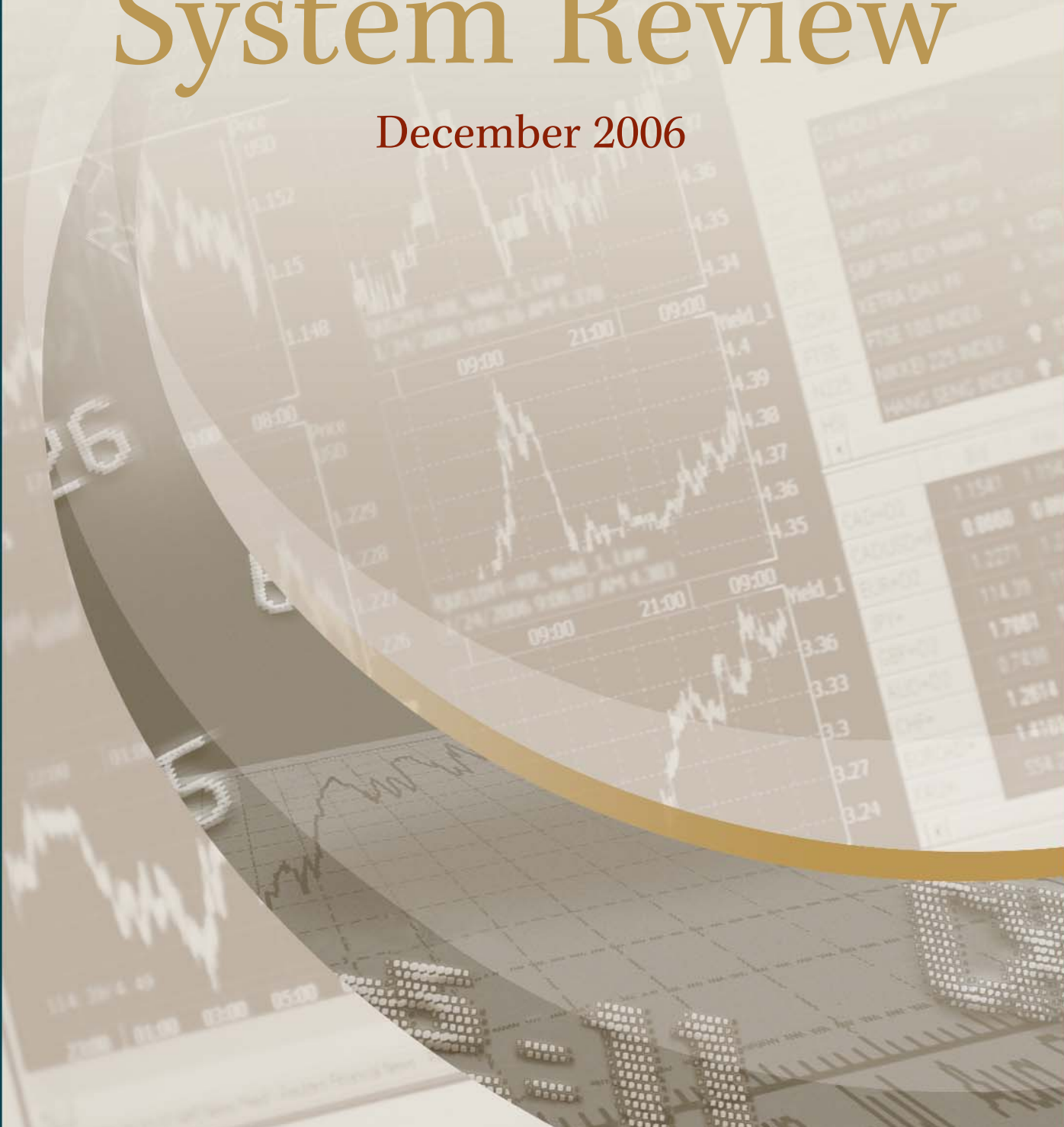




BANK OF CANADA

Financial System Review

December 2006



The Financial System Review and Financial Stability

The financial system makes an important contribution to the welfare of all Canadians. The ability of households and firms to confidently hold and transfer financial assets is one of the fundamental building blocks of the Canadian economy. As part of its commitment to promoting the economic and financial welfare of Canada, the Bank of Canada actively fosters a safe and efficient financial system. The Bank's contribution complements the efforts of other federal and provincial agencies, each of which brings unique expertise to this challenging area in the context of its own institutional responsibilities.

The financial system is large and increasingly complex. It includes financial institutions (e.g., banks, insurance companies, and securities dealers); financial markets in which financial assets are priced and traded; and the clearing and settlement systems that underpin the flow of assets between firms and individuals. Past episodes around the world have shown that serious disruptions to one or more of these three components (whether they originate from domestic or international sources) can create substantial problems for the entire financial system and, ultimately, for the economy as a whole. As well, inefficiencies in the financial system may lead to significant economic costs over time and contribute to a system that is less able to successfully cope with periods of financial stress. It is therefore important that Canada's public and private sector entities foster a financial system with solid underpinnings, thereby promoting its smooth and efficient functioning.

The *Financial System Review* (FSR) is one avenue through which the Bank of Canada seeks to contribute to the longer-term robustness of the Canadian financial system. It brings together the Bank's ongoing work in monitoring developments in the system and analyzing policy directions in the financial sector, as well as research designed to increase our knowledge. The strong linkages among the various components of the financial system are emphasized by taking a broad, system-wide perspective that includes markets, institutions, and clearing and settlement systems. It is in this context that the FSR aims to

- improve the understanding of current developments and trends in the Canadian and international financial systems and of the factors affecting them;
- summarize recent work by Bank of Canada staff on specific financial sector policies and on aspects of the financial system's structure and functioning;
- promote informed public discussion on all aspects of the financial system, together with increased interaction on these issues between public and private sector entities.

The FSR contributes to a safe and efficient financial system by highlighting relevant information that improves awareness and encourages discussion of issues concerning the financial system. The Bank of Canada welcomes comments on the material contained in the FSR.

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December 2006

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Lea-Anne Solomonian
(Editors)

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Publications Distribution, Communications Department, Bank of Canada, Ottawa,
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Telephone: 1 877 782-8248; email: publications@bankofcanada.ca

Please forward any comments on the *Financial System Review* to

Public Information, Communications Department, Bank of Canada, Ottawa,
Ontario, Canada K1A 0G9
Telephone: 613 782-8111, 1 800 303-1282; email: paffairs@bankofcanada.ca

Website: <http://www.bankofcanada.ca>

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The following people contributed to the
Developments and Trends section:

Jim Armstrong
Eric Chouinard
Umar Faruqui
Céline Gauthier
Chris Graham
Dylan Hogg
Ilan Kolet
Simon Lai
Robert Lavigne
Jean Mair
Christopher Reid
Oana Secrieru
Gerald Stuber
Virginie Traclet
Harri Vikstedt
Lorie Zorn

Developments and Trends

Notes

The material in this document is based on information available to **23 November 2006** 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, RBC Financial Group, Scotiabank, and TD Bank Financial Group.

Assessing Risks to the Stability of the Canadian Financial System

The *Financial System Review* is one vehicle that the Bank of Canada uses to contribute to the strength of the Canadian financial system. The Developments and Trends section of the *Review* aims to provide analysis and discussion of current developments and trends in the Canadian financial sector.

The first part of this section presents an assessment of the risks, originating from both international and domestic sources, that could affect the stability of the Canadian financial system. Key risk factors and vulnerabilities are discussed in terms of any potential implications for the system's overall soundness. The second part of the Developments and Trends section examines structural developments affecting the Canadian financial system and its safety and efficiency; for example, developments in legislation, regulation, or practices affecting the financial system.

The current infrastructure, which includes financial legislation, the legal system, financial practices, the framework of regulation and supervision, and the macroeconomic policy framework, significantly influences the way in which shocks are transmitted in the financial system and in the macroeconomy, and thus affects our assessment of risks.

Our risk assessment is focused on the vulnerabilities of the overall financial system, and not on those of individual institutions, firms, or households. We therefore concentrate on risk factors and vulnerabilities that could have systemic repercussions—those that may lead to substantial problems for the entire financial system and, ultimately, for the economy. In examining these risk factors and vulnerabilities, we consider both the likelihood that they will occur and their potential impact.

Particular attention is paid to the deposit-taking institutions sector because of its key role in facilitating financial transactions, including payments, and its interaction with so many other participants in the financial system. For instance, these institutions assume credit risks with respect to borrowers such as households and non-financial firms. Thus, from time to time, we assess the potential impact that changes to the macrofinancial environment may have on the ability of households and non-financial firms to service their debts.

Risk factors and vulnerabilities related to market risks are also examined. The potential for developments in financial markets to seriously affect the financial position of various sectors of the economy and, ultimately, to disrupt the stability of the Canadian financial system is assessed.

Financial System Risk Assessment

This section of the Review presents an assessment of the risks arising from both international and domestic sources bearing on the stability of the Canadian financial system. The objective is to highlight key risk factors and vulnerabilities in the financial system and to discuss any potential implications for the system's overall soundness.

Key Points

- The global economic outlook continues to be favourable.
- The financial positions of the Canadian financial, non-financial corporate, and household sectors remain solid.
- A key short-term risk is the possibility of an abrupt slowing in the U.S. economy, which might affect the financial health of customers of Canadian banks.
- Other (low-probability) risks include the possibility of a disorderly resolution of global imbalances and a significant correction in the prices of risky assets.
- The Canadian financial system appears to be in a good position to withstand these potential shocks.

Overall Assessment

Our overall assessment is largely unchanged from that in the June *Financial System Review* (FSR). Canada's financial, non-financial, and household sectors are in good shape. This reflects the continued prudent behaviour of companies in the financial and non-financial sectors, as well as a generally favourable economic environment in Canada and abroad.

Recently, a number of encouraging external developments have lent support to the base-case scenario of continued solid growth in Canada and abroad and have lessened the risks to financial stability. First, although the weakening in the U.S. housing sector has been greater than expected, growth in U.S. investment and exports seems to be solid. Second, economic activity in Europe and Japan has picked up, while that in Asia remains strong, suggesting that global economic activity should remain robust despite the slowing of the U.S. economy. Energy prices have also declined significantly; while this adversely affects Canada's terms of trade, it also helps to support growth in oil-importing countries and to ease inflation pressures in Canada and abroad. As well, the increase in volatility in financial markets observed at the time of the June FSR was short-lived, and since then markets have been surprisingly calm.

Potential risks

The continued favourable risk assessment is predicated largely on the expectation of continued solid economic growth in Canada and abroad.

We see three key risks to financial stability. One of these is a new short-term risk: the possibility that the slowing of the U.S. economy could be sharper than currently anticipated, which might affect the financial health of certain customers of Canadian banks. The other risks are those identified in the June FSR: (i) a disorderly resolution of global imbalances; and (ii) a significant and widespread reduction in risk appetite. Thus, the overall level of risk has increased somewhat, despite the fact that the risk of a disorderly resolution of global imbalances seems to have diminished.

The Bank's base-case scenario described in the October *Monetary Policy Report* factored in some slowing in the U.S. economy associated with the

weakness in the housing sector. At present, it appears that non-housing demand is continuing to grow at a solid pace. There is, however, a risk that the slowing in the U.S. economy could be greater than currently expected if the decline in the housing sector became more pronounced, or if the weakness in that sector spread to consumption spending.

A significant slowing in the U.S. economy would affect Canadian banks indirectly through its effect on the creditworthiness of Canadian exporters to the United States. It would also affect Canadian banks through their loans to U.S. consumers and businesses and through their exposure to U.S. financial institutions, which might also be hurt by an abrupt slowing of the U.S. economy. However, the strength of the balance sheets of Canadian banks should permit them to absorb this.

The base case referred to above assumes that there will be a gradual and orderly unwinding of global imbalances. The rotation of demand away from the United States towards the rest of the world, and the stabilization of the U.S. current account deficit over the past year, appear to make such an outcome more likely than in June. Nevertheless, the imbalances remain large, and there is a danger that growth outside the United States might falter. Thus, there is still a small risk of a less benign outcome involving abrupt movements in currencies and in the prices of other financial assets, increased protectionism, and much slower world economic growth than expected.

A significant reduction in world economic growth arising from a disorderly resolution of global imbalances would adversely affect Canada. The financial positions of Canadian export-oriented and related sectors would be weakened, increasing credit risk in the Canadian financial system. Even the rotation of demand away from the United States to the rest of the world is likely to have some impact on Canadian exports, given the high proportion of exports that go to the United States. Problems in export-oriented and related sectors would impinge on employment and, thus, might impair the ability of some households to service their debts. A disorderly resolution of global imbalances would increase volatility in financial markets. While the strong balance sheets of most sectors of the economy would help them to weather these shocks, there could be a sharp tightening of credit conditions and an associated repricing of risk.

Markets have demonstrated resilience this year in the face of rising concerns about inflation in May and June, increased tensions in the Middle East in July, and a large loss at a hedge fund in September. Nevertheless, there is still some uncertainty about how markets would react to a sudden significant decrease in risk appetite that could happen, for example, if there were a resurgence of uncertainty about the strength of global economic activity. This would affect the prices of risky assets in Canada and the position of Canadian holders of these assets. This risk remains at much the same level as it was at the time of the June 2006 FSR.

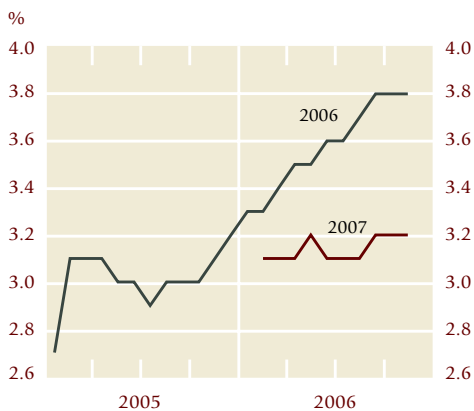
Canadian financial situation

Canadian banks remain in a good position to withstand shocks, since they are well capitalized and are posting strong profits. Credit quality remains good, with non-performing loans at a very low level. Our forward-looking indicator for the sector suggests that the market is viewing the financial position of the major Canadian banks as strong.

The position of the non-financial corporate sector overall is still very favourable. Aggregate profits remain at a high level. Firms are using these profits to finance investment, reduce debt, and accumulate liquid assets. However, the slowing of the housing sector and auto sales in the United States will exacerbate the already difficult position of many companies in the Canadian wood products and auto manufacturing sectors. As in the June FSR, our indicators are signalling some possible weakening ahead in the creditworthiness of the non-financial corporate sector, although from a very high level.

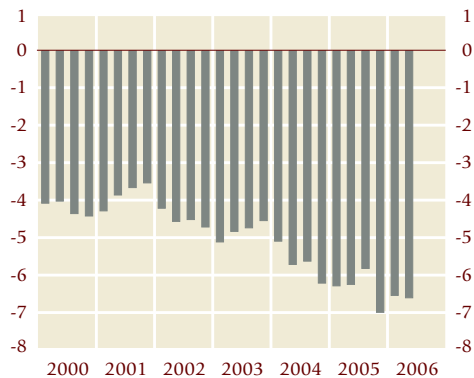
Household sector debt continues to increase at a rapid pace. With rising debt and interest rates, the household debt-service ratio has risen. Nevertheless, the ratio remains at a relatively low level. Updated assumptions based on an analysis of microdata have resulted in a downward revision in our estimates of the debt-service ratio back to 1999. These microdata also show that the situation of the most vulnerable households has improved slightly over the last six years. The continued rapid growth in household credit and the escalation in housing prices in Alberta, however, suggest that the financial position of the household sector bears watching.

Chart 1 Evolution of Consensus Estimates for Annual Global Economic Growth*



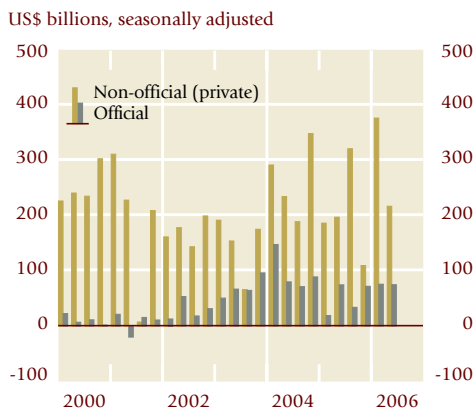
* This estimate covers 46 countries. Country weights are determined using country GDPs converted at 2005 market exchange rates.
Source: Consensus Economics Inc.

Chart 2 U.S. Current Account
Per cent of GDP



Source: U.S. Bureau of Economic Analysis

Chart 3 Foreign Inflows



Source: U.S. Bureau of Economic Analysis

The Macrofinancial Environment

The international environment

Although the U.S. economy is projected to slow over the coming year, there are signs of stronger activity in Japan and the euro area, as well as a continued robust expansion in emerging economies. Thus, the outlook for global growth remains favourable (Chart 1). This is generally supportive of an orderly resolution of global imbalances. However, risks to financial stability arising from the cooling U.S. housing market may have risen since the June FSR.

Global imbalances

There are signs that conditions facilitating an orderly resolution of global imbalances are now falling into place: the rotation in global growth away from the United States has begun; developments in interest rate differentials may also encourage a depreciation of the U.S. dollar; and recent data revisions suggest that the U.S. current account deficit may be peaking (Chart 2). In the second quarter of 2006, the external deficit stood at 6.6 per cent of GDP, essentially unchanged from the 2005 average.

The risk of a disorderly adjustment remains small. There are no indications of waning foreign investor confidence in U.S.-dollar-denominated assets. Indeed, private sector inflows have reached all-time highs over the past two years (Chart 3). Moreover, much of the increase in inflows over this period has come from private sector agents in advanced countries (Chart 4), somewhat alleviating concerns that the United States had become too dependent on official financing from emerging economies. Indeed, recent data suggest that the extent of foreign central banks' purchases of U.S. federal debt has receded from its 2004 peak, supporting official announcements of a gradual diversification of reserves away from U.S. assets. Financial markets have taken these public announcements in stride, indicating significant resilience.

Nevertheless, the possibility of a disorderly adjustment remains. The ongoing rotation of demand is encouraging, but it will need to be sustained. Moreover, while the U.S. current account deficit may be peaking, the level of imbalances is unprecedented. Foreign holdings of U.S. assets reached over one-fifth of world GDP

(excluding the United States) last year and continue to grow. The larger the global current account imbalances, the larger the adjustment to reduce them will need to be and the greater the risk that the process will be disorderly. An abrupt change in investor expectations, triggered by a severe slowdown in either China or the United States, or some other low-probability event, could potentially disrupt global financial markets.

The U.S. housing market

Attention has recently focused on the cooling U.S. housing market. The anticipated slowdown in residential investment is well under way (Charts 5 and 6), and consensus forecasts are calling for a further moderation in housing activity in 2007.

The housing market affects GDP directly as residential investment and indirectly through its effects on the wealth and expenditures of households. The housing market has supported U.S. consumption over recent years. The rapid rise in housing prices helped to offset the effects on household wealth of the sudden decline in equity values in 2000–01, and led to a surge in home equity withdrawals (Chart 7). The preponderant role of housing in household wealth raises concerns that the wealth effects of a housing slowdown could be large. In fact, equity withdrawals and mortgage refinancings are now declining.

Innovative mortgage products have become much more popular since 2000. Adjustable-rate mortgages now make up approximately 30 per cent of all outstanding mortgages in the United States, while subprime mortgages accounted for 20 per cent of all new mortgages in 2005 (Chart 8). The increased use of these mortgage products may pose concerns for financial stability, since they have higher delinquency rates and are more sensitive to increasing mortgage rates.¹ Moreover, a fall in housing prices may lead to negative equity for households with high loan-to-value mortgages.

To date, non-performing loans at financial institutions have remained low by historical standards. Both provisioning and capital positions at financial institutions in the United States are

1. This point was also discussed in the section on the international environment in the June 2006 issue of the FSR.

Chart 4 Net Purchases of U.S. Long-Term Securities by Foreigners

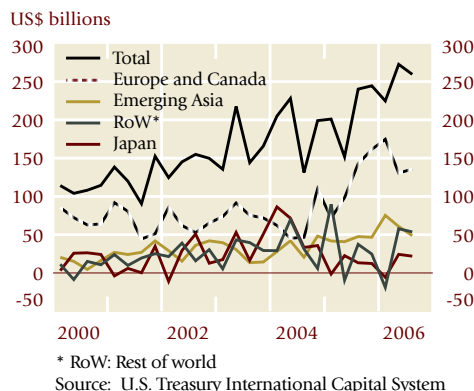


Chart 5 U.S. Median Selling Price for Housing

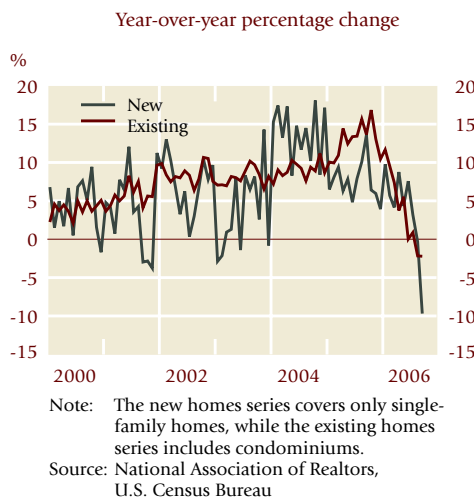


Chart 6 United States: Building Permits and Inventory of New Single-Family Homes

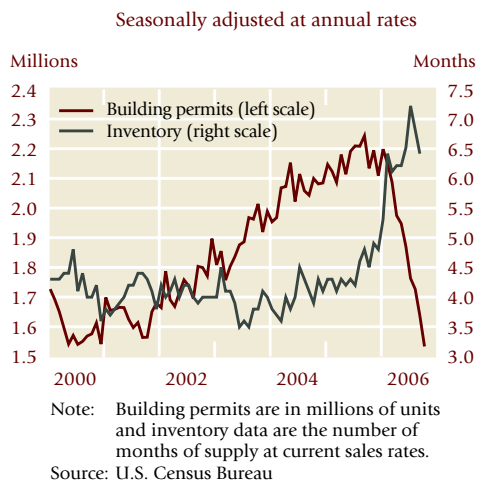
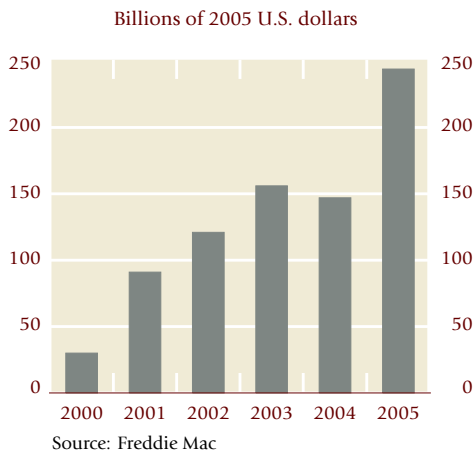


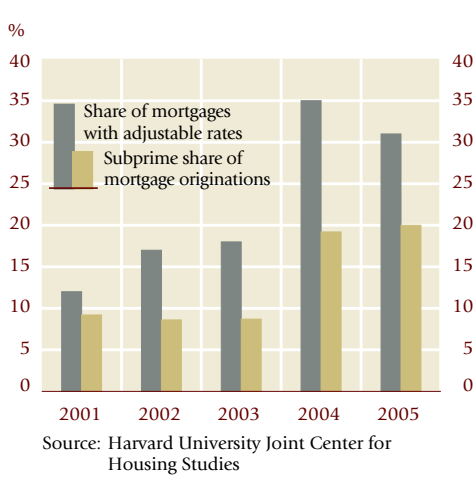
Chart 7 United States: Real Home Equity Cashed Out at Refinance



ample, on average, indicating that they are well positioned to handle an increase in default rates.

