267
Peru	558	493
Venezuela	537	508
Uruguay	96	110

* Includes local claims of subsidiaries

** Does not reflect the sale of Quilmes Bank by Scotiabank (in the third quarter of 2002)

Source: Bank of Canada

Ongoing geopolitical concerns have been an additional source of uncertainty. These include tensions in the Middle East and the possibility of military action in the Persian Gulf. Although these concerns have induced some additional volatility in oil prices, price levels have moved up only moderately from the beginning of the year (Chart 15).

Emerging markets

Economic growth in emerging Asia has remained relatively robust, although showing some recent signs of weakening. The region has experienced only modest increases in interest rate spreads. Although the picture is less sanguine in Latin America (Box 3), emerging-market debt and equities generally have recently rallied as risk aversion appears to have diminished somewhat.

Economic and financial problems in Argentina, which effectively defaulted on its sovereign debt in early January, have persisted. The Argentine authorities and the International Monetary Fund have so far been unable to reach a successful conclusion to their discussions on a new financial program. In November, Argentina fell into arrears on its World Bank debt.

The financial situation is particularly volatile in Brazil, owing to uncertainty over the new government's economic program. This has been reflected in a sharp deterioration in Brazilian financial indicators, although they have recently improved (Chart 16).

Although some smaller Latin American countries have also come under increased financial stress, Mexico, assisted by a strengthened policy framework, has been largely unaffected by regional developments. The exposure of Canadian banks to Latin America is largely concentrated in Mexico (Table 1).

Japan and Europe

In Japan, near-term prospects for growth in domestic demand remain relatively poor, owing partly to low consumer confidence and persistent excess capacity. The weak economic performance of the economy since the early 1990s has been associated with persistent problems in the Japanese financial sector. Japanese banks have disposed of about ¥90 trillion (approximately Can$1.1 trillion) in non-performing loans over the past decade. Nevertheless, non-performing

Box 3

Economic and Financial Developments in Latin America

Many economies in Latin America have experienced deteriorating financial market conditions this year, as evidenced by rising bond spreads (Chart 1). The region has also experienced a sharp slowdown in economic activity, with some economies sustaining significant contractions in real GDP. Argentina's financial crisis is not yet resolved and has led to a reduction in output of 16 per cent in the first half of 2002 compared with the first half of 2001. Brazil and Uruguay also remain vulnerable, despite large financial packages from the IMF. Uncertainty regarding the new Brazilian government's economic program is contributing to financial market volatility in that country, while concerns about the viability of the Uruguayan banking system are undermining financial conditions there. Brazil experienced no growth in the first half of 2002 compared with the first half of last year, while Uruguay's GDP has contracted nearly 8 per cent.

Domestic political uncertainties in Venezuela, Ecuador, and Colombia have contributed to financial market volatility in these countries and to slowing growth as investment deteriorates.

While Mexico and Chile have experienced some financial sector turbulence, it has been on a much smaller scale than that seen in other Latin American economies. An adverse terms-of-trade shock (low copper prices and high oil prices) for Chile and the hesitant U.S. recovery help explain the financial market volatility in these countries. Both economies are expected to grow modestly this year.

Consensus forecasts indicate that growth in the region will rebound to 2.3 per cent next year from -0.6 per cent this year (Chart 2). An important factor driving expectations of a recovery is a bottoming out of the recession in Argentina and modest growth rebounds in Brazil and Mexico, as their major export markets pick up.

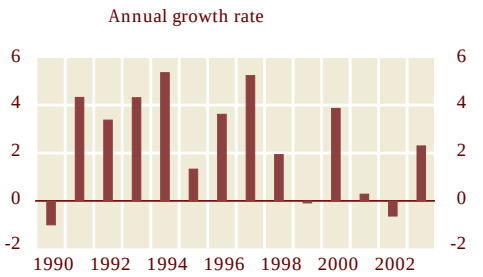
There are two important risks to the outlook in Latin America. One is the strength of the recovery in industrial countries, particularly in the United States. The second is whether Brazil's new government will be able to restore lasting confidence and reduce vulnerabilities there. Continued difficulties in Brazil would negatively affect its closest trading partners in the region (Argentina, Uruguay, and Paraguay).

The direct economic and financial links between Canada and Latin America are relatively small. Within Latin America, Canada is most closely linked with Mexico and Chile, currently two of the healthiest economies in the region. Also, given the relatively small size of the Latin American economy and the structure of its trade, even a further deterioration of demand conditions would probably have a relatively small impact on global commodity prices. Nevertheless, the need to increase loan-loss provisions on their Latin American exposure is one factor behind increased provisioning levels at Canadian banks this year.

Chart 1 Spreads on Selected Emerging-Market Bonds (EMBI+)

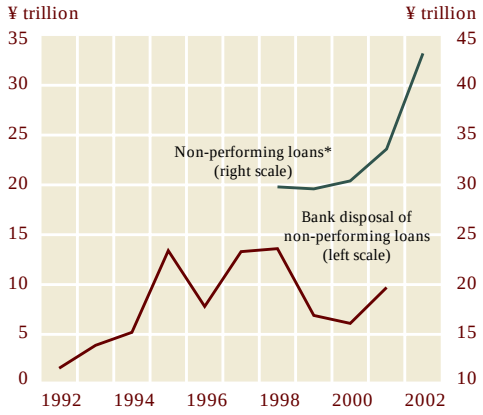
Source: J.P. Morgan

Chart 2 Real GDP Growth: Latin America



Notes: 1. Latin America in this chart includes Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela.
2. Forecasts for 2002 and 2003 are from Consensus Forecasts

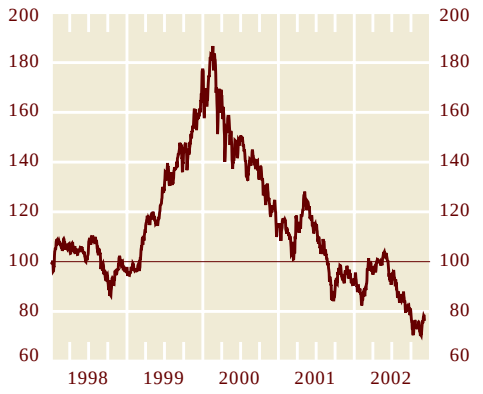
Chart 17 Non-Performing Loans: Japan



* Change in definition with respect to non-performing loans affected the 2002 level
Source: Bank of Japan and Japanese Financial Services Agency

Chart 18 Japanese Stock Market (Nikkei)

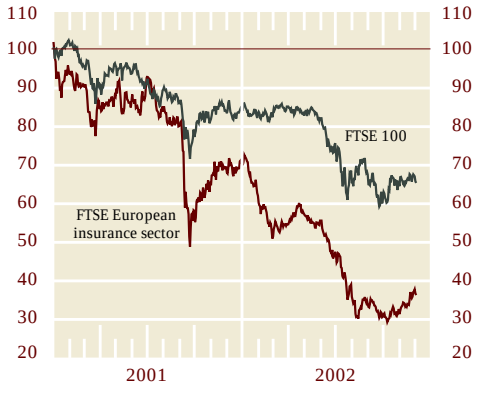
Indexed to 2 January 1998 = 100



Source: Thompson Financial Datastream

Chart 19 European Insurance Sector: Equity Prices

Indexed to 2 January 2001 = 100



Source: Thompson Financial Datastream

loans still on the banks' books remain at high levels (Chart 17).

In a report published by the Bank of Japan, the persistent high level of bad loans was attributed to newly generated non-performing loans from corporate restructuring. In addition, the report pointed to problems at banks created by the low lending margins and the fact that unrealized gains on bank shareholdings which, at one time, acted as a financial reserve for banks, have evaporated as a result of the decline in equity prices (Chart 18). With the shift to mark-to-market accounting last year, market risk pertaining to bank shareholdings is now considered to be a significant destabilizing factor. To help mitigate this, the Bank of Japan announced that it would buy up to ¥2 trillion of equities from domestic banks, with purchases beginning in late November. The impact of this measure is not yet clear.

Despite past efforts, the overall level and quality of the capital of Japan's major banks is considered to compare poorly relative to their international peers. Action to support the financial sector has been hampered by a lack of domestic consensus, although the government recently announced a set of proposals aimed at reducing problem loans in the banking system.

The European banking sector began the most recent credit cycle in a sounder position than at the beginning of the previous decade. Nevertheless, weaker economic growth and deteriorating credit quality have placed banks under increased pressure. This has been particularly true in Germany, where bank sector profitability had been comparatively weak. The credit ratings of several major European banks were reduced in recent months, and bank spreads have widened.

The European insurance sector has also come under increased pressure, partly as a result of the decline in equity prices. Despite significant strengths as a group, European insurance companies tend to invest a relatively large proportion of their assets in equities and thus have experienced significant investment losses (adding to those on their bond portfolios). This, together with higher insurance payouts, has adversely affected their financial strength and is reflected in the substantial decline in the equity valuation of the sector (Chart 19). The capital levels of large European reinsurance companies have also been adversely affected by developments

over this period, and some companies have had their credit ratings lowered.

United States

U.S. real GDP growth rebounded in the third quarter of this year (Chart 20). Despite this, the recent softening in business and consumer confidence and the slowing in manufacturing output have contributed to continued uncertainty about the persistence of the current recovery.

In this environment, business conditions remain difficult. U.S. corporations continue to be affected by a relatively high pace of credit downgrades (recently including Ford and General Motors), and corporate profits remain under pressure.[6] Nevertheless, aggregate corporate debt and net interest payments relative to cash flow have moved down from their recent peaks (Chart 21).

In spite of the elevated level of corporate defaults and a continued deterioration in syndicated loan quality (Chart 22), U.S. banks have been able to maintain a high level of profitability. Commerical banks earned US$68.6 billion in the first three quarters of the year, more than 10 per cent above earnings for the same period in 2001. Non-performing loans have continued to rise, but the overall coverage ratio of reserves to non-performing loans has remained well above 100 per cent (Chart 23).

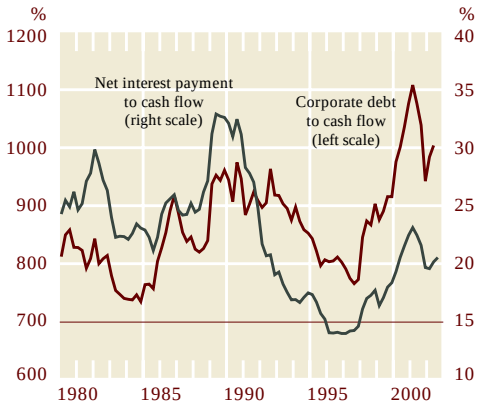
Some large U.S. banks that are heavily involved in investment banking have fared relatively poorly. Activity levels in the investment banking area have diminished, reducing revenues and, in some cases, leading to substantial reductions in staffing. The credit ratings of several large institutions have been downgraded. One risk that is difficult to evaluate is the extent of the legal risk of litigation and investigation that financial firms face in the United States in the aftermath of the recent financial and accounting improprieties on the part of some corporations.

Reflecting developments in the global industry, the financial position of U.S. insurance companies has deteriorated. Declining investment revenues and higher insurance payouts have hurt profits. Property and casualty insurance firms have been most heavily affected, and a portion

Chart 20 Real GDP Growth: United States

Source: Thompson Financial Datastream

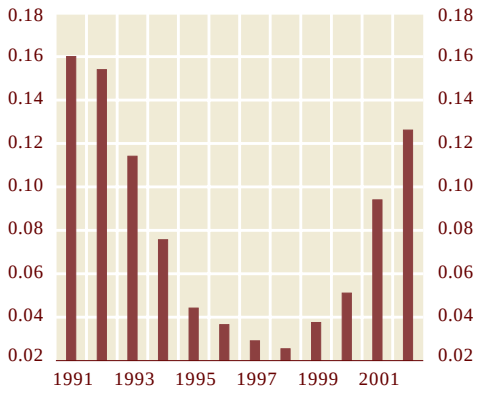
Chart 21 U.S. Corporate Debt and Net Interest Payments



Source: Thompson Financial Datastream

Chart 22 U.S. "Adversely Rated" Syndicated Loans

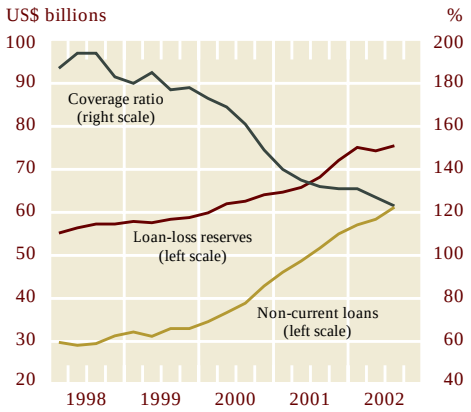
As a per cent of commitments



Source: U.S. Federal Deposit Insurance Corporation *Shared National Credit Review*

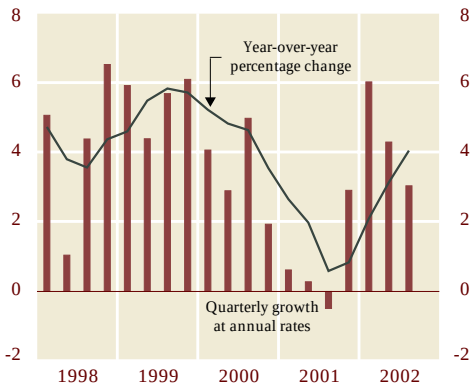
6. Standard & Poor's reported that U.S. companies incurred 157 credit-rating downgrades in the third quarter and only 40 upgrades.

Chart 23 U.S. Banks



Source: U.S. Federal Deposit Insurance Corporation *Quarterly Banking Profile*

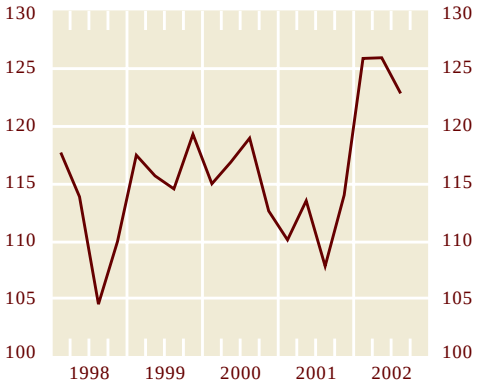
Chart 24 Real GDP Growth: Canada



Source: Statistics Canada

Chart 25 Canadian Consumer Confidence

Indexed to 1991 = 100



Source: The Conference Board of Canada

of the sector's largest companies are believed to be currently under-reserved against losses. This suggests that some insurers, in conjunction with adjusting premiums, will need to take measures to boost reserves.

Canadian Developments

Domestic factors that have an important influence on developments in the Canadian financial system include the state of the Canadian economy, the financial position of the household and corporate sectors, and developments within specific industrial sectors (e.g., the telecommunications sector).

Canadian economy

Canada experienced a robust economic expansion in the first three quarters of 2002 (Chart 24).[7] The growth of household spending has been quite strong. In addition, the resumption of inventory accumulation, marked gains in exports, and a recovery in business spending on machinery and equipment all helped to support economic expansion during this period. The consensus view calls for Canadian economic growth to exceed that of other G-7 economies in both 2002 and 2003.

There are, nevertheless, a number of uncertainties in the current environment. Global economic, financial, and geopolitical developments (discussed in previous sections) have contributed to a weaker near-term outlook for the expansion of the global economy (relative to consensus expectations at the beginning of the summer) and therefore of Canada's exports. Spending by corporations and households could also be adversely affected by the increased uncertainty associated with concerns about corporate governance and the unsettled geopolitical climate.

Household and corporate sectors

The financial condition of the household sector continued to be relatively healthy in 2002. With strong employment gains, consumer confidence has remained at a fairly high level despite a slight easing since mid-year (Chart 25).

7. The Bank of Canada's interpretation of global and domestic economic trends is published every spring and autumn in the Bank's *Monetary Policy Report*.

Personal sector indebtedness has risen sharply over the past decade, stabilizing in recent years at about 110 per cent of personal disposable income. Reflecting the higher level of household assets, however, the household debt-to-asset ratio has been more stable, exhibiting only a modest upward trend over the past several years (Chart 26). Household debt-service costs have remained low throughout the current cycle, aided by past declines in consumer and mortgage interest rates.

