



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). Other linkages of importance may include those between the Canadian financial system and the rest of the economy, as well as those with the international environment, including the international financial system. This section summarizes some of the Bank's recent work.

Within the next several years, the implementation of an updated global bank capital accord (Basel II) developed by the Basel Committee on Banking Supervision will begin. It should strengthen the stability of the global financial system as a whole. One way in which Basel II is designed to achieve this goal is by aligning capital more closely with credit risk in order to ensure that appropriate levels of capital are held by the banking system. But because credit risk is strongly related to the business cycle, some observers have wondered whether the new rules would exacerbate cyclicality in the banking industry and, in particular, the behaviour of bank capital and lending. In *Basel II and Required Bank Capital*, the potential for cyclicality in bank capital requirements is explored by applying Basel II rules to Canadian bank data on corporate and sovereign exposures under various scenarios. One finding is that required capital for corporate exposures could be more volatile than under Basel I, in particular, the greater the use of market-based measures of credit risk relative to "through-the-cycle" measures.

Models of information asymmetry suggest that if investors believe that insiders systematically trade corporate shares on material, non-public information, this will ultimately raise the cost

of capital for firms. In *Pre-Bid Run-Ups Ahead of Canadian Takeovers: How Big Is the Problem?* Bank of Canada staff investigate whether there is evidence of illegal insider trading in Canada ahead of a specific type of corporate event; namely, a takeover bid. This line of research addresses an important dimension of capital market efficiency—the degree of information asymmetry among market participants.

What drives the common variation in the movements of international stock markets? Knowledge of how asset prices in an open economy like Canada's are affected by foreign information is of direct importance to understanding how the Bank of Canada could reduce the likelihood that problems in another financial system would trigger instability in Canada. In particular, an assessment of the stability of financial markets requires an understanding of how and what information is incorporated into asset prices. The article *Monetary Policy, Private Information, and International Stock Markets* summarizes a paper in which researchers assess whether sophisticated investors possessing superior (private) information about future U.S. interest rates and stock market movements affect international stock market comovements.

Basel II and Required Bank Capital

*Mark Illing and Graydon Paulin**

Within the next several years, implementation of an updated global bank capital accord (Basel II) will begin in a number of countries. The new framework is designed to align bank capital more closely with risk, thereby ensuring that appropriate levels of capital are held by the banking system. In particular, capital requirements for credit risk will be modified along the lines of how the most sophisticated banks currently calculate economic capital for their loan books. Since credit risk is strongly related to the business cycle, however, it is useful to examine the degree to which required bank capital is likely to be cyclical.

Basel II is composed of three “pillars.” The first is an enhanced set of rules for calculating minimum capital requirements, embodying advances in risk measurement since the first capital accord (Basel I). The second pillar addresses the supervisory review of bank capital adequacy, while the third addresses disclosure rules to facilitate the public assessment of banks.¹ The three pillars together will determine the actual level of capital held by banks, but this article focuses on the minimum capital requirements arising from the first pillar.

The central objective of Basel II’s first pillar is to increase the sensitivity of bank capital to the risks associated with specific classes of financial assets (particularly credit risk). To this end, Basel II offers banks two potential approaches for calculating required capital: the Standard approach and the Internal Ratings Based (IRB) approach. The latter is divided into the Foundation and Advanced approaches. The major Canadian banks, provided they meet regulatory requirements, are most likely to adopt the Advanced IRB approach.

With respect to credit risk, a key aspect of Basel II’s Advanced IRB approach is its use of a credit value-at-risk model (VaR)² to determine minimum

levels of regulatory bank capital and loss provisions.³ Banks that meet rigorous standards will be allowed to use their own parameter estimates in this model.

If the credit risk faced by a bank is cyclical, it is conceivable that the output of this VaR will yield cyclical minimum capital requirements. Credit risk in Canada does indeed contain a strong cyclical component. Together with the observation that over 90 per cent of the credit losses of Canadian banks in the past two decades have occurred on their corporate and sovereign exposures,⁴ this raises the issue of how Basel II might affect the cyclicity of required bank capital held against their corporate and sovereign portfolios.

To address this question, we applied Basel II rules to two decades of Canadian bank data on corporate and sovereign exposures and examined the results under various scenarios.⁵ An

1. A full description of the pillars can be found in BIS (2004).
2. A value-at-risk model generates a statistical distribution of the potential loss associated with holding a specific financial portfolio over a given period (one year in the case of Basel II).
- * This is a summary of a recently published working paper (Illing and Paulin 2004).