There is a risk that the slowing of the U.S. economy could be more pronounced than currently anticipated if the decline in the housing sector was greater than expected or if the weakness spread to consumption expenditures. A sharper slowing in the U.S. economy could affect Canadian banks both directly and indirectly. It would significantly affect Canadian export sales (80 per cent of which are to the United States) and, thus, the creditworthiness of Canadian export-related sectors. There could also be some impact on Canadian banks through their direct exposure to U.S. consumers and non-financial businesses. (As of June 2006, loans by Canadian banks to these sectors represented 12 per cent of their total assets.) Canadian banks could also be affected indirectly if U.S. banks were hurt significantly by an abrupt slowing in the U.S. economy, since the claims of Canadian banks on U.S. banks amounted to 2 per cent of their total assets as of June 2006. But given the strong profit and capital position of the Canadian banks, they appear to be in a good position to cope with these effects.

Chart 8 United States: Adjustable-Rate and Subprime Mortgages

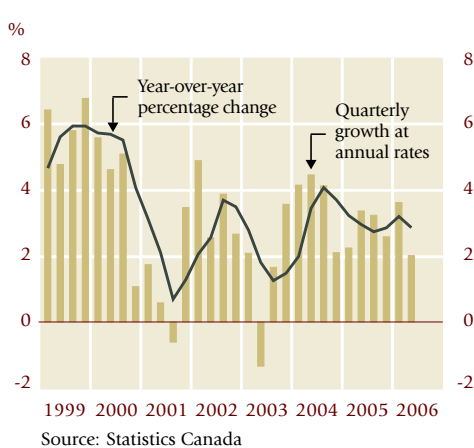


Canadian developments

Canadian economy

The growth of Canada's real GDP (expressed at an annual rate) eased to 2 per cent in the second quarter of 2006 from an average of just over 3 per cent in the second half of 2005 and the first quarter of this year (Chart 9). Growth in final domestic demand is expected to continue to underpin the economic expansion in Canada through 2008. Net exports will likely exert a significant drag on growth through 2007, but this effect should diminish over time.

Chart 9 Real GDP Growth: Canada



The Canadian economy is continuing to adjust to the appreciation of the Canadian dollar, the high prices of many commodities, and strong competition from some Asian countries. Energy and metals prices have been quite volatile over the past year (Chart 10). Although the high prices for both crude oil and metals chiefly reflect strong growth in global economic activity, some uncertainty remains about whether these prices can be maintained. In particular, oil prices have eased since mid-July, reflecting expectations of reduced supply risk and some easing in the prospects for global oil demand.

Corporate sector

The financial position of the aggregate non-financial corporate sector continued to be healthy in the third quarter of 2006. Profitability, while easing from the high level reached in the preceding quarter, remained relatively strong, and leverage decreased further, reaching a low level (Chart 11).

Profitability has remained at a high level in most sectors with a low exposure to international trade, as well as in the oil and gas extraction and other mining sectors. However, overall profitability for the other industries with a high exposure to international competition, which has been relatively weak in recent years, decreased markedly in the third quarter (Chart 12).

As in June, it is our view that there could be some weakening in corporate credit quality going forward. While corporate bond spreads remain at a very low level, downgrades as a percentage of ratings actions have increased slightly: from 61 per cent in 2005 to 65 per cent for the year to date (Chart 13). The microdata indicator developed by the Bank of Canada, which measures the share of assets concentrated in companies considered to have weak profit margins, liquidity ratios, and leverage ratios, also points to the possibility of worsening corporate credit quality (Chart 14). This share rose to about 8 per cent in 2005, which is well below the peak in 2001, but higher than the levels seen through the last half of the 1990s. This increase appears to be driven by the materials and telecommunications sectors. A second and more current indicator, based on the contingent claims approach, is also signalling a possible increase in risk in the non-financial corporate sector.^{2,3} While the rise in this indicator partly reflects movements in the indicators for the

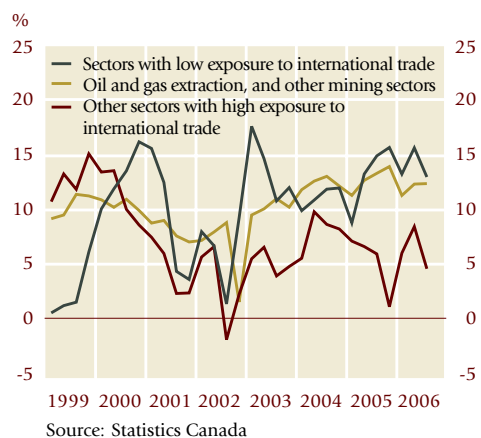
Chart 10 Bank of Canada Commodity Price Index



Chart 11 Financial Position of the Canadian Non-Financial Corporate Sector

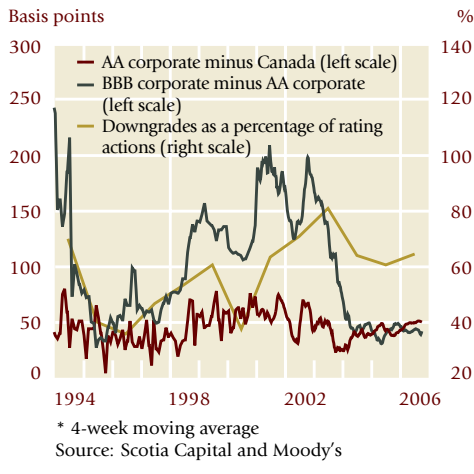


Chart 12 Rate of Return on Equity for Selected Sectors



2. The report containing details of the microdata indicator was published in the December 2005 *Financial System Review* (pp. 37-42), and the contingent claims approach (CCA) was discussed in the June 2006 issue (pp. 43-51.)
3. These indicators were used in the analysis of the corporate sector in the June 2006 FSR (p. 11). At that time, balance sheet information for 2005 was available for only about one-half of the sample companies. The indicator now includes information for virtually all companies. The CCA estimate now includes balance sheet information on a larger number of companies than was the case in June, as well as market data up to 17 November 2006.

Chart 13 Bond Yield Spreads* and Ratings Actions



retail trade, forestry, accommodations, and transportation sectors, the result should be viewed with some caution, since it is driven primarily by an increase in volatility in the oil and gas sector between 2005 and 2006.⁴

Industry

A limited number of industries, such as auto manufacturing, wood and paper products, and computer and electronics manufacturing, have been experiencing considerable financial stress over most of the period since 2001.

The Canadian auto manufacturing industry registered a small loss in the third quarter (Chart 15). Profitability is likely to remain weak over the near term. One important contributing factor is the decline in U.S. sales of SUVs and trucks, which typically generate higher profit margins for some manufacturers than do most other vehicles. Still more cutbacks in production likely took place in the second half of 2006, and further restructuring of operations by Ford and several auto parts companies have recently been announced.

Profitability in the wood and paper products industry remained low in the first three quarters of 2006 (Chart 16). Given the impact of the slowdown in the U.S. housing market on lumber prices and export volumes, profitability is likely to remain weak over the near term. Indeed, many firms have recently announced further layoffs and restructuring, especially of their lumber operations. The Canada-U.S. Agreement Ending the Softwood Lumber Dispute will have a positive near-term effect on the financial positions of lumber producers as a result of the return of at least 80 per cent of duties paid since 2002. But while the U.S. duties were revoked, lumber producers are now subject to an export charge of 15 per cent, since lumber prices are currently well below the threshold level for such charges under the Agreement.

The electronics and computer manufacturing industry registered a low rate of return in the third quarter of 2006 (Chart 17). While sales volumes are at relatively high levels, the industry continues to face intense competitive pressures from firms in emerging markets. Consequently, consolidation and restructuring are under way, especially in the global telecommunications

Chart 14 Microdata and CCA Indicators

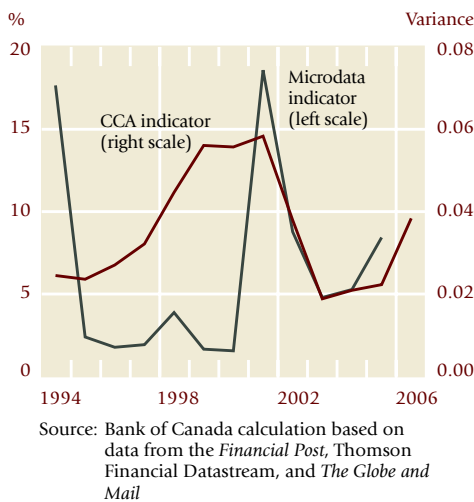
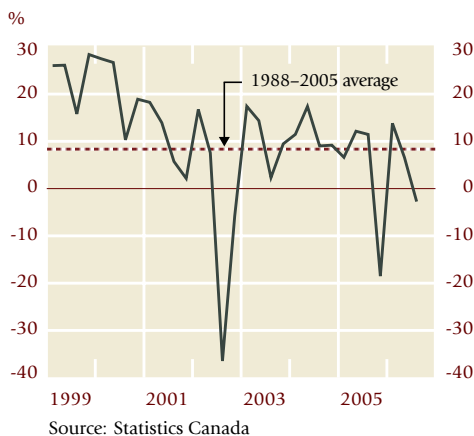


Chart 15 Return on Equity: Automotive Manufacturing



4. The oil and gas sector accounts for about 35 per cent of the market value of assets included in the sample.

equipment industry. These developments may lead to further restructuring of operations in the Canadian segment of this industry.

Grains producers have continued to be adversely affected by past weakness in global grains prices, the appreciation of the Canadian dollar, and rising input costs. As well, the size of the grains and oilseeds crop was down from the record level of 2005 as a result of hot, dry weather conditions on the Prairies. However, the quality of the crop appears to have been above average, and grains prices have also risen markedly in recent weeks.

Canadian banks hold both securities and loans of companies in these sectors, and thus are exposed to both credit and market risk; however, it is unlikely that difficulties in these sectors would have significant adverse effects on the Canadian financial system. Moreover, many of these firms are continuing to undertake major adjustments in their operations to improve their profitability over the longer term.

Household sector

Household debt continues to grow at a robust pace (about 10 per cent year over year), although it has slowed slightly in recent months. This slowing is partly due to a deceleration in the still buoyant rate of growth in personal lines of credit. Growth in household credit has been very strong in Western Canada. While this is mainly associated with population movements and growing incomes, the dramatic increase in housing prices in that region has also been a factor.

The increase in debt has contributed to a further rise in the debt-to-income ratio. (For a discussion of some of the factors that may have contributed to this increase since the mid-1980s, see Box 1.) With higher interest rates and debt levels, the debt-service ratio (DSR) rose again in the first half of 2006 (Box 2). However, it remains at a relatively low level, suggesting that the financial health of households remains sound.

The interest rates on many outstanding mortgages are below current mortgage rates. As these mortgages are renewed, it is likely that many householders will see a higher interest rate on their mortgages. Thus, the debt-service ratio will likely continue to rise.

Chart 16 Return on Equity: Wood and Paper Manufacturing

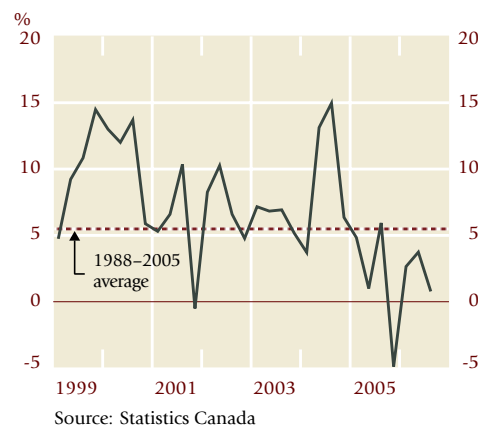


Chart 17 Return on Equity: Electronics and Computer Manufacturing

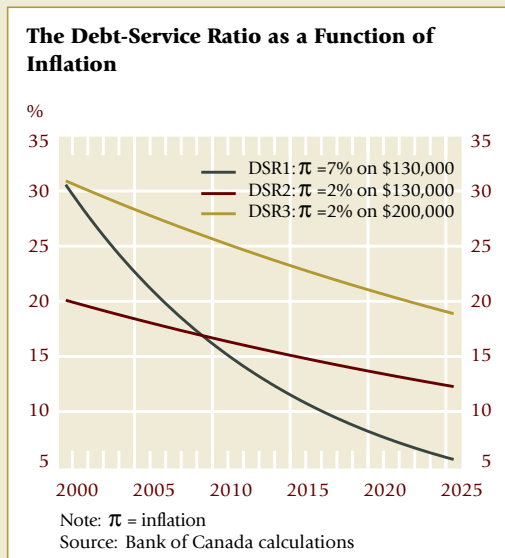


Box 1

Low Inflation and Canadian Household Indebtedness

The ratio of debt to disposable income of the Canadian household sector has increased systematically, from 67 per cent in the mid-1980s, to more than 120 per cent currently. Financial deregulation and technological advances, by increasing competition for loans and lowering transactions costs, have certainly contributed to the higher level of debt.

An environment of low inflation has also contributed.¹ By reducing the front-loading of nominal interest payments on long-term debt (such as mortgage debt), lower inflation has relaxed credit constraints for some borrowers, allowing them to increase their ratios of debt to disposable income.



The chart illustrates the impact of different levels of inflation on the evolution of the debt-service ratio (DSR)² over time on a \$130,000 mortgage loan with a fixed interest rate and an amortization period of 25 years. It is assumed that the typical household income is \$50,000 at the beginning of the mortgage contract, and that it increases at the same rate as inflation thereafter. The DSR1 line shows the evolution of the DSR for such a mortgage loan (and income growth) when inflation is 7 per cent (the average level over the 1970–85 period), while the DSR2 line shows the DSR when inflation is at 2 per cent. Both scenarios

assume that the real interest rate of the mortgage is 4 per cent.

Given the assumed size of the mortgage, the mortgage payments reach a threshold of 30 per cent in the high-inflation regime but fall far short of that threshold (20 per cent) in the low-inflation world.³ Consequently, the amount of money that can be borrowed before the DSR reaches 30 per cent is higher when inflation is low. For example, the debt-service limit of 30 per cent is reached with a \$130,000 debt when inflation is high, as it was in the 1970s and early 1980s. However, when inflation is low (2 per cent), the same 30 per cent limit would be reached only with a much higher debt—\$200,000—assuming that real interest rates remain at 4 per cent.⁴ This is illustrated by the DSR3 line in the chart.

The upward trend in the ratio of debt to disposable income should occur only during the transition from a high-inflation environment to one of low inflation. After this transition period, the aggregate ratio of debt to disposable income should stabilize at a new level consistent with the low nominal interest rate environment.

A key issue from a financial-stability perspective is that the DSR stays higher for a longer period in the low-inflation environment (compare DSR3 with DSR1 in the chart). This is because nominal income is not rising as rapidly when inflation is low, while nominal payments remain fixed. Hence, vulnerable households remain vulnerable for a longer period when inflation is low.

As noted above, lower inflation allows households to borrow more. However, many may choose not to increase their debt to the full extent possible. Rather than increasing debt by an amount that would result in a debt-service ratio equivalent to what they would have had in a high-inflation environment, households might choose instead a debt level that would result in a debt-service ratio between DSR2 and DSR3. It thus seems plausible that the DSR distribution may have shifted to the left (that is, the proportion of households with a high DSR may have declined) as inflation fell, reducing vulnerabilities in the household sector.

1. This analysis is inspired by Guy Debelle (June 2004), "Macroeconomic implications of rising household debt," BIS Working Paper No. 153.
2. Interest and principal payments as a proportion of disposable income

3. For insured mortgages, CMHC requires mortgage payments (principal and interest) plus heating costs, property taxes, and 50 per cent of applicable condominium fees to represent not more than 32 per cent of the household gross income. Financial institutions use similar eligibility criteria for uninsured mortgages.
4. Since lower inflation also tends to be associated with less inflation uncertainty and a lower inflation risk premium, real interest rates would also be lower in the low-inflation world, pushing up the amount of debt that individuals could take on still more. This is not taken into consideration here.

Box 2

Updating the Estimate of the Aggregate Debt-Service Ratio

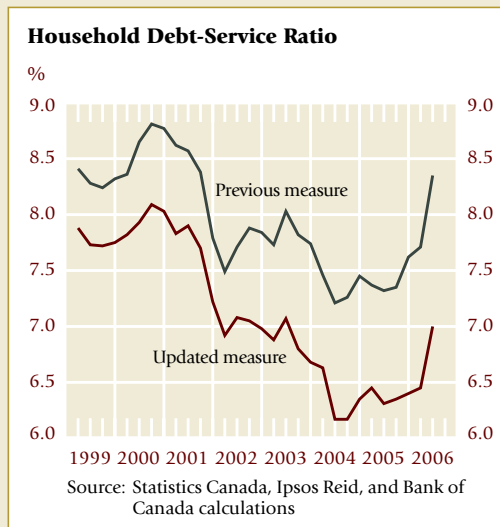
In the FSR, the debt-servicing capacity of households is typically gauged by the aggregate debt-service ratio (DSR), which is calculated as the share of disposable income devoted to interest payments on debt.

The estimate of the aggregate DSR used in the FSR is based on a number of assumptions.¹ Recently, information from the Canadian Financial Monitor survey, conducted by Ipsos Reid Canada, has allowed us to refine and update our assumptions about the relative importance of the types of debt that households have and the interest rates that they are paying. The estimate of the aggregate DSR from 1999Q1 to 2006Q2 has been updated based on these new assumptions.

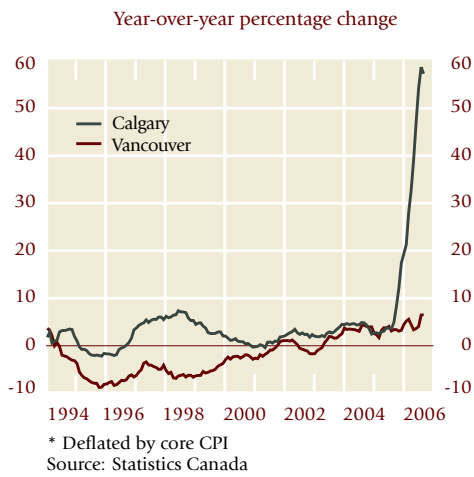
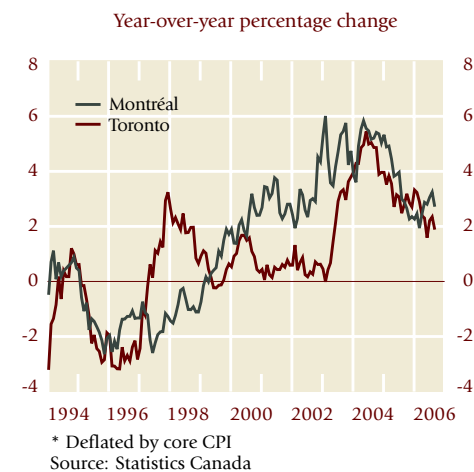
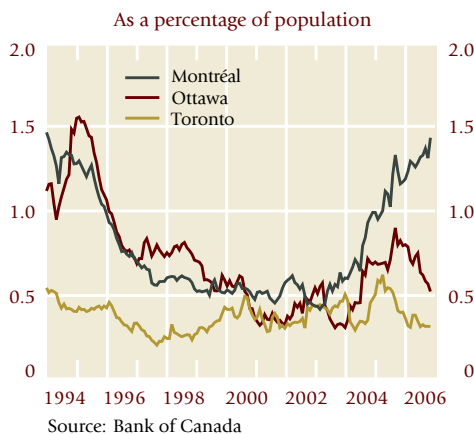
Our estimated aggregate DSR has been revised down over that period. This is largely due to (i) lower effective interest rates on consumer loans, owing to the growing importance of secured personal lines of credit; (ii) more pronounced discounting on mortgage loans, especially variable-rate mortgages, than previously assumed; and (iii) larger weights on variable-rate mortgages over the 1999–2005 period than previously assumed.

The new estimate of the DSR in 2006Q2 is 7.0 per cent—1.4 percentage points lower than our previous measure (see chart below).

This suggests that, overall, households are in a better position to service their debt than previously thought.



1. See Box 1 in the December 2004 FSR.

Chart 18 Real Prices for New Houses, Western Canada***Chart 19 Real Prices for New Houses, Central Canada*****Chart 20 Recently Completed Unoccupied Dwellings, Central Canada**

Housing prices

Despite higher interest rates, average housing prices have continued to increase in Canada, fuelled by income growth and strong employment. Recent innovations announced by mortgage issuers could further support housing demand and prices, since they may lead to lower monthly mortgage payments.⁵ Aggregate housing prices, however, mask significant regional differences: while the pace of increase in real housing prices remains very strong in Western Canada, especially in Alberta, it has decelerated significantly in Central Canada.

The increase in housing prices in Alberta has been supported by strong income growth, employment gains, and in-migration, causing housing demand to outstrip supply (Chart 18). There was also some evidence of flipping among buyers over the summer, suggesting some speculation, particularly in Calgary.⁶ There are now some indications that price increases in Alberta are slowing as more supply comes on the market, although they continue to increase at a rapid pace. It is thus important to continue to monitor developments closely.