With real estate assets accounting for about one-third of household wealth in Canada, the current strength in housing prices has provided some offset to the loss in wealth arising from weaker equity prices (Chart 27). Residential mortgage arrears have remained relatively flat in level terms and have fallen as a percentage of total mortgages outstanding, despite the recent cyclical slowdown in economic growth (Chart 28).

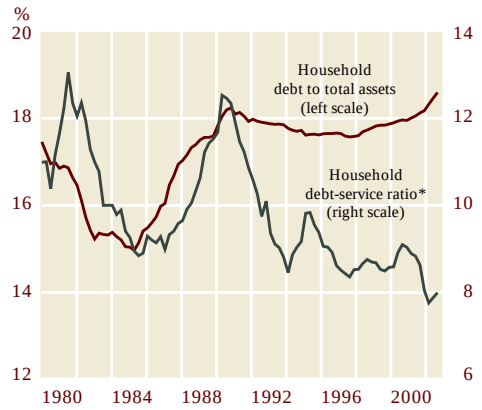
The financial condition of the overall non-financial corporate sector also improved in the first half of 2002. However, with the volatility in financial markets, business confidence, especially that of large firms, fell appreciably in the third quarter. Indeed, the proportion of large firms that were unsure whether it was a good or bad time to undertake capital spending to expand plants (one measure of uncertainty) has risen to a high level.[8] As a result, firms have continued to make more use of cash balances and less use of borrowings to help fund operations and capital spending.

Corporate credit quality, after deteriorating for a number of quarters, has shown some signs of stabilizing, supported by an improvement in corporate profits (Chart 29). The overall level of credit-rating downgrades compared with upgrades has remained elevated throughout the year (Chart 30), and the number of firms assigned a negative outlook by credit-rating agencies remains high. Nevertheless, there have been no additional reductions to below-investment-grade status among large firms in recent months.

Industry

Although the financial position of the overall non-financial corporate sector is relatively

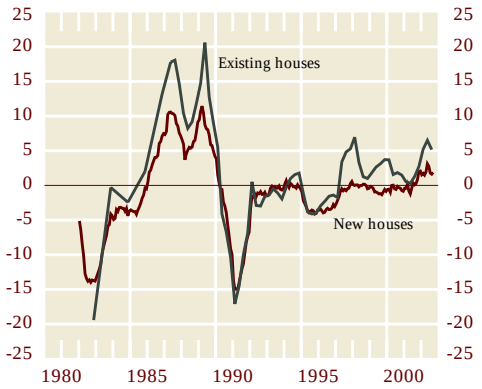
Chart 26 Personal Sector Debt



* Does not include principal repayments
Source: Statistics Canada

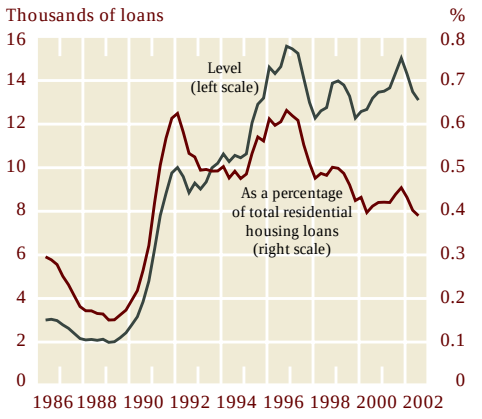
Chart 27 Growth in Real House Prices*

Year-over-year percentage change



* Deflated by total CPI
Source: Statistics Canada, Royal LePage

Chart 28 Residential Mortgage Loans in Arrears 3 Months or More

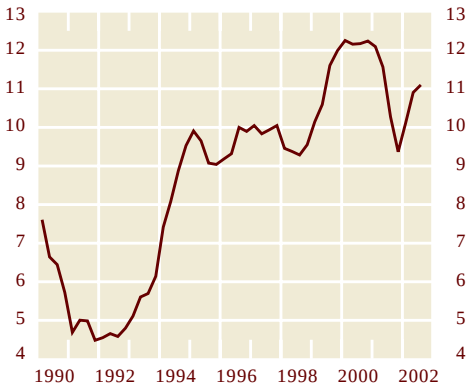


Source: Canadian Bankers Association and Bank of Canada

8. The Conference Board of Canada, *Index of Business Confidence*, Autumn 2002.

Chart 29 Pre-Tax Corporate Profits

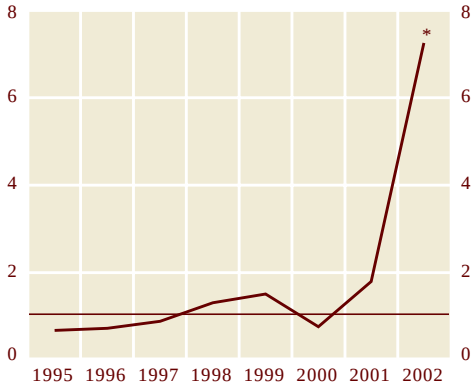
As a per cent of GDP



Source: Statistics Canada and Bank of Canada

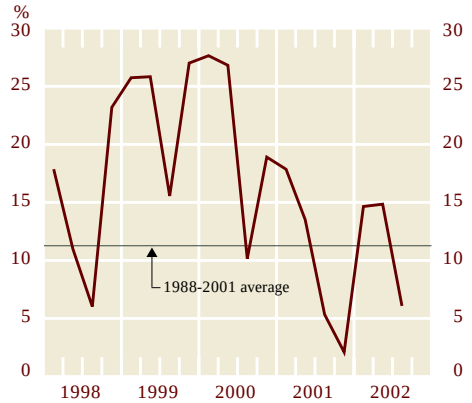
Chart 30 Corporate Issuers Downgrade/ Upgrade Ratio

Excludes financial sector



* Based on the first three quarters
Source: Moody's

Chart 31 Return on Equity: Automotive Manufacturing



Source: Statistics Canada

healthy, some industries (amounting to about 15 per cent of total GDP) experienced significant financial stress, especially in the second half of 2001. These include automotive manufacturing and air and truck transport, as well as most high-technology industries and producers of non-energy commodities.

However, with the overall economic recovery in Canada during 2002, activity increased substantially in most of the financially vulnerable industries. As a result, there was some improvement in their financial situations. These gains occurred for automotive manufacturing (Chart 31), for air and truck transport, and producers of metallic products.

Even so, the near-term financial outlook has worsened for other industries experiencing financial stress. Levels of profitability are still very low for many telecom equipment manufacturers (Chart 32) and telecom service firms,[9] and numerous companies are being forced to undertake further major restructuring of their operations (Box 4). Activity in telecom equipment manufacturing decreased further in recent months, and most observers now expect that a significant recovery in activity will not take place until 2004.

In addition, short-term financial prospects for many forest products companies remain weak. Prices are still very low, and lumber prices have fallen considerably since mid-year. The implementation by the United States of high duties on imports of lumber from Canada has added to the downward pressure on profitability in this industry.

The financial situation in Canada's farm sector has also deteriorated. In particular, many grain and livestock producers are experiencing financial stress as a result of the Prairie drought and very low hog prices.

The Financial System

Financial Markets

Canadian markets have been influenced by global financial developments. Financial markets worldwide experienced an above-average level of volatility during the summer in response to a

9. The telecom services sector includes phone companies, wireless carriers, and cable companies.

Box 4

Developments in Canada's Telecom Sector

Canada's telecom sector experienced very strong growth in the second half of the 1990s, reflecting the impact on demand of marked reductions in relative prices and booming export markets. This was followed last year by a collapse in export demand and a marked weakening in profitability.

It is useful to put the recent developments in Canada's telecom sector in an international context. The commercialization and mass-market adoption of the Internet during the second half of the 1990s (and also the deregulation of the local U.S. telephone market) contributed to the belief that there were spectacular opportunities for growth worldwide. Firms in all parts of the global telecom sector substantially increased their capital outlays during this period, mainly with the intention of building additional national and global communications networks based on new fibre-optic technologies. A relatively high share of this rise in business investment was financed through debt issuance.

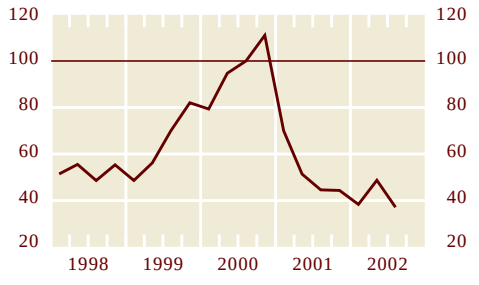
While the growth of demand since the late 1990s was strong, it nonetheless fell well short of expectations and of the growth of capacity. With the buildup of considerable excess capacity, prices fell markedly. Rates of profitability fell drastically, and some telecom companies failed. Other firms resorted to questionable accounting procedures to help boost apparent revenue growth, leading to many of the recently revealed accounting scandals. Access to capital markets has subsequently been curtailed, investment expenditures have been scaled back dramatically, and more telecom firms have entered bankruptcy proceedings.

Canadian manufacturers of telecom equipment have been hard hit by these developments and have been forced to drastically cut levels of activity and employment (Chart 1). Even with these adjustments, most of these companies are still experiencing substantial financial losses. Most industry observers currently expect that a marked increase in capital outlays by the global telecom sector will not take place until 2004, so that the return to profitability in Canada's telecom manufacturing industry may be delayed for some time to come.

Canada's telecom services industry has faced many of the same problems as its foreign counterparts. With substantial debt-financed increases in capital spending in 2000 and 2001, this industry experienced a marked increase in its debt-equity ratio. Revenue growth has fallen well short of expectations, and profitability has been very weak since mid-2001 (Chart 2). Indeed, some wireless services providers are having particularly serious financial difficulties. Moreover, with recent downgrades of much of the industry's debt, most of the largest companies have announced major restructuring of their operations and measures to reduce indebtedness.

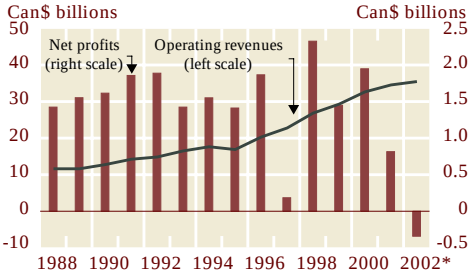
Chart 1 **New Orders: Communication-Equipment Manufacturing**

Indexed to 2000Q3 = 100



Source: Statistics Canada

Chart 2 **Operating Revenues and Net Profits: Canadian Telecommunications Services**



* Annualized figure based on first two quarters

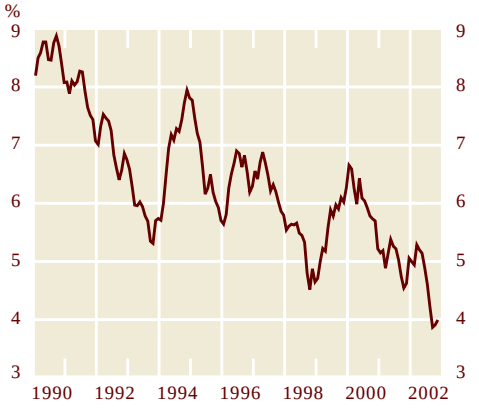
Source: Statistics Canada

Chart 32 Return on Equity: Electronic and Computer Manufacturing

Source: Statistics Canada

Chart 33 Yield for 10-Year U.S. Benchmark Bond

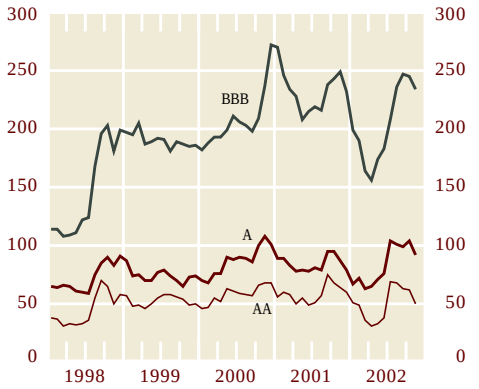
Month average



Source: Thompson Financial Datastream

Chart 34 Canadian Corporate Spreads by Credit Quality (5-10 years)

Basis points (over government securities)



Source: Thompson Financial Datastream

range of factors that included revelations of deficient corporate accounting and governance practices, geopolitical tensions, and changing perceptions about the economic outlook. In this uncertain environment, market participants in Canada and elsewhere reacted with increased sensitivity to new pieces of economic information. Risk aversion continues to be an important factor influencing markets, although recent financial indicators suggest that market participants are becoming less risk averse.

Given the elevated level of loan losses, markets for credit-risk transfer, which continue to evolve rapidly, have attracted considerable attention (Box 5). Despite the relative newness of some of these financial instruments, they appear to have operated largely as expected in the current environment.

Fixed-income credit markets

In fixed-income markets, international developments have been significant. U.S. government bonds, which often benefit from "safe haven" flows during periods of increased turbulence, saw their yields approach historical lows in the third and fourth quarters (Chart 33). Developments in credit markets suggest that there has been a shift to higher-quality assets, both corporate and government, although recent evidence indicates this effect is becoming less important. It is interesting to note that the risk premium between bank and government credit in the United States (as represented by the spread between the Treasury and fixed-rate portions of a fixed-floating swap) has not increased, in contrast to the experience during some previous turbulent periods (e.g., the autumn of 1998, during the problems associated with Long-Term Capital Management). Although other factors were also present, this suggests that recent developments have not markedly raised concerns over the longer-term health of the U.S. banking sector.

In Canada, corporate credit spreads (over government bonds) have risen from the lows reached in the first half of the year, although declining somewhat in recent months (Chart 34). Although funding costs were near historical lows for many high-quality issuers, the uncertain economic environment and financial volatility led a number of firms to emphasize debt reduction. Canadian corporate debt issuance fell as financial market volatility peaked in July

Box 5

Evolution of Financial Markets for Transferring Credit Risk

Techniques for credit-risk transfer (CRT), although not new, have recently attracted significant attention with the development of markets for credit default swaps (CDSs) and collateralized debt obligations (CDOs). From the perspective of a financial institution, company, or investor, CRT instruments can be attractive because they allow them to alter their financial-risk profile, either by increasing their risk exposure (i.e., acquiring risk) or reducing it. Certain types of CRT, such as securitization, can also represent an alternative source of funding for institutions that carry loans as assets on their balance sheets.

Significant developments in the CRT market include the introduction of primary market syndication of bank loans in the 1960s and the development of a secondary market in bank loans in the United States in the 1980s. Also in the United States, the 1970s saw the packaging and sale of loan portfolios (securitization) to fund the financing of residential mortgages.

In recent years, the use of securitization and special-purpose vehicles (SPVs) to create asset-backed securities (ABSs) has spread to credit card receivables, car loans, and commercial paper, among other areas. Increasingly, originating institutions do not necessarily expect to hold on to assets, such as mortgage loans or credit card receivables, to maturity. Instead, these are seen as assets to be bundled and sold in order to finance other activities.

Collateralized debt obligations (CDOs) are similar to ABSs. The underlying assets for the CDO are typically corporate bonds or loans, and the associated SPV uses two or more tranches of debt. The "junior" tranche absorbs any initial losses by the SPV, thereby insulating the more "senior" tranches. In a CDS, one counterparty agrees to compensate the other if one or more specified credit events (such as a debt default or a credit-rating downgrade) occur during the life of a contract, in exchange for a fee or premium. The market or standardized, "single-name" CDS is currently the most active and liquid area of the credit derivatives markets. Finally, a "synthetic" CDO is created when an underlying portfolio of high-quality debt securities is combined with CDSs to replicate the risks and returns of a portfolio of higher-yielding securities. CDSs and synthetic CDOs can be used to transfer credit risk without transferring the underlying assets or, in the case of loans, without even informing the borrower.

One implication of this activity is that risk exposure can be shifted more easily among financial system participants. But only limited information is available on how this has influenced aggregate risk exposures within the financial system. One recent survey suggests that banks, securities houses, and hedge funds tend to be the most active buyers of credit protection (which, alone, would reduce their risk exposure), while these institutions, together with insurance and re-insurance companies, are the most active sellers (see chart).