3. Bank capital will continue to be defined according to the rules outlined in Basel I and its subsequent revisions. Loss provisions, alternatively known as reserves, are an amount set aside by banks to cover anticipated losses on assets, potential litigation costs, and other costs not usually defined as operating expenses.
4. Exposures include loans, securities, and other claims. The corporate sector includes interbank exposures. Corporate and sovereign exposures currently represent approximately 28 per cent and 7 per cent of overall assets in the Canadian banking system, respectively.
5. Other types of bank exposures were not examined (e.g., residential mortgages or asset-backed commercial paper), since in aggregate they do not generate significant losses, and are thus expected to have relatively stable capital requirements.

important caveat is that these simulations cannot capture behavioural responses that might be induced by the new rules. In addition, we had to estimate a significant amount of the data—most critically, the credit-quality distribution of corporate exposures. Therefore, we report results for a range of scenarios that cover different portfolio distributions and assumptions. These scenarios provide a sense of how significant the behavioural responses might be and how sensitive the Basel II requirements are to various assumptions. Finally, our base-case simulations use what we consider to be the most plausible and realistic assumptions for the Canadian banking system.

The simulations use detailed data on actual banking system exposures to corporations (by industry) and to sovereigns (by country). However, since the precise credit-quality distribution of the corporate exposures is unknown, we provide results for high-, medium-, and low-quality portfolios (indicated by their median credit ratings). The distribution for sovereign exposures is known precisely, so estimation is not necessary.

We use two methods to track the evolution of the corporate distributions over the period 1984–2003. First, we use credit-rating-transition matrices based on the actual evolution of Canadian corporate credit ratings (from ratings agencies) over this period. Credit ratings provide relatively stable estimates of credit risk but are typically slow to respond to a rapid change in credit quality. Second, we track the change in credit quality with credit spreads on corporate bonds. These spreads tend to respond quickly to changes in credit quality but are more volatile than credit ratings.

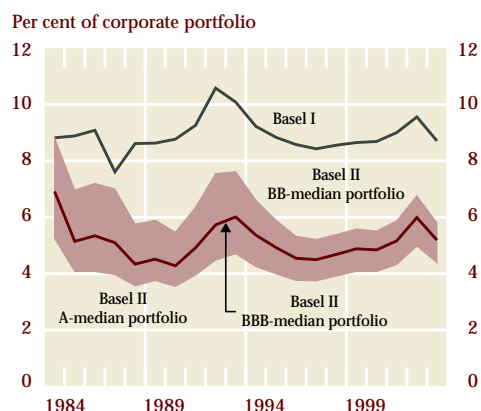
Both methods are based on data that pertain to only large Canadian corporations.⁶ However, these two methods are simplified characterizations of common techniques that banks use to measure credit risk. These assumptions and data are fed into Basel II’s Advanced IRB model to generate our simulated results.

Note that the Basel II model distinguishes between expected (average) loss and unexpected (upper-bound) loss. Banks must make provisions against expected loss (or hold capital against the shortfall), and they must hold capital against unexpected loss. We present results

6. Thus, we assume that the credit-quality distribution of small corporations is the same as that of large corporations.

Chart 1 Requirements for the Corporate Exposures of Canadian Banks

Basel I versus simulated Basel II (credit ratings)



Basel I ratio includes capital plus general and specific provisions.
 Basel II ratio includes minimum required capital for unexpected loss, required specific provisions for expected loss, and a charge for operational risk.
 Source: Authors’ calculations based on BIS (2002).

Table 1 Volatility of Basel II Requirements

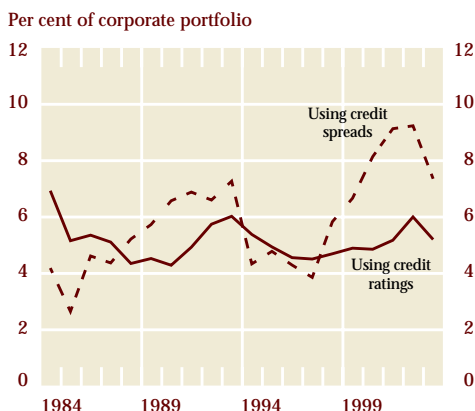
For the Canadian Banking System, 1984–2003

	Portfolio quality	Standard deviation in percentage points		
		Basel I including provisions	Basel II using credit ratings	Basel II using credit spreads
Corporate exposures of Canadian banks	A-median	0.39	0.44	1.49
	BBB-median	0.60	0.65	1.80
	BB-median	0.86	0.96	2.71

Memorandum item:
 Observed standard deviation of Canadian banks’ total actual eligible capital plus allowances for losses was 0.90.