The pace of increase in housing prices in Central Canada has continued to slow gradually, as housing supply is catching up with demand (Chart 19). Rising listings in resale markets suggest that the pace of the price increase should continue to moderate. Nevertheless, with little evidence of widespread excess supply, as measured by the number of unoccupied dwellings as a ratio of population (Chart 20),⁷ no major widespread reversal in housing prices is expected.⁸

5. These changes include an increased maximum amortization period for insured mortgages, split fixed/float mortgages, and interest-only mortgages.
6. Some observers have suggested that many purchases of new condominiums in Calgary were for investment purposes.
7. A steady increase in this ratio in Montréal explains the marked slowdown in the pace of increase in real housing prices in Montréal.
8. There could, however, be imbalances in certain segments of local housing markets. See the Highlighted Issue on condominium prices in the June 2006 FSR (p. 14).

Highlighted Issue

An analysis of the financial position of the household sector using microdata

Prepared by Umar Faruqui, Simon Lai, and Virginie Traclet

Household credit accounts for about 70 per cent of the total Canadian-dollar loan exposure of Canadian banks. Consequently, assessing the financial health of Canadian households is an important part of our assessment of risks in the banking sector and in the financial system as a whole. This is especially true in the current context of steadily rising household indebtedness, with the aggregate ratio of debt to income currently standing at 124.7 per cent.

Our past analysis, based on debt-service and debt-to-asset ratios calculated using aggregate data, suggests that financial system risks relating to the Canadian household sector appear to be low. But aggregate data can mask information about the underlying distribution of debt, especially information about the proportion of vulnerable households; i.e., households that could be particularly affected by negative shocks. This Highlighted Issue supplements our past analysis by using microdata to examine the distribution of debt indicators across households (by income and age groups). This analysis supports the view that, overall, the Canadian household sector seems to be in good financial health and, thus, should not pose a major threat to the stability of the Canadian financial system.

The data

The microdata used here come from the Canadian Financial Monitor (CFM), a survey conducted by Ipsos Reid Canada that provides detailed information on household balance sheets. The survey is distributed throughout the year. About 12,000 households participate annually, which represents a response rate of approximately 35 per cent. CFM data are available beginning in 1999.

The CFM is available on a timely basis, while Statistics Canada's Survey of Financial Security (SFS) is conducted infrequently.⁹ CFM data are, therefore, useful for analyzing recent develop-

ments. However, the most recent results should be interpreted with some caution, because data are available only for the first half of 2006 and, thus, the sample for that year is smaller.¹⁰

For our analysis, households are divided into five income groups and four age groups, as defined in Table 1.

Two elements suggest that the quality of CFM data is satisfactory. First, a comparison of microdata from the 1999 CFM with microdata from the 1999 SFS shows that CFM and SFS data on gross income, mortgage debt, and consumer debt (which are particularly important for our analysis of the debt-service ratio) are broadly comparable. The asset holdings reported by CFM, however, are lower than those reported by SFS. Second, as illustrated by Table 2, the distribution of debt and assets by age and income groups are consistent with expectations: (i) close to half of total household debt is held by middle-aged households (age group 2); (ii) the debt of higher-income households (income group 5) is large relative to their size in the population; and (iii) asset holdings increase with income.

An analysis of the distribution of various debt indicators

Household indebtedness is traditionally gauged using three indicators: (i) the debt-to-income ratio; (ii) the debt-service ratio, which measures the fraction of their income that households must devote to servicing their debts; and (iii) the debt-to-asset ratio, which shows to what extent debt is backed by assets. Microdata allow us to analyze the distribution of these indicators (i.e., to see how they vary across income groups and how they have evolved over time) and to assess the proportion of vulnerable households (i.e., households that could be more severely affected by negative shocks, because they have either high debt-service ratios and/or high debt-to-asset ratios). The analysis in this Highlighted Issue is based only on households that have debt.

CFM data indicate that the debt-to-income ratio of households across all income groups is currently higher than in 1999. At the same time, they indicate that the proportion of households

9. The 1999 SFS was the most recent available at the time of writing.

10. In the first half of 2006, 5,930 households were surveyed, which compares with an annual target of 12,000 households.

Table 1

Definition of Age Groups and Income Groups

| | 1 | 2 | 3 | 4 | 5 |
|---------------------------------|--------------|-------------------|-------------------|----------------|---------------|
| Age groups | Below 35 | Between 35 and 49 | Between 50 and 63 | 64 and over | |
| Income groups (\$) ^a | Below 32,500 | 32,500-57,499 | 57,500-84,999 | 85,000-124,999 | Above 125,000 |

a. Income is measured by gross family income.

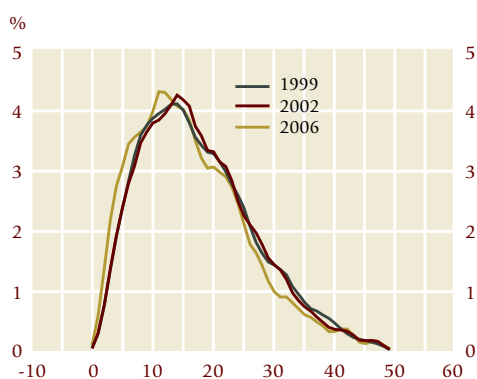
Table 2

Distribution of Debt and Assets by Age and Income

Per cent ^a

| | Age group | | | | | | | | | |
|--------------|--------------|-------|------------|-------|--------------|-------|------------|-------|-------|-------|
| | 1 (22.4%) | | 2 (36%) | | 3 (22.6%) | | 4 (19%) | | Total | |
| Income group | Debt | Asset | Debt | Asset | Debt | Asset | Debt | Asset | Debt | Asset |
| 1 (29.6%) | 2.3 | 0.9 | 2.5 | 1.8 | 1.5 | 2.7 | 1.0 | 4.1 | 7.3 | 9.5 |
| 2 (27.7%) | 7.3 | 2.7 | 8.9 | 5.7 | 3.6 | 5.9 | 1.4 | 6.9 | 21.2 | 21.2 |
| 3 (13.1%) | 6.2 | 2.1 | 7.2 | 4.8 | 2.7 | 4.3 | 0.6 | 3.5 | 16.7 | 14.7 |
| 4 (17%) | 9.1 | 3.6 | 14.0 | 9.6 | 4.6 | 6.9 | 0.6 | 4.0 | 28.3 | 24.1 |
| 5 (12.6%) | 5.7 | 2.9 | 14.9 | 13.2 | 5.4 | 9.9 | 0.5 | 4.5 | 26.5 | 30.5 |
| Total | 30.6 | 12.2 | 47.5 | 35.1 | 17.8 | 29.7 | 4.1 | 23.0 | 100 | 100 |

a. The numbers in brackets represent the proportion of households in each income and age group relative to the whole population.

Chart 21 Distribution of the Debt-Service Ratio, Evolution Over Time

with debt has fallen somewhat and is now 75 per cent, compared with 78 per cent in 1999. Thus, the rise in the household debt-to-income ratio occurred not because a larger proportion of households are indebted, but because indebted households are carrying more debt.

The second indicator used to assess household indebtedness is the debt-service ratio (DSR), which is calculated here as total debt payments (interest and principal payments on debt) divided by gross household income. As illustrated in Chart 21, there are more people with a low DSR than with a high DSR, which suggests that debt sustainability should not be an issue for the large majority of households. However, the distribution of the DSR by income group over 1999–2006 suggests that the proportion of low-income households (group 1) devoting a large fraction of their income to debt payments is higher than that of households with higher incomes (Chart 22).¹¹

Despite the increase in overall household debt compared with income, the situation of the most vulnerable households has marginally improved (Table 3). Data for the proportion of vulnerable households (i.e., households with a DSR above some vulnerability threshold)¹² show that: (i) the proportion of households with a DSR above 23 per cent has decreased in the past two years and is significantly below the peak value in 2000; and (ii) while the proportion of households with a DSR above 40 per cent increased in the first half of 2006, it is still at about the average since 1999. Overall, the proportion of total debt held by vulnerable households is at its lowest level for the whole sample period.

11. Pooled data, rather than individual years, were used to examine the distribution of the DSR by income group because of problems associated with small samples.
12. Vulnerable households are defined using two different vulnerability thresholds for the DSR. The first threshold, which is commonly used in the literature, is reached when debt payments exceed 30 per cent of household net income, which translates into a 23 per cent threshold for our DSR, which is calculated using gross income. (We make the assumption that disposable income is about 75 per cent of gross income.) The second threshold—commonly used by financial institutions—is reached when total debt payments exceed 40 per cent of household gross income.

There are more households with a high DSR in Western Canada (i.e., Manitoba, Saskatchewan, Alberta, and British Columbia) than in the rest of Canada. In British Columbia, this might be explained, at least partly, by higher housing prices in Vancouver. However, thanks to sustained income growth in those provinces, this has not resulted in a rise in the proportion of vulnerable households in Western Canada.

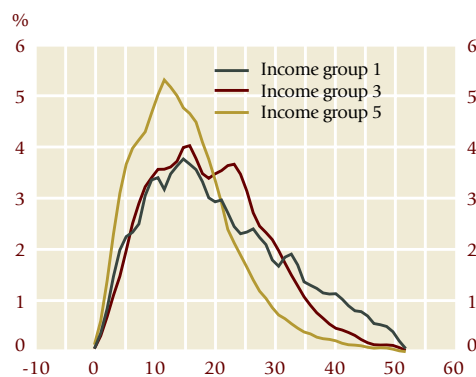
Overall, the DSR distribution suggests that despite rising debt and rising short-term interest rates, the financial position of the household sector has recently shown marginal improvement.

The last indicator used to assess household indebtedness is the debt-to-asset ratio (DAR), which is calculated as total debt divided by total assets.¹³ The distribution of the DAR suggests that debt and asset holdings are relatively well matched; i.e., households that have debts also have assets (recall Table 2, left column). We define vulnerable households with regard to the DAR as households with a DAR above 2, which is consistent with the fact that, from 1987 to 2004, the average DAR of insolvent households in Canada hovered around 2 (Office of the Superintendent of Bankruptcy Canada 2006).¹⁴ As illustrated in Table 4, the proportion of vulnerable households (DAR above 2) has risen since 2004. This has been accompanied by a rise in the share of total debt held by these vulnerable households. There is no benchmark for the proportion of vulnerable debt above which there is a risk for the financial system. But since the level of vulnerable debt accounts for 3.6 per cent of household debt, we do not think that the situation poses an increased risk to the financial system. A focus on households that are vulnerable with regard to both the DSR and the DAR supports this view: the debt held by households that have both a DSR and a DAR above vulnerability thresholds accounts for 2.8 per cent of total household debt, using the 23 per cent DSR vulnerability threshold, and for less than 0.4 per cent of total household debt, using the 40 per cent DSR threshold.

13. The DAR is interpreted with some caution since, as mentioned before, asset data from CFM may underestimate true asset data.

14. Assets in the OSBC study include: house, financial assets, cars, furnishings, and personal assets.

Chart 22 Distribution of the Debt-Service Ratio by Income Group



Source: Ipsos Reid and Bank of Canada calculations

Table 3

Proportion of Households with a DSR above Vulnerability Thresholds

| | Proportion of households with DSR>23% ^a | Share of total debt held by households with DSR>23% ^b | Proportion of households with DSR>40% ^a | Share of total debt held by households with DSR>40% ^b |
|------|--|--|--|--|
| 1999 | 29.3 | 40.5 | 2.6 | 4.9 |
| 2000 | 31.2 | 43.8 | 4.6 | 6.3 |
| 2001 | 30.6 | 43.8 | 3.9 | 5.8 |
| 2002 | 28.4 | 41.1 | 3.0 | 4.6 |
| 2003 | 29.2 | 39.8 | 2.7 | 4.3 |
| 2004 | 26.3 | 36.5 | 3.6 | 5.6 |
| 2005 | 25.1 | 34.7 | 2.6 | 4.0 |
| 2006 | 25.2 | 34.4 | 3.2 | 4.0 |

a. As a percentage of total households with debt
b. Vulnerable debt as a percentage of total household debt

Table 4

Proportion of Households with a DAR above the Vulnerability Threshold (2)

| | Proportion of households with DAR>2 ^a | Share of total debt held by households with DAR>2 ^b |
|------|--|--|
| 1999 | 4.7 | 0.6 |
| 2000 | 5.1 | 0.6 |
| 2001 | 5.2 | 0.8 |
| 2002 | 4.7 | 1.1 |
| 2003 | 5.2 | 1.9 |
| 2004 | 6.6 | 3.6 |
| 2005 | 6.8 | 3.1 |
| 2006 | 6.9 | 3.6 |

a. As a percentage of total households with debt
b. As a percentage of total household debt

Overall, this analysis broadly supports our past conclusion: Canadian households seem to be in rather good financial health, with debt largely held by households with sufficient income and/or assets. Therefore, the household sector should not pose a major threat to the stability of the Canadian financial system, at least in the short term.

References

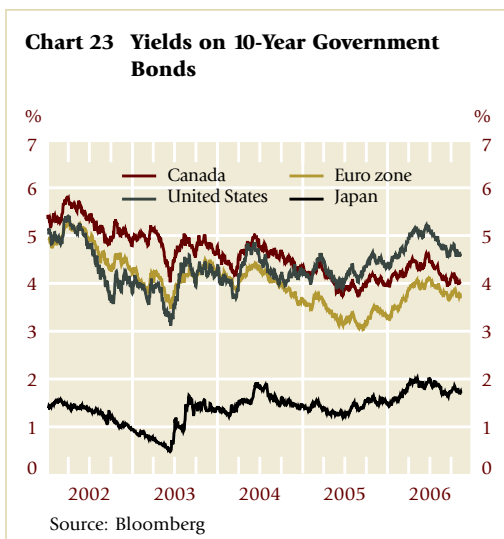
Office of the Superintendent of Bankruptcy Canada. 2006. "An Overview of Canadian Insolvency Statistics, up to 2004." Available at <http://strategis.ic.gc.ca>

The Financial System

Financial markets

Prices for a number of commodities and riskier assets, including those for global equities, declined sharply in May and June. In a historical context, the market turbulence at that time was relatively minor, with the prices of many risky financial assets remaining above the levels that prevailed at the start of the year. Since the end of June, equity prices have again generally been appreciating. Although the prices of some commodities, particularly energy, have declined since the June FSR, they have done so in an orderly manner. Overall, despite the repricing in May and June, risk appetite remains generally high. As such, there is still some concern, first expressed in the December 2005 FSR, that market risk may be underpriced.

The market turbulence in May and June can be partly attributed to greater uncertainty about the macroeconomic outlook, coupled with market concerns that monetary policy might need to be tightened by more than anticipated to ward off inflationary pressures. This increased level of uncertainty has since largely dissipated, with financial markets generally expecting a slowing in the economies of industrialized countries to restrain inflation and to reduce the need for any significant tightening of monetary policy. This reduction in inflation concerns has contributed to the recent declines in the yields on long-term government bonds in all major industrialized countries (Chart 23). In addition, even though global policy rates have increased and further modest increases are expected in some countries, global economic growth has



remained resilient, providing a strong fundamental backdrop for financial-asset prices.

While there is some evidence that investors are paying closer attention to fundamentals (e.g., differentiating among emerging markets), there is little indication of an overall reduction in investors' risk appetite. This most recent period of market turbulence seems to have had little impact on investors' appetite for high-yield, less-liquid assets. Numerous indicators suggest that market participants assess risks to be relatively low and/or that they have a healthy appetite for risk. For example, the implied volatility of the S&P (VIX) and spreads on emerging-market bonds have both fallen back to historically low levels (Chart 24).

This healthy risk appetite may reflect improvements in risk management and a reduction in systemic risk arising from new financial products, new hedging possibilities, and a higher degree of global capital mobility. Nevertheless, it is still possible that volatility and risk premiums could rise abruptly, perhaps triggered by lower-than-expected global economic growth or higher inflation, resulting in a more substantial and widespread decline in asset prices.

Financial institutions

The large Canadian banks remain very profitable and well capitalized, enjoying record profits through the first three quarters of fiscal 2006. The banks have been generating an underlying return on equity of about 20 per cent, on average.

These strong profits have been broadly based. The domestic personal and small business side of the banks' operations has continued to perform strongly. In addition, growth in corporate lending has increased somewhat in 2006. Banks continue to benefit from very firm credit quality in their retail and corporate loan portfolios, in spite of such potentially adverse factors as the strong Canadian dollar and high oil prices. Securities underwriting and trading activity have also been favourable for earnings. Financial intermediation spreads, which had been declining for some time, are starting to stabilize. Some of the Canadian banks have continued to make investments and strategic moves aimed at enhancing the profitability of their retail banking and wealth-management operations in the United States.

Chart 24 Implied Equity Volatility*

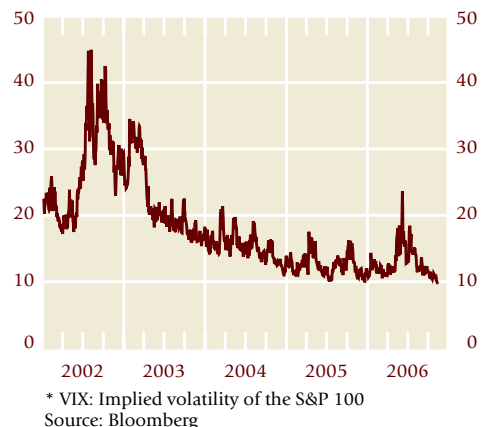
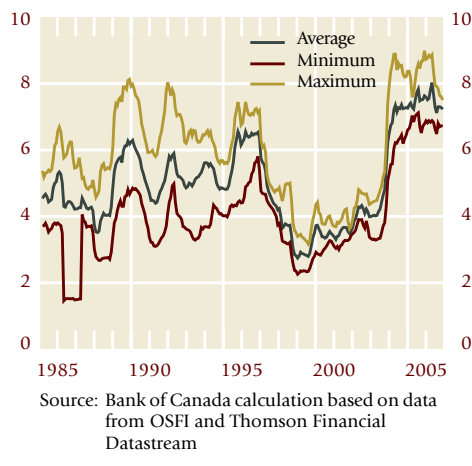


Chart 25 Distance to Default for Major Banks

Market indicators support the view that Canadian banks are financially healthy. For example, a measure of the perceived riskiness of banks based on the Merton contingent claims approach shows that the banks are in a strong financial position (Chart 25).¹⁵

The three large Canadian life and health insurance companies also enjoyed firm profits in the first three quarters of 2006. The companies recorded strong operating results in both their protection (individual and group) and wealth-management products, although weaker equity markets in the second quarter affected variable annuity sales to some extent. They have also been benefiting from the strong global economy, given their geographic diversification (although the strong Canadian dollar had some dampening effect on the Canadian-dollar value of profits earned in the United States), and they continue to explore expansion opportunities overseas. The life and health insurance companies are well capitalized and enjoy strong credit quality in their fixed-income portfolios.

The Canadian securities industry reported record profits in the first half of 2006, with operating profits up 43 per cent over the same period a year ago. However, profits in the second quarter were 20 per cent lower than in the robust first quarter. This reduction was largely due to the stock market pullback and increased market volatility in the spring, which adversely affected trading profits.

15. This measure was discussed in the June 2006 FSR.

Important Financial System Developments

This section of *Developments and Trends* examines structural developments affecting the Canadian financial system and its safety and efficiency.

Financial Markets

Principal protected notes

Principal protected notes (PPNs) are a growing class of investment products that have a fixed term to maturity and offer a rate of return based on the performance of an underlying investment, typically hedge funds, mutual funds, or stock market indexes. One of the main characteristics of this type of financial instrument is a guarantee that the holder will recover the capital invested if the note is held until maturity.¹⁶ The investor is not, however, guaranteed to receive any income in addition to this principal. The ability to earn a profit depends on the performance of the underlying investment, net of fees and other expenses paid to the guarantor, sponsor, fund manager, or other institution involved in creating the product.

The stock of Canadian PPNs roughly doubled between 1999 and 2004 to reach \$21 billion.¹⁷ This financial product widens the spectrum of investment opportunities available to retail investors by making it possible to gain exposure to vehicles such as hedge funds without having to make a large investment. PPNs also provide investors interested in gaining exposure to some risky—and potentially high-performing—

investments with an opportunity to do so while, in principle, eliminating the downside risk.

As with any other financial asset, investors purchasing PPNs need to understand the characteristics of the instrument. The Investment Dealers Association (IDA) and the Canadian Securities Administrators (CSA) are concerned that, given the increasing complexity of PPNs, disclosure standards may not be sufficient to properly inform prospective investors about the structure of these instruments and about the various factors affecting cash flows, such as fees. This makes it more difficult for investors to assess the value of these notes. The IDA and the CSA are also concerned that investors can buy some types of PPNs from salespeople who are not required either to meet the same proficiency standards as registered investment advisers or to ensure that the investment products sold meet the specific needs of the client.

Securities transfer legislation

This past May, the legislative assemblies of Ontario and Alberta passed legislation to modernize the systems of rules governing the transfer and holding of securities in their respective provinces. These new Securities Transfer Acts are both modelled on Article 8 of the U.S. Uniform Commercial Code and are broadly similar. Other provinces are expected to follow suit. The objective is to have a largely harmonized framework across provinces—and between Canada and the United States—to facilitate capital flows across jurisdictions.

This improvement in the legal foundations that support securities transactions is crucial for the efficiency of the financial system. Modernizing legislation on securities transfer became a priority after previous attempts by Canadian provinces to catch up with progress made internationally

16. Often, PPNs are not insured by the Canadian Deposit Insurance Corporation or the Régie de l'assurance-dépôts du Québec. In these cases, the guarantee is supported by the creditworthiness of the guarantor—generally a Schedule I or Schedule II bank or a credit union—and by the security backing it.

17. Source: Investor Economics

resulted in a patchwork of laws that were inconsistent across jurisdictions. More specifically, the Canadian system continued to rely on the concepts of possession and delivery of negotiable security certificates. These concepts cannot adequately deal with book-entry settlement systems, the indirect holding of securities (i.e., through an intermediary), or the direct holding of securities without certificates, all of which have become an integral part of modern-day reality. The new system replaces outdated concepts of transferring securities held on the books of financial intermediaries through deemed transfers of possession with a new set of legal rights arising from holding securities positions in accounts with the intermediary. The legislation also clearly determines which jurisdiction's law will govern securities transfers that have connections to more than one jurisdiction. This stronger legal framework is expected to increase confidence in the system for transferring and holding securities, particularly for cross-jurisdiction transactions.

Proposal to strengthen the enforcement of securities law

The Task Force to Modernize Securities Legislation was established in June 2005 by the Investment Dealers Association to examine investor protection, corporate governance requirements, access to capital, regulatory burden, and enforcement in Canada. Its goal was to recommend revisions to Canadian securities legislation and regulation to achieve a dynamic, fair, efficient, and competitive capital market. In its October 2006 report, the Task Force recommended 65 Canada-wide reforms, 34 of which relate to the enforcement of securities law.