Breakdown of Participants in Credit Derivatives Markets

Showing institutions buying and selling credit protection

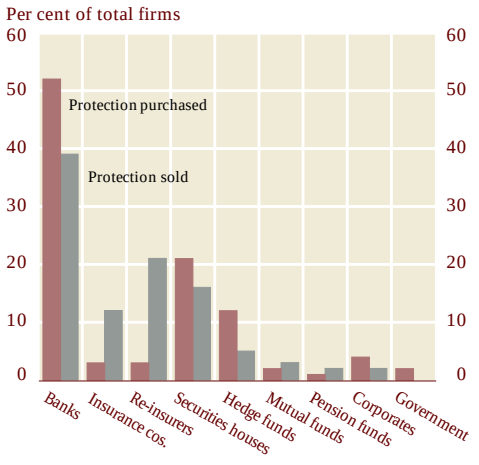
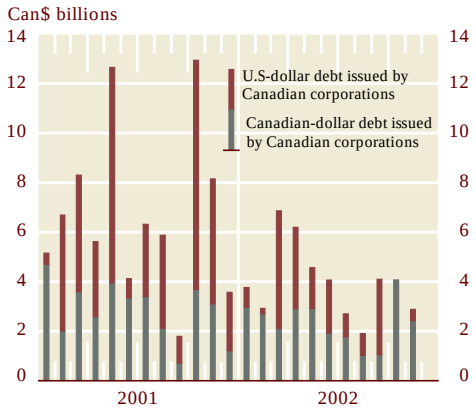


Chart 35 Corporate New Issuance



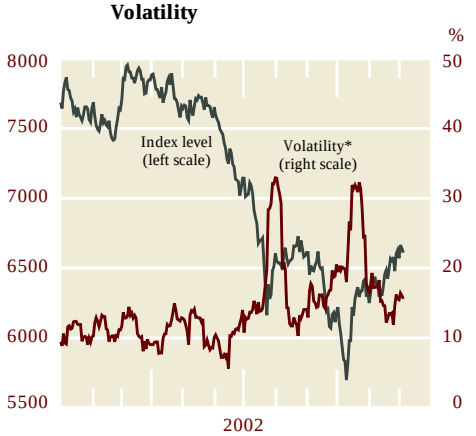
Source: Bank of Canada

Chart 36 Equity Indexes

Indexed to 2 January 2002 = 100

Source: Thompson Financial Datastream

Chart 37 S&P/TSX Index Level and Volatility



* 10-day annualized historical volatility
Source: Thompson Financial Datastream and Bank of Canada calculations

and August, and many issuers chose to remain out of the market.[10] Assisted by diminished market volatility, bond issuance has recovered somewhat (Chart 35).

Equity markets

Although global equity prices had been falling since May, the pace of decline accelerated in mid-June, and international markets subsequently posted broad-based losses (Chart 36). The market declines themselves added to fears about the resiliency of consumer confidence and spending and, in turn, the outlook for continued economic recovery. Most recently, equity markets in Canada and elsewhere have moved back from their lows, although in the context of above-average levels of volatility (Chart 37). The Canadian S&P/TSX index is nonetheless still about 15 per cent below its level during the first part of the year.

The observed volatility in financial markets may be linked to uncertainty among market participants regarding appropriate equity valuations in the current climate. The declines in equity markets have tended to move price-earnings ratios in Canada and elsewhere (based on trailing, i.e., actual, earnings) down towards their historical trend values. However, uncertain prospects over the future growth in company earnings, and in the economy more generally, suggest that the volatility in equity market values may persist.

Foreign exchange markets

The Canadian-dollar exchange rate also reflected the volatility that affected fixed-income and equity markets during the summer (Chart 38). Volatility in the Canadian/U.S. dollar exchange rate (which has typically been quite modest relative to that of other major currencies against the U.S. dollar), has since returned to more normal levels. The Canadian dollar has generally remained in a range of 0.63 to 0.64 U.S. dollars over the past several months. The U.S. dollar, which had moved down against the yen and euro through the summer, has regained some of its lost ground, particularly against the yen.

10. Similar to the United States, swap spreads on bank and government bonds in Canada have also remained relatively stable.

Financial Institutions

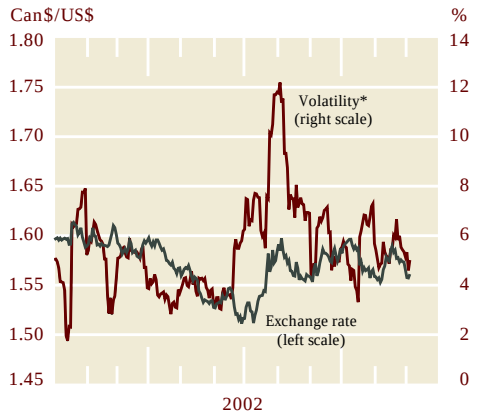
The Canadian banking sector has responded to the weakening in the overall quality of its asset base. In the second half of fiscal 2002, the major banks again made large additions to loan-loss provisions (Chart 39). Total loan-loss provisions in fiscal 2002 increased substantially relative to a year earlier.

Specific problem areas for banks have been their loans to the telecommunications sector, involvement in the U.S. syndicated loan market, exposure to Latin America, and losses on their merchant banking portfolios. Banks have been working to reduce their exposure to the troubled telecommunications sector. It nevertheless remains at about $18 billion, although the banks have provisioned against a substantial portion of this exposure. While the troubled U.S. merchant energy and power-generation sector will also contribute to losses, the impact is expected to be relatively limited. Banks have also been affected by the decline in equity valuations, which has become more important to them in recent years in view of the trend increase in bank holdings of equities (Chart 40). This increase reflects activities such as their venture capital and merchant banking operations, and investment dealer inventories of equities.

The more difficult credit environment and increased provisioning has placed downward pressure on bank profits, and their return on equity has deteriorated, with some banks reporting quarterly losses in the second half of fiscal 2002 (Chart 41). The credit ratings of two major Canadian banks were lowered by rating agencies in the autumn.

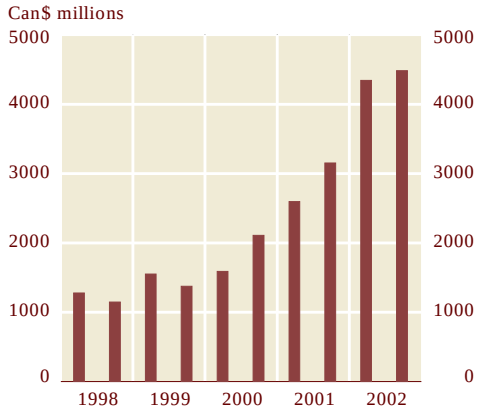
Canadian banks are nevertheless benefiting from the fact that their financial position as they entered the current period of credit deterioration was much improved relative to that of the early 1990s. Their aggregate capital base has remained strong in the face of recent developments. Despite an increase in impaired loans, the extent to which they are covered by allowances (the "coverage ratio") remains at much higher levels than was the case in previous cyclical slowdowns (Chart 42). Several banks have indicated that, over the next several years, they intend to place less emphasis on corporate lending. They plan to reduce the capital devoted to such lending by approximately one-third, and

Chart 38 Exchange Rate and Volatility



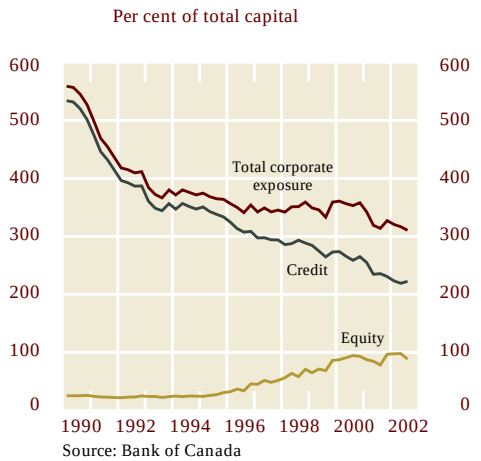
* 10-day annualized historical volatility
Source: Thompson Financial Datastream and Bank of Canada calculations

Chart 39 Provision for Credit Losses: Major Canadian Banks



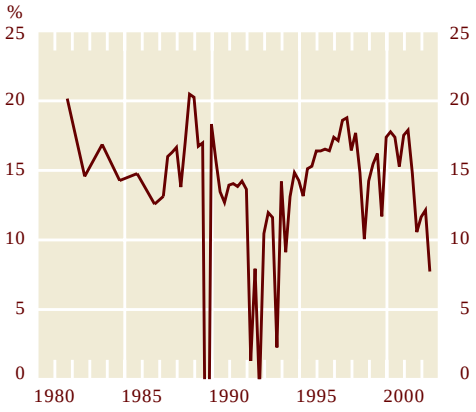
Calculated from quarterly financial statements published by the major Canadian banks
Source: Bank of Canada

Chart 40 Corporate Exposure of Banks



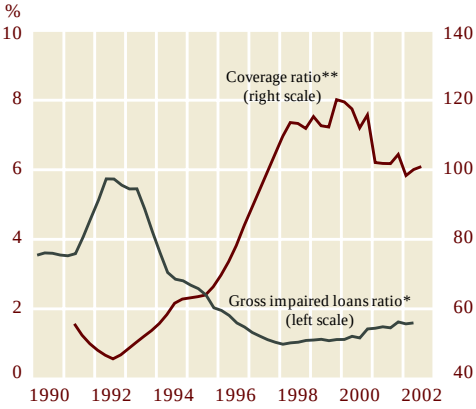
Source: Bank of Canada

Chart 41 Return on Equity of Major Canadian Banks



Source: Canadian Bankers Association

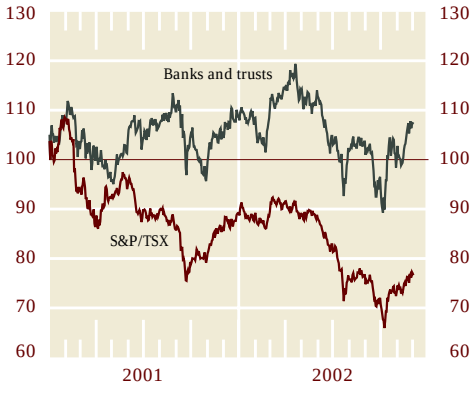
Chart 42 Major Canadian Banks: Asset Quality



* Relative to loans and acceptances less allowances
** Total allowances/Gross impaired loans
Source: Office of the Superintendent of Financial Institutions

Chart 43 Equity Price Indexes

Indexed to 2 January 2001 = 100



Source: Thompson Financial Datastream

reinforce areas such as retail banking and wealth-management operations. Bank sector equity values have fared relatively well compared with broader equity indexes in Canada (Chart 43).

The Canadian insurance industry is well capitalized and, as a whole, was not heavily exposed to claims arising from the 11 September terrorist attacks last year. Nevertheless, the sector faces a number of challenges. Investment income, an important source of revenue for the industry, has been adversely affected in the current environment. In addition, insurance companies face losses on their extensive corporate bond portfolios (e.g., those involving firms in the North American telecommunications, merchant energy, and airline and aerospace sectors). Several firms have announced significant provisions for credit losses.

The return on equity can vary substantially across the industry. While remaining relatively robust among some of the major life insurers, the return on equity of the aggregate insurance sector has tended to decline, falling in the second quarter (Chart 44). The situation among property and casualty insurers has been comparatively difficult. Within this relatively heterogeneous group of companies, recent increases in premiums and tighter underwriting criteria have been at least partly offset by intense cost pressure from claims, particularly from the auto insurance segment of the industry.

The securities industry has experienced a reduction in operating profits from the peak levels achieved in 2000 (Chart 45). Revenues from equity trading fell sharply in the second quarter, a development that likely continued into the third quarter. Firms that primarily serviced retail clients have been particularly hard hit. In contrast, firms serving institutional clients have fared better, as rising issuance of income trust units relative to a year earlier (Chart 46) and higher equity financings in the second quarter contributed to investment banking revenues. Commission revenues have been under downward pressure as a result of reduced investor activity. Another indicator of reduced investor activity has been the lower demand for margin debt by clients. Nevertheless, profits have been supported by firms' efforts to reduce costs, which have included significant staff reductions in some areas.

Investor concern in the current environment has also been reflected in declining investment in mutual funds. The industry has experienced net redemptions in recent months (Chart 47), and some smaller funds are being shut down or consolidated.

Payment, Clearing, and Settlement Systems

Systems designed to clear and settle payments and other financial obligations in Canada (Box 6) have undergone some key changes.

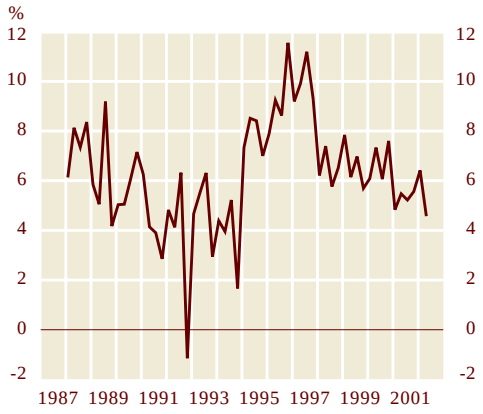
Recent developments

In September 2002, the Continuous Linked Settlement Bank (CLS Bank) began commercial operations. The CLS Bank, based in New York, is an international system for the settlement of foreign exchange transactions. It settles trades in seven currencies, including the Canadian dollar. The CLS Bank has been designated under the Payment Clearing and Settlement Act (PCSA). It is an important initiative that will reduce risk in the settlement of foreign exchange transactions.[11]

The Governor of the Bank of Canada has taken the decision not to designate the Automated Clearing Settlement System (ACSS) under the PCSA. The ACSS is primarily a system for smaller-value retail payments. In conjunction with the decision that the ACSS does not currently pose systemic risk, effective 2 December 2002, the Bank of Canada reduced the interest rate spread that is applied to the ACSS by 50 basis points, to 300 basis points. Thus, when the ACSS settles each day, the Bank will extend collateralized overdraft loans to settle positions in the ACSS at the target rate plus 150 basis points and will pay the target rate of interest less 150 basis points on deposits arising from ACSS settlement. The target rate is the midpoint of the 50-basis-point-wide operating band for the overnight interest rate that is used to implement monetary policy.

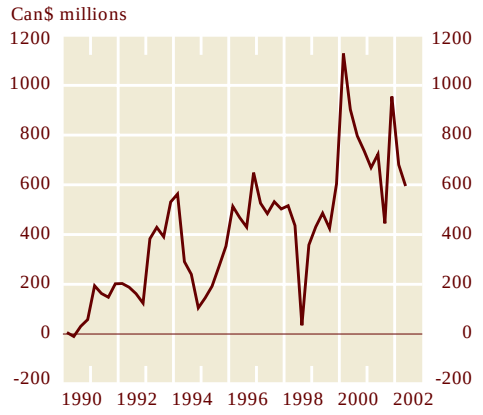
A $25 million cap on paper items eligible for clearing in the ACSS will be implemented by the Canadian Payments Association (CPA) in February 2003 (with a six-month grace period). Currently, it is estimated that about 35 per cent

Chart 44 Insurance Industry Profitability: Return on Equity



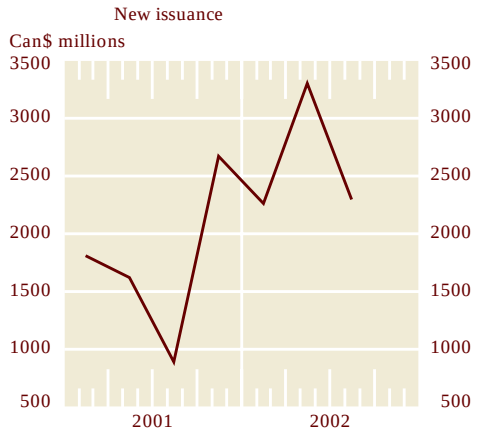
Source: Statistics Canada

Chart 45 Operating Profits: Securities Industry



Source: Investment Dealers Association of Canada

Chart 46 Canadian Income Trust Units

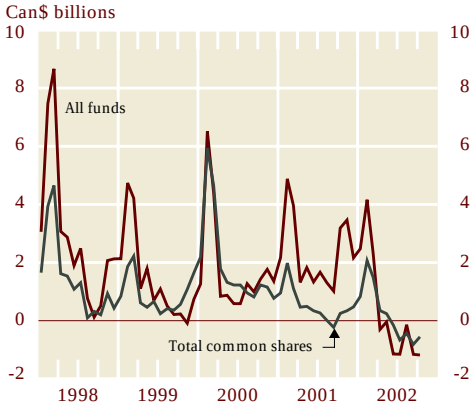


Source: Investment Dealers Association of Canada

11. For more information on the CLS Bank, see the article by Miller and Northcott in this *Review* (page 41).

Chart 47 Net New Sales of Mutual Funds

Excluding reinvested distributions



Source: The Investment Funds Institute of Canada

of the ACSS's daily payment flows of about $21 billion are accounted for by payments over $25 million. The CPA decision will encourage the migration of large-value items to the LVTS, which has payment flows of about $114 billion per day. The LVTS has stronger risk controls and provides users with intraday finality and certainty of settlement.[12]

The Canadian Depository for Securities (CDS) is working to implement a new system for the settlement of debt, equities, and some U.S.-dollar-denominated securities. The new system, called CDSX, is expected to be available in early 2003, although equities are not expected to be brought into the system until some time later. Once the new system is fully operational, the Debt Clearing Service (DCS) and the book-based Securities Settlement Service (SSS), which currently settles equities, will both cease to exist. While the risk controls for the CDSX are based on those of the DCS, a thorough review and redrafting of system rules is underway.