Note: The comparison is based on Basel I capital requirements plus actual provisions. Basel I requirements are estimated prior to 1988. Basel II requirements include capital for unexpected loss, provisions for expected loss, and an operational charge as per BIS (2002).

Chart 2 Alternative Simulated Basel II Requirements for Corporate Exposures of Canadian Banks

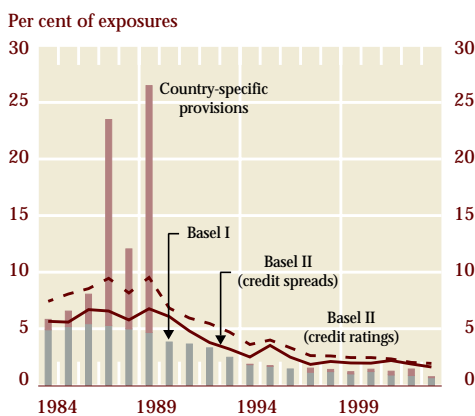


Both ratios include minimum required capital for unexpected loss, required specific provisions for expected loss, and a charge for operational risk. A median portfolio rating of BBB+ and an LGD of 45 per cent are assumed.

Source: Authors' calculations based on BIS (2002)

Chart 3 Requirements for the Sovereign Exposures of Canadian Banks

Basel I versus simulated Basel II



The Basel II ratio includes minimum required capital for unexpected loss, required specific provisions for expected loss, and a charge for operational risk.

Sources: Moody's (2004), S&P (2004), and authors' calculations based on BIS (2002)

for the total requirements (minimum required capital and provisions combined). Although the tax implications vary between the two, both affect earnings. Canadian banks raise most new capital through retained earnings, while provisions are a deduction from earnings.

Corporate Exposures

When credit ratings are used to measure corporate credit risk, the simulated minimum capital and provisions for corporate exposures required under Basel II over the period 1984–2003 fell by about one-third relative to the equivalent Basel I measure (Chart 1).⁷ And there was only a modest increase in the volatility of requirements (Table 1, middle column).⁸

In contrast, when yield spreads on bonds are used to measure credit risk, simulated minimum requirements for corporate exposures were clearly more volatile under Basel II than under Basel I (Table 1, last column). For example, using this measure, required capital and provisions for a BBB-median-rated corporate portfolio doubled between 1997 and 2002 (Chart 2), a period where there was substantial cyclical deterioration in credit quality.

Sovereign Exposures

Next, we measured sovereign credit risk with both country-specific credit ratings and yield spreads on sovereign bonds. In both cases, the simulated Basel II capital and provisions for sovereign exposures were about two times higher than the capital requirements under Basel I (Chart 3). However, during the late 1980s several Canadian banks made large country-specific provisions for the debts of less-developed countries (LDC), most of which occurred before the Basel I rules actually took effect.⁹ If we add

7. We compare Basel II total requirements to Basel I capital requirements plus actual provisions adjusted for the credit-quality distribution of the portfolio.
8. Although the decline in capital sounds dramatic, the results are consistent with those obtained elsewhere. See, for example, Kiesel, Perraudin, and Taylor (2003) and French (2004) for U.S. banks.
9. In addition to the implementation of Basel I in 1988, the supervisory regime in Canada was being reorganized, and the large provisions partly reflected the recognition of losses that had, in fact, occurred earlier in the decade during the previous supervisory regime.

these provisions to the Basel I ratio (the red bar in Chart 3), then the Basel II requirements appear to be less volatile. This is because Basel II rules require banks to either provision against or capitalize probable losses as *they are identified*.

Conclusions

Our simulations illustrate the change in minimum required bank capital in response to historical changes in the level and credit distribution of bank assets. By definition, however, they do not capture the behavioural changes that would be induced by the different incentives under Basel II. To some extent, however, the different scenarios provide an indication of the potential behavioural impact.

We find that minimum required capital for corporate exposures could be more volatile than under Basel I. The increase in volatility is greater the lower the quality of the portfolio and the greater the use of market-based measures of credit risk (such as yield spreads) relative to “through-the-cycle” measures (such as credit ratings). In contrast, we find that for sovereign exposures the new rules could produce higher, but less volatile, minimum capital requirements.