The recommendations on enforcement encompass multi-level reform across all jurisdictions and emphasize co-operation with respect to resources, evidence, and information. The Task Force envisions a national approach to enforcement in order to develop expertise, ensure the effective use of resources, and foster an independent and accountable enforcement process. A co-operative national enforcement program could also set enforcement priorities and develop reporting and data-collection systems so that quantitative analyses and performance evaluations could be conducted by an independent research body.

The Task Force indicates that ensuring the credibility of securities regulation in Canada through vigorous enforcement will "attract risk-averse investors to our markets, and thereby increase liquidity and correspondingly reduce the cost of capital to Canadian issuers." Policy-makers in Canada are encouraged to "step up" to the challenge and make changes in the regulations governing capital markets and their enforcement.

Highlighted Issue

Lessons learned from international experiences with market transparency

Prepared by Lorie Zorn

Market transparency is often defined as the degree to which trading-related information is publicly disseminated in a timely manner. It encompasses price and quantity details that are available before a trade occurs (pre-trade transparency) and details about the actual transaction (post-trade transparency). Transparency is an important consideration,¹⁸ since it affects the quality of financial markets and, ultimately, the economic well-being of a country.

The Bank of Canada has been a proponent of enhanced transparency in fixed-income markets for some time (Dodge 2004–05; 2005). By increasing participants' information about market conditions, transparency typically allows fixed-income markets to operate more efficiently, providing direct benefits to the Canadian financial system, as well as helping the Bank to fulfill its responsibilities in monetary policy and financial stability and in managing the federal government's debt.

At the same time, the Bank also recognizes that greater transparency will influence the provision of market liquidity and can, at some point, reduce market liquidity and efficiency. For example, transparency can directly affect the risks and costs of making markets. Given the nature of the securities and the participants in fixed-income markets, market-makers are needed to

18. Market quality reflects the implicit and explicit costs of trading and is affected by informational efficiency, volatility, and liquidity, as well as by transparency. See Vu (2003) for a discussion on transparency and market quality.

facilitate trading. This role is played by investment dealers, who commit their own capital to meet investor trading demand. Following a trade, dealers will typically redistribute some of their inventory among their peers to reduce exposure to potential price changes. This inventory management is hindered when competing dealers know the extent of each others' positions, thereby increasing the cost of market-making and, in turn, the costs of trading for investors. Thus, the quality of fixed-income markets depends on a delicate balance between the benefits of greater transparency and any negative impacts on liquidity stemming from such an increase.

Enhanced transparency can result from both regulatory inducement and market-led innovation. In certain countries, transparency in fixed-income markets has advanced more rapidly than it has in Canada. But the relative influence of regulators and the industry on transparency varies widely in these countries.

Canada can benefit from the experiences that other countries have had with market transparency by encouraging the positive aspects and limiting the potential for negative consequences. To inform future policy considerations relating to transparency in fixed-income markets, this article examines the relationship between regulation and transparency, as well as the effects of imposed changes in transparency on market quality.

Regulation and transparency

In most developed countries, the regulatory environment for transparency in fixed-income markets has been shaped by two common experiences. First, regulators and policy-makers became more attuned to transparency issues as electronic trading and data dissemination increased in the 1990s. More recently, as the Enron-era market scandals raised issues of investor protection, regulators focused their efforts on providing investors with more trading-related information. Country-specific influences have helped to shape different regulatory models for transparency in fixed-income markets.

In the United States, high-profile problems in fixed-income markets and active political interest have resulted in detailed rules for transparency, specifically for corporate and municipal bonds. However, U.S. Treasury securities are the exception. In the late 1980s, a Congressional

review of the Treasury market included an evaluation of the accessibility of trading-related information. The securities industry pre-empted likely regulatory action to impose transparency rules by establishing GovPX in 1992.¹⁹ Since then, further industry-led initiatives have resulted in a well-functioning U.S. Treasury market, characterized by a high degree of pre-trade transparency without any regulation regarding transparency.

Other industrialized countries do not have an extensive regulatory framework for transparency in fixed-income markets. In the European Union, where policy-makers have focused on the integration of financial markets, transparency rules are not as detailed and currently apply only to debt that is traded on an exchange. Stricter transparency requirements for equities will be implemented in November 2007, but the issue is still under review for other securities. European policy-makers have recognized that debt markets are structurally different from equity markets and, as such, warrant separate consideration.²⁰

Within the European Union, the United Kingdom has examined the transparency of fixed-income markets extensively over the past five years. Although limited rules were implemented a few years ago for bonds traded on electronic trading systems, U.K. securities regulators have recently determined that the level of transparency now delivered, particularly pre-trade transparency, is sufficient for wholesale market participants. Based on their assessment that market failure has not occurred, U.K. regulators have concluded that more extensive regulation of transparency is not necessary for U.K. debt markets.²¹

In Australia, regulators have explicitly followed a "light-touch" approach to debt market issues,

19. GovPX Inc. is an initiative by the major U.S. bond dealers and inter-dealer brokers (IDBs) to consolidate and distribute quotation and transaction information from IDB trading systems. This information is available to the public via the Internet, as well as through commercial vendors of information.
20. The European Commission is required to publish its decision on whether or not to proceed with regulations for debt market transparency by the autumn of 2007.
21. U.K. regulators found no evidence of inefficiency in the price-formation process nor of a failure of best execution in U.K. wholesale bond markets. See U.K. FSA (2006).

including transparency. Australian fixed-income markets have functioned well and, on that basis, it has been sufficient for regulation merely to point to the desirability of transparency rather than to mandate specific requirements.

Overall, in terms of regulatory intervention to enhance transparency, the approach of other industrialized countries varies widely, with the United States at one end of the scale and Australia at the other. Although Europe is currently in between, it is not certain what its eventual position will be until its review of non-equity markets has been completed.

Transparency delivered

Given the different regulatory influences and approaches, one might expect the United States, with its detailed, rules-based framework for securities regulation, to have a very high level of market transparency. This is certainly the case. But an abundance of trading-related information is also available in the European Union, where relatively modest regulatory requirements are currently in effect. In the end, the high level of market transparency in these two jurisdictions results mainly from industry innovation rather than from regulation. Not only are their fixed-income markets highly developed and competitive, but there is an extensive amount of electronic trading and data dissemination. In Australia, where electronic trading in bonds is not as widespread, the level of transparency is naturally lower.

Natural experiments in transparency

How have actual changes in transparency influenced market behaviours and dynamics? The academic literature is dominated by studies of so-called natural experiments with transparency in equity markets, and the impact on market liquidity is often examined. In terms of transparency in fixed-income markets, the literature to date encompasses only one event—the implementation of transparency requirements in the U.S. corporate bond market. There are no studies of transparency in government bond markets, probably because of the limited number of transparency rules for government bonds. Given the available body of research, transparency in markets with a dealership structure (i.e., where dealers are market-makers) is most relevant to fixed-income markets.

Three sets of studies examine the effects on market liquidity of changes in transparency in dealer markets. The effects are typically measured in terms of transactions costs, represented by the difference between bid and ask prices: lower transactions costs or smaller bid-ask spreads are associated with greater market liquidity.

The first set of studies examines the effect of the 1997 introduction of Order Handling Rules on the U.S. Nasdaq market,²² which were designed to significantly increase investor access to pre-trade information. Five different papers found that, on the whole, the Rules prompted more competitive behaviour among dealers, and that both quoted bid-ask spreads and realized transactions costs declined as a result.

The second set of research examines changes in the publication rules for stocks traded on the London Stock Exchange (LSE).²³ Finding the appropriate delay for the dissemination of trade details was motivated by a desire to protect the inventory-management function of LSE market-makers and, hence, to preserve large-size/block trading at the exchange. A number of authors found that adjusting the timeliness of post-trade publication for LSE stocks did not have an adverse effect; in fact, prices were largely unaffected by these changes.

The third set of studies analyzes the introduction of post-trade transparency in the U.S. corporate bond market as part of the TRACE initiative.²⁴ Of the four papers made public to date, none indicate a negative impact on liquidity. For the most part, transactions costs declined for those bond trades published on TRACE—particularly for small-sized trades—

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22. The rules required dealers to display the best price quotes and limit orders across Nasdaq and electronic communications networks.
 23. Over a 10-year period, large-size trades intermediated by dealers were subjected to five different publication regimes. This ranged from immediate publication of price and size at the beginning of the period, to a 24-hour delay for price publication; there is currently a 60-minute delay for both price and quantity.
 24. Under the Trade Reporting and Compliance Engine (TRACE), the dissemination of details on price and volume for an initial segment of corporate bond trades began in July 2002, with gradual expansion to nearly all corporate bond trades and reductions in dissemination delays over the following 3-year period.

relative to those of other corporate bonds. The reasons given for this vary: some authors indicate that the negotiating power of investors increases with more information; some find that transparency increases price competition among dealers; others note that trading is more widely dispersed among dealers after the cost of acquiring information falls.

In general, the academic research suggests that the *introduction* of transparency in a dealer market does not adversely affect market quality. It seems to increase liquidity, as measured by lower trading costs. Yet, the LSE studies imply that when there is already some transparency in a market, *further* enhancements may be of little benefit to liquidity. Thus, altogether, the research seems to support the widely held theory that transparency engenders declining benefits to market liquidity, to the point of an eventual trade-off once the optimum level has been surpassed.

Caution must be exercised when considering the results of these studies. First, since changes in transparency often occur in tandem with other changes, it is difficult to isolate the effects of transparency on market liquidity and to draw firm conclusions. For example, some attribute the improvements in transactions costs for corporate bonds found by the TRACE studies to increased trading in credit derivatives over the past few years, rather than to increased transparency. These credit instruments can reduce the cost to dealers of providing liquidity in the underlying corporate bond market. This cost reduction may, in turn, be passed on to investors in the form of tighter bid-ask spreads.

Second, the literature examines transparency for equities and corporate bonds, which are not only different from each other, but also from other assets, such as government debt securities. Different market characteristics across asset classes imply differences in the exposure of dealers to transparency-related liquidity risks and, hence, differences in the appropriate level of transparency. Moreover, there can even be differences across markets that trade in similar securities. For example, U.K. regulators have concluded that the implementation of TRACE-like transparency rules would not have the same effects in the United Kingdom as in the United States, owing to the different makeup of the

U.K. and U.S. corporate bond markets.²⁵ So, observations stemming from one particular market cannot necessarily be extended to other markets.

Relevance for Canada

The experiences of other countries, to date, demonstrate that transparency can have benefits for market quality and that both regulators and the industry have a role to play. What is not yet clear is the appropriate level of transparency for fixed-income markets and how this can be achieved, particularly how it might be or should be translated into specific rules.

Stakeholders might focus on the following key points when considering transparency issues in Canada.

Transparency in fixed-income markets warrants separate consideration from transparency in equity markets. The unique trading structure of debt markets implies a unique approach to achieving appropriate transparency, and regulators in both the United States and the European Union have realized this. There are also differences in participation and trading practices between the various sectors of the fixed-income market (e.g., corporate bonds versus government bonds), which suggest different approaches to transparency.

Regulatory intervention should be based upon indications of market failure, as well as on indications that the benefits from regulation will be greater than the costs. The view of U.K. and Australian regulators is that mandatory transparency may not be necessary when a fixed-income market is functioning well. Moreover, market-led innovation can provide solutions to transparency outside of regulation.

The widespread adoption of trading technologies by market participants is an important component of enhanced transparency. U.S. and

25. For example, there is a lower proportion of direct retail participation in the U.K. corporate market, and dealer activity in the United Kingdom tends more towards a principal (market-maker) basis rather than an agency (or brokered) basis as in the United States. This implies that U.K. dealers are more exposed to the risk that greater transparency will lead to lower liquidity.

European experience illustrates that the more participants use electronic trading and data-dissemination services and the more sophisticated these become, the greater is the level of transparency. In assessing the means to address transparency issues, policy-makers should consider the state of technological development, and, if regulation is imposed, it should not stifle future gains from advances in technology.

Pre-trade transparency is valuable to investors and interferes less with the market-making function. More importantly, markets that have a high degree of pre-trade transparency, such as the U.S. Treasury market, can be very efficient. Regulators in the United States and the United Kingdom recognize that pre-trade information can be just as representative of market prices as post-trade information.

The current state of transparency in Canada's fixed-income markets

Canadian regulators, policy-makers, and other stakeholders have been considering transparency in fixed-income markets for many years. As in other countries, the debate intensified in Canada owing to a number of factors, including the appearance of electronic trading systems and an increase in regulatory focus on retail investor issues. Resolution of debt-transparency issues, from a regulatory perspective, is evolving. Currently, transparency rules are applied only to certain corporate bonds, while government securities are exempt until 31 December 2006.²⁶ Even so, the Canadian requirements for corporate debt transparency are relatively extensive when compared with those of other major countries.²⁷

26. Transparency is addressed under National Instrument 21-101 *Marketplace Operation*, National Instrument 23-101 *Trading Rules*, and their companion policies (collectively, the ATS Rules). Amendments to transparency rules for government securities were proposed by the CSA in July 2006. The proposal, along with a joint response by the Bank of Canada and the federal Department of Finance, is available at: www.osc.gov.on.ca/Regulation/Rulemaking/Current/Part2/Comments/21-101/com_21-101_index.jsp

27. In the United States, the only information required for corporate and municipal bonds is information on completed trades. There are no requirements for federal government bond trades. In Canada, transparency rules in effect for corporate bonds include both pre-trade and post-trade requirements.

Despite the absence of mandatory transparency for government securities in Canada, industry initiatives have increased the level of transparency available to market participants. Over the past few years, several electronic trading systems and commercial data services firms have been launched in Canada, resulting in a substantial increase in information on fixed-income trading. In addition, the prices of benchmark government securities are now publicly available on several Internet sites. Although technological advances in trading and data dissemination have only recently taken hold in Canada, this industry-driven momentum seems to be building.

Looking ahead

Policy-makers worldwide are still grappling with issues related to transparency in fixed-income markets. Even those jurisdictions that have implemented transparency rules are continually reviewing the impact of these requirements in the context of industry developments. The experiences and deliberations of other countries will continue to provide Canadian regulators, policy-makers, and other stakeholders with insights for determining the appropriate long-run approach to transparency in fixed-income markets in Canada.

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Highlighted Issue

Exchange-traded funds

Prepared by Harri Vikstedt

Although exchange-traded funds (ETFs) were launched in the United States in 1993, they are relatively new to Canada.²⁸ They are investment vehicles that invest in many of the same types of assets that mutual funds do. They are traded on exchanges, have a high degree of liquidity, and are available to both retail and institutional investors. They provide investors with the ability to acquire exposure in one transaction to a market index or specific asset class, such as commodities, that has not always been easily accessible to retail investors in the past.

Equity funds, either in general index or sector form, account for over 90 per cent of the US\$500 billion global ETF market. The remaining 10 per cent of the market is composed of both fixed-income ETFs, which were introduced in 2002, and, more recently, commodity ETFs.

This article provides an overview of ETFs and discusses their role as an alternative for investors seeking exposure to a specific index or asset class. The first section explains the basic structure of ETFs and how they have improved market efficiency by lowering costs, improving transparency, and helping to complete markets by increasing market access for retail clients. The second section provides a summary of the global ETF market, with a focus on Canadian developments.

The ETF structure

ETFs are passive investment vehicles that represent a fractional ownership in an underlying portfolio of securities. They are designed to closely track the performance of either a basket of securities (index) or a single asset. Investors receive returns based on the performance of the index or of the underlying asset, less a management fee paid to the fund manager.

ETFs are a hybrid of an open-end mutual fund and a closed-end mutual fund (Table 5). They are listed on a stock exchange, like a closed-end fund, and can be traded like a standard stock whenever the market is open. However, ETFs possess a unique creation and redemption process that differentiates them from closed-end funds. The number of outstanding shares may be increased or decreased, on a daily basis, to reflect demand.²⁹ This process removes the potential problem of significant price discounts or premiums of the fund related to the net asset value (NAV) of the underlying assets.

ETFs are an attractive alternative investment vehicle to indexed mutual funds, since they provide the investor with continuous exchange-based pricing, as well as the ability to execute limit and stop-loss orders. The ETF structure also provides a high level of transparency, since investors know the composition of the specific ETF's portfolio on a daily basis. ETFs should also have a lower tracking error compared with traditional indexed mutual funds because they are fully invested and do not need to hold cash for redemptions. The tax treatment of ETFs is more direct, and, given their structure, ETFs usually generate a capital gain only when the actual units are sold.³⁰ But despite their many advantages, ETFs are not actively managed and, thus, will not outperform a designated index.

As a portfolio-management tool, ETFs can be used for a number of purposes, including short-term hedging or speculative trading, investing in certain sectors of an equity index, and altering overall portfolio exposure to certain assets in a cost-effective manner. ETFs are also used in long-term, buy-and-hold strategies by both retail and institutional investors.

The development of the ETF market has helped to enhance market efficiency, particularly for retail investors, since it provides easier and direct

28. Canadian investors have been able to buy U.S. ETFs since their introduction in 1993.

29. Defined market participants (brokers and/or dealers) can create new ETF shares by delivering additional underlying assets to the ETF when demand for the ETF increases. They can redeem existing shares by taking back the underlying assets from the ETF against the delivery of the ETF shares when demand decreases. They can also do either if the ETF price deviates from its NAV.

30. ETFs are obliged to distribute portfolio gains to shareholders by year-end. These may arise from index rebalancing or from the need to meet diversification requirements.

Table 5
Funding Structure Comparison

| | Open-end fund | Closed-end fund | ETF |
|-----------------------|---------------|---------------------|-----------|
| Fee level | Varies | High | Low |
| Transparency | Periodic | Periodic | Daily |
| Multi-dealer | No | Varies/ exchange | Exchange |
| Index-tracking | Varies | Varies | Yes |
| Net asset value (NAV) | End of day | End of day | Intra-day |
| Trade price | NAV | +/- NAV | Real time |
| Execution | End of day | Real time | Real time |

Source: Barclays Capital

access to asset classes such as commodities. ETFs are an efficient investment vehicle for both retail and institutional investors interested in portfolio diversification at a global, regional, and industry sector level. These funds have made portfolio investing easier, more transparent, and more cost-effective, particularly for the retail client. The ability to trade at intra-day prices has also allowed investors to manage their portfolio risk more prudently.

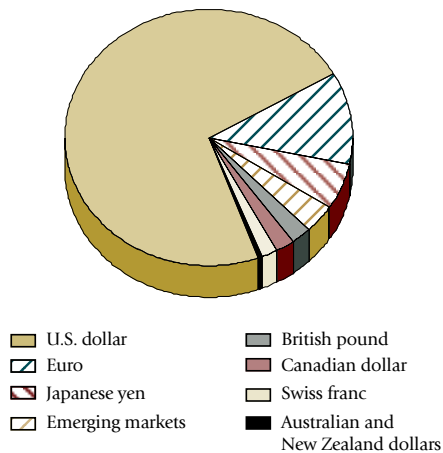
Overview of the ETF market

The first ETF was designed to replicate the performance of the S&P500 equity index and began trading on the American Stock Exchange on 22 January 1993. A second ETF, tracking the S&P MidCap 400 index, was added in 1995, and 17 ETFs linked to international stock exchanges began trading in 1996.

The market for ETFs is now over US\$500 billion, with over 650 funds, including 20 Canadian-dollar-based ETFs with a total capitalization of over Can\$12 billion. The Canadian ETF market is still very small compared with the traditional Canadian mutual fund market, equivalent to just over 2 per cent of its size; this is slightly less than half of the equivalent U.S. percentage. The global ETF market remains U.S. focused, with over 70 per cent of all ETF assets under management denominated in U.S. dollars (Chart 26). Most of these are traded on one of the U.S. exchanges. Initially, participants in the market were primarily institutional investors, but as it developed, retail investors have become increasingly involved.

The majority of Canadian ETFs have been issued by Barclays Global Investors under their iShares trademark, which has the largest global market share of ETFs by market capitalization. The iShares S&P/TSX 60 index accounts for over 60 per cent of the total Canadian ETF market capitalization and tracks the TSX 60 index. Globally, it is the 14th largest ETF by market capitalization. Bond ETFs account for over 8 per cent of the Canadian ETF market—slightly higher than in the United States but below the 12 per cent in Europe. There are no Canadian-specific commodity ETFs, although the US\$iShares COMEX Gold Trust is cross-listed on the Toronto Stock Exchange.

Chart 26 Global ETF Market by Currency of Issue



Source: Bloomberg

The top ten global ETFs by market capitalization have all been issued in the United States.³¹ They account for approximately 35 per cent of the global market and are largely dominated by the earliest funds. The first ETF, known as Spiders (Standard & Poor's Depository Receipts), continues to be by far the largest at just over US\$56 billion.

The only non-equity ETF in the top ten is the streetTRACKS Gold Trust, which tracks spot gold prices and began trading at the end of 2004. Although still only a small part of the overall market, commodity ETFs³² possess the potential to greatly improve financial system efficiency by adding to the completeness of markets. Before the establishment of commodity ETFs, retail clients faced significant hurdles in acquiring direct financial exposure to commodity prices because of various factors, including high transactions and storage costs. Commodity ETFs provide small investors with the ability to further diversify their portfolios. In fact, the appreciation of several commodity prices in the first half of 2006 may be partly attributable to the growth of ETFs and the release of pent-up demand from smaller investors.

The ETF market is expected to continue to grow at a brisk rate as additional investors discover the product. However, the development of the ETF market beyond equities will depend on the development of liquidity in the markets for other underlying assets.

31. Bloomberg, as of 25 September 2006

32. Unlike traditional ETFs, some commodity ETFs may hold futures contracts and not the underlying commodity.

Reports

Introduction

Reports address specific issues of relevance to the financial system (whether institutions, markets, or clearing and settlement systems) in greater depth.

Maple Bonds are defined as Canadian-dollar bonds issued by foreign borrowers in the Canadian market. In his article, **The “Maple Bond” Market**, James Hatley examines what has become the fastest-growing sector of the Canadian bond market since the elimination of the Foreign Property Rule in 2005. The development of the foreign-issue market reflects the increase in the global mobility of capital and is likely increasing the efficiency of the international financial system. In Canada, the Maple Bond market has contributed to a wider range of possible investments for domestic investors, permitting increased portfolio diversification, lower risk, and potentially higher returns. Although the market for Maple Bonds is still in its infancy, the popularity and durability of foreign-issue bond markets in other countries suggests that it will remain a viable segment of the Canadian bond market.