Operational events in payment, clearing, and settlement systems

Payment, clearing, and settlement (PCS) systems in Canada generally operate without major disruption or lengthy systems or telecommunications outages. The LVTS has a one-hour Disaster Recovery Plan (DRP) that allows

12. For more information on the ACSS, see the article by Northcott in this *Review* (page 29).

Box 6

Payment, Clearing, and Settlement Systems in Canada

An essential component of the financial system is a robust set of arrangements to clear and settle payments and other financial obligations. Given their central role in settling financial transactions, clearing and settlement systems have the potential to pose systemic risk should they fail to operate as expected. Under the Payment Clearing and Settlement Act (PCSA), the Governor of the Bank of Canada designates systems that have the potential to pose systemic risk.[1] The Bank of Canada has responsibility for the oversight of such domestic systems and shared oversight with other central banks for international systems that involve the Canadian dollar.

The Bank currently oversees two domestic systems: the Large Value Transfer System (LVTS) for the exchange of payments, operated by the Canadian Payments Association (CPA), and the Debt Clearing Service (DCS) for the clearing and settlement of securities transactions. The DCS is operated by the Canadian Depository for Securities (CDS). The Bank of Canada shares oversight of the Continuous Linked Settlement Bank (CLS Bank) with other central banks, including the U.S. Federal Reserve, which is the lead overseer. Based in New York, the CLS Bank is an international system for the settlement of foreign exchange transactions, involving seven currencies including the Canadian dollar.

Other systems, while not judged to have the potential to pose systemic risk, are nevertheless important to the financial system. These include settlement systems such as the Automated Clearing Settlement System (ACSS), which settles mainly smaller-value retail payments, and the Canadian Derivatives Clearing Corporation (CDCC), which clears and settles exchange-traded interest rate and equity derivative contracts in Canada.

The Bank of Canada supplies services to the LVTS, the DCS, the CLS Bank, and the ACSS by providing settlement assets and liquidity, as well as collateral and settlement-agent services. The Bank of Canada also provides contingency arrangements for these settlement systems.

1. The Minister of Finance must also be of the opinion that such designation is in the public interest.

operations to resume if primary systems fail. The DCS has a two-hour DRP and LVTS participants are also expected to be able to resume operations within two hours of a system outage. Longer outages would be of greater concern because they would be more likely to lead to negative impacts on system participants or to significant settlement delays.[13]

The Bank of Canada monitors problems that occur as indicators of the reliability of these systems. Serious events in PCS systems, if they were to occur, could affect financial stability because these systems underpin much of the financial activity in the economy.

13. For further discussion of participant outages, see the article by McPhail and Senger in this *Review* (page 45).

Report

Reports address specific issues in some depth. The report in this issue of the Financial System Review *discusses the decision not to designate the Automated Clearing Settlement System as a systemically important system, as well as some of the research contributing to that decision.*

Systemic Risk, Designation, and the ACSS

Carol Ann Northcott

Clearing and settlement systems operate virtually unnoticed in our daily lives and yet are crucial to a well-functioning financial system and economy. By creating tight linkages between financial institutions they also provide a way to transmit risk. Therefore, if not well designed, some clearing and settlement systems have the potential to pose a serious risk to the financial system.

Because of their importance, the Bank of Canada is responsible, under the Payment Clearing and Settlement Act (PCSA), for identifying and designating for its oversight those systems that are seen to have the potential to pose a systemic risk (Goodlet 1997). Three systems are currently designated under the PCSA, and the Bank of Canada has recently examined a fourth, the Automated Clearing Settlement System (ACSS), to assess whether it too should be designated.

The first part of this note sets out the framework within which an assessment of the risks posed by the ACSS took place. This is the basis on which the Governor formed the opinion that the ACSS does not currently pose systemic risk to the financial system and, hence, that it need not be designated at this time. The second part describes the model used for the analysis of risk exposures in the ACSS. The results of this work were an important contributing factor to the decision not to designate the system.

Designation and the PCSA

The Governor of the Bank of Canada may designate under the PCSA those clearing and settlement systems that could be operated in such a way as to pose systemic risk.[1] Once a system has been designated under the Act, the Bank of Canada is responsible for its regulatory oversight, and the system is expected to meet minimum standards set out by the Bank to control systemic risk. These standards currently incorporate those advocated by the Bank for International Settlements (BIS) in its *Core Principles for Systemically Important Payment Systems* (BIS 2001).

The PCSA defines systemic risk in the context of clearing and settlement systems as the risk that the inability of one participant to meet its obligations to the system could cause

- other participants in the system to be unable to meet their obligations when due;
- financial institutions in other parts of the Canadian financial system to be unable to meet their obligations when due; or
- the clearing and settlement system's clearing house or the clearing house of another clearing and settlement system to be unable to meet its obligations when due.

Determining whether a clearing and settlement arrangement could have such serious implications for the financial system can be quite difficult. There are, however, certain characteristics that would make a system more likely than others to pose such a risk.

The larger the payments processed by a system, the larger the potential exposures for participants. Therefore, systems that process mainly large-value (often called wholesale) payments come under particular scrutiny. The size of the potential exposures relative to participants' capital is also important, since this will largely determine whether participants can absorb the potential exposures. As well, those systems that play a central role in supporting transactions in either the financial markets or in the economy more broadly come under particular scrutiny, since a failure

1. The Minister of Finance must also be of the opinion that such designation is in the public interest.

within such a system could have broader implications for the financial system.[2]

Three systems are currently designated under the PCSA. The Large Value Transfer System (LVTS) is an electronic funds-transfer system used especially for large-value and time-critical payments. The average daily value of all payments in 2002 (to November) was $114 billion. The Debt Clearing Service (DCS) clears and settles debt securities, and the CLS Bank settles foreign exchange transactions. Both the DCS and the CLS Bank are not only integral to financial markets, but also process very large transactions. The DCS processes approximately $100 billion to $150 billion per day, and the CLS Bank processes approximately US$400 billion per day. All three designated systems are explicitly linked such that the smooth functioning of each is essential to the smooth functioning of the overall financial system. For example, payment obligations arising from the settlement of debt securities and foreign exchange transactions are cleared and settled through the LVTS. Clearly, all three systems are systemically important in the Canadian financial system.

Over the past year, the Bank of Canada has examined a fourth payments system, the Automated Clearing Settlement System, to determine whether or not it too should be designated under the PCSA.

The Automated Clearing Settlement System

The ACSS is a multilateral net settlement system owned and operated by the Canadian Payments Association (CPA). It is an uncollateralized system that does not provide its participants with real-time information or real-time, risk-control tools to manage their exposures each day. Participants in the ACSS are therefore exposed to both liquidity and credit risk on a daily basis.

Credit risk is assumed throughout the day because while value is credited to client accounts, final settlement does not occur until the next day. But this value may not be received, either because of insufficient funds in the account on which the payment item was drawn or, more importantly, because a participant in the ACSS defaults on its obligation to the system.

In the event that a participant does default on its obligation, other participants (the "survivors") face a credit exposure on two fronts. First, they are exposed for the value already deposited in client accounts, which will now not be received from the defaulter. The larger the value they expected to receive, the larger this exposure. Second, survivors may be required to pay additional value to ensure that the system completes settlement.[3]

Participants face liquidity risk on a daily basis because of uncertainty in determining their multilateral net position in the ACSS. This uncertainty is exacerbated in the event of a participant default.

In the ACSS, therefore, it is the survivors that are exposed if a participant defaults, which creates the potential for systemic risk.

The Designation Decision

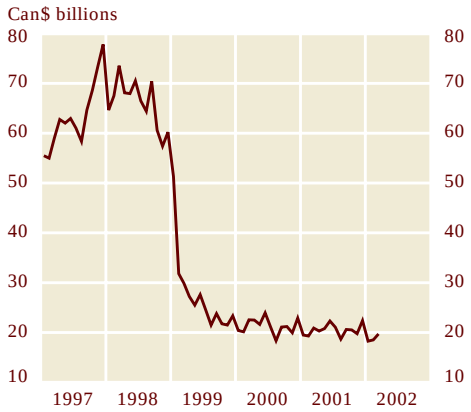
In conducting its review of the ACSS, the Bank of Canada examined the ACSS and the broad environment in which it operates to determine whether the ACSS has the potential to pose a systemic risk. The main considerations were the role of the ACSS in financial markets, the size of exposures taken on by participants in the system, and whether such exposures were manageable.

Prior to the introduction of the LVTS in February 1999, the ACSS was the only system to clear and settle interbank payments. At that time, it would have been considered to have the potential to pose a systemic risk. It processed a very high volume of large-value payments, leading to substantial exposures for participants. It was also crucial to financial markets, since it processed payment obligations arising from foreign exchange transactions and from the settlement of debt and equity securities. Once the LVTS began operations, payment obligations from foreign exchange transactions and from the settlement of debt securities in the Debt Clearing Service immediately moved to this well-risk-

2. For more details on these considerations, see Bank of Canada (1997).

3. These exposures result from ACSS rules, which require the defaulter to return (unwind) certain payments to other ACSS participants and which stipulate how any shortfall is allocated among survivors. The recovery of value from client accounts and from the estate of the defaulting participant will reduce losses from these exposures. These issues are discussed further in the second part of this article.

Chart 1 Average Daily Value: ACSS



proofed system. This greatly reduced the ACSS's importance to financial markets.

The migration of payment obligations arising from the settlement of foreign exchange and debt securities transactions to the LVTS greatly contributed to the substantial decrease in the value of payments processed through the ACSS (see Chart 1). Other wholesale payments have also migrated, with the result that the ACSS is becoming increasingly characterized by the high volume of small payments that it settles. This has led to a great reduction in the exposures taken on by participants. This trend is further underpinned by the CPA's active support for the continued migration of wholesale payments. Indeed, the CPA recently announced a cap on the value of payments that can be processed through the ACSS. This cap is set at $25 million. It is expected that once this cap is put in place in February 2003, the value of payments in the ACSS, and hence potential exposures, will decrease further.

With the decrease in exposures brought on by migration to the LVTS, it is believed that participants' exposures in the ACSS are now small relative to their capital. This judgment was reached largely on the basis of research done within the Bank, which used a model of the ACSS to estimate potential exposures using actual data from the system. This work is discussed in the second part of this report.

The Governor of the Bank of Canada is of the opinion that the ACSS does not pose a systemic risk to the Canadian financial system at this time. This is based on a broad range of considerations, including a downward trend in the value of payments in the ACSS and the commensurate decrease in the potential exposures taken on by participants in the system. Hence, the ACSS will not be designated at this time.

Nevertheless, in keeping with its responsibilities under the Payment Clearing and Settlement Act, the Bank of Canada will continue to monitor developments that may necessitate a re-evaluation of the risk potential of the system. For example:

- An important risk factor is the value of items sent through the system. The migration of value to the LVTS is expected to continue with the CPA initiative to impose a cap on individual payments processed through the

system. Were this initiative not to succeed, however, or if value were to rise in the ACSS, the system might need to be re-assessed.

- New legislation has recently opened access to the payments system to three new classes of institutions: life insurance companies, money market mutual funds, and securities brokers. The first two are constrained to be indirect clearers. The exposures in the ACSS will be re-assessed if these new entrants become an important part of the system.

Understanding Risk in the Automated Clearing Settlement System

One factor considered by the Bank in its designation discussions was the potential size of exposures that could arise in the ACSS and whether such exposures could be successfully managed by participants. To assist the discussion, a model of the ACSS, incorporating its unique design and risk characteristics, was developed to estimate the size of exposures that could occur under various conditions. The results contributed to the Governor's assessment that the ACSS does not currently pose a systemic risk.[4]

The Nature of Risks in the ACSS

The ACSS is a net settlement system that clears and settles paper-based payments (such as cheques) and certain electronic payments (such as debit card payments) in Canada. Financial institutions that are members of the CPA can participate in the ACSS as either direct or indirect clearers. Direct clearers have a settlement account at the Bank of Canada across which all obligations in the ACSS are settled. Indirect clearers access the system through a direct clearer.

A variety of payments are made every day. For example, a tenant paying rent may write a cheque drawn on an account at Bank A, which the landlord then deposits in a chequing account at Bank B. Bank B will enter the value of the cheque drawn on Bank A into an ACSS terminal.[5] Once all the payment items are entered into the system, the ACSS nets the payment obligations.[6] Each direct clearer in the ACSS will either owe money to other participants in the system or be owed money—its multilateral net position. Obligations for payments entered throughout the day are settled by each direct clearer making or receiving a single payment equal to its multilateral net position. This is accomplished through a debit or credit to its settlement account at the Bank of Canada.

Participants in the ACSS are exposed to risk daily. Direct clearers may owe or be owed money on any given day and cannot precisely forecast which will occur. This uncertainty carries a degree of liquidity risk. Through the netting process, direct clearers extend credit to one another throughout the day. Since the ACSS does not have real-time information technology, direct clearers cannot control to whom they are extending credit during the day, nor how much, and thus are exposed to credit risk.

A default occurs in the ACSS when a participant that owes money at the end of the day cannot meet its obligation. In this event, the defaulter returns (i.e., unwinds) certain payment items to the other participants (the survivors). As a general rule, the defaulter returns items that require it to pay the survivors, while keeping items that require the survivors to pay money to it, the defaulter. Once this is done, the net positions of all direct clearers are recalculated. If the defaulter continues to owe money after the unwinding process, the amount needed to bring its position to zero (the "shortfall") is divided on a proportional basis among the survivors, based on their original dealings that day with the defaulter.[7] Therefore, a survivor's *final position* on the day of default comprises both its revised net position and its share of any shortfall.

4. For more information on this research and further results, see Northcott (2002).
5. Bank B *pulls* the value from Bank A—the ACSS is a "debit-pull" system.
6. This amount will include the payments entered into the ACSS by all the direct clearers for their indirect clearers as well.
7. If all items are returned by the defaulter, it would necessarily be owed funds after the unwinding process. However, certain items cannot be returned, either because they are no longer in the defaulter's possession, or because it is prohibited in the ACSS rules. Therefore, it is possible that a defaulter could continue to owe funds after the unwinding process.

Measuring Risk Exposures in the ACSS

The unwinding of payments and the allocation of a shortfall enable the defaulter, and thus the system, to complete settlement. These actions also expose survivors to liquidity pressures and credit losses. One approach to measuring these exposures is discussed below.

The immediate settlement concern is one of liquidity—whether survivors can meet their final positions on the day of default, thereby allowing the ACSS to complete settlement. Moreover, after the unwinding process, participants are subject to a liquidity "surprise," since they may owe more funds or be due less funds than they had anticipated. If a survivor owes funds, it must find the liquidity to cover the (larger-than-expected) obligation. Therefore, its *settlement liquidity exposure* is equal to its obligation to the system.[8] If a survivor is owed funds, and so does not pay into the system, its settlement liquidity exposure is zero.

Survivors' *credit exposure* appears on two fronts: the value of payment items sent to the defaulter that are unwound plus their share of any shortfall. Potentially, the survivor has deposited funds into clients' accounts for which it will not receive value from the defaulter because of the unwinding process. From our previous example, Bank B may have deposited the funds into the landlord's account expecting to receive the funds from Bank A. But, if Bank A defaults and the cheque is returned to Bank B, Bank B may realize a loss if it cannot recover the value from the landlord's account. Credit exposure is reduced if the survivor can recover value from clients' accounts and if it can recover some of its credit loss from the estate of the defaulting institution.