If the increased risk sensitivity in Basel II contributes to changes in overall required capital that are unacceptable to the banks, they may try to mitigate this effect by adjusting their lending (reducing it during periods of deteriorating credit quality) or by adjusting the quality distribution of their portfolios (shifting towards higher-quality assets). Thus, the actual observed volatility in capital may not change significantly once Basel II is implemented, but perhaps only because banks are adjusting their loan portfolios accordingly. This is precisely the cyclical behaviour that has raised some concern.

Several factors may mitigate the potential impact of Basel II on the cyclical behaviour of capital, however. Cyclicity is already present in the banking system. Indeed, the volatility of actual bank capital over the 1984–2003 period was already comparatively high relative to our base-case scenario and most of the alternatives examined, suggesting that non-regulatory phenomena are also important factors influencing volatility in bank capital.

Our analysis shows that an important consideration is precisely how banks choose to calculate their capital requirements, which will also be influenced by accounting and tax regimes that vary across countries. Our expectation is that they would tend towards smoother measures of credit risk (such as credit ratings), although these effectively reduce the short-term sensitivity to changes in risk. Canadian banks are also well capitalized, and they may use this high level of capital to create an effective buffer to absorb volatility in required capital.

Eligible banks might be expected to opt for the IRB approach if it provides them with potential efficiency gains (i.e., owing to lower required levels of capital than under the Standard approach). As suggested above, to offset the increased volatility of minimum capital requirements that arises from the IRB rules, banks may tend to maintain buffer stocks of capital, in which case, there may be little induced cyclicity in lending via this channel. They may follow this strategy if the resulting level of capital, including the buffer, would be lower than under Basel I.

The analysis in this article focused on the implications of Basel II’s first pillar, and implies that banks need to carefully assess which method they will use to calculate required capital in the IRB approach, as well as the implications for the desired level of buffer capital. In practice, the level of capital actually held by banks will also be influenced by Basel II’s second and third pillars. This analysis emphasized the banking system’s corporate and sovereign portfolios, which make up about 35 per cent of total bank assets and which have the greatest potential for cyclicity in capital requirements. One would expect the results to be less pronounced for the banking system as a whole, because the capital requirements for the remaining 65 per cent of bank assets are expected to be relatively stable.

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Pre-Bid Run-Ups Ahead of Canadian Takeovers: How Big Is the Problem?

*Michael R. King and Maksym Padalko**

This study addresses an important dimension of capital market efficiency; namely, the degree of information asymmetry among market participants (Bauer 2004). Insider trading is defined as trading by managers and board members in the stock of their own firms. Regulators in many countries have adopted securities laws restricting when and how these corporate insiders may trade in these shares. These laws make it illegal for insiders to trade while in possession of material, non-public information, or to share this information selectively with other investors. Instead, companies are required to disclose material information through a press release so that all investors have an equal opportunity to trade on this information. Despite arguments that suggest illegal insider trading is a victimless crime that promotes market efficiency and provides an efficient means of compensating managers, regulators have taken the view that it is harmful to public welfare (Bainbridge 2000). Models of information asymmetry suggest that if investors believe that insiders systematically trade on material, non-public information, this will increase the rate of return demanded by less-informed investors, widen the bid-ask spreads set by market makers, and reduce liquidity in secondary markets. These effects would raise the cost of capital for firms and ultimately hurt public welfare by reducing economic growth.

Scope

This paper investigates whether there is evidence of illegal insider trading in Canada ahead of a specific type of corporate event; namely, a takeover bid. We examine 420 takeover bids of

publicly listed Canadian firms from 1985 to 2002. We determine whether there are any systematic price and volume increases in the target firm's shares ahead of the first public announcement (a pre-bid run-up). We document the pattern of these pre-bid run-ups and compare them with the results from similar studies of U.S. takeovers. We propose a test to differentiate between competing explanations of run-ups based on the coincidence of abnormal price movements and abnormal volume, and the timing of the pre-bid run-up in relation to the first public announcement.

Methodology

Pre-bid run-ups ahead of a takeover announcement may be caused by information leakage as a result of insider trading, market anticipation by investors who correctly identify a potential takeover target prior to the announcement, or some combination of both. We begin with the assumption that capital markets exhibit informational efficiency; namely, that stock prices incorporate all public and private information about a firm. As our null hypothesis, we propose that pre-bid price run-ups reflect the market's anticipation of a takeover announcement. Investors anticipate that a given firm will be subject to a takeover based on rumours in the press, an analysis of industry trends, or factors specific to a company, such as financial distress. This market anticipation—whether accurate or not—becomes incorporated into prices through trades, leading to a run-up ahead of the first public announcement.