Since 2000, the funding challenges of defined-benefit pension plans in Canada and in other industrial economies have increased significantly, largely reflecting financial market developments that have adversely affected both pension fund assets and liabilities. Unfunded pension obligations can adversely affect the financial position of the sponsoring corporation or government entity, representing a potential drain on cash flow. At a minimum, this creates a financial “headwind” and, under an extreme scenario, could have adverse consequences for the financial system. In the report, **An Update on the Funding Status of Defined-Benefit Pension Plans in Canada**, Jim Armstrong reviews recent developments related to the funding situation of pension plans in Canada and assesses their impact

on the financial system. The article highlights the results of a new study by Mercer Human Resources Consulting that updates an earlier study discussed in the June 2004 issue of the FSR. The study provides an assessment of the current situation and a 5-year projection under three economic scenarios.

In December 2005, the Bank of Canada surveyed the readers of the FSR. In **Results of the FSR Readership Survey**, Jean Mair summarizes the survey findings. The results suggest that the FSR has a diverse audience with a wide range of interests, and that readers seem to be generally satisfied with the FSR.

The “Maple Bond” Market

James Hately

Corporate bond issuance in Canada has grown significantly over the past decade. Since the elimination of the Foreign Property Rule (FPR) early in 2005, one specific sector of that market, Maple Bonds, has shown particularly rapid growth. Maple Bond issuance has totalled over \$17 billion so far in 2006 and approximately \$30 billion since the beginning of 2005.

Maple Bonds are defined as “Canadian-dollar-denominated bonds issued by foreign borrowers in the domestic Canadian fixed-income market.” Foreign-issued bonds are popular in most major fixed-income markets, including the United States (Yankee Bonds), the United Kingdom (Bulldog Bonds), Japan (Samurai Bonds), New Zealand (Kiwi Bonds), and Australia (Kangaroo Bonds). Even though the Canadian fixed-income market possesses the conditions that make these other markets attractive to foreign issuers (including a developed government bond market and a liquid foreign exchange derivatives market), the Maple Bond market was practically non-existent until 2005.

This report discusses the development of the Maple Bond market and how it has likely improved the efficiency of the Canadian financial system. We begin with an examination of the growth of the Maple Bond market, including an analysis of why the market has developed. The second and third sections provide an examination of the reasons why Maple Bonds are attractive to both issuers and investors. The fourth section discusses issues related to secondary-market liquidity. The fifth concludes with an evaluation of the potential impact of this relatively new class of fixed-income securities on the efficiency of Canadian capital markets.

Development of the Maple Bond Market

The rapid development of the market for Maple Bonds can be primarily attributed to the underlying positive financial environment that has supported the continued growth of Canadian corporate bond issuance, combined with the recent elimination of the FPR. While these factors have supported strong investor demand for Maple Bonds, the supply of this nascent fixed-income instrument has also benefited from favourable conditions in the swap market.

A supportive environment for the Canadian corporate bond market

Two features have supported growth in the Canadian corporate bond market. The first is the reduction in federal government borrowing. The fiscal deficits of the 1980s and early 1990s resulted in large borrowing requirements for the federal government, with gross federal debt issuance reaching \$60 billion in 1996. This level of government issuance tended to crowd out corporate bond issuance in Canada, and the amount of non-government issuance was relatively small (Chart 1).

The subsequent reduction in gross borrowing by the federal government has been largely mirrored by a significant increase in corporate bond issuance, which has doubled since 1996 (Chart 2).

The second contributing factor is the increasing size and sophistication of fixed-income institutional investors in Canada. The enhanced ability of Canadian institutional investors to analyze credit risk, the increasing range of products, and the ability to hedge some credit risk through the use of derivatives have all helped to increase investor interest in this type of security.

Elimination of the Foreign Property Rule

The federal government announced the abolition of the FPR in its 2005 budget. The FPR was originally introduced in 1971 to limit tax-shielded individual and institutional investments in foreign assets to a maximum of 10 per cent of the total value of a portfolio. In subsequent years, the maximum was increased a number of times and, since 2001, the FPR had restricted Canadian retirement plans and pension funds from holding more than 30 per cent of their portfolios in foreign assets.

Each time the FPR ceiling was raised, net investment by Canadians in foreign securities also rose. Most investors, however, used almost all of their allowable foreign content to buy foreign equities, which are generally seen as providing more significant diversification benefits and returns than bonds. Reflecting this concentration in equities, the amount of foreign stocks purchased by Canadians almost tripled, increasing from slightly over \$20 billion in 1999 to over \$60 billion by 2000 as the foreign content was raised from 20 per cent to 25 per cent (Statistics Canada 2006). The total amount invested in foreign bonds, however, remained fairly low, at approximately \$3 billion. The Canadian fixed-income market was seen as generally “closed,” with investors continuing to hold almost all of their fixed-income assets in domestic Canadian issues. This was generally regarded as causing domestic issues, particularly those of financial firms, to be valued at narrower spreads vis-à-vis Government of Canada bonds in the domestic market than was necessarily warranted by their credit quality.

The removal of the FPR, however, provided investors with an increased opportunity to diversify their holdings, investing not just in foreign equities, but also in foreign debt. Since the abolition of the FPR, the amount of foreign securities purchased by Canadian investors, particularly foreign bond issues that include Maple Bonds, has increased significantly, reaching a monthly record of \$5.2 billion in March 2006.

Conditions Supporting the Issuance of Maple Bonds

Issuers of Maple Bonds are typically large institutions with sophisticated treasury operations

Chart 1 Gross Canadian Bond Issuance

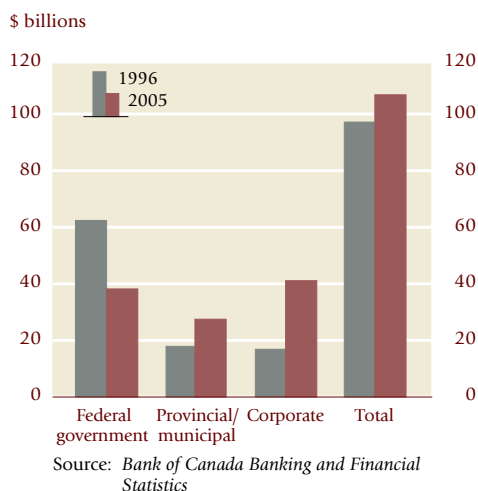


Chart 2 Gross Canadian Corporate Bond Issuance

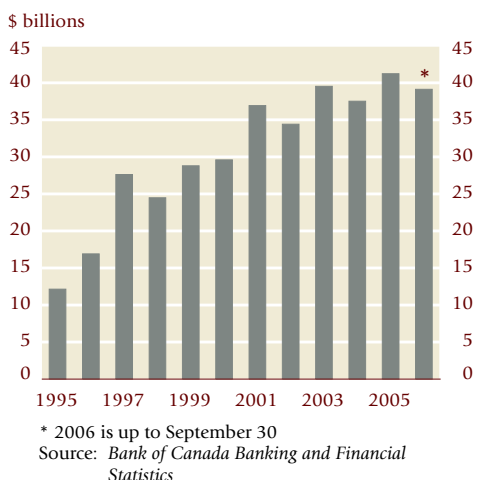
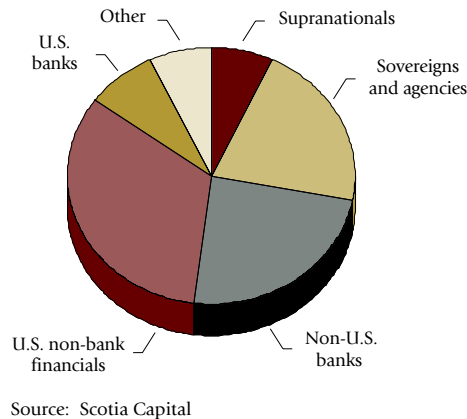


Chart 3 Maple Bond Issuers**Chart 4 Canadian 5-Year Basis Swap versus U.S.**

that are active borrowers globally. Approximately 50 per cent of Maple Bond issues have been completed by European-domiciled borrowers, while U.S issuers have been responsible for slightly more than 40 per cent.¹ Approximately two-thirds of the Maple Bonds issued in 2006 have been by sovereigns and agencies and U.S.-domiciled financial firms (Chart 3).

Given that most Maple Bond issuers have no natural need for Canadian dollars, activity in the market tends to be driven by arbitrage opportunities. Borrowers will generally issue in the Maple Bond market if they can attain funding at an equivalent or lower cost than what is available in other markets. The issuance of Maple Bonds is therefore affected by how cost-effective it is for the issuer to borrow in Canadian dollars and swap the proceeds back into their funding currency of choice.

Prior to the elimination of the FPR, transactions in the Canada-U.S. basis swap market were generally driven by large Canadian borrowers, predominantly the provincial governments and chartered banks, issuing U.S.-dollar debt in the U.S. market and swapping the proceeds back to Canadian dollars. The lack of transactions occurring in the opposite direction tended to result in relatively wide basis swap spreads.²

The recent increased issuance of Canadian securities by foreign entities and the resulting need to swap the Canadian-dollar proceeds into a different funding currency have offset, and put downward pressure on, the basis swap (Chart 4). This narrowing of the basis swap should act to reduce the incentive for foreign issuers to issue Maple Bonds, potentially making the supply dependent on the cycles of the basis swap market. This would be consistent with conditions in other foreign-issuer bond markets, such as the Kangaroo market, where issuance diminished in 2002–03 when the Australian basis swap narrowed.³

1. The remaining 10 per cent has been from issuers domiciled in Australia and Asia.
2. There is no economic reason why a basis swap should have a spread of anything other than zero. Any positive or negative spread is generally indicative of an imbalance between supply and demand pressures for a particular currency or floating-rate index.
3. See Australian Bureau of Statistics for issuance statistics. For background on Kangaroo Bonds, see Battellino and Chambers (2006).

The general level of corporate bond spreads in the Canadian market also affects the cost competitiveness of issuing in the Maple Bond market. It is generally believed that, owing to the existence of the FPR, the cost of funding for financial firms and provincial governments in Canada has been low in recent years, compared with what entities of a similar credit quality could issue in other markets. As evidence of this, highly rated foreign creditors can often issue Maple Bonds at spreads that are above lower-rated domestic issues, yet still provide cost-effective funding for the issuer. Recent examples include KFW, a AAA-rated German financial institution whose debt is fully guaranteed by the German government. KFW issued in the Canadian market at a slightly higher spread than that available on bonds of similar term issued by the Province of Ontario, which is a AA credit (Chart 5).⁴

KFW's total cost of funds on this issue was, however, comparable to what it could obtain by issuing similar debt in other major bond markets. While most of the issuers in the Maple Bond market have been financial corporations or supnationals, the market is also open to non-financial corporations. For example, Britain's Network Rail, France Telecom, and New Zealand Telecom have also completed Canadian-dollar bond issues.

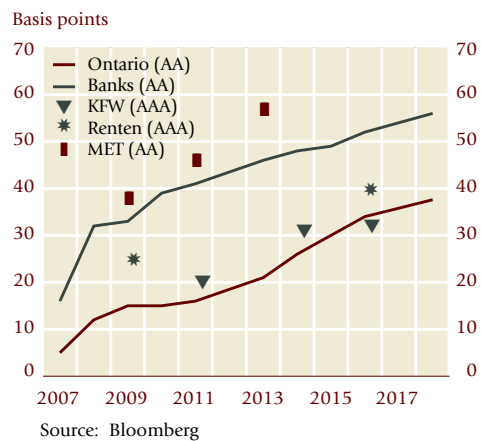
Maple Bond Investors

Investor interest in Maple Bonds continues to grow, and there are currently about 100 institutional accounts buying them, about three times the number recorded a year ago. In addition, other investors have suggested that they will buy Maple Bonds in the coming months.⁵

Maple Bonds expand the universe of investable fixed-income assets available to domestic Canadian institutional investors. They also offer domestic investors the ability to diversify their fixed-income holdings and earn incremental yield (relative to domestic issues of similar credit quality), while avoiding foreign exchange risk.

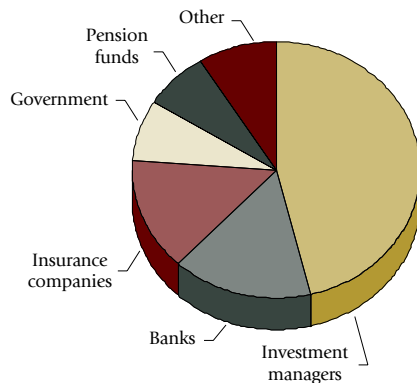
Chart 5 Comparative Credit Spreads

July 2006



4. Some of this higher spread is also likely to be compensation for the lower level of liquidity of Maple Bond issues. Rentenbank (Germany's AAA agency for agriculture) and MetLife are also shown on Chart 5.

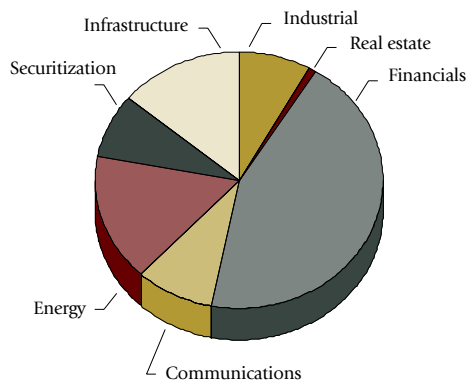
5. Sources: Scotia Capital Markets and Greenwich Associates.

Chart 6 Buyers of Maple Bonds in 2006

Source: Scotia Capital

Chart 7 Scotia Capital Corporate Bond Index

Weightings by sector



Source: Scotia Capital

The largest purchasers are investment managers (Chart 6).

Diversification of credit exposure is the most popular reason cited by investors for purchasing Maple Bonds, because they allow these institutions to reduce their exposure to large provincial and domestic financial issuers. Domestic issuance in the Canadian fixed-income market remains relatively concentrated, with approximately 75 per cent of provincial issuance coming from Ontario and Quebec. In 2005, less than \$25 billion in bonds was issued by non-financial firms in Canada. Financial firms, predominantly the major banks, make up 44 per cent of the Scotia Capital Corporate Bond Index (Chart 7).⁶ In a recent survey, 35 per cent of institutional clients indicated that they would use Maple Bonds as a substitute for provincial bonds.⁷

Most of the diversification benefits from owning Maple Bonds come in the form of specific credit (or name) diversification, and not diversification across sectors, because of the large number of international financial firms that have issued Maple Bonds. The Maple Bond market does, however, offer investors the ability to diversify their financial holdings away from Canadian financial firms to the larger international firms at similar credit spreads.

Maple Bonds also offer opportunities to diversify credit exposure beyond the large domestic issuers without any currency risk. Issues may also offer more attractive spreads than similar domestic credits, since highly rated Maple Bond issues typically include a risk premium on the yield that is higher than that offered by large domestic issuers.

Domestic fixed-income investors can create this diversification without Maple Bond issues by purchasing a foreign-pay bond in the issuer's local market and then swapping the cash flows into Canadian dollars. This is a more complicated transaction than purchasing the Canadian-dollar-denominated security, because a swap requires that investors have an ISDA agreement with their banks since they may, at some time,

6. The Scotia Capital Corporate Bond Index includes all Canadian-dollar investment-grade corporate bond issuance from Canadian-domiciled issuers, subject to a minimum size of \$100 million and at least 10 buyers.

7. Fixed-income survey of 85 institutional clients by BMO in March 2006.

have to post collateral. Keeping track of the value of the swap and a foreign issue may require additional systems and increased operational costs for the investor. Moreover, many investors have mandates that limit their use of swaps.

Liquidity in the Maple Bond Market

Secondary-market liquidity is limited, as would be expected in a developing bond market. Issues may be irregular and are sometimes small in size. There are also two structural factors that may be limiting liquidity in the secondary market.

First, the process of issuing a Maple Bond often differs from that for a regular domestic corporate bond and may be limiting liquidity in the secondary market. Maple Bonds are typically issued as a Foreign Property Private Placement (FPPP), while most corporate bonds are sold through a public offering by a group, or syndicate, of investment dealers. The advantage of an FPPP for a foreign issuer is that the issuer does not need to file a full prospectus in Canada for disclosure purposes.⁸ Instead, the issuer uses an outstanding shelf prospectus filed in Europe or the United States. This form of prospectus saves the issuer time and money and is used to issue bonds regularly in other markets. Legal fees are lower, quarterly statements do not have to be audited, and filings with provincial and territorial securities commissions are not required.⁹

While demand for Maple Bonds from institutional investors is relatively strong and continues to grow, it is possible that the reliance by issuers on a self-prospectus route is acting as a constraint to liquidity. A Canadian investor may be required to undertake legal action in another country if the issuer goes bankrupt. Some Canadian investors have restricted their purchases of Maple Bonds because of this concern.

8. The multi-jurisdictional disclosure system is another way that allows firms to issue without having to file a full prospectus. It is a joint initiative by the CSA and the SEC to reduce the need for continuous disclosure and other filings.

9. Many Canadian retail investors are unable to purchase Maple Bonds that are issued as private placements. Provincial securities regulations generally limit the purchase of non-exempt private-placement issues to qualified investors (as defined by net worth and income levels).

Second, liquidity may also be limited because of the relatively small size of the dealer syndicates used to issue Maple Bonds. Many Maple Bond issues have involved only one, or sometimes two, dealers. This means that few dealers are prepared to make markets in a specific Maple Bond, thus limiting the overall liquidity of the specific issue. This has caused some concern among investors over conditions in the secondary market. These concerns, coupled with the tendency for these bonds to be privately placed (via the FPPP process), may lead investors to hold Maple Bond issues until maturity, thus compounding the lack of liquidity for these securities. As the market matures, issuers would be expected to seek out multiple-dealer syndicates, establish a more frequent issuance calendar, and issue through the public markets, rather than through private placements. This would contribute to a higher level of secondary-market liquidity, similar to that in other foreign bond markets.

Impact on Efficiency of the Canadian Fixed-Income Market

The development of foreign-issuer bonds in a number of countries is contributing to the improvement of market efficiency globally. They have increased the pool of investable assets for investors and provided issuers with more cost-effective financing. The recent growth of the Maple Bond market since the removal of the FPR has allowed the Canadian market to follow this global trend and has helped to improve the efficiency of Canadian capital markets.¹⁰

The development of the Maple Bond market has increased the completeness of the Canadian bond market by broadening the spectrum of assets available to Canadian investors. This provides investors with increased opportunities for portfolio diversification and the construction of more efficient portfolios.

By increasing competition for domestic investment funds, the development of the Maple Bond market has also enhanced allocative efficiency. This is because the presence of Maple Bonds may lead to better pricing of other

10. See Bauer (2004) and Hendry and King (2004) for discussions on the efficiency of financial markets.

domestic corporate issues and a narrowing of the basis swap. While this does not necessarily result in cheaper financing for large domestic borrowers, better pricing of risk benefits the Canadian financial system as a whole. There is some anecdotal evidence that Maple Bond issuance has been putting some upward pressure on domestic credit spreads, particularly for Canadian financial firms and provincial borrowers.¹¹ Any such widening, however, would be partially offset by the benefit certain Canadian issuers get from the narrowing of the basis swap and the benefit Canadian investors receive from a better, more representative return for their risk. A narrower swap creates cheaper funding opportunities in foreign markets for large domestic issuers.

While the development of the Maple Bond market has helped to improve the efficiency of Canadian fixed-income markets, that contribution has been held back by secondary-market activity and by the limited range of foreign issuers. A more active secondary market in existing Maple Bond issues would further increase market efficiency by lowering the cost of adjusting investor portfolios. In addition, a wider range of foreign issuers would allow investors to further diversify their holdings and benefit from sectoral diversification in addition to name diversification. It is possible that this will occur as the market matures. More gains in efficiency are thus expected in the future.

The Maple Bond market is continuing to develop in important ways. For instance, Scotia Capital has created Canada's first Maple Bond Index. The index started with 55 securities comprising a total market value of approximately \$20 billion. The index is important, since it provides a benchmark against which Canadian bond investors can measure their performance. In addition, Moody's announced in May 2006 that they are starting credit research on all rated Canadian bonds issued by foreign entities. Moody's has added more than 70 foreign issuers to its Canadian research service and will add new companies as they enter the market.

11. CIBC World Markets (4 July 2006) suggests that some widening of corporate spreads in 2006 has been due to Maple Bond issuance.

Conclusion

Foreign-issued domestic currency bonds have been popular in most major fixed-income markets for some time. Historically, this has not been the case in Canada, however, since legislative restriction on the amount of foreign assets that could be held by tax-exempt investors had restricted this type of market from developing.

The recent development of this market has increased the efficiency of Canada's financial system. Domestic investors benefit from a wider range of possible investments, allowing for increased portfolio diversification, lower risk, and potentially higher returns. In addition, increased competition for domestic investor funds leads to better pricing of risk on corporate deals. The Maple Bond market is still in its infancy, with limited secondary-market activity, and issuance is highly concentrated in the financial and supranational sectors. But the experience with foreign-issue bond markets in other countries suggests that the Maple Bond market will remain a viable segment of the Canadian bond market in the future, although its relative size is likely to be driven by cyclical factors.

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An Update on the Funding Status of Defined-Benefit Pension Plans in Canada

Jim Armstrong

Since 2000, the funding adequacy of defined-benefit (DB) pension plans in Canada and in other industrial economies has deteriorated, largely reflecting financial market developments that have adversely affected both pension fund assets and liabilities. Unfunded pension obligations can affect the financial position of the sponsoring corporation or government entity, representing a potential drain on cash flow through the need to make special contributions. At a minimum, this represents a financial burden and, under extreme scenarios, can have adverse consequences for the financial system, as well as for the sponsor and its employees.

Of course, employees might well bear some of the burden of persistent deficits in DB pension plans through higher contribution rates, reduced benefits, and, in some cases, plan conversions or terminations. Indeed, pension deficits are one factor that can threaten the viability of DB plans.¹

The pension system is an important element of the financial system. The focus of this report is on the near-term outlook for the solvency situation of pension plans, particularly its sensitivity to financial market developments. It highlights the results of a new study by Mercer Human Resources Consulting conducted for the Bank of Canada that is an update of a 2004 study (Armstrong 2004). The study is based on Mercer's client database of plan sponsors, which contains information on registered federal and provincial pension plans across Canada in both the public and private sectors.²

1. For more on the issues concerning the future of DB plans in Canada see Armstrong and Selody (2005).
2. Mercer's plans represent about 35 per cent of the registered pension plan universe in Canada, using Statistics Canada data as the benchmark. It is the private sector database that provides the largest snapshot of the system. Excluded from the study are government plans, such as the Old Age Security (OAS) and the Canada/Quebec Pension Plans (CPP/QPP) that are partially funded and are not registered pension plans, as well as public service pension plans having all or a portion of their assets in governments' consolidated revenue funds, such as the federal and Quebec plans.