These two exposures, liquidity and credit, contribute to the possibility of systemic risk—the risk that the inability of one participant in the payments system to meet its payment obligation will cause other participants to be unable to meet their obligations. In the context of the ACSS, an important factor in assessing systemic risk rests on the size of survivors' exposures following an initial default and whether such exposures can be managed.

Estimating the Potential for Systemic Risk in the ACSS

A model of the ACSS that incorporates its design and risk characteristics was developed to estimate the potential for systemic risk (contagion). An initial participant default is simulated in the model using bilateral payments data from the ACSS. Liquidity and credit exposures for the survivors are calculated based on assumptions regarding the following three factors, which are set at the beginning of the simulation and reflect a particular state of the world:

- the proportion of payment items received by the defaulter that are returned to the survivors in the unwinding process
- the proportion of value that a survivor can recover from client accounts, following the unwinding process
- the proportion of a credit loss that survivors can eventually recover from the estate of the defaulting institution

To determine whether there is contagion within the context of the model, a rule is used to define when a survivor "fails" because of the initial default. The rule used is that a survivor subsequently defaults (a "knock-on" default) if its credit and liquidity exposures resulting from the unwinding process and allocation of a shortfall are both larger than its ability to cover them (see Box 1). Assumptions regarding two factors pertaining to survivors' ability to cover exposures are made at the beginning of the simulation:

- the proportion of a survivor's Tier 1 capital that can be used to cover the credit exposure
- the proportion of a survivor's liquid assets that is available to cover a liquidity exposure

If there is a knock-on default, a further unwinding takes place, and the process continues until all the remaining survivors can cover their exposures. Systemic risk is measured as the number of knock-on defaults experienced for a given initial default.

This process is carried out using each direct clearer that is initially in a net debit position as the initial defaulter. The simulation can then be

8. *Settlement liquidity exposure* is defined here as the amount the survivor must cover in order to allow the ACSS to settle. It does not consider liquidity pressures that the participant may have outside of the ACSS because of the default.

performed changing the five assumptions to reflect different states of the world (see Box 2).

Data and Results

For each of the 231 days in the data set (August 2000 to June 2001 inclusive), the bilateral value of items sent between each of the 12 direct clearers in the ACSS is used to determine credit and liquidity exposures. Over this period, the average daily value of items sent through the ACSS was $20.6 billion.

To determine a participant's ability to cover a liquidity exposure, a portfolio of liquid assets is constructed from monthly or quarterly balance sheet data. To determine its ability to cover a credit exposure, Tier 1 capital (as reported to the Office of the Superintendant of Financial Institutions) is used.

Result 1: There is very limited potential for systemic risk in the ACSS.

When the model is run under assumptions that represent a "normal" state of the world, we find no evidence of contagion over the period studied. That is, for each participant default simulated, all other participants are able to handle their exposures without subsequently defaulting (as defined in the model). More importantly, this is the case even when individual assumptions are adjusted to reflect a much more risky environment; for example, assuming there is no recovery from the estate of the defaulting institution.

Assumptions are then made in the model that consider an extraordinarily unlikely environment—an "extreme" state. Even here, on average, not even one knock-on default occurs. There is, however, the potential for contagion if certain direct clearers default on certain days, depending on the configuration of exposures. In some highly unusual cases, the initial default causes all direct clearers (excluding the central bank) to subsequently default.

Result 2: A uniform decrease in the value of payments sent by all participants leads to a decreased risk of contagion.

As discussed earlier, the less payment value processed through a system, the lower the potential exposures and the lower the risk of contagion in

Box 1

Defining a Contagion Threshold

To determine whether there is contagion from the initial default (i.e., systemic risk), a rule must be set that defines when a survivor "fails" because of the initial participant default.

To define such a threshold, we first define illiquidity and insolvency in the context of the model. A survivor with a liquidity exposure must have enough liquid assets available to cover the exposure in order to complete settlement in the ACSS. If the survivor's exposure is greater than its available liquid assets, it is "illiquid." A survivor with a credit exposure must be financially sound enough to be able to withstand the credit loss while continuing to function; otherwise it is "insolvent."

To define contagion, consider four cases. If a survivor is liquid and solvent following the unwinding process and allocation of any shortfall, it will fulfill its settlement obligation. If it is illiquid but solvent, it is assumed that the central bank will advance the funds necessary to complete settlement. If an institution is liquid but insolvent, it will complete settlement, since it will be able to meet its obligation to the system. In each of these cases, despite the default of the initial participant, the survivor is able to meet its obligation to the system. If, however, the survivor is illiquid and insolvent, it will not be able to meet its obligation to the system. Therefore, a knock-on default (contagion) occurs if, following a default and unwinding of payments, a survivor is illiquid and insolvent.

Box 2

State-of-the-World Assumptions

Under the "normal state," it is assumed that survivors use 100 per cent of their Tier 1 capital to cover a credit exposure and that 50 per cent of their liquid assets are available to cover a liquidity exposure. The defaulter returns payment items representing 50 per cent of the value of the items it received, and survivors can recover 50 per cent of the returned items from client accounts. In addition, survivors recover a net present value of 75 per cent of their credit loss from the estate of the defaulting institution. From this normal state, one assumption at a time is altered to consider contagion under a variety of conditions, from benign to risky.

The "extreme state" is a worst-case world. It is assumed that survivors can use only 10 per cent of their current Tier 1 capital levels to cover a credit exposure and only 10 per cent of their liquid assets are available to cover a liquidity exposure. It is assumed that the defaulter returns all the payment items it originally received, but survivors cannot recover any of this value from client accounts. Finally, survivors cannot recover any loss from the estate of the defaulting institution. Each of these assumptions is considered extremely unlikely, let alone their occurring simultaneously.

See Northcott (2002) for more details on these assumptions.

the event of a failure. A trivial case, of course, is where the value goes to zero: a system cannot pose risk if it is not used. What is interesting, however, is how quickly risk is reduced as the value sent through the system falls. Once again, using parameters reflecting an "extreme" state, a 25 per cent decrease in the value of items sent through the system leads to a dramatic decrease in the maximum number of knock-ons that occurs from 10, the largest number possible, to 2.[9]

The overall results are highly encouraging, since it appears to require a confluence of extraordinary conditions for the ACSS to give rise to contagion. Given this, and given that no contagion is observed under a range of normal conditions from benign to very risky, the research supports the view that the exposures in the ACSS at this time are manageable by participants. This position is strengthened by initiatives to further migrate value to the LVTS.

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9. Since no knock-on defaults are produced under a range of normal conditions, an extreme scenario is used to demonstrate the effect of decreasing value in the system.

Policy and Infrastructure Developments

Introduction

The financial system and all of its various components (institutions, markets, and clearing and settlement systems) are supported by a set of arrangements, including government policies, that influence its structure and facilitate its operation. Taken together, these arrangements form the financial system's infrastructure. Experience has demonstrated that a key determinant of a robust financial system is the extent to which it is underpinned by a solid, well-developed infrastructure. This section of the Review *highlights work in this area, including that related to relevant policy developments.*

For this issue, the articles in this section focus on the payment, clearing, and settlement systems used by Canadian financial institutions. These systems are at the core of the financial system, providing the links through which major participants can transfer financial instruments and make payments between themselves safely and reliably.[1]

The CLS Bank: Managing Risk in Foreign Exchange Settlements describes a major international initiative to create a private sector institution that offers simultaneous settlement for both currency legs of foreign exchange transactions, thereby reducing the risk of non-payment. The CLS Bank, which became active in September, is initially operating in seven currencies, including the Canadian dollar. The Bank of Canada supports the CLS Bank by providing it with banking services that facilitate its interaction with Canadian financial institutions. The Bank of Canada also contributes to the oversight of the CLS Bank, with particular responsibility for its Canadian-dollar operations.

The Large Value Transfer System (LVTS), operated by the Canadian Payments Association, is one of Canada's most important payments systems, processing an average total value of $114 billion each business day. Although the LVTS is an extremely reliable system, on rare occasions a significant outage in the computer or telecommunications systems of a participant could disrupt the flow of payments in the LVTS and adversely affect liquidity in the payments system. *The Impact of Participant Outages on Canada's Large Value Transfer System* examines how participant outages can affect payment flows and offers suggestions to help minimize their impact.

One factor hampering the study of the operation of payments systems has been a lack of robust "benchmarks" against which to assess payment flows through them. In *Understanding Intraday Payment Flows in the Large Value Transfer System*, the early stages of building a set of benchmarks for payment flows within the LVTS are discussed. These preliminary benchmarks are compared with actual payment flows on 11 September 2001, providing some insight into the ability of the LVTS to operate under difficult circumstances.

1. Information on clearing and settlement systems in Canada can be found on the Bank of Canada's Web site at http://www.bankofcanada.ca/en/payments/mainpage.

The CLS Bank: Managing Risk in Foreign Exchange Settlements

Paul Miller and Carol Ann Northcott

The foreign exchange market is the largest financial market in the world, with an average daily turnover of approximately US$1.2 trillion (BIS 2002). Participants in this market take on significant risks in settling their transactions. Indeed, these risks are so significant that exposures created by disruptions in settling these transactions have the potential to pose systemic risk.[1]

The CLS Bank International was created to address foreign exchange settlement risk, particularly its most significant component, credit risk. It does this by providing a form of payment-versus-payment settlement for foreign exchange transactions, virtually eliminating credit risk for counterparties settling through the system.

The CLS Bank began operations on 9 September 2002. It is a significant contribution to the global financial system generally and to the Canadian financial environment specifically, since the Canadian dollar is one of seven currencies that can be settled through the system.[2]

Foreign Exchange Settlement Risk

Foreign exchange traders engage in various kinds of transactions that involve exchanging one currency for another. But once a deal has been struck, how does the actual exchange take place? To understand how a typical foreign exchange transaction is settled (without the CLS Bank), consider the following example involving two banks. Bank A is based in Japan and is a participant in the Japanese large-value payments system, BOJ-NET. Bank B is based in Canada and is a participant in the Canadian large-value payments system, the LVTS. Bank A and Bank B enter into a foreign exchange transaction when Bank A sells yen to Bank B for Canadian dollars. How is this transaction settled?

Bank A will pay Bank B the yen through the BOJ-NET. Since Bank B is not a participant in the BOJ-NET, it must engage a bank that is a participant to receive the payment on its behalf. This is Bank B's correspondent, or "nostro," bank. Likewise, Bank B will pay Canadian dollars to Bank A through the LVTS via Bank A's nostro bank.

Foreign exchange trades are two-way transactions: each counterparty pays one currency and receives another in return. One source of risk for counterparties arises when payments systems are in different time zones. In the above example, Bank A pays out the yen through the BOJ-NET before the Canadian payments system is open. If Bank B defaults in the interim, Bank A will have paid out the yen but will not receive the Canadian dollars. This is often termed "principal risk," a type of credit risk. As well, because of limitations on current information-management practices, it could be several days from the time a counterparty initiates the process to pay the "sold" currency until it knows with certainty whether it has received the "bought" currency, subjecting it to liquidity risk and replacement risk if the bought currency arrives later than expected. Finally, given that countries have different legal and regulatory regimes, legal risk may also be a factor in the event a counterparty fails to deliver a currency. All risks that arise in the settlement of foreign exchange transactions comprise foreign exchange settlement risk, with credit risk being the most significant component.

1. Systemic risk in this context is often defined as the risk that the failure of one participant in a financial system to meet its required obligations will cause other financial institutions to be unable to meet their obligations when due.
2. For more information on the topics discussed here, see Miller and Northcott (2002).

The CLS Bank

Based in New York City, the CLS Bank is designed specifically for the settlement of foreign exchange transactions. Seven currencies can currently be settled through the system: the Australian, Canadian, and U.S. dollars, the euro, the yen, the Swiss franc, and the pound sterling.[3]

The CLS Bank virtually eliminates the credit risk associated with settling foreign exchange transactions. It does this by providing a payment-versus-payment arrangement, settling both sides of a transaction simultaneously across accounts that financial institutions (settlement members) hold at the CLS Bank.[4] So, if the transaction from our previous example is settled in the CLS Bank, Bank A and Bank B receive their expected currencies simultaneously in their respective settlement accounts at the CLS Bank. Counterparties do not give up the sold currency without receiving something in return.

Settlement members pay currencies that are owed to the CLS Bank's accounts, which are held at central banks, through domestic payments systems. Currencies that are due to settlement members are paid out by the CLS Bank in the same way.

Risk Management in the CLS Bank

The simultaneous settlement of foreign exchange transactions across the books of the CLS Bank means that the settlement asset for foreign exchange transactions is an intraday claim on the CLS Bank. For this to be acceptable to participants and to the central bank community, the CLS Bank must be virtually risk-free. Therefore, risk-management controls are applied to each trade before it is settled to protect the CLS Bank from credit and liquidity risk. First and foremost, although each settlement member will owe some currencies and be owed other currencies over the course of settlement, the balance in each member's settlement account at the CLS Bank over all currencies must always be positive. There are also limits on how much a

Types of Risk

Banker risk	The risk that the bank where a settlement account is held could become insolvent.
Credit risk	The risk that a counterparty will not settle an obligation for full value, either when due or at any time thereafter. This includes principal risk, the risk that a counterparty could pay the currency sold without receiving the currency bought (BIS 2001).
Legal risk	The risk of loss because of the unexpected application of a law or regulation, or because a contract cannot be enforced (BIS 2001).
Liquidity risk	The risk that a counterparty will not settle an obligation for full value when due but will settle at some unspecified time thereafter (BIS 2001).
Operational risk	The risk that deficiencies in information systems or in internal controls, human errors, or management failures will cause or exacerbate credit or liquidity risks (BIS 2001).
Replacement risk	The risk that a counterparty to an outstanding transaction will fail to perform on the settlement date. The resulting exposure is the cost of replacing, at current market prices, the original transaction (BIS 1996).
Systemic risk	The risk that the failure of one participant in a financial system to meet its required obligations will cause other financial institutions to be unable to meet their obligations when due (BIS 2001).

3. More currencies are expected to be added in the future.
4. Financial institutions can participate in the CLS Bank in various ways, but only settlement members hold settlement accounts at the CLS Bank.

settlement member can owe in aggregate across all currencies, and how much it can owe in a particular currency.

To protect itself from legal risk, the CLS Bank has obtained legal opinions that the finality of transactions settling across its books can be supported in the legal systems of all jurisdictions with currencies settling through the system. As well, all payments to the CLS Bank from settlement members are made through payments systems that provide intraday finality.[5] The CLS Bank holds these payments in accounts at central banks, ensuring that the CLS Bank is protected from banker risk. Finally, the CLS Bank has an explicit plan to address operational risk.

For participants in the CLS Bank, the risk-management controls and other arrangements ensure that, in virtually all circumstances, participants will receive either the currency transacted for or a refund of the amount they contributed, even if another participant defaults on its payment obligations. That is, participants are protected from credit risk arising from the failure of another participant.[6] Nevertheless, in the event of a failure, participants do continue to be potentially exposed to liquidity risk and replacement risk, although it is expected that these risks are manageable.

The CLS Bank and the Canadian Financial System

The CLS settlement cycle takes place during the North American overnight period, normally from 1 a.m. until 6 a.m. ET. The approved payments system for the Canadian dollar is the Large Value Transfer System (LVTS), and the Debt Clearing Service (DCS) will continue to be used to support LVTS collateral operations. Currently, only one Canadian bank is a settlement member, the Royal Bank of Canada, with some others intending to enter the system as settlement members in the future.

The Bank of Canada plays three key roles with respect to the CLS Bank in the Canadian financial system.

- To mitigate major disruptions caused by the operational failure of a Canadian settlement member, a nostro agent, or the LVTS, the Bank of Canada is prepared to assist, if necessary, by entering payments directly across the CLS Bank's and participants' settlement accounts with the Bank of Canada.
- The Bank of Canada acts as banker for the CLS Bank, providing it with two main services. First, the Bank of Canada provides a settlement account to the CLS Bank. Second, the Bank of Canada makes and receives payments through the LVTS on behalf of the CLS Bank.
- The CLS Bank is subject to regulation by the Board of Governors of the Federal Reserve System in the United States. Supported by the Federal Reserve Bank of New York, the Board is therefore the lead overseer of the system and consults with the central banks of those countries whose currencies will settle in the CLS Bank, including the Bank of Canada. In addition, the Governor of the Bank of Canada has designated the Canadian-dollar operations of the CLS Bank for Bank of Canada oversight under the Payment Clearing and Settlement Act. The Bank of Canada is satisfied that the system meets the standards that the Bank has set for designated systems.