The alternative hypothesis is that pre-bid run-ups are caused by information leakage associated with insider trading. In this scenario, the increase in the stock price ahead of the announcement of a takeover bid is caused by insiders who are trading illegally to profit from the price jump

* This article summarizes a forthcoming Bank of Canada working paper.

when the takeover is announced. Studies of actual cases of illegal insider trading support this view. These studies document that illegal insider trades are accompanied by both abnormal price movements and abnormal trading volume in a stock (Cornell and Sirri 1992; Meulbroek 1992). Illegal insider trading typically takes place far ahead of the announcement, since insiders seek to avoid the period shortly before the announcement when regulatory scrutiny is highest. We use these stylized facts to identify illegal insider trading, consistent with the detection algorithms used by regulators when reviewing trading patterns after major corporate events. This approach cannot be used to prove illegal insider trading, but it can be used to detect its presence or to suggest its absence. The key point to note is that abnormal price movements that are not accompanied by abnormal volume changes (or vice versa) would constitute a rejection of this alternative hypothesis. Likewise, abnormal price movements or volumes that occur shortly before the announcement are more likely to be caused by market anticipation.

We conduct a standard event study to examine abnormal price movements and trading volumes (MacKinlay 1997). This approach involves choosing an event—such as a takeover announcement—and looking at the behaviour of the stock before and after the event. The aim is to determine how the event affected the stock by comparing actual movements in stock prices with changes that might have been expected if the event had not taken place. For each takeover in our sample, we set the date of the announcement as day 0, and we calculate daily abnormal price movements over the prior three months. We then calculate the average abnormal price movements across the 420 transactions for each day in our event window, and we accumulate these daily abnormal price movements over some time horizon. Given that we expect no abnormal price movements in the absence of a takeover announcement, we test to see whether these average and cumulative abnormal price movements are statistically different from zero using both a standard parametric z-test and a non-parametric, signed-rank test. We conduct a similar analysis of trading volume using average abnormal volume and cumulative average abnormal volume for each of the 420 takeover announcements.

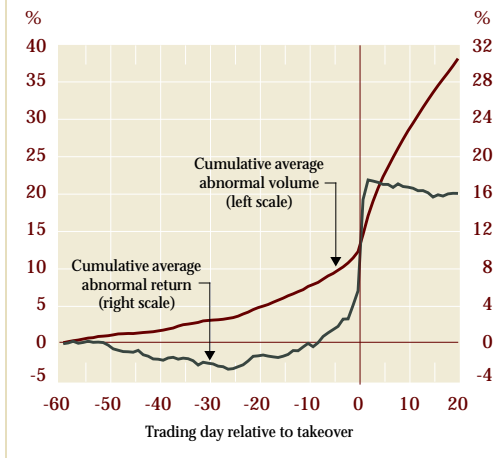
Summary of Findings

We find that both average and cumulative abnormal price movements become positive and statistically significant only shortly before the first public announcement (Chart 1). Across our sample, the average abnormal price movement on day 0 is 9.8 per cent, which captures the increase in the stock price on the day when the takeover is announced. The magnitude and timing of pre-bid run-ups for the Canadian sample are very similar in magnitude to run-ups documented for U.S. takeovers, suggesting that stock prices react in the same manner in both countries.

We divide our sample into various sub-samples to investigate the impact on the run-ups of industry membership and the time period when the takeover bid occurred. Previous studies suggest that a clustering of takeovers in one sector or during one time period increases the ability of the market to anticipate future potential takeovers. Our sample exhibits a high number of takeovers in the natural resource sector, and a clustering of bids over a few key years. We hypothesize that the cumulative abnormal price movements for takeovers of natural resource firms should be higher than for non-resource firms that are more heterogeneous. Contrary to our expectations, the run-up for natural resource firms is almost half the comparable run-up for non-resource firms. Additional analysis is needed to explain this result.