The study assumes that, over the near term, sponsors bear the burden of a funding deterioration through higher special contributions, although it is understood that this is a simplification of likely outcomes where employees would also have to bear some of the costs.

Background

Weak equity markets from 2000 through late 2002 initially raised concerns about the deteriorating funding condition of corporate defined-benefit pension plans in Canada (Chart 1). This is because the typical large Canadian corporate pension fund has 50 to 60 per cent of its assets invested in equities. An even more important adverse factor for pension plan funding has been the decline in long-term interest rates, which has increased actuarial estimates of pension plan liabilities. These liabilities are a function of the present value of future retirement benefits.³ While equity markets have subsequently recovered, bond yields have tended to stay low (Chart 1).⁴

Compounding the problem is the fact that many sponsors took contribution holidays in the 1990s when plans were in surplus, either voluntarily or because of the limits imposed by Income Tax Act regulations.

3. Lower bond yields increase the value of bond holdings (which typically comprise about 40 per cent of pension plan assets), but also increase the value of 100 per cent of plan liabilities. The net effect is substantially unfavourable for funding. This problem is amplified by the fact that the duration of the bond portfolio tends to be shorter than the duration of liabilities, making liabilities relatively more sensitive to interest rate movements.
4. It should also be noted that the funding positions of plans have been hurt by recent changes in actuarial standards that reflect longer life expectancy. This makes the calculation of solvency liabilities more sensitive to prevailing market interest rates.

Regulations Pertaining to Pension Funding

In Canada, defined-benefit plans are regulated at either the federal or provincial level, depending on whether employees work in business areas that fall under federal or provincial jurisdiction.

Funding rules

With respect to funding, DB pension plans must file an actuarial valuation report at least once every three years with their respective regulator (OSFI at the federal level or one of the provincial pension regulators).

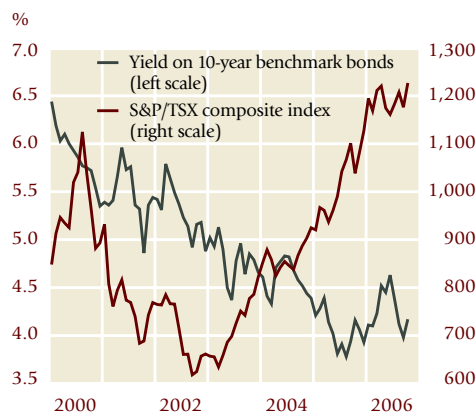
Both a *going-concern* and a *solvency* valuation are required. The going-concern assessment is based on long-run values for plan assets and liabilities.⁵ A going-concern deficit (i.e., liabilities exceed assets, resulting in a funded ratio under 100 per cent) must be funded by the employer sponsor over a maximum of 15 years—the sponsor must make special contributions to close the shortfall, in addition to the normal contributions to cover ongoing pension service costs.

A solvency assessment is made on the assumption that the plan is wound up on valuation day. This method typically uses market value or fair value for plan assets and windup values for plan liabilities. A solvency deficit must be funded over a maximum of five years.

If a plan is facing both a solvency and going-concern deficit, the higher required minimum payment is binding. In the vast majority of cases, the higher payment would be the required solvency payment. Thus, the focus of this study is on the solvency situation.

In terms of other applicable funding rules, the federal Income Tax Act prohibits the sponsors of plans in surplus from making contributions

Chart 1 Key Variables Affecting Pension Funding



Source: Bank of Canada

5. The going-concern assessment can be based on either market values or long-run values for plan assets, the latter being derived from smoothing or modelling procedures. Liabilities are calculated as the present value of the expected stream of pension payments, factoring in the effect of variables such as salary increases.

Table 1
Evolution of Solvency Position
 \$ billions

| | 31 December 2003 | 31 May 2006 |
|--|------------------|-------------|
| 1 Number of plans | 847 | 761 |
| 2 Number of plans in deficit | 603 (71%) | 594 (78%) |
| 3 Number of plans in surplus | 244 (29%) | 167 (22%) |
| 4 Assets of plans in deficit/total assets | 79% | 44% |
| 5 Aggregate solvency ratio | 93% | 95% |
| 6 Solvency ratio of plans in deficit | 89% | 85% |
| 7 Solvency ratio of plans in surplus | 112% | 104% |
| 8 Aggregate solvency position of all plans—surplus (deficit) | (15.4) | (14.1) |
| 9 Aggregate solvency position of plans in deficit | (20.0) | (20.2) |
| 10 Yield on Canada bonds 10 years and over | 5.13% | 4.53% |

when pension surpluses exceed certain thresholds.⁶

Solvency-relief measures

In the May 2006 Federal Budget, the federal government introduced temporary solvency funding relief—“to help re-establish full funding of federally regulated defined benefit pension plans in an orderly fashion, with safeguards for promised pension benefits.” The principal measure (among others) permits plan sponsors to extend the solvency payments from five to ten years, subject to certain terms and conditions. These include achieving a certain level of approval from members and retirees, or obtaining letters of credit for the difference between solvency payments made on a ten-year schedule and those that would have been required on a five-year schedule.

The Province of Quebec, through its pension regulator *la Régie des Rentes*, also implemented similar funding relief measures for Quebec plans.

Estimating the Current Solvency Situation

The Mercer study estimates the current solvency situation as follows. First, for each plan in the sample, Mercer extrapolates the funding situation from the time of its last regulatory filing to 31 December 2005 and 31 May 2006. The projected market value of plan assets is based on the pension fund returns derived from each plan’s target asset mix and actual market returns. Plan liabilities are projected based on the information for each client in the database.

Table 1 presents the situation on a solvency basis as of 31 December 2003 (the date of the previous study) and as of the latest estimated date of 31 May 2006. On balance, it appears that there was some improvement in the funding situation over the two-and-one-half-year period:

- the proportion of assets of insolvent plans (solvency ratio less than 100 per cent) to total assets in the sample (row 4) decreased from 79 per cent to 44 per cent;

6. Under Section 147.2 of the Income Tax Act, employer contributions to registered pension plans must stop when a certain maximum allowable surplus is reached, typically 10 per cent of plan liabilities.

- the aggregate solvency ratio (assets/liabilities) for all plans (row 5) increased from 93 per cent to 95 per cent, mainly because some large plans have gone from being moderately underfunded to being moderately overfunded.

The moderate improvement achieved over this period reflects strong equity markets in Canada and the fact that many plans have been making special solvency payments. However, the yield on benchmark Government of Canada bonds declined by about 0.60 per cent over the period (row 10). This factor significantly hindered efforts to improve solvency ratios.

Distribution of solvency ratios

Table 2 presents the distribution of plan assets on a solvency-ratio basis as of the three estimation dates: 31 December 2003; 31 December 2005; and 31 May 2006.

It indicates that, as of 31 May 2006, about 46 per cent of plan assets were in plans with a small surplus (100 to 110 per cent), 22 per cent of assets were in plans that were only moderately underfunded (with a solvency ratio between 90 and 100 per cent), 10 per cent were underfunded at 80 to 90 per cent, and about 12 per cent were severely underfunded, with solvency ratios under 80 per cent.

Note that, between 31 December 2005 and 31 May 2006, there was a large shift in assets from the moderate deficit category (90 to 100 per cent) to the moderate surplus category (100 to 110 per cent). It is also interesting to note that the proportion of plans that were severely underfunded (solvency ratio less than 80 per cent) fell back from 16 per cent at the end of 2005 to 12 per cent at the end of May 2006.

The improvement in the distribution of solvency ratios in the very short period between 31 December 2005 and 31 May 2006 highlights how sensitive the solvency situation is to movements in the bond yield, which increased almost 50 basis points over this period.

Comparison of study results with OSFI solvency test for federal plans

It should be noted that OSFI (2006) released the results of its solvency test for all federally regulated defined-benefit plans, which represent about 10 per cent of all defined-benefit

Table 2

Distribution of Solvency Ratios

Per cent of assets

| Ratio (%) | 31 December 2003 | 31 December 2005 | 31 May 2006 |
|-----------|------------------|------------------|-------------|
| <80 | 11 | 16 | 12 |
| 80-90 | 11 | 15 | 10 |
| 90-100 | 57 | 51 | 22 |
| 100-110 | 10 | 9 | 46 |
| >110 | 11 | 9 | 10 |

Table 3

Economic Assumptions

Per cent

| Yields | Current 31 May 2006 | 2010 Baseline case | 2010 Case A | 2010 Case B |
|--|---------------------------|--------------------------|----------------|----------------|
| Differential between the long-term GOC nominal and Real Return bonds | | 2.25 ^a | 2.62 | 1.94 |
| GOC treasury bill | 4.18 | 3.76 | 4.49 | 3.12 |
| GOC bonds 10 years and over | 4.53 | 4.53 | 5.27 | 3.90 |
| Real Return Bond | 1.87 | 2.28 | 2.65 | 1.96 |
| Average portfolio returns ^b | | 5.76 | 8.80 | 2.88 |

a. The long-term yield differential between GOC nominal and Real Return bonds is used as a proxy for expected inflation, bearing in mind potential distortions, such as liquidity in the Real Return Bond market. The differential has been 2.25 per cent, on average, since 1998.

b. These are projected returns for a plan with a typical asset mix: 35 per cent Canadian equities, 12 per cent U.S. equities, 10 per cent international equities, 40 per cent fixed-income investments, and 3 per cent short-term investments.

Table 4

Evolution of the Solvency Situation for Plans in the Mercer Study

Per cent

| | 31 May 2006 | 2010 Baseline case | 2010 Case A | 2010 Case B |
|--|----------------|--------------------------|----------------|----------------|
| 1. Solvency ratio—all plans | 95 | 109 | 131 | 92 |
| 2. Solvency ratio—plans in deficit as of 31 December 2005 | 85 | 107 | 128 | 91 |
| 3. Solvency ratio—plans in surplus as of 31 December 2005 | 104 | 120 | 150 | 100 |
| 4. Proportion of system assets accounted for by plans in deficit | 44 | 6 | 0 | 94 |

plan assets in Canada. Its results are broadly similar to the Mercer sample for Canada. OSFI estimates an average aggregate solvency ratio of about 90 per cent as of December 2005, compared with 91 per cent as of June 2005. It estimates that about three-quarters of federally regulated defined-benefit plans are in deficit.

The Mercer sample includes both federal plans and provincially regulated plans. At the national level, Ontario accounts for about 50 per cent of all plan assets.

Funding Projections to the end of 2010

In a forward-looking exercise, Mercer uses a model to project solvency ratios ahead to 31 December 2010 under three economic scenarios: baseline, Case A (favourable for solvency positions), and Case B (unfavourable for solvency positions).

These scenarios are obtained in two steps. A stochastic model (with percentiles) is used to project the end points in 2010. A deterministic model is then used to project the values of the variables on intervening dates. Each variable converges to its 2010 value.

Table 3 presents these scenarios. The baseline scenario is a continuation of the current low-inflation environment over the projected horizon. The Case A scenario assumes economic developments that are favourable for pension plan solvency assessments; that is, higher interest rates and higher equity returns. This scenario uses the 25th percentiles of these variables under Mercer's stochastic model. The Case B scenario assumes economic developments that are unfavourable for pension plan solvency assessments; that is, lower interest rates and lower equity returns, reflected by the 75th percentiles of these variables coming from Mercer's model.⁷

Table 4 presents the projections for the solvency position in 2010 for the three cohorts as measured at 31 December 2005—*all plans, insolvent plans, and solvent plans*—under the three scenarios.

7. The net impact of inflation on projected solvency positions is complex. It depends of the proportion of plans in the sample that have liabilities indexed to inflation versus non-indexed plans. It also depends on the impact of inflation on portfolio returns.

Incorporated in the projections in Table 4 is the fact that plans starting in deficit are, in most cases, making special contributions to eliminate solvency deficits over five years. The required solvency payment tends to be a “moving target” from year to year, since financial market movements affect the estimated solvency position and, in the study, the required solvency contribution is reset each year to capture this effect.

The bottom line: Solvency projections to 2010

The Mercer solvency projections are as follows.

Under the baseline scenario, there will be a substantial improvement in the system in aggregate, resulting in a surplus of 109 per cent in 2010 (Table 4, row 1). Moreover, only a very small proportion (6 per cent) of pension assets will be in deficit (row 4).

Under the Case A scenario, the system will be robustly in surplus with a projected aggregate solvency ratio of 131 per cent, and a negligible proportion of system assets would be insolvent.

Under the Case B scenario, the system would persist in deficit to the extent of 92 per cent (row 1), lower than at the starting point of 31 May 2006. Furthermore, 94 per cent of plan assets in the sample would be in deficit, compared with 44 per cent at the end of May 2006 (row 4).

Projected Solvency Contributions

The next step in the study is to project solvency contributions to 2010 on a year-by-year basis.

Charts 2 and 3 present projections to 31 December 2010 for total employer contributions (expressed as a per cent of total payroll) for deficit plans and surplus plans, respectively, under Mercer’s three scenarios. Implicit in the projections is the assumption of all funding risk by the employer and no adjustment of employee contribution rates or benefit rates to offset current or anticipated changes in financial variables.

Chart 2 shows that the cohort of plans starting in deficit face the need to make contributions that are relatively high as a share of payroll compared with those in surplus (Chart 3). Under the baseline scenario (gold line), the group of sponsors with plans in deficit at the start of the period would need to pay, as a group, between

Chart 2 Deficit Plans

Total employer contributions as a percentage of total payroll under three scenarios

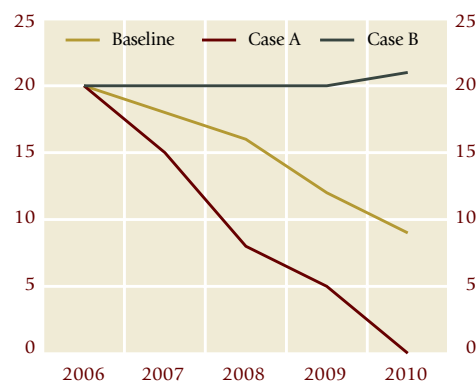
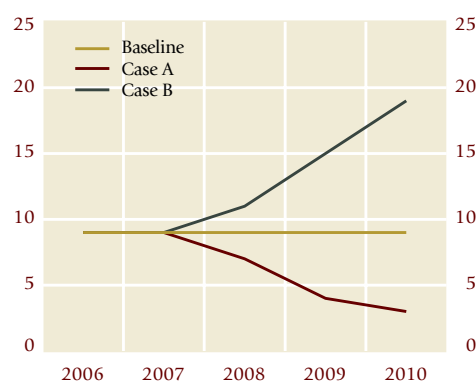


Chart 3 Surplus Plans

Total employer contributions as a percentage of total payroll under three scenarios



16 and 20 per cent of their payroll in total contributions to cover the deficit in the first three years, before falling to 11 per cent in year 4 and 9 per cent in year 5. This compares with a constant 9 per cent of payroll throughout for sponsors with plans starting in surplus at the end of 2005 (Chart 3).

Under the Case B unfavourable scenario (Chart 2, green line), the group of companies with plans in deficit at the start of the period will be paying, through the period, 20 to 21 per cent of their payroll in total contributions to cover the deficit—much more than under the other two scenarios.

Impact of the Solvency-Relief Measures

The updated Mercer projections do not incorporate the potential effects of solvency-relief measures.

To assess the possible impact of the temporary federal and Quebec solvency-relief measures, a projection was made assuming that, on average, employers will elect to amortize solvency deficits over 7 years instead of 5 years.⁸ It is estimated that the measures have their maximum benefit in year 1, reducing solvency special contributions by 9 per cent, followed by reductions of 4 per cent in years 2 and 3.

Thus, it appears that, in aggregate, the potential impact of the measures is fairly modest. They could, however, be quite important for individual plans, particularly plans that choose to extend the solvency period to 10 years, as allowed under the regulations.

Other Studies on the Canadian Pension Funding Situation

Other studies have recently reviewed the pension funding situation, using different samples of sponsors than the Mercer study.

For example, Dominion Bond Rating Service (DBRS 2006) has shed some light on the sectoral dimensions of pension deficits. The study notes the following with respect to Canadian and U.S. corporate defined-benefit plans:

“Pension plans are only a concern for a minority of industries and companies, typically those that exhibit the risks of an aging workforce and are highly labour-intensive with strong unions. Examples of these industries are auto parts, forestry and manufacturing.”

The DBRS study goes on to list about 40 corporations in Canada and the United States that report a pension deficit, on a GAAP basis (rather than a solvency basis), in excess of 20 per cent of net worth. DBRS calculates that a 200-basis-point increase in interest rates would significantly reduce underfunding with no action by the companies necessary.

The firm of Towers Perrin completed its sixth annual review of defined-benefit pension plan financial disclosures by 83 of the 100 largest Canadian companies traded on the Toronto Stock Exchange (S&P/TSX). The study compares a number of key financial results for 2005 derived from the annual reports of non-financial corporations. Towers Perrin found that, in spite of double-digit equity returns and sponsors making record contributions, there was no improvement in the funding position (as measured under GAAP accounting) for the third straight year. The authors attributed this lack of improvement to lower bond yields but expressed hope that rising yields in 2006 would provide some relief for sponsors.

Conclusion

The results of the updated Mercer pension study are moderately encouraging, but highlight the high sensitivity of the pension-solvency situation (and the path of future contributions) to economic conditions, in particular, movements in high-grade bond yields.

The baseline scenario—essentially a continuation of the current low-inflation environment with moderate portfolio returns—suggests that the system as a whole will be in surplus in 2010 (enjoying an aggregate 109 per cent solvency ratio). Of course, to achieve this improvement, many plans that are starting in deficit will be making special contributions over the roughly 5-year period, representing a substantial

8. The decision to use 7 years as the effective amortization period in aggregate for applicable plans is a function of Mercer’s judgment of the number of federal and Quebec plans that will either chose not to take advantage of the relief measures or will not be able to because of the various conditions attached to the measures.

proportion (up to 21 per cent) of their total payroll costs. It seems reasonable to assume that, in many cases, this will entail hardship for sponsors.

Furthermore, it is important to keep in mind that the unfavourable Case B scenario would have plans making high contributions for almost five years and, in the end, the solvency situation would be worse than at the start.

To conclude, it appears that the direct consequences for the Canadian financial system of current pension deficits are not large. However, they can have important consequences for the financial condition of individual firms in vulnerable sectors, particularly if combined with another shock. And ultimately, plan members will probably have to share in the adverse consequences falling out of a major funding problem, with the potential for increased contributions, reduced benefits, and even the elimination of the plan.

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Results of the FSR Readership Survey

Jean Mair

Table 1

Summary of Survey Responses

| Reader profile | Number of respondents | Per cent of total |
|-----------------------------|-----------------------|-------------------|
| Domestic | 112 | 83.0 |
| Foreign | 16 | 11.9 |
| Did not identify themselves | 7 | 5.2 |
| Affiliation | | |
| Banking/financial services | 34 | 25.2 |
| Academia | 24 | 17.8 |
| Corporation/business | 20 | 14.8 |
| Government | 16 | 11.9 |
| Student | 9 | 6.7 |
| Other | 21 | 15.6 |
| Did not identify themselves | 11 | 8.1 |

Table 2

Sections of the FSR Read Regularly

| Section | Per cent of respondents |
|---|-------------------------|
| Financial System Risk Assessment | 69.6 |
| Important Financial System Developments | 71.9 |
| Reports | 50.8 |
| Policy and Infrastructure Developments | 47.4 |
| Research Summaries | 49.6 |

Table 3

Views on the FSR

| Question | Average rating ^a |
|---|-----------------------------|
| High-quality writing | 4.03 |
| Interesting topics | 3.98 |
| Visually appealing layout and design | 3.96 |
| Rigorous economic analysis | 3.86 |
| Clear assessment of risks to the financial system | 3.82 |
| To the point | 3.73 |

a. Respondents were asked to evaluate various aspects of the FSR on a scale of 1 (lowest rating) to 5 (highest rating).

The *Financial System Review* (FSR) has been published since December 2002. Currently, the FSR has about 1,500 subscribers. As well, some 3,000 persons are notified of its publication through Bank Messenger, an email alert service.

Early in 2005, the Bank of Canada decided that it was time to collect readers' views on the publication. A readership survey was circulated with the December 2005 issue and was also posted on the Bank's website. This note presents the results of that survey. We thank those readers who took the time to complete it.

Some 135 readers responded to the survey questionnaire. The results are summarized in Tables 1 to 3. They suggest that the FSR has a diverse audience with a wide range of interests, and that the readership seems generally satisfied with the publication. We will be taking into account the interests and views of our readership as revealed in this survey as we draft future issues of the FSR.

Who reads the FSR?

The survey results indicate that the audience is primarily domestic (close to 90 per cent of those respondents that identified themselves). The audience is also very diverse, with no single group accounting for much more than a quarter of the readership. The largest groups of readers are in banking/financial services, academia, business, and government.

Why do they read the FSR?

The FSR aims to improve the reader's understanding of current developments and trends in the Canadian and international financial systems and of the factors affecting them. It also summarizes recent work by Bank of Canada staff on specific financial sector policies and on aspects of the structure and functioning of the financial system.

About 80 per cent of the respondents said that they read the FSR for "information on developments in the Canadian financial system." Close to half read it for information on the Canadian banking sector, information on the global financial system, and for an assessment of the soundness of the Canadian financial system. About one-third wanted to learn about initiatives to enhance the efficiency of the Canadian financial system. And

about half of the respondents use it as a reference.

Most people were looking for relatively wide coverage:

- Virtually all respondents said that they read the FSR to obtain information on the Canadian financial system. But over 70 per cent were also looking for information on developments outside of Canada.
- Over 80 per cent were interested in current analysis. Two-thirds of those replying read the FSR for the “research articles.” And some 60 per cent of respondents said that, on average, they read more than one research article per issue.
- Close to 60 per cent of respondents were looking for both quick updates and in-depth assessments of financial system issues. About 30 per cent wanted only a quick update of these issues, and the balance, only in-depth analysis.

Information content was rated as more important than topic timeliness by a ratio of about 2 to 1.

What do they read?

The Developments and Trends section was the most widely read part of the FSR, with close to 70 per cent of respondents regularly reading both the Financial System Risk Assessment and Important Financial System Developments. Close to 50 per cent stated that they regularly read the other three sections (Reports, Policy and Infrastructure Developments, and Research Summaries).