Conclusion

Through the co-operative efforts of private sector financial institutions, central banks, and the operators of domestic payments systems, the CLS Bank has been created to address foreign exchange settlement risk—particularly credit risk, which use of the CLS virtually eliminates. The world's largest foreign-exchange-dealing institutions are shareholders of the CLS Bank, and it is expected that most will interact directly or indirectly with it. Growing participation has the potential to position the CLS Bank as the dominant global mechanism for settling foreign exchange transactions.

5. Intraday finality indicates that once a payment has been accepted within a payments system, the receiver has irrevocable access to the funds that same day.
6. Only under the most extreme conditions does some element of credit risk remain. See Miller and Northcott (2002).

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The Impact of Participant Outages on Canada's Large Value Transfer System

Kim McPhail and David Senger

Each business day, about 15,000 payment messages, with a total value averaging $114 billion, flow through Canada's Large Value Transfer System (LVTS). The Bank of Canada and 13 deposit-taking financial institutions participate directly in the LVTS.[1] It is owned and operated by the Canadian Payments Association (CPA).

The LVTS functions smoothly because, on most days and for most participants, inflows and outflows tend to be roughly offsetting. This, together with the legally enforceable netting of payments, as well as intraday borrowing backed by collateral held at the Bank of Canada, reduces participants' intraday liquidity requirements. If an LVTS participant was unable to send payments to other participants because of an outage of its own internal systems, the payment flows of other participants and of the LVTS as a whole might be disrupted and could be made only at greater expense (because of increased collateral requirements).

Lengthy outages in the computer systems or telecommunications systems of LVTS participants are infrequent. Between June and August 2002, seven outages occurred. Four were resolved fairly quickly. However, one lasted one and a half hours, and two lasted for just over two hours. The potential effects of disruptions to the flow of payments in the LVTS increase with the length of an outage. It is therefore important that participants have reliable backup systems that they can switch to quickly if primary systems fail. It is also important that procedures are in place to deal with participant outages in order to limit their impact on the payments system as a whole.

In this article, a simple illustrative model is used to describe how a participant outage affects the payment flows of other participants and of the LVTS as a whole. The model is then used to provide an indication of the effect of an actual participant outage on the LVTS. The procedures that are currently in place to deal with the potential problems raised by participant outages are also described. When an outage occurs, it is important that these procedures be implemented quickly.

How Does a Liquidity Drain Occur?

Consider an outage that prevents a participant from sending payment instructions to the LVTS. Payments sent to that participant by other participants will continue to pass through the LVTS until those participants take specific action to delay payments or until sending additional payments would violate the LVTS's risk controls. These payments will be recorded as a "credit" to the position of the problem participant. If this position becomes sufficiently large, substantial liquidity could be drained from the system.

The LVTS has two separate payments streams. In the first stream (called Tranche 1 or T1), the sender, in effect, fully collateralizes each payment sent through the system. In this article, we focus on the second stream (Tranche 2 or T2), because it accounts for about 90 per cent of the value of payments sent through the LVTS and because it is the stream for which the issue of liquidity drains is most relevant. To support payment flows, T2 relies on intraday credit extended between participants, a collateral pool, and robust risk controls rather than on

1. For more information on Canadian payments systems and the structure of the LVTS, see the Bank of Canada's Web site at http://www.bankofcanada.ca/en/payments/mainpage. The LVTS is a multilateral netting system. Payments made during the day through the LVTS are final and irrevocable. The risk-control mechanisms in the LVTS ensure that it will be able to complete settlement in all circumstances at the end of each day.

full collateralization by the sender of a payment. Payments sent via T2 are as protected from risk as those sent by T1. When sufficient credit is available to them, LVTS participants generally choose to send payments via T2 because the collateral requirements are lower.

To contain the risk in the T2 stream, each payment sent via T2 during the day must pass certain risk controls. A hypothetical example, outlined in Table 1, uses five financial institutions to demonstrate how the risk controls and multilateral netting mechanism in T2 function. Two types of risk controls (explained below) are applied to each payment sent through T2: bilateral credit limits (BCL) and T2 multilateral net debit caps (T2NDC).

Each participant can grant each other participant a BCL. The BCL granted by one participant to a second participant represents the maximum net debit (or negative) position that the second participant is allowed to incur with respect to the first. This BCL can also be viewed as the maximum positive balance that the first participant will allow with respect to the second. For example, in Table 1, A has granted a BCL of 30 to B and a BCL of 50 to C. Thus, B's bilateral net debit position with respect to A cannot exceed 30 and C's negative balance with respect to A cannot exceed 50.

The first step in calculating a participant's T2NDC is to add the BCLs granted to that participant by all other participants (e.g., for A, this is equal to 25 + 45 + 60 + 65 = 195). This sum is then multiplied by a "system parameter" to calculate each participant's T2NDC. (In Table 1, this is 0.24, the system parameter currently used in the LVTS.) The T2NDC represents the maximum allowable T2 negative position that results from one participant's flow of payments to and from all other participants. In the case of A, for example, the T2NDC is 47.

Because of the offsetting nature of payments in a multilateral netting system, a relatively small T2NDC (i.e., much smaller than the sum of the BCLs) can support a large number of payments. The greater the power of multilateral netting is, the more the sum of the BCLs can be scaled down by the system parameter without impairing the smooth flow of payments through the LVTS. The CPA has chosen a small system parameter (which results in smaller T2NDCs) that still allows payments to flow smoothly, because

Table 1

Risk Controls and the Multilateral Netting Mechanism in T2 of the LVTS: An Example

		BCL granted to:					Sum
		A	*B*	*C*	*D*	*E*	
BCL granted by:	*A*	x	30	50	60	70	210
	B	25	x	60	50	70	205
	C	45	60	x	300	300	705
	D	60	75	250	x	500	885
	E	65	60	250	500	x	875
Sum of BCLs		195	225	610	910	940	
X							
System parameter		0.24	0.24	0.24	0.24	0.24	
=							
T2NDC		47	54	146	218	226	

this reduces the collateral requirements of LVTS participants.

Suppose that, at the beginning of the day, participant A (a small financial institution that grants and receives relatively small BCLs) is unable to send payment messages because of a technical outage, but continues to receive payments from other participants. In this example, B can send a maximum of 30 (the BCL) to A, C can send a maximum of 50, and so on. Thus, participant A can drain 210 in liquidity from other participants—i.e., the sum of BCLs granted by A. Participants B, C, D, and E, however, each retain the ability to send payments to each other (e.g., given that B has sent 30 to A and since B's T2NDC is 54, B can still send up to 24 to C, D, and E). The outage at participant A drains liquidity from other participants, but they retain the ability to send and receive T2 funds.

Now, suppose participant E (a large financial institution that grants and receives relatively large BCLs) has an outage. The BCL that E has granted to A is 65; however, A's ability to send 65 to E is constrained because its T2NDC is smaller than the BCL. Participant A can send a maximum of 47, its T2NDC, to E. The same situation applies for B, C, and D. In this worst-case scenario, E has drained all T2 liquidity from other participants because their T2NDC prevents them from making any payment to any other participant.

The Potential Impact on the LVTS of Participant Outages

Both large and small financial institutions participate in the LVTS. If a small LVTS participant experiences an outage, and other participants continue to send payments to the problem participant until their BCL or T2NDC is reached (i.e., a worst-case scenario), that participant could drain about 15 per cent of the T2 liquidity of other participants. An outage at one of the large participants in the LVTS, however, could theoretically drain about 85 per cent of T2 liquidity from the system.

In practice, this worst-case scenario is unlikely to ever occur because other participants would eventually stop sending payments to the problem participant. Nevertheless, if there was an outage when a large participant had already built up a large positive balance in the LVTS, a substantial liquidity problem would result, because that participant would be unable to recycle liquidity back to other participants. If that participant continued to receive LVTS funds without being able to send LVTS payments for a considerable length of time, it would continue to drain liquidity. In actual practice, an outage lasting several hours at a large LVTS participant might quickly drain on the order of 30 to 40 per cent of the total T2 liquidity that exists in the LVTS. Other participants would still be able to divert payments from the T2 stream to T1, but this is much more expensive because it requires more collateral.

How Does the CPA Limit the Consequences of Participant Outages?

The LVTS has several mechanisms in place to address this issue. They are designed to make the consequences of a participant outage much less severe than the worst-case scenarios described above.

First of all, there is an expectation among LVTS participants that participants should be able to resume payment operations within two hours of a technical failure, although this is not currently incorporated into the LVTS rules. This should limit the length of time during which a participant with a problem could drain funds from other participants. The Bank of Canada has noticed a tendency among LVTS participants with outages to prefer to try to restore their primary systems, rather than switching to backup systems, since they hope that the primary-system outage can be resolved within two hours. However, if primary systems cannot be restored fairly quickly, an outage could persist for several hours before a decision is taken to transfer operations to backup systems. Additionally, once this decision is made, it can take up to two hours to begin operations at backup facilities. Thus, a stronger incentive for participants to resume processing within two hours, perhaps by incorporating this requirement within LVTS rules, might be beneficial.

Equally important, under the CPA rules, an LVTS participant with a technical outage is required to notify the system operator immediately. The system operator then notifies other participants, so that they can choose to temporarily stop sending payments to the affected

participant until the problem is resolved. By doing this, other participants can monitor and preserve their liquidity.

As noted above, lengthy participant outages are infrequent, but they do sometimes occur and, on rare occasions, it may be difficult to resolve the problem in a reasonable length of time. Use of reliable backup processing capabilities that can restore payments processing within a maximum of two hours is important. Moreover, tighter domestic and international requirements regarding time-sensitive payments are shortening the acceptable duration of participant outages.[2] When a participant outage does occur, it is important that the participant follow the CPA rules and notify the CPA promptly in order to prevent the buildup of liquidity at the failed participant and a corresponding drain of liquidity from other participants. This will minimize the impact of such outages on the payments system as a whole.

2. See "The CLS Bank: Managing Risk in Foreign Exchange Settlements," on page 41.

Understanding Intraday Payment Flows in the Large Value Transfer System

Lindsay Cheung

The Large Value Transfer System (LVTS) is the key mechanism in Canada for settling large-value and time-sensitive payments, such as those involved in settling foreign exchange transactions, since it is the only electronic transfer system in Canada that processes payments in real time and with intraday finality and irrevocability. Major disruptions affecting this system could therefore have potentially severe ramifications for the financial system. An understanding of the normal patterns of intraday payment flows in the LVTS will enable us to quickly assess and monitor the impact of an intraday disruption to the system. This article presents a preliminary benchmark for these intraday flows using data provided by the Canadian Payments Association (CPA).[1] Although the benchmark is still preliminary, since it is derived from a very limited amount of data, it is used to assess the impact of the events of 11 September 2001 on the Canadian payments system.

Data

Two weeks' worth of hourly aggregated payment volumes and values sent between 28 January and 1 February and between 11 and 15 February 2002 were used to derive the benchmark. Statistical analysis of total data flows shows that volume increases on the first two and the last five business days of each month, as well as at mid-month and on Fridays. Value increases on the first two and the last three business days of each month and at mid-month, but falls on Tuesdays.[2] The intraday payment flows were adjusted by scaling them to remove these systematic effects on aggregate daily volume and value. This method assumes that the intraday pattern is not altered by either the business day or the day of the week.

Intraday Pattern

The LVTS allows participating financial institutions to exchange payments, either for themselves or for their clients, between 8 a.m. and 6 p.m. every business day, and it begins settlement at 6:30 p.m.[3] Some LVTS payments are time sensitive because of the time-critical nature of client payments, deadlines associated with the settlement of other systems, or because of payment flows involving the Government of Canada. More important to the overall intraday LVTS flows, the CPA's guideline on the *Timing of Payment Messages* states that each participant, excluding the Bank of Canada, should complete a certain percentage of its daily payment flows according to the following schedule:

1. We would like to thank the Canadian Payments Association for providing the data and for agreeing to its use in this article, as well as for their comments.

2. Both daily volume and value also drop on all U.S. national holidays but rise on the business day immediately thereafter. In addition, the levels of volume and value fall on every first Monday in August, since it is a holiday in all provinces except Quebec. Thus, while the LVTS is open on that day, there are significantly fewer payments. Volume and value increase on days when the Government of Canada pays interest on many of its bonds. These fall on the first business day in June, September, and December. These payments generate increased activity in the LVTS.
3. To support the overnight operation of the Continuous Linked Settlement (CLS) Bank, the LVTS is now open at 1 a.m. every business day for payment processing. In particular, the period between 1 a.m. and 8 a.m. is reserved for payments related to the CLS Bank. The impact of transactions involving the CLS Bank on the intraday payment flows of the LVTS still needs to be assessed.

Hours of operation	Volume (per cent)	Value (per cent)
Before 10 a.m. local time	40	25
Before 1 p.m. local time	60	60
Before 4:30 p.m. Eastern Time	80	80

To reduce the need for borrowing from, or to avoid holding deposits at, the Bank of Canada overnight, participants may exchange payments with each other between 6 p.m. and 6:30 p.m. in order to to even out or "flatten" their surplus or deficit positions.[4] This is called the presettlement period.

Volume

Data on hourly payments volumes show a stable intraday pattern from one day to another (Chart 1a), with standard deviations that vary between 10 to 20 per cent during various hours of the day. The highest volume occurs during the first hour of operation and averages about 30 per cent of total daily volume. This is because participants enter many previously "known" payments in their internal systems overnight, which are then automatically transmitted to the LVTS for processing when it opens at 8 a.m.

The volume falls sharply between 9 a.m. and 10 a.m., remains flat between 10 a.m. and 3 p.m, and then increases slightly between 3 p.m. and 4 p.m. This rise in volume is associated with the completion of most client payments before 4 p.m. As suggested by the guideline, about 60 per cent of total daily payment volume is typically completed before 1 p.m. Hourly volume declines slightly between 4 p.m. and 5 p.m. to about 1,000 payments and to about 300 payments for the following hour (as participants complete any remaining transactions, such as Settlement Exchange Transactions).[5] The day typically ends with 5 to 7 payments during the presettlement period, when participants exchange a small number of payments to flatten their positions. Overall, the hourly payment volume follows the CPA guideline (indicated by the horizontal lines in Chart 1b).

Value

Intraday payment values exhibit a more volatile pattern (Chart 2a), with standard deviations varying between 20 to 30 per cent. Although the highest hourly volume occurs during the first hour of operation, value does not peak at this time. On average, 20 per cent of the total daily payment value is completed before 10 a.m., slightly less than the 25 per cent contained in the CPA guideline (indicated by the horizontal line in Chart 2b).

Hourly payment value tends to increase slightly between noon and 1 p.m. This is partially due to the settlement of the federal government Receiver General (RG) morning auction and the release of overnight deposits in the Automated Clearing Settlement System (ACSS). By 1 p.m., about 50 per cent of the daily payment value has been processed; the CPA guideline is 60 per cent.[6] The largest spike in hourly value emerges between 4 p.m. and 5 p.m., when participants settle the Debt Clearing System (DCS)[7] and the

4. The spread between the rates that the Bank of Canada charges for lending and pays for overnight deposits forms the "operating band" for the overnight rate of interest. The Bank conducts its monetary policy by setting a target for the overnight rate that is at the centre of the band.

5. Settlement Exchange Transactions are transactions between direct clearers in the Automated Clearing Settlement System (ACSS) and direct participants in the LVTS. They are used to correct the dislocation of payment flows between the two systems. In short, a participant who is long in the LVTS and short in the ACSS would swap with another participant who is short in the LVTS and long in the ACSS.

6. One possible explanation for why participants are not meeting the guideline could be the greater concentration of larger-value payments towards the end of the day compared with the level at the time the guidelines were originally established. This concentration includes payments for the settlement of DCS and government-related items. The CPA plans to revisit the guidelines.