What do readers think of the FSR?

Overall, survey respondents seemed satisfied with the FSR.

Respondents were asked to assess various aspects of the FSR on a scale of 1 to 5, with 1 being the lowest rating and 5 the highest. The weighted-average answers clustered between 3.7 and 4, a reasonably favourable result. The highest marks were for high-quality writing, interesting topics, and layout. The lowest mark was in the “to the point” category. With these comments in mind, every effort will be made to ensure that

the material in the Bank’s *Financial System Review* is presented in a clear and direct manner.

Most respondents found the language in the FSR to be at an appropriate technical level.

Over 80 per cent of respondents were satisfied with the current frequency (twice per year) and length of the publication.

How do readers access the FSR?

The print version of the FSR is available to subscribers on request. The FSR can also be accessed on the Bank’s website. About two-thirds of those replying to the questionnaire use only the print version of the FSR, while another 13 per cent use both the print and online versions. Some 20 per cent of respondents (many from abroad) read the FSR only online.



Research

Summaries

Introduction

Bank of Canada staff undertake research designed to improve 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) linkages between the Canadian financial system and the rest of the economy, and linkages to the international environment, including the international financial system. This section summarizes some of the Bank's recent work.

Financial institutions and clearing houses face a number of financial risks, including the credit and market risks that arise from their participation in financial infrastructures, such as the securities clearing and settlement system. Collateral in the form of equities and fixed-income instruments is commonly used to manage these risks. But collateral itself can change in value over time. Thus, it is important to require a pledge of collateral large enough to cover any losses should a risk materialize. In **Collateral Valuation for Extreme Market Events**, Alejandro García and Ramazan Gençay propose a framework that can be used to compare different methods of measuring the risk surrounding the future value of collateral. This analysis is useful in determining the amount of collateral required to cover risks.

An efficient and productive financial system is important for the development and longer-run growth of the economy. To better understand the factors that might contribute to improved economic performance, policy-makers are often interested in cross-country comparisons. In this regard, comparisons of Canada-U.S. productivity have become topical, with suggestions of a "productivity gap" in some Canadian industries, including financial services, where Canadian banks play a very prominent role. Jason Allen, Walter Engert, and Ying Liu have recently

studied the efficiency of major Canadian banks, measuring it against that of comparable U.S. banks. That work is summarized in **Are Canadian Banks Efficient? A Canada-U.S. Comparison**.

Payments systems are typically characterized by some degree of tiering, with upstream firms (clearing agents) providing settlement accounts to downstream institutions that wish to clear and settle payments indirectly (indirect clearers). Clearing agents provide their indirect clearers with an essential input (clearing and settlement services), while also competing directly with them in the retail market for payment services. In the article, **Credit in a Tiered Payments System**, Alexandra Lai, Nikil Chande, and Sean O'Connor construct a model of a clearing agent with an indirect clearer to examine the clearing agent's incentives to lever its upstream position to gain a competitive advantage in the market for retail payment services. The model demonstrates that a clearing agent can achieve this competitive advantage by raising the indirect clearer's costs; however, the incentive to raise these costs is mitigated by credit risk to the clearing agent arising from the provision of uncollateralized overdrafts to its indirect clearer. The results suggest that tiered payments systems, which require clearing agents to provide overdraft facilities to their indirect clearers, may result in a more competitive retail payment services market.

In the article, **Using No-Arbitrage Models to Predict Exchange Rates**, Antonio Diez de los Rios proposes a model of the joint behaviour of interest rates and the exchange rate in two countries. In the model, movements in these variables are related in such a way as to preclude the existence of arbitrage opportunities. The term structure and the expected rate of depreciation of the exchange rate are functions of both domestic and foreign short-term interest rates.

The author finds that imposing the no-arbitrage restrictions in the estimation of the model produces exchange rate forecasts that are superior to those produced by time-series methods such as a random-walk model or a vector autoregression. This is a notable result, given that the random-walk model has proved very difficult to beat in forecasting exchange rates.

Collateral Valuation for Extreme Market Events

*Alejandro García and Ramazan Gençay**

Clearing and settlement systems are critical to the infrastructure of financial markets because of the large values of funds and securities that settle through them. For instance, in 2005, \$49.9 trillion was settled through the Canadian securities clearing and settlement system (CDSX). Given the large values flowing through these systems, regulators and banking professionals have taken initiatives to make them safer.

A common factor in many of these initiatives is the use of collateral to manage financial risks. For example, participants in a clearing and settlement system may have to pledge collateral equivalent in value to the amount they owe. If a participant fails and is unable to pay the amount owing, the collateral can be sold to generate the needed funds. But collateral itself may consist of risky assets and thus can change in value over time. It is therefore necessary to require a pledge of collateral large enough to adequately cover all losses in the event of a failure.

To manage the risk created by the uncertainty surrounding the future value of collateral, the initial value of the collateral is discounted. In other words, participants must pledge a greater amount of collateral than the amount owing. This discount is often referred to as the “haircut.”¹ The larger the haircut, the lower the risk, but the higher the costs incurred by participants using the system.

In this article, we propose a framework that can be used to compare different methods for calculating haircuts. Particular attention is paid to selecting an appropriate method for low-probability events (e.g., large, unexpected declines in

asset prices) that might affect the stability of the financial system, and one that also takes into account the cost of pledging collateral.

Methods for Estimating Haircuts

Two components are needed to calculate a haircut for collateral. The first is a model of the distribution of losses (i.e., frequency with which the asset declines in value), since the distribution of returns is unknown. The second is a risk measure, which can be thought of as a way of mapping the loss distribution into a single number (the haircut).

There are several ways to model the loss distribution for collateral based on historical data for returns. These include:

- **Parametric approaches** that use historical data to obtain the parameters necessary to characterize a given distribution (e.g., Normal, t , etc.). These parameters are then used to approximate the return distribution, and the haircut is obtained from the resulting quantile, given a particular distribution and a confidence level.²
- **Non-parametric approaches**, such as historical-simulation techniques, that do not model the return distribution under some explicit parametric model, but instead use the empirical distribution of the data to estimate the quantiles, for a given confidence level.

1. The haircut represents the amount by which the security could decline in value subject to a confidence level and a holding period.

* This article summarizes García and Gençay (2006).

2. Quantiles are points taken at regular intervals from the cumulative distribution function. Dividing the ordered data into q equal-sized data subsets is the motivation for q -quantiles. The quantiles are the corresponding data values marking the boundaries between consecutive subsets.

Along with choosing one of the above approaches, the estimation of haircuts requires a means of quantifying risk: a risk measure. Various risk measures can be used. One of the most common is the Value at Risk (VaR). We also use an alternative risk measure called Expected Shortfall (ES).³

The method for calculating a haircut can most easily be explained with an example. Consider an exposure of \$100 in a system for clearing and settling securities. This exposure is collateralized by an asset that has a market price of \$100. To estimate the haircut for such an asset, we use a parametric approach (e.g., a normal return distribution) and select a risk measure (e.g., VaR). Knowing that the asset has a daily percentage change in price with a mean of zero and a standard deviation of 3 per cent, we estimate the corresponding normal distribution. Next, we choose a confidence level for the haircut (e.g., 0.5 per cent)⁴ and then select a holding period (e.g., 1 day). Finally, we calculate the corresponding VaR obtained from a normal distribution with the mean and standard deviation of the data and assign this value as the haircut.⁵ This parametric approach, combined with VaR, yields a haircut of 7.72 per cent (quantile of the distribution), which is associated with a tail risk of 0.5 per cent (confidence level). With this haircut, the amount of collateral required to cover the exposure of \$100, given the characteristics of the asset pledged, would be \$108.36 which is $(100/[1-\text{haircut}])$.

Using Extreme Value Theory to Characterize the Distribution of Returns

A number of empirical observations generally hold for a wide range of financial time series.⁶ One of these is that return series have fat tails. This means that compared with a normal distribution, there are fewer observations around the

mean, and more in the tails or extremes of the distribution. This is true for many equities and certain fixed-income instruments that may be pledged as collateral. For such assets, it is not appropriate to use a normal distribution to estimate the distribution of market returns. This is because the normal distribution cannot capture values at very low or high tails of the distribution. Extreme value theory (EVT) methods are more appropriate for modelling the tail behaviour of the distribution of returns for securities.⁷

The intuition of EVT is as follows. While the normal distribution is the important limiting distribution for sample averages (central limit theorem), *the family of extreme value distributions is used as the limiting distribution of the sample extremes*. Thus, it is more relevant when we are interested in the extremes of the distribution. This family can be presented under a single parametrization known as the generalized extreme value distribution.⁸

The power of EVT methods to capture extreme events is illustrated in Gençay and Selçuk (2006), where the authors use data for Turkey's overnight interest rate prior to the crisis when the rate reached a level of 873 per cent on 1 December 2000 and 4,000 per cent on 21 February 2001. The authors find that estimation results from the pre-crisis data indicate that a day with overnight interest rates over 1,000 per cent (simple annual) could be expected every 4 years. In other words, the extraordinary levels observed during the crisis were in the nature of the economy before they actually materialized.

The Risk-Cost Frontier

Having suggested some alternative methods for estimating collateral haircuts, we now need a framework for comparing the methods. We propose the "risk-cost frontier" as such a framework. The frontier is a way of summarizing the risk-cost trade-off implied by each method. Each method has its own trade-off between the risk that price fluctuations in collateral value are not covered by a haircut (tail risk), and the cost of pledging collateral, measured by the excess collateral above the exposure that corresponds

3. ES is a *coherent* alternative to VaR, where *coherence* is defined as axioms that capture the desired properties of a risk measure. This term is from Artzner et al. (1997, 1999).

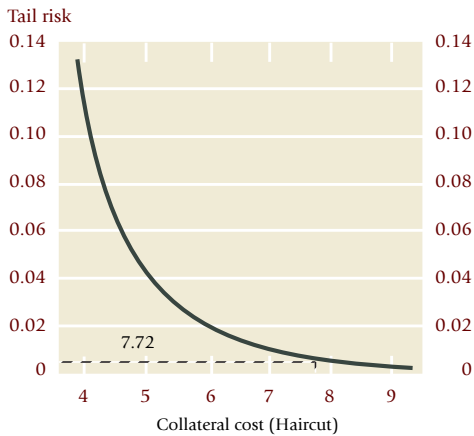
4. This means that 1 day out of 200, the haircut would not be sufficient to cover the daily price fluctuations.

5. VaR is simply a quantile of the loss distribution of returns. This quantile represents the maximum loss that is not exceeded with a given high probability.

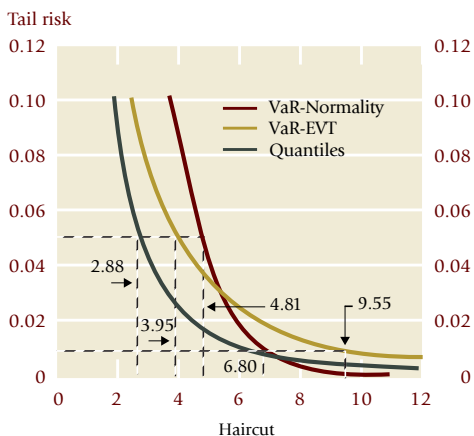
6. A good reference of the stylized facts for financial time series can be found in Mandelbrot (1963).

7. Embrechts, Klüppelberg, and Mikosch (1997) is a comprehensive source of theory and applications of extreme value theory to the finance and insurance literature.

8. This result is known as the Fisher-Tippett theorem.

Chart 1 Risk-Cost Frontier under Normality

Note: Haircuts and tail risk values obtained from a simulation of a normal distribution with a zero mean and standard deviation of 3 per cent.

Chart 2 Comparison of Methods for Calculating Haircuts

Note: Collateral returns are simulated from a t distribution with 2.2 degrees of freedom.

to the haircut (collateral cost). The trade-off exists because *larger haircuts* imply *lower tail risk* but *higher collateral cost*.

The risk-cost frontier can be constructed by calculating haircuts for different levels of tail risk but using the same method to model the return distribution. For example, the level of tail risk could start at 0.5 per cent and go up to 10 per cent. We can then calculate the associated haircuts. From these pairs of points, we can construct a risk-cost frontier. Chart 1 depicts the risk-cost frontier corresponding to the example given earlier (normal with mean zero and standard deviation of 3 per cent and a VaR risk measure).

Evaluating Haircut Estimation Methods

The risk-cost frontier can be used to compare different methods of calculating haircuts. Haircuts for the same levels of tail risk are calculated using different methods (i.e., combinations of (i) models for the loss distribution and (ii) risk measures).

The risk-cost frontier can then be used to determine the most appropriate method by selecting one whose frontier is closest to a benchmark frontier constructed from the data, but that does not cross it and, therefore, does not underestimate the haircuts. Consider the following example. First, the returns on a hypothetical asset are simulated using a t -distribution with 2.2 degrees of freedom. This specification shares similar statistical properties, such as fat tails, with those in financial time series. Two different methods are then used to estimate the haircuts. Knowing the underlying data-generating distribution allows us to determine that the best method for calculating the haircut is the one that has a risk-cost frontier closer to the risk-cost frontier calculated directly for the simulated data (using a non-parametric approach).

In this example, we compare two methods: both use a parametric approach, but one will assume a normal distribution and one an extreme value distribution. Both methods use VaR as the risk measure. Chart 2 shows the three risk-cost frontiers: the benchmark case with a green line (non-parametric approach for the empirical quantiles), the method based on the normal distribution with a red line, and the method that uses an extreme value theory distribution with a gold line.

Chart 2 illustrates the mismeasurement of risk when comparing the risk-cost frontier of the method that assumes a normal distribution, with the benchmark risk-cost frontier calculated from the simulated data (denoted by a green line). In Chart 2, we also observe that use of an extreme value distribution gives haircuts that are closer to benchmark given by the quantiles of the simulated t data (green line in Chart 2). Chart 2 suggests that the method that uses an extreme value distribution is the more appropriate one.

In our study, we also conduct the same analysis using real market data and find similar results. These results can be summarized as follows:

- Methods that use VaR on the assumption of normality overestimate (at high levels of tail risk) and underestimate (at low levels of tail risk) the values for the haircuts. This happens because the risk-cost frontier that uses the normality assumption crosses the benchmark frontier constructed from the empirical quantiles (green line in Chart 2). Thus, for the purpose of covering extreme risk, VaR with normality may not be adequate.
- VaR calculated with EVT methods provides a good fit in terms of slope to quantiles of the data. Nevertheless, VaR with EVT gives larger values for haircuts compared with the actual quantiles of the data. For the purpose of covering extreme risk, VaR with EVT is adequate. It should be kept in mind, however, that although they provide a cushion for extreme events, larger haircuts are costly to participants of the system.

Ultimately, the selection of the method for calculating haircuts depends on the weight placed on collateral costs versus coverage of extreme risk, and this depends on the objectives of the risk manager. Managers in critical financial infrastructures may choose to select a haircut that corresponds to a higher quantile than managers in organizations with greater tolerance for risk. No matter what the weights placed on risk and cost may be, a careful examination of the statistical properties of the return distribution is always recommended in order to select the most appropriate method for calculating haircuts.

Conclusions

We propose a framework that allows us to (i) characterize the risk-cost trade-off for a particular risk measure and method of haircut estimation, and (ii) compare different risk measures from alternative estimation methods, using the risk-cost frontier. The framework proposed is useful for understanding the risk-cost trade-off implied by the method used to calculate the collateral value (haircuts) that institutions must pledge to cover their exposures. These institutions may be clearing houses, central counterparties, payment system operators, central banks, or commercial banks determining their risk capital.

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Are Canadian Banks Efficient? A Canada-U.S. Comparison

Jason Allen (Bank of Canada), Walter Engert (Bank of Canada), and Ying Liu (Université de la Méditerranée)

Box 1

Canadian and U.S. Banks

The six major Canadian banks in our sample comprise over 90 per cent of the assets of the Canadian banking sector. The banks are Royal Bank Financial Group, Bank of Montreal, Canadian Imperial Bank of Commerce, TD Bank Financial Group, Bank of Nova Scotia, and National Bank.

The comparisons reported in this article consider total U.S. banks and a sample of 12 U.S. bank holding companies (BHCs). The BHCs are selected from the top 20 U.S. banks in terms of assets as of 31 December 2004. They were selected because there are continuous data from 1986 to 2004, and because most of these banks have a business mix broadly similar to that of the Canadian banks, benchmarked in a specific manner. That is, most of these BHCs make a similar proportion of revenue from retail banking.

The BHCs are JPMorgan Chase & Co., Bank of America Corp., Wachovia Corp., Wells Fargo & Co., U.S. Bancorp, SunTrust Banks Inc., National City Corp., Citizens Financial Group Inc., BB&T Corp., Fifth Third Bancorp, Keycorp, and The PNC Financial Services Group Inc.

An efficient and productive financial system is important for the development and longer-run growth of the economy. Indeed, a recent comprehensive survey of the research literature suggests that the quality of financial service provision is a key ingredient for economic growth (Dolar and Meh 2002).

To better understand the factors that might contribute to improved economic performance, policy-makers are often interested in cross-country comparisons. In this regard, Canada-U.S. productivity comparisons have become topical, with suggestions of a “productivity gap” in some Canadian industries, including financial services—where Canadian banks play a very prominent role.

Given these various considerations, we recently studied the efficiency of major Canadian banks, and compared it with the efficiency of U.S. banks (Allen, Engert, and Liu 2006). This article presents a summary of that work.

Performance Measures

We begin by considering common performance ratios, comparing the six largest Canadian banks (which account for the vast majority of Canadian banking assets) with total U.S. banks, and with a subset of U.S. bank holding companies (BHCs). (See Box 1 for more on these banks.)

The data that we use are from the balance sheets and income statements reported by these institutions to the banking supervisors in Canada and in the United States. We deflate all variables by the consumer price index, excluding food and energy prices, in the respective country. We also adjust the data for the different purchasing powers of the Canadian and U.S. currencies.¹

1. We use the Rao, Tang, and Wang (2004) calculation of a PPP measure for value-added in financial services (1.09 in 1999).

Expense ratio

The expense ratio is often used by analysts to evaluate bank performance. It is defined as the ratio of non-interest expense to net operating revenue (net interest income plus non-interest income).²

Chart 1 presents the expense ratio for Canadian banks, the U.S. BHCs, and total U.S. banks. The expense ratio of Canadian banks was lower than that of U.S. banks in the late 1980s and early 1990s. But this measure has been trending up at the Canadian banks and down at the U.S. banks over the sample period, so that the expense ratio of Canadian banks currently exceeds that of U.S. banks.

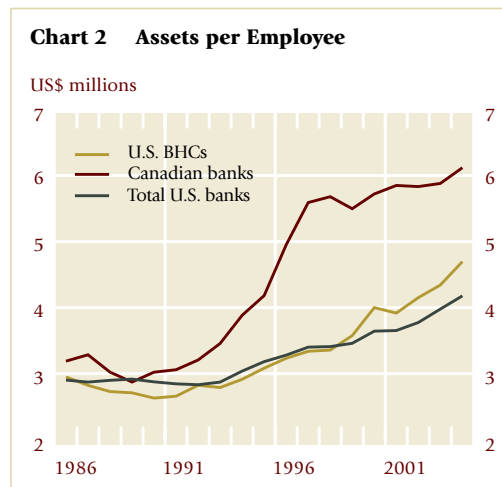
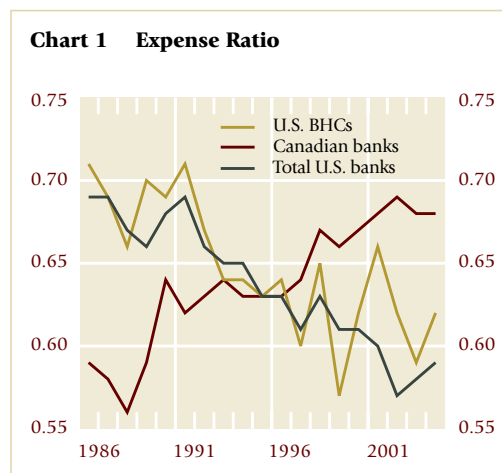
Our analysis indicates that the difference in the expense ratios can be currently attributed to a higher labour cost component (wages and benefits) at Canadian banks. However, this differential does not imply disparities in productivity, which concerns how much output is produced per unit of input (typically, labour).

Labour productivity ratio

Accordingly, we also consider measures that focus on the output produced by banks, relative to labour input. Bank output is difficult to measure, on both conceptual and pragmatic grounds. Indeed, it is widely believed that official statistics (based on the system of national accounts) on output in financial-services industries are subject to large errors. (See, for example, Triplett and Bosworth 2004 or Diewert 2005.)

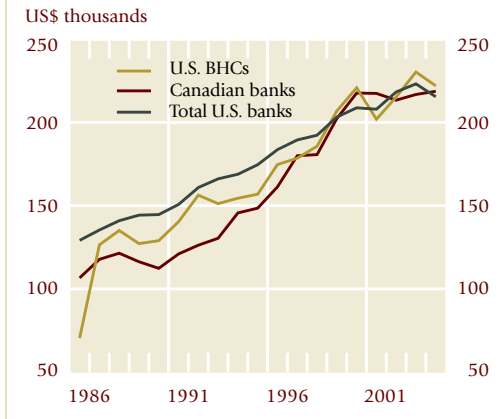
In our study, we do not use national accounts data. As noted above, we draw on data from balance sheets and income statements provided to bank supervisors. To measure productivity, we begin with total assets reported on balance sheets as our measure of output.

Chart 2 compares total assets per full-time equivalent employee of Canadian banks, the



2. The denominator of this ratio—particularly net interest income—depends on the risk differential between assets and liabilities. Therefore, a change in the ratio can be caused by changes in risk taking and not necessarily by changed efficiency. A change in the mix of a bank's services or products (say, towards non-traditional banking services) can also affect this ratio by altering the mix of inputs and expenses. Thus, we prefer the term "expense ratio," and not "efficiency ratio," as it is sometimes called.

Chart 3 Net Operating Revenue per Employee



U.S. BHCs, and total U.S. banks, in constant 1999 U.S. dollars. This chart suggests that the productivity of Canadian banks has been considerably higher than that of U.S. banks in the past decade.³

Next, we consider a measure that effectively internalizes differences in asset generation and management, and focuses on overall results. Specifically, Chart 3 shows net operating revenue per full-time equivalent employee of Canadian banks, the U.S. BHCs, and total U.S. banks.