7. The DCS is a real-time trading system for Government of Canada and most provincial government bonds and bills, as well as for money market instruments and corporate bonds. This system is owned by the Canadian Depository for Securities, which uses the Bank of Canada as its settlement agent. The DCS settles via the LVTS between 4 p.m. and 5 p.m. every business day.

Chart 1a Hourly Payments Volume

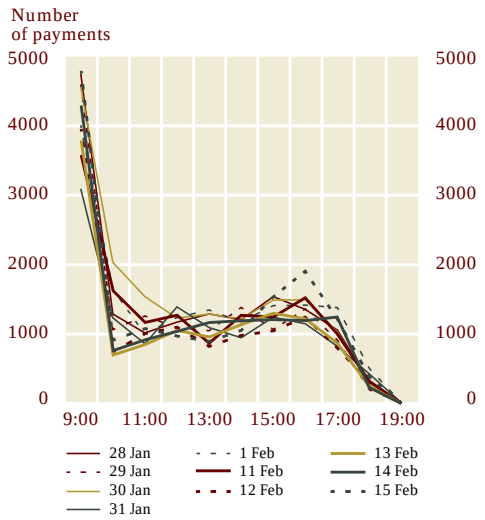


Chart 1b Cumulative Payments Volume

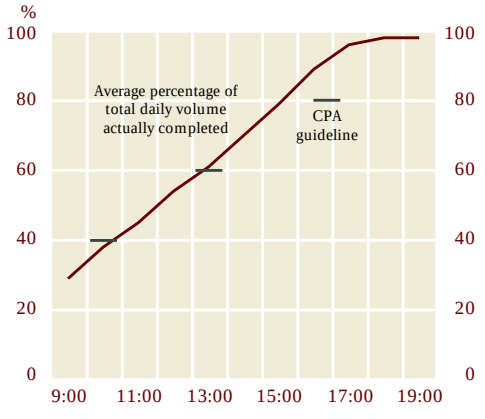


Chart 2a Hourly Payments Value

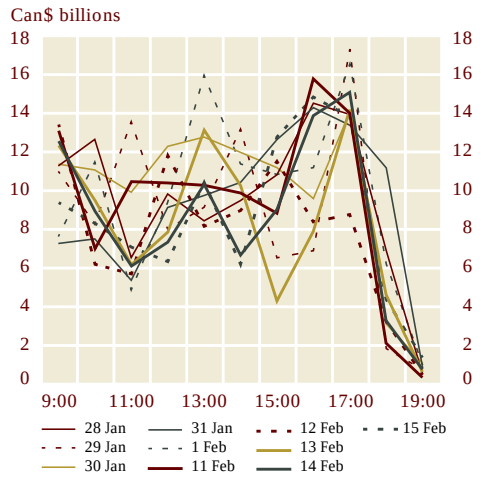


Chart 2b Cumulative Payments Value

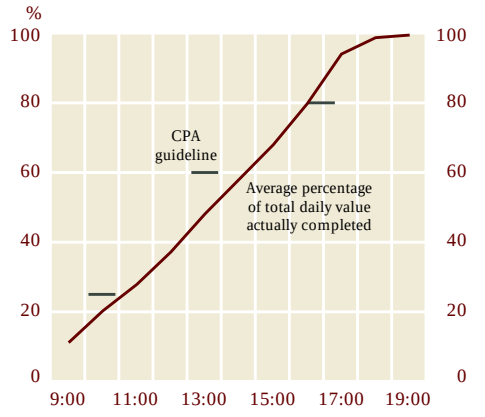


Chart 3a Impact of 11 September on Hourly Payments Volume

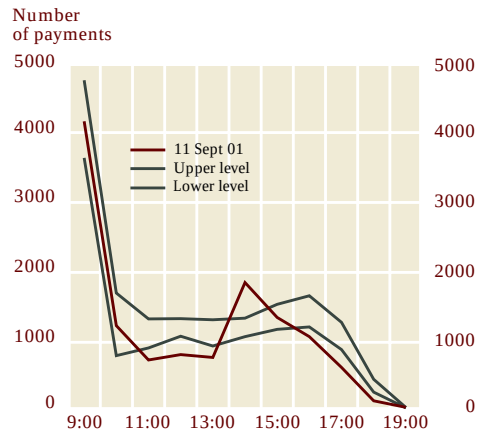
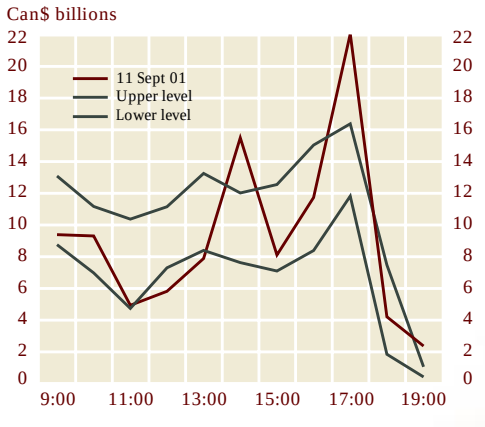


Chart 3b Impact of 11 September on Hourly Payments Value



Note: Each data point (in Charts 1a, 2a, 3a, and 3b) represents total activity over the past hour.

RG afternoon auction. By this time of the day, the LVTS has already processed about 95 per cent of total daily value, exceeding the CPA target of 80 per cent. Hourly payment value declines sharply between 5 p.m. and 6 p.m. and continues to decline during the presettlement period, as participants exchange only a few payments.

Average Value per Payment

Average value per payment is lowest between 8 a.m. and 9 a.m. It increases for the next three hours, peaks at noon at $10 million, and returns to the $7 million to $8 million level between 1 p.m. and 4 p.m. Average value per payment rises substantially between 4 p.m. and 6 p.m. and spikes significantly during the presettlement period. This spike occurs because participants are evening out positions by making only a few, but possibly very large, payments.

Assessing the Impact of 11 September 2001

In this section, the intraday benchmark is used to assess how the Canadian payments system was affected by the terrorist attacks in the United States on 11 September 2001. To do so, the hourly intraday payments data for 11 September 2001 are plotted against the benchmark (Charts 3a and 3b).

On that day, both volume and value were operating normally before 10 a.m. Between 10 a.m. and noon, they fell below their lower level (minus one standard deviation). In response to the slowdown in payment flows, the Bank of Canada announced at 1:30 p.m. that there would be a liquidity injection of $1 billion on that day (raising excess settlement balances in the LVTS from the typical $50 million).[8] As a result, the volume and value of payments recovered and rose above the upper level (plus one standard deviation) between 1 p.m. and 2 p.m.

Volume started to decline between 2 p.m. and 3 p.m. and remained below the lower level prior to the presettlement period. In contrast, value rose above the upper level again between 4 p.m. and 5 p.m. This increase in value might have been triggered by the release of extra liquidity committed by the Bank through the RG afternoon auction. During the presettlement period, volume and value were also higher than normal.

For the day as a whole, volume and value were operating at about 90 and 100 per cent of the benchmark, respectively.

Summary and Future Research

This is only a preliminary analysis of normal LVTS intraday payment flows. More work is undoubtedly necessary because the benchmark is derived from a limited amount of intraday data. Accordingly, we plan to collect additional intraday data to more fully explore the underlying factors in order to understand how they influence intraday payment patterns. In addition, future consideration should be given to developing real-time access to intraday payment data, which would allow ongoing monitoring, as well as an immediate assessment when major disruptions in the payments system occur. Regular data on intraday flows could also be used to assess the impact of structural changes to payment flows, such as those caused by the introduction of the CLS Bank in September 2002 and the migration of payments exceeding $25 million from the ACSS to the LVTS as a result of the cap to be introduced starting in February 2003.

8. For additional details on the Bank of Canada's actions with respect to financial markets at that time, see "Actions Taken in Canada to Deal with Possible Disruptions to the Financial System," Technical Box 2, Bank of Canada *Monetary Policy Report*, November 2001, p. 17.

Research Summaries

Introduction

Bank of Canada staff undertake research designed to improve the overall knowledge and understanding of the Canadian and international financial systems. This work is often pursued from a broad, system-wide perspective that emphasizes linkages across the different parts of the financial system (institutions, markets, and clearing and settlement systems). Other linkages of importance may include those between the Canadian financial system and the rest of the economy, as well as those with the international environment, including the international financial system. This section summarizes some of the Bank's recent work.

This issue of the *Financial System Review* highlights research that addresses the changing structure of the Canadian financial services industry, as well as aspects of the structure and functioning of the Canadian foreign exchange market. Linkages are also emphasized. These include the relationship between the structure of the financial system and economic growth and the links between the banking systems of different countries when a serious disturbance arises in one of them.

Innovation and change in the provision of financial services has been a hallmark of the industry for many years. *The Financial Services Sector: An Update on Recent Developments* reviews developments in the Canadian financial services sector. With a number of forces continuing to spur rapid innovation, the pace of change has, if anything, accelerated. Within this context, Canadian financial service providers are examining the profitability of individual business lines more closely and developing new ways to deliver financial products.

The Canadian foreign exchange market involves a number of financial institutions and participants, together with large trading flows. In *Canadian Foreign Exchange Market Liquidity and Exchange Rate Dynamics*, a market-microstructure approach is used to examine how market participants use certain types of information and, in turn, how this affects the exchange rate and the underlying liquidity in the foreign exchange market. This approach can also be used to study the effect of the risk-management practices of banks on market liquidity.

It is readily accepted that a well-functioning financial system is an important contributor to an environment of sustained economic growth, but there is less agreement on which specific structure of the financial system contributes to growth most strongly. In *Financial Structure and Economic Growth: A Non-Technical Survey*, the authors identify the two main types of financial structure and discuss whether one of them is more beneficial to long-run growth than the other. They conclude that different structures can, in fact, be complementary, and that it is the overall level and quality of financial services that is most important. To enhance the latter, policy-makers should focus on pursuing supportive legal, regulatory, and other policy reforms.

Fortunately, serious disturbances in the Canadian banking system are rare. Nevertheless, from a global perspective, post-war history has produced a number of banking crises in both the industrialized and emerging economies. When problems arise in the banking sector of one country, how are the banking systems of other countries affected? *Banking Crises and Contagion: Empirical Evidence* examines this issue based on an empirical model of contagion and finds that contagion is more likely to occur between two countries if they share similar macroeconomic characteristics. It is important that policy-makers understand how information from the occurrence of a banking crisis affects the behaviour of market participants.

The Financial Services Sector: An Update on Recent Developments

Charles Freedman and Clyde Goodlet

An updated review of the Canadian financial industry shows that it continues to experience significant changes.[1] In an earlier Bank of Canada technical report, the driving forces behind the developments that had been taking place over the previous decade or so were examined, and some of the challenges that these forces would pose for financial service providers (FSPs) were indicated. The key factors identified were technological change, the changing nature of competition in the financial services sector, and changes in household demographics. The challenges facing the financial services industry were discussed under two main headings—the importance of size and the choice of the range of services and products that an FSP would provide.

This update builds on the previous work and, in particular, highlights the role of economies of scale and scope,[2] mergers and concentration, the strategies being followed by FSPs, and the role of changes in information technology on service delivery. Developments in these areas continue to pose significant challenges for FSPs as they attempt to develop strategies to maintain their profitability and long-run viability. While change in the financial sector is not new, the current period is noteworthy because of the pace and the scope of change, which appear to be greater than ever.

Canadian financial service providers continue to search for ways to operate at an efficient scale in their back-office activities. They are following three different strategies to achieve this scale: (i) creating or building it; (ii) buying it; or (iii) borrowing it. Because of technological change, the optimum scale of activities in many back-office operations has increased. As a result, some FSPs are trying to gain the largest market share in Canada in particular activities (for example, transactions processing). Other FSPs are exiting these same areas, having decided that they will not be able to achieve a sufficient size of operations to be efficient. They are then purchasing these services from low-cost providers. Specific examples of back-office activities where technological change has significantly increased the scale at which FSPs must operate to be efficient include credit card processing and payment processing activities, such as debit card acceptance services.

With regard to involvement in existing and new financial instruments, FSPs continue to emphasize the need for each product or service to be profitable. Some FSPs have rigorously assessed the profitability of each business activity in an attempt to allocate balance sheet resources towards activities of high strategic value and sustainable profitability. A consequence of such assessments is that the FSP will exit areas that do not meet the test; for example, selling non-core subsidiaries or getting out of certain lending activities. This development has been facilitated and accompanied by an unbundling of activities. One example of unbundling is the further separation of loan-origination activities from the ongoing credit-risk exposure to the borrower, resulting from the development and spread of various credit-risk-transfer arrangements.

At the same time, some FSPs have announced strategies that involve the rebundling of products and services, particularly where economies of scope are significant. This can be seen in the areas of consumer lending and corporate lending. For example, some banks are linking their willingness to extend corporate loans to

1. This note summarizes the recently published Bank of Canada Technical Report No. 91, Freedman and Goodlet (2002), which updates Technical Report No. 82, published in 1998.
2. Economies of scale and scope refer to the possibility that a firm will realize a reduction in the cost of producing goods and services as a result of an increase in the size or breadth of its activities.

customers to the readiness of those customers to undertake their capital market business (such as underwriting) with the bank.

Electronic money, which was introduced a number of years ago with great fanfare, has been shown to be technically feasible but not economically viable at this time. The potential revenues from a fully functioning arrangement appear to be insufficient to offset the high costs of establishing a national infrastructure capable of supporting such a scheme. Expectations of a rapid deployment of electronic money schemes, either using stored-value cards or network money, have all but disappeared.

Mechanisms used to deliver financial services and products continue to evolve. A broader range of delivery channels has been developed, including expanded use of Automated Banking Machines, computer banking, and the use of the Internet, to handle routine, low-margin financial transactions. Nevertheless, branches continue to play a very central role in the plans of FSPs, but their nature is changing (a strategy characterized as "bricks and clicks"). Branch staff must now have different qualifications, be better trained, and have access to much better information technology. Branches are also being opened on the premises of non-financial companies. Some FSPs are placing increasing emphasis on the revenues to be earned from the distribution of financial services or products (their own and others) and from the development and operation of Web-based auction sites. But there continue to be significant barriers to the use of information technology by FSPs in the innovation of products and services and their delivery channels.

With regard to the size of institutions, it is important to distinguish between the business lines of FSPs and the size of a financial institution as a whole. The recent literature seems to suggest that economies of scale in a number of business lines extend further than previous empirical work had indicated. Evidence of this is seen in the growth of financial firms that specialize in a small number of product areas (the so-called "monolines"). These firms exploit scale economies in process-intensive or information-intensive areas such as credit card processing. The growing importance of outsourcing in certain areas is also in part a recognition that significant scale economies exist. The benefits from the overall size of a financial institution come from somewhat different sources, such as an increased possibility of economies of scope in institutions with multiple business lines and the ability to engage in activities that require more capital. In addition, diversification across business lines can lead to smoother revenue flows.

The prevalent view is that Canadian markets for financial services are too small for even the largest FSPs to operate in at an efficient scale in certain lines of business. Large Canadian FSPs believe that they must operate as North American entities. Indeed, there are a number of recent examples of Canadian FSPs implementing such a strategy. The key questions for these FSPs are the extent of the economies of scale in their various areas of specialization and, where the economies of scale are important, whether the FSPs can achieve the size necessary to realize them and to be competitive with the very large FSPs in the United States. Regulatory restrictions may limit the ability of FSPs to realize these economies. Finally, there continue to be questions regarding the importance of economies of scope or synergies. In the non-financial sector, there have been waves of conglomeration and divestiture as views about the benefits and costs of size change. It will be interesting to see whether the financial sector experiences a similar pattern.

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Canadian Foreign Exchange Market Liquidity and Exchange Rate Dynamics

Chris D'Souza

A liquid financial market is a market in which supply and demand can be matched at a low cost. It is important that there be ample liquidity in the Canadian foreign exchange market, since a poorly functioning foreign exchange market will create additional costs for companies engaged in international trade or investments, thereby adversely affecting the economy. One way to analyze liquidity in the foreign exchange market is through market-microstructure research, which focuses on market arrangements and practices.

The foreign exchange (FX) market in Canada consists of a network of financial institutions linked together by a high-speed communications system. The participants in the FX market include dealers, customers, and brokers. Dealers continuously supply bid and ask quotes to both customers and other dealers. Through the course of the day, they stand ready to buy and sell foreign exchange, thus providing liquidity to the market. Brokers in the FX market are those intermediaries who match the best buy and sell orders of dealers. Unlike dealers, who sometimes take speculative positions, brokers act as pure matchmakers. In Canada, most of the actual trading in the foreign exchange spot market is handled by the top Canadian banks through their foreign exchange operations. Customers in these markets are those financial and non-financial corporations that need foreign currencies for financing international trade, investing overseas, hedging cross-currency transactions, or pursuing short-term investment opportunities, and those corporations that have supplies of foreign exchange.

Dealers in the foreign exchange market distinguish between two types of trades: customer trades[1] and proprietary trades. For customers, the ability to complete trades quickly is important when adjusting their FX position. Dealers provide this fundamental element of liquidity to the market by trading with the customer. In providing these liquidity services, however, dealers may take on an undesired amount of exposure to foreign exchange risk. Proprietary trades are trades on a dealer's own account to adjust its own FX portfolio position. These trades are undertaken to help dealers manage their exposure to foreign exchange risk in a profitable fashion. Proprietary trades are typically undertaken on the basis of available information about likely changes in foreign exchange rates. To achieve their foreign exchange investment objectives, dealers must be assured that their information is at least as good as that of their trading counterparty, since trading against better-informed traders is a losing proposition.

One way that dealers gauge market information is to observe order flow. One measure of order flow is the aggregate value of buy orders relative to sell orders that have been completed or that are "queued up" for future trades. An excess quantity of net buy (sell) orders for the Canadian dollar suggests that other market participants have a positive (negative) impression about the future prospects of the Canadian dollar based on available information. Dealers acquire order-flow information from customer trades and through their communications with brokers. In this last case, they may have electronic access to broker "screens," which contain a part of the order flow.

Order flow is one key component of the market-microstructure approach,[2] and is found to explain a large proportion of the short-term (daily, weekly, or even quarterly) variation in nominal exchange rates. In contrast to traditional models of the exchange rate, which rely on factors such

1. Customers include the Bank of Canada, commercial client businesses, and non-dealer financial institutions. Canadian chartered banks also trade with each other as part of the interdealer market.

2. See O'Hara (1995) for a review of market-microstructure models.

as interest rates, money supply, rates of inflation, gross domestic product, the trade account balance, and commodity prices to explain exchange rate movements, order flow focuses on changes in the market expectations of changes in these factors. Therefore, it often performs more favourably than the individual factors themselves in empirical studies of short-term FX rate movements.

While recent market-microstructure studies of the FX market have had some preliminary success empirically in explaining exchange rate movements using order-flow information, the underlying determinants of order flow and the behaviour of the dealers who provide liquidity to this market have not been tested explicitly. According to the microstructure view, liquidity will be affected by the institutional features and information flows of the foreign exchange market. It is therefore of interest to examine whether access to private information via customer trades, and the management of their own FX positions affect a dealing bank's willingness to supply liquidity to the Canadian FX market.

Some researchers (e.g., Lyons 1997) have argued that customer trades are the catalyst for profitable dealer strategies. Our work suggests that dealers behave similarly in response to all types of trades, independent of where trades originate. This indicates that valuable private information about the fundamentals that may affect the value of the exchange rate is not obtained only from individual customer trades. Instead, it appears that dealers use private information about their inventories, which are affected partly by their own customer orders, as a profitable avenue for speculation in the interdealer market.

This has direct implications for liquidity in the FX market. Providing liquidity to customers allows dealers the opportunity to speculate in the interdealer market. The more profitable such speculative opportunities are, the more competitive dealers will become in attracting customer orders. Consequently, the spreads between their bid and ask quotes for customer trades will be smaller. Furthermore, our work suggests that liquidity in the Canadian FX market is not affected by the type of trading with the dealer, i.e., it occurs from both customer trades and trades in the interdealer market.

Daily hedging and risk-management practices of banks with dealing operations can also be examined. Information about each dealer's net trading position over the course of a day, in both spot and forward contract FX markets, suggests that financial institutions operating in the FX market behave in a similar way when managing their exposure to market risk. In particular, dealing banks do not fully hedge their spot market risk. The amount of hedging depends on market volatility, the magnitude of banks' risk exposure, and their comparative advantage in bearing risk, especially compared with their customers.

There are various sources of comparative advantage for dealing banks in bearing risk: First, reciprocal agreements between dealing banks guarantee that these market-makers have access to liquidity. Customers, however, do not have this same access. Second, banks allocate capital across business lines in order to diversify risk and return. This allows intermediaries to bear risk with a higher tolerance than the customers at non-financial institutions that may be specialized in relatively few business lines.[3] Hedging by dealers is found to depend on the overall risk-bearing capacity of dealers in the market and on each dealer's individual access to order flow. Analysis suggests that liquidity provision in spot and derivatives markets is determined interdependently, since prices in these markets are correlated, and dealers are able to hedge risk across markets.

Interpreting FX trading data through market-microstructure models helps characterize some of the factors that determine liquidity in the FX market. Results obtained to date suggest that dealers with greater opportunities for profitable speculation and a larger appetite for risk will provide greater liquidity to the market. More generally, a focus on the institutional features of the market that determine its dynamics is critical to understanding market liquidity. Policy-makers and researchers can use the tools developed in the field of market-microstructure finance to determine the effects of various factors on liquidity. These factors include the increased utilization of electronic brokering systems, a declining number of reciprocal agreements among dealing banks to provide liquidity, possible consolidation of dealing banks, and the greater participation of foreign dealers in the Canadian FX market.

3. D'Souza and Lai (2002) show that a decentralized capital-allocation function can reduce the overall risk of a financial institution with business lines that have correlated cash flows.

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Financial Structure and Economic Growth: A Non-Technical Survey

Veronika Dolar and Césaire Meh

In any modern economy, a primary economic function of the financial system (financial markets, intermediaries such as commercial banks, and payments systems) is to transform household savings into productive investments. This function can be separated into three basic subfunctions: the mobilization of savings, the acquisition of information, and the management of risk. Financial markets (stock and bond markets) and intermediaries (which include banks, insurance companies, and mutual funds) are two alternative types of agents that perform more or less the same functions but in different ways and with different degrees of success. Financial systems that rely mainly on the former are deemed market-based, while those that rely mainly on the latter are called intermediary-based.

Many researchers have presented evidence from cross-country, industry-level, firm-level, and time-series studies to show that financial development exerts a positive impact on long-run economic growth. This raises an important question: Which specific types of financial systems are more growth-enhancing? There are four competing views of financial structure and its relationship to long-run economic growth:

- The *intermediary-based view* asserts that intermediary-based systems are more growth-promoting than market-based systems. This is mainly explained by the fact that close relationships between intermediaries and firms reduce information costs and ease financing constraints on firms, with positive ramifications for investment spending and economic growth.
- The *market-based view* argues that market-based systems encourage long-run economic growth better than intermediary-based systems. This view stems primarily from the fact that markets, by allowing people with similar views to join together to finance projects, are effective at financing new technologies which, in turn, boost economic growth.
- According to the *financial services view*, the issue is not intermediaries *versus* markets, but rather the creation of an environment for the optimal functioning of intermediaries *and* markets, or for the efficient provision of financial services generally, regardless of the mixture of intermediaries and markets. What matters for growth is the overall level and quality of financial services and not the distinction between markets and intermediaries.
- The *law and finance view*, a subset of the financial services view, also rejects the intermediary-versus-market-based distinction, but instead emphasizes that legal and regulatory systems play the key role in determining growth-fostering financial services. For example, a well-developed legal system that enforces property rights and contracts reduces the cost of external financing by lowering the costs of acquiring information about firms. This increases external financing and enhances economic growth.

According to the first two views, markets and intermediaries are *substitutes*, whereas the last two views stress the *complementarity* of markets and intermediaries in providing growth-promoting financial services.

Which of these competing views of the link between financial structure and growth are consistent with the data? Investigating the link between financial structure and long-run growth involves complex relationships, and it is therefore not surprising that there are no straightforward conclusions. A survey of the literature, however, suggests that there is more empirical support for the financial services and the law and finance views than for either the intermediary-

based view or the market-based view. The majority of empirical researchers on this topic argue that financial structure (the degree to which the financial system of a country is intermediary-based or market-based) is not important for explaining differential growth rates across economies. For example, countries do not grow faster, and firms' access to external financing is not systematically easier, in either system. This conclusion is in line with the broad empirical analysis of financial structure and economic growth by Demirgüç-Kunt and Levine (2001), who use the most complete existing data set and a variety of econometric methods and yet consistently find that financial structure is not important for economic development. They argue that "through a diverse set of analyses, the answers are surprisingly clear.... Overall financial development [efficient financial services, well-developed intermediaries and well-functioning markets] matters for economic success, but financial structure per se does not seem to matter much" (p. 12).

Another reason to view markets and intermediaries as complements is that intermediaries are key participants in markets, and they tend to play a supporting role in ensuring that financial markets function properly. Investors need considerable expertise to participate in financial markets, which makes their participation costly in terms of time and money. Financial intermediaries help to reduce these costs. More precisely, by bundling investors' funds together, the costs of participation in markets for each investor are smaller (*economies of scale*). That is, because of the economies of scale, there is a reduction in the cost per dollar of investment as the size of transactions increases. In facilitating participation in financial markets, financial intermediaries contribute substantially to the effective functioning of markets. The most obvious example of a financial intermediary that emerged because of economies of scale and that supports markets is the mutual fund. Because the mutual fund buys large blocks of stocks or bonds, it can take advantage of lower transactions costs. This argument is supported by Allen and Gale's (2001) survey of financial systems. They present evidence on the ownership of corporate equities in the U.S. economy. They find that in the year 2000, households held less than 40 per cent of corporate equities, while intermediaries, particularly pension funds and mutual funds, held over 40 per cent of total corporate equities. They conclude that "it is no longer possible to consider the role of financial markets and financial institutions (intermediaries) separately. Rather than intermediating *directly* between households and firms, financial institutions have increasingly come to intermediate between households and markets, on the one hand, and between firms and markets, on the other" (p. 1).

We argue that the relationship between financial structure and financial stability provides another reason for focusing on the need for both well-developed intermediaries *and* markets. In the event of a crisis in one system, the other system can perform the function of the "spare wheel." Greenspan (1999) advocates this view and argues persuasively that

> What we perceived in the United States in 1998 may reflect an important general principle: multiple alternatives to transform an economy's savings into capital investment act as backup facilities should the primary form of intermediation fail. In 1998 in the United States, banking replaced the capital markets. Far more often it has been the other way around, as it was most recently in the United States a decade ago. When American banks stopped lending in 1990, as a consequence of a collapse in the value of real estate collateral, the capital markets were able to substitute for the loss of bank financial intermediation. Interestingly, the then recently developed mortgage-backed securities market kept residential mortgage credit flowing, which in prior years would have contracted sharply. Arguably, without the capital market backing, the mild recession of 1991 could have been far more severe (p.1).

These arguments suggest that it is not a question of markets *versus* intermediaries but of markets *and* intermediaries.

This implies an important policy message. Policy-makers should focus their attention on legal, regulatory, and other policy reforms that encourage the effective functioning of both markets *and* intermediaries, rather than concerning themselves with the degree to which their national financial system is market-based or intermediary-based.

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Banking Crises and Contagion: Empirical Evidence

Eric Santor

Financial deregulation and the global integration of markets have heightened the awareness of the potential fragility of banking systems in the face of external crises. From a global perspective, banking crises are numerous: Glick and Hutchison (1999) document 90 crises since 1975 across a sample of 90 developing and developed countries.[1] High-profile events such as the U.S. Savings and Loan, Mexican, Scandinavian, East Asian, and Argentinian crises reinforce this perception. Unfortunately, despite considerable efforts to empirically model the nature of banking crises, current analyses do not provide uniform conclusions regarding the determinants of crises.[2] Likewise, little is known with respect to the presence and effect of contagion across banking systems.

This leaves several questions unanswered in the empirical literature:

- First, does the theoretical literature on banking crises and contagion provide suitable testable hypotheses with respect to the likelihood of a banking crisis when interbank markets exist, and can these hypotheses be empirically assessed?
- Second, given the limitations of the data, can the onset of a banking crisis be accurately predicted?
- And third, conditional on the ability to robustly predict banking crises, can the existence of contagion be assessed? Moreover, does the occurrence of a crisis in one market allow the prediction of crises in other markets, over and above the effects of macroeconomic interconnections?

With regard to the first of these questions, contagion can be defined in terms of "fundamental" and "informational" channels. Fundamentals-based contagion is used to describe shocks that affect markets because of common components, such as changes in U.S. interest rates, the price of oil, or the growth rate of the OECD countries (Dornbusch, Park, and Claessens 2000). These shocks lead to contagion because of the normal interdependence of banks and real-side markets. Information-based contagion occurs when the onset of a crisis in one market leads investors to re-assess the risks associated with investments in other markets, regardless of whether or not there are any real-side linkages between the respective markets. The subsequent impact on asset prices from changes in investor behaviour can negatively affect the balance sheets of banks and, ultimately, the stability of the banking system.

In both cases, there are several pathways by which these shocks can lead to banking crises within and across banking systems. It is therefore interesting to consider how contagion is modelled in the theoretical literature and whether the predictions can be empirically tested. For instance, Allen and Gale (2000) show that the likelihood and effect of contagion depends on the degree of interbank market completeness; i.e., the extent to which banks are interconnected with other banks. But the data required to assess their model simply do not exist. Alternatively, Chen (1999) shows that the failure of one bank can lead to the failure of other banks simply because of informational

1. Banking crises are defined when one or more of the following events occur: the ratio of non-performing loans to total assets is greater than 10 per cent, the cost of rescue operations is more than 2 per cent of GDP, and/or banks are nationalized, a bank holiday, or a guarantee of deposits, or loan losses and the erosion of bank capital exceed defined thresholds.
2. Given the current emphasis of the International Monetary Fund and central banks on constructing "stress indicators" and "early-warning systems" to quantify the potential risks in the financial system, it is important to be confident of the methods of empirical assessment used in these processes.

contagion. This suggests that crises can be propagated without any real-side links among banks. This notion of informational contagion can be empirically assessed.

With regard to the second question, the empirical literature on banking crises does not adequately address the issue of how to choose an appropriate sample of countries to test hypotheses. Most studies arbitrarily choose the sample of crisis and non-crisis countries, neglecting the potential impact of sample selection on the appropriate estimation procedure. It would be preferable to pay particular attention to the construction of the cross-country sample: matching-method techniques should be used to construct a suitable control group analogue to the set of crisis countries. This would allow the probability of the occurrence of a banking crisis and of banking-system contagion to be quantified more accurately. Sample selections in previous studies introduced bias into the estimates of the probability of the occurrence of a banking crisis, because of differences between the characteristics of the crisis and non-crisis country groups.

Finally, in terms of the third and final question, given a clearly defined empirical benchmark, an empirical model of contagion can be estimated. Following Ahluwalia (2000), it is possible to construct contagion indexes to capture the notion of "informational contagion," reflecting the extent to which a country shares macroeconomic characteristics with a country that previously experienced a banking crisis: the index takes positive values proportional to the degree of similarity. The contagion index does not require the respective countries to share any real-side links; rather, the empirical specification suggests that the information associated with the crisis leads to changes in investor behaviour that may affect banks' balance sheets. This allows a simple empirical test to be conducted: Do lagged values of the contagion index accurately predict the occurrence of a banking crisis in the current period, conditional on macroeconomic fundamentals? The analysis indicates that the probability of a banking crisis increases when countries have characteristics similar to those that have experienced a crisis, regardless of the degree of actual economic linkages between the respective countries.

In conclusion, the implications of these results are intriguing. If the fundamentals are controlled, then the occurrence of a banking crisis in the previous period in one country predicts the onset of a banking crisis in another country, if the countries have similar macroeconomic characteristics. This suggests that informational contagion plays a larger role than previously suspected, since the onset of a crisis is related to the information provided by the initial crisis event, over and above macroeconomic effects. The existence of informational contagion raises many issues for policy-makers. In particular, institutions that oversee, supervise, or regulate financial institutions need to account for the process by which information from the occurrence of one banking crisis affects the behaviour of market participants, and how market completeness propagates or mitigates the transmission of macroeconomic effects.

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