According to this measure, Canadian bank employees were less productive than their U.S. counterparts in the late 1980s, but started to catch up in the early 1990s. In fact, according to this measure, the three groups of banks have converged since the late 1990s, indicating that Canadian banks are as productive as their U.S. counterparts.⁴

Economies of Scale and Cost-Inefficiency

We also consider another means of gauging bank efficiency, based on econometric methods, using disaggregated bank data. In this case, our analytical framework is the translog cost function (as in Allen and Liu 2005), which has become a standard tool in the research literature.

Methodology

In this framework, a bank's cost-minimization problem can be written as a general cost function:

$$C = f(\mathbf{q}, \mathbf{w}) + \theta + \xi,$$

where C is bank costs; \mathbf{q} is a vector of bank outputs; \mathbf{w} is a vector of input prices that a bank faces; and $f(\mathbf{q}, \mathbf{w})$ is a translog function, consisting of the individual and cross-product terms of \mathbf{q} and \mathbf{w} . The term θ represents effects unique to each bank, and the error term ξ represents all other unexplained influences on a bank's cost structure.

3. Including a measure of non-traditional activities (such as those related to off-balance-sheet assets) in total assets does not change this conclusion.
4. It follows from these various performance ratios that the return on assets of Canadian banks is less than that of U.S. banks, which is what we see in the data. On the other hand, the return on equity of Canadian banks is comparable to (if not greater than) that of U.S. banks.

Inferences regarding economies of scale are drawn from the derivative of C with respect to q ; that is, how a bank's costs vary with its scale of output.

The error term ξ provides the basis for the measurement of "cost-inefficiency." We define the efficient frontier as the (benchmark) bank with the lowest inefficiency measure (based on its ξ), and then measure each bank's distance from that efficient frontier. An efficient banking system is represented by relatively small inefficiency measures and convergence over time towards the efficient frontier.

An additional parameter of interest is technological progress, which we approximate initially with a quadratic time trend and then with other variables in different specifications of the model. We also include variables to capture the effects of regulatory changes in Canada and the United States.⁵

Data

Three input prices are included in the model: labour, capital, and deposits. They are measured, respectively, as the average hourly wage of bank employees, the expenses on real estate and fixtures divided by the total stock of these items, and the effective interest rate paid on deposits. A bank's output is divided into five categories: consumer loans, mortgage loans, non-mortgage loans, other financial assets on the balance sheet, and an asset-equivalent measure of non-traditional activities (following the method of Boyd and Gertler 1994).

We estimate the model by panel dynamic least squares using quarterly data from 1983 through 2004 for the Canadian banks, and from 1986 through 2004 for the U.S. BHCs.⁶

5. The financial systems in Canada and the United States have been affected by a series of legislative changes over the past 20 years regarding bank powers, organization, and regulation. The specific nature and timing of these changes have been different in the two countries. But a cumulative effect has been the development of essentially universal banks in both countries over time.
6. Given the differences in the development of the institutional and regulatory environments (among other things) in Canada and in the United States, separate cost functions and efficient frontiers are estimated for the two countries. (Pooling the data across countries would make interpretation of ξ unreliable.) Also relevant in this regard is the fact that there is a larger size dispersion among the U.S. BHCs than in the Canadian bank sample.

Results

For our sample of Canadian banks, we reject the null hypothesis of constant returns to scale. Instead, we find increasing returns to scale (of about 7 per cent), suggesting that Canadian banks would gain (modestly) from being larger.

As regards the measure of cost-inefficiency for Canadian banks, we find that the gap between the efficient frontier and other banks averages less than 10 per cent, depending on the specification considered. More refined measures of technological change (capturing investment in employee training and automated banking machines, for example) lead to measures of cost-inefficiency among Canadian banks averaging about 6.5 per cent. As well, the estimates indicate that Canadian banks have tended to move closer to the efficient frontier over time.

For the U.S. case, the null hypothesis of constant returns to scale is rejected as well. Increasing returns to scale of about 2 per cent are estimated.

Estimates of cost-inefficiency for the sample of U.S. banks indicate that the gap between the efficient frontier and other banks is greater than 10 per cent, which is a typical result in the academic literature on U.S. bank efficiency (for example, Berger and Mester 1997). In our preferred specification, the average cost-inefficiency measure is about 14 per cent. As well, cost-inefficiency among the U.S. BHCs has not narrowed appreciably over the sample period.

We also find that the estimate of technological progress for Canadian banks is greater than for U.S. banks. Indeed, the results suggest that the effect of technological progress in lowering Canadian bank costs is three times greater than in the U.S. case—a result that we find surprising.⁷

Finally, we find that some of the legislative changes that have occurred in the past 20 years have reduced the cost structures of banks in both countries. For example, in Canada, the financial legislation revisions in 1987 and 1997

7. Other research, such as Tang and Wang (2004), also suggests that, in the recent past, productivity growth in Canadian financial services has been greater than in U.S. financial services, but not by a large margin. In our work, the time trend used to proxy technological progress is probably capturing the large increase in Canadian bank assets in the 1990s, when banks were expanding into a wide range of financial services.

were particularly beneficial in lowering banks' costs.

Conclusions

This work examines the efficiency and productivity of Canadian and U.S. banks in three ways. First, we compare key performance ratios and find that (i) the average Canadian bank employee produces more assets than the average U.S. bank employee, and (ii) in terms of producing net operating revenue, Canadian and U.S. bank workers are similarly productive.

Second, we investigate whether there are economies of scale in the cost functions of Canadian banks and a sample of U.S. BHCs. We find larger economies of scale for Canadian banks than for the U.S. BHCs. This suggests that Canadian banks are less efficient with regard to the scale of their operations and would have more to gain in terms of efficiency benefits from becoming larger.

Third, we measure cost-inefficiency in Canadian banks and in U.S. BHCs relative to the domestic efficient frontier in each country (the domestic best-practice institution). We find that Canadian banks are closer to the domestic efficient frontier than are the U.S. BHCs, and that they have moved closer to that efficient frontier over time.

Overall, these results do not suggest relative efficiency or productivity gaps in the Canadian banking industry. On the contrary, Canadian banks compare generally favourably.

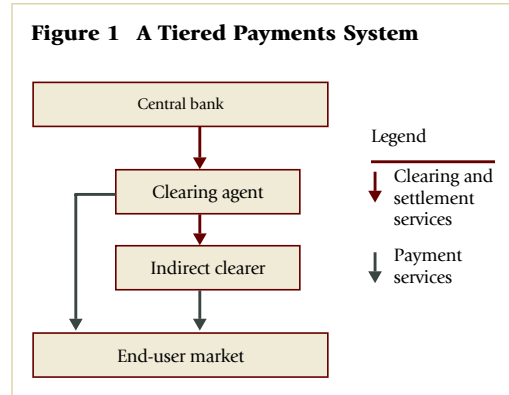
Finally, as noted above, legislative and regulatory changes have benefited efficiency in Canadian financial services. This shows the importance of removing any remaining restrictions that inhibit competition and efficiency, but provide little (or no) benefit in terms of financial soundness.

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Credit in a Tiered Payments System

*Alexandra Lai, Nikil Chande, and Sean O'Connor**



Most payment, clearing, and settlement systems are characterized by some degree of tiering. In a tiered system, some of the financial institutions participating directly in a first-tier network for clearing and settlement (clearing agents) operate a second-tier network that provides similar services to other institutions (indirect clearers). Clearing agents not only provide wholesale clearing and settlement services to the indirect clearers participating in their second-tier networks, but also compete against these same indirect clearers in the provision of retail payment services to individuals and businesses. This arrangement is illustrated in Figure 1.

Survey evidence in Canada (Tripartite Study Group 2006) indicates that because of the high fixed costs associated with operating in the first-tier network, indirect clearers prefer to participate in a clearing agent's lower-cost, second-tier network. Clearing agents choose to operate second-tier networks to obtain scale economies and additional fee revenue. There are, however, some questions about the efficiency of pricing in service markets in tiered networks.

In a tiered payments system, a clearing agent has the ability, and may have the incentive, to raise the marginal cost for an indirect clearer in order to gain a competitive advantage in the market for retail payment services. Because of data-processing lags and distribution problems in the flow of settlement funds, the process of settling payments combines settlement services with credit services to network participants. For example, clearing agents provide overdraft credit to indirect clearers. We investigate the impact of uncollateralized overdrafts provided by a clearing agent in a second-tier system on the pricing strategy for its payment services, and on equilibria in the wholesale and retail markets.

If we abstract from inter-network competition to focus on within-network competition, the analysis indicates that the incentive for the clearing agent to raise the indirect clearer's costs is mitigated by the credit risk from the uncollateralized overdrafts that the clearing agent provides to its indirect clearer. In fact, in the model, the wholesale service fee charged by the clearing agent is always lower when credit risk is a meaningful consideration. The results also indicate that a clearing agent would then alter the price of its retail services to allow

* This article summarizes Lai, Chande, and O'Connor (2006).

its indirect clearer to acquire a greater share of the retail service market and higher profits. Furthermore, with a sufficiently high degree of competition in the retail market, customers are charged lower service fees by both the clearing agent and the indirect clearer.

Approach to the Analysis

The analytical approach builds on the existing research on the vertical integration of firms in wholesale and retail markets and on settlement credit. It links and extends these separate bodies of literature.

The literature on vertical integration establishes that where there is imperfect competition in both upstream and downstream markets (Spengler 1950), and even where competition is perfect in the downstream retail market (Salop 1998), incentives exist for a firm to vertically integrate the production of complementary services in both markets. Vertical integration eliminates double markups in the integrated firm's retail price and gives the integrated firm an opportunity to raise its rival's costs. Economides (1998), for example, demonstrates that when the price of upstream (input) services is regulated, a vertically integrated firm has an incentive to impose non-price costs on its downstream rivals. In the absence of input-price regulation, Bustos and Galetovic (2003) show that a vertically integrated firm prefers to increase a downstream rival's costs through the input price.

Similar modelling approaches have been applied to securities settlement systems. In particular, Holthausen and Tapping (2004) demonstrate that a central securities depository (CSD), vertically integrated with a custodian bank, will raise the costs of a rival custodian bank. Rochet (2005) shows that a CSD has an incentive to vertically integrate with a custodian bank and would either refuse to provide a rival bank with settlement services or, if regulation prevents exclusion, would raise the rival's costs.

None of this literature models the joint provision of settlement services and credit by the service provider, which is the case in a payments settlement system. Kahn and Roberds (1998) construct a single-network model for banks facing uncertain payment inflows and outflows

through the period, with final settlement at the end on a net basis. In this system, network participants exchange intraday credit bilaterally or multilaterally to settle payments but, in doing so, also face the prospect of credit default.

Key Model Features

By combining the survey information with relevant studies on vertical integration, tiered systems, and settlement credit, we construct a model of a vertically integrated bank (the clearing agent) that competes downstream with a rival bank (the indirect clearer) in the end-user market for retail payment services. The clearing agent and the indirect clearer are Cournot competitors in the market for retail payment services,¹ but the indirect clearer purchases clearing and settlement services, and acquires overdraft credit, from the clearing agent. The clearing agent first chooses a clearing and settlement fee to charge the indirect clearer. Then, the clearing agent and indirect clearer simultaneously choose a desired volume of payment services in the end-user market and charge the corresponding retail service fee. Since each unit of service is measured by a payment transaction, and since the net value of these transactions is allowed to be random, net payment flows and settlement overdrafts from the clearing agent to the indirect clearer are uncertain at the time of their wholesale and retail pricing decisions.

Results

The results are derived from both analytical and numerical solutions to the model. The model shows that, to maximize expected net worth, the clearing agent will take advantage of its upstream position as an essential provider of clearing and settlement services to raise the indirect clearer's costs relative to its own marginal cost of clearing and settling these payments. Consequently, the indirect clearer offers its services at a higher price than those of the clearing agent, which enables the clearing agent to attract a greater share of the retail market and a relatively higher overall profit than the indirect clearer. This is the "integration" effect.

1. Cournot competitors select optimal strategies that take account of the rival's market reaction.

Credit risk to the clearing agent from the provision of overdrafts to its indirect clearer mitigates the clearing agent's incentive to raise the indirect clearer's costs. A default by the indirect clearer on its overdraft credit, resulting from insufficient profits and available assets, will lower the clearing agent's expected net worth. In selecting its pricing strategy, a forward-looking clearing agent will therefore take account of the prospect of overdraft credit to the indirect clearer, the probability of credit default by the indirect clearer, and the possible impact of higher pricing on the indirect clearer's default probability. The clearing agent must balance its potential gains in net worth from vertical integration against the potential losses it might incur by indirectly increasing its credit risk through its own pricing strategy. Therefore, recognizing that a decrease in the indirect clearer's profits implies that the indirect clearer is more likely to default, the clearing agent lowers its service fee. This is the "credit-risk" effect.

Numerical techniques help to determine whether the integration effect or the credit-risk effect dominates under different market conditions. For a broad range of parameter values, the credit-risk effect dominates. Specifically, when credit risk is meaningful to the clearing agent, it selects a wholesale service fee that is lower than the risk-free price. This allows the indirect clearer to acquire market share and earn higher expected profits, which lowers the probability of default on any overdraft credit that it may incur. There is, however, a level of retail competition below which the indirect clearer's profits are sufficiently high (with greater market power) that it can easily repay the settlement overdrafts provided by the clearing agent. Below this critical level of retail competition, credit risk is no longer a meaningful concern to the clearing agent, which allows the agent to charge a higher wholesale service fee. But the range of parameter values for which the integration effect dominates the credit-risk effect is very small. The presence of credit risk generally results in the clearing agent lowering its wholesale service fee relative to the risk-free case.

In addition to lowering its wholesale service fee when faced with sufficient credit risk, the clearing agent also selects a retail service price that lowers its own volume of retail payments. This

pricing strategy allows the indirect clearer to raise the volume of its retail payments. Despite the loss of retail market share and a lower wholesale service fee, the clearing agent earns higher expected profits from combining clearing and settlement services with overdraft credit. The indirect clearer also earns higher profits, except where the degree of competition between the indirect clearer and the clearing agent is so low that the credit risk imposed on the clearing agent is insufficient to encourage the agent to lower its fee.

While the price of retail payment services charged by the indirect clearer is always lower in the presence of sufficient credit risk, the clearing agent's price is lower only when there is a high degree of competition between the two. In other words, significant competition is required for credit risk to lower the clearing agent's fee for retail payment services and, thus, make consumers unambiguously better off.

Conclusion

In a tiered payments system, a clearing agent provides its indirect clearer with an essential input (clearing and settlement services), but may also compete against the indirect clearer in the retail market for payment services. In the stylized model developed for this analysis, the clearing agent could take advantage of its position as operator of the second-tier network by strategically pricing its wholesale clearing fee so as to raise its rival's costs. But when the credit effect dominates, the clearing agent's incentive to raise the indirect clearer's costs is mitigated by the provision of overdraft settlement loans to the indirect clearer.

When clearing agents provide uncollateralized overdraft credit to indirect clearers and credit risk is significant, wholesale service fees are generally lower and the market for retail payment services can be more competitive. Furthermore, when there is a high degree of competition between clearing agents and indirect clearers, a tiered arrangement with credit is welfare-superior, from a consumer-price perspective, to one without credit and meaningful credit risk.

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Using No-Arbitrage Models to Predict Exchange Rates

Antonio Diez de los Rios

Exchange rate predictions have many important applications. Risk managers use exchange rate predictions when deciding if (and when) to hedge currency movements. Portfolio managers use exchange rate predictions to obtain expected returns on foreign assets. Academics test their models of exchange rate determination on the basis of their ability to predict exchange rate movements.

Central bankers are also interested in having accurate models of exchange rate determination. For example, it is important to understand the forces that are driving currency movements, because different causes will have different implications for the economy. Ultimately, they may even require a different monetary policy response (Bailliu and King 2005; Ragan 2005). An assessment of international financial market stability and contagion also depends on the ability to understand large movements in currency markets.¹

Predicting currency movements is, however, a difficult task. Despite the large body of research on exchange rate modelling, a key stylized fact in international finance is that the best prediction for tomorrow's exchange rate is today's rate (known as the "random-walk forecast").² This result was first discovered by Meese and Rogoff (1983a, b) and, even 25 years later, few models can do better than this one.³ A related result, also found in the literature starting in the early 1980s, is that the forward rate does not provide the best prediction for tomorrow's exchange

rate.⁴ Thus, Clarida et al. (2003) note that "from the early 1980s onwards, exchange rate forecasting in general came increasingly to be seen as a hazardous occupation, and this remains largely the case."

This article summarizes a working paper (Diez de los Rios 2006) that proposes an arbitrage-free model of the joint behaviour of interest rates and exchange rates that provides exchange rate forecasts with improved predictive power when compared with the current set of foreign exchange rate models that do not impose these no-arbitrage restrictions.

No Arbitrage

It is hard to believe that exchange rates move independently of, for example, interest rates. The reason for such a skeptical statement is the concept of arbitrage in financial markets. If the prices of two related securities differ by a great amount, then an investor will have an incentive to buy the undervalued asset and sell the overvalued one to make a profit.⁵ Thus, in an efficient market, arbitrage ensures that the prices of both assets do not move independently. For example, spot, forward, and Eurocurrency interest rates are mutually dependent through the familiar covered interest parity condition.⁶

1. See Berg, Borensztein, and Pattillo (2004) for a review on early-warning systems for currency crises.
 2. Similarly, the best prediction at the one-month or one-year horizon is also today's exchange rate.
 3. See Bailliu and King (2005) for a review of these successful models (including the Bank of Canada's Exchange Rate Equation).

4. Finance theory suggests that a risk-neutral investor should be indifferent between buying a one-month forward contract for a foreign currency or waiting one month and buying the currency directly in the spot market. This theory, known as "uncovered interest rate parity," implies that the best prediction for the future exchange rate is its forward counterpart (see Hansen and Hodrick 1980).
 5. The technical definition of the absence of arbitrage states that it is impossible to obtain a portfolio that might provide a positive payoff (and never incur losses) without cost (see Cochrane 2001).
 6. See Mark (2001) for more details on the covered interest parity condition.

A similar argument applies to domestic and foreign bonds. These assets are essentially imperfect substitutes with different levels of exchange rate risk. For instance, a Canadian investor who buys a one-year bond in the United Kingdom will know how many pounds sterling he will get in the future, but not how many Canadian dollars. Therefore, a Canadian investor will demand compensation for bearing the exchange rate risk. In other words, he will expect compensation for holding an asset that, from his point of view, is not perfectly risk free. If the rate of return (in Canadian dollars) of this British bond does not reflect this compensation, then the prices of British and Canadian bonds, as well as the bilateral exchange rate, should adjust until any arbitrage opportunities disappear. Therefore, the absence of arbitrage opportunities links the way in which interest rates and exchange rates can move over time.⁷

Overall, these so-called “no-arbitrage restrictions” provide useful information on how to model exchange rate movements and, therefore, how to improve exchange rate predictions.⁸

Model and Methodology

Motivated by the above arguments, Diez de los Rios (2006) uses a two-country affine term-structure model⁹ to predict currency movements. The model leverages the no-arbitrage relationship between interest rates and exchange rates, itself a generalized version of the covered interest rate parity relation described above. In this model, the yield curve and the expected rate of depreciation of a currency are functions of the same set of state variables: domestic and foreign short-term interest rates.

The model is estimated for two different currency pairs: U.S. dollar–pound sterling and U.S. dollar–Canadian dollar. The dataset consists of

monthly rates of depreciation¹⁰ of these two currency pairs over the period January 1976 to December 2004, along with monthly observations of the corresponding U.S., British, and Canadian Eurocurrency interest rates for maturities of one, three, six, and twelve months. These Eurocurrency deposits are essentially zero-coupon bonds whose payoffs at maturity are the principal plus the interest payment.

The estimations are carried out using data over the period January 1976 to December 1997 in order to reserve the last seven years for an out-of-sample forecasting exercise. The exchange rate forecasts, in particular, are computed according to a recursive procedure: at each month t , the model is re-estimated using data up to and including that month, and then forecasts of the spot exchange rate, up to one year ahead, are obtained.

A “horse race” is conducted between the forecasts obtained using this no-arbitrage model and those generated by three alternative benchmarks: a random walk, a vector autoregression on the forward premiums and the rate of depreciation, and the forward-premium regression. A comparison of the author’s forecasts with those produced by the random-walk model is motivated by the fact that the random-walk model is considered to be the usual metric by which to evaluate exchange rate forecasts since the original work of Meese and Rogoff (1983a, b). However, Clarida and Taylor (1997) show that if one uses a vector autoregression (VAR) on the forward premiums and the rate of depreciation, it is possible to obtain out-of-sample forecasts of spot exchange rates that beat the random-walk model. Therefore, a VAR model is also included as a second benchmark. Finally, and for completeness, the author also includes the forecasts produced by a standard ordinary least-squares regression of the rate of depreciation onto a constant and the lagged forward premium (the forward-premium regression).

The forecasts produced by the term-structure model, as well as those of the three competing models, are evaluated in terms of two widely used criteria: the root-mean-square error (RMSE) and the mean-absolute error (MAE). The smaller these criteria are, the better the performance of the model.

7. The absence of arbitrage opportunities will not only restrict the way in which interest rates and exchange rates move, but will also restrict how interest rates at different maturities move together.
8. In fact, there is empirical evidence that one can also improve interest rate predictions if such no-arbitrage restrictions are exploited (Duffee 2002; Ang and Piazzesi 2003).
9. For a review of affine term-structure models and their applications, see Piazzesi (2003).

10. Note that a negative rate of depreciation would imply an appreciation in the currency.

Results

The author finds that using no-arbitrage restrictions reduces, for example, the RMSE in forecasting the spot U.S. dollar–pound sterling rate by about 35 per cent at the one-year forecast horizon relative to the VAR approach, and by about 15 per cent for the U.S. dollar–Canadian dollar rate. The gains from using a VAR model over a random-walk model are negligible. For example, the gain at the one-year horizon for the U.S. dollar–pound sterling pair is only 2.4 per cent (versus the 40 per cent reported by Clarida and Taylor 1997). Similar results are obtained when using the MAE criteria.

Conclusions

Overall, these results support the use of no-arbitrage methods to generate more accurate exchange rate predictions. The success of this approach provides indirect support for the assumption that markets are efficient, since it is based on a generalization of covered interest rate parity. Still, more work can be done in this direction. The predictions in these models are based exclusively on the information contained in interest rates, while one would also like to use the information contained in other macroeconomic variables (such as output growth, inflation, or even commodity prices) to obtain even better predictions. Developing a no-arbitrage model of the joint behaviour of macroeconomic variables, interest rates, and exchange rates that, at the same time, is able to deliver good exchange rate forecasts is a new challenge that is left for further research.

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