We also consider the impact of institutional changes on pre-bid run-ups. If illegal insider trading is the source of pre-bid run-ups, increased supervision and enforcement, as well as advances in technology should discourage this behaviour by making it easier to detect ex post. The resources devoted to monitoring and enforcement increased significantly in 1998, after the Ontario Securities Commission became self-funded. At the same time, the TSX closed its trading floor and moved all stocks to an electronic trading system. Both changes lead us to expect that pre-bid run-ups may be smaller post-1997 than during the earlier period. Instead, we find that both the pre-bid run-ups and the price jump over the event window were larger for takeovers announced after 1997. This finding, together with the finding that more media rumours are observed over this period, suggests that market anticipation has increased,

Chart 1 Cumulative Abnormal Return and Volume for 420 Takeovers, 1985 to 2002



possibly because of improvements in market transparency. This hypothesis will be tested in future research.

To test whether pre-bid price run-ups are explained by information leakage or market anticipation, we examine whether abnormal price movements during the pre-event window are accompanied by abnormal trading volumes. A naïve comparison of the abnormal price movements during the pre-event window with the abnormal volumes on the same day suggests that there are almost no cases, on average, when both were observed on the same day (Chart 1). A more formal test of the relationship is provided by running panel regressions of abnormal volumes on abnormal price movements. Abnormal price movements are statistically associated with abnormal volumes at the 99 per cent level, although the small size of the coefficient suggests that the relationship is not economically important. From these panel regressions, we conclude that abnormal price movements during our pre-event window are not importantly associated with abnormal volumes. We fail to reject the null hypothesis, and conclude that pre-bid run-ups are caused by market anticipation, not by information leakage as a result of illegal insider trading.

Conclusion

We find evidence of pre-bid run-ups in a sample of 420 Canadian takeovers, consistent with similar studies of U.S. takeovers. In our study, pre-bid run-ups occurred shortly before the first public announcement and were of comparable magnitude to the run-ups ahead of U.S. takeovers. The size of price run-ups increased in our sample for deals announced after 1997, during a period when regulators devoted greater resources to the monitoring of markets and the enforcement of insider-trading regulations. Contrary to our expectations, run-ups were lower for firms in the natural resource sector, despite the clustering of deals in this sector.

Based on the pattern of run-ups, the absence of abnormal trading volumes on days with abnormal price movements, and the timing of the run-up shortly before the announcement date, we conclude that pre-bid run-ups are consistent with market anticipation and reject an explanation based on information leakage from illegal insider trading. This study suggests that Canadian

equity markets are efficient, and does not support the view that Canada has a greater problem with insider trading than the United States.

While this conclusion applies to the average takeover announcement in our sample of 420, we cannot dismiss the possibility of illegal insider trading in any of the individual takeovers in our sample. Likewise, this article has not examined insider trading ahead of other important corporate events, such as earnings announcements, dividend changes, and bankruptcy announcements. We leave these topics to future research.

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Monetary Policy, Private Information, and International Stock Markets

by Gregory H. Bauer and Clara Vega*

Financial economists are uncertain as to the cause of common movements in international stock markets. Previous studies have found that only a small fraction of the movements can be attributed to public news about macroeconomic variables. This has led some to suggest that investor irrationality is responsible. In this article, we assess whether investors possessing superior (private) information about future U.S. interest rates and stock market movements affect international stock market comovements.

What drives the common variations in international stock market movements? This is an important question for a number of reasons. First, researchers have identified a large degree of risk reduction in equity portfolios from diversifying funds into international stocks. The more that stock markets around the world move together, the smaller are the gains from diversification. Second, it is important to know whether the comovements are driven by rational responses to new information or by the over-reaction of one market to movements in another. Third, it is important for the Bank of Canada to understand how asset prices in a small, open economy are affected by foreign information. In particular, an assessment of the behaviour of financial markets requires an understanding of how and what information is incorporated into prices. Finally, it is important for central bankers to know how much of the movement is caused by changes in monetary policy. This will, in turn, help explain how the cost of capital for domestic corporations is determined in global markets.

Background

Financial research provides a compelling answer to this question. Asset-pricing models show that expected stock returns vary in response to changes in risk-free interest rates, changes in expected future cash flows, and/or changes in the equity risk premium.¹ In a rational asset-pricing framework,

1. The equity risk premium is the extra return required on (risky) stocks above the return required on (less risky) bonds.

* This article summarizes a recently published Bank of Canada working paper (Bauer and Vega 2004).

with integrated international stock markets, comovements in international stock returns would be driven by news about macroeconomic variables that affect cash flows, risk-free rates, or risk premiums in many countries.²

But existing studies, using daily or monthly data, show that public news about macroeconomic variables has a limited impact on international equity returns. For example, King, Sentana, and Wadhvani (1994) construct a factor model of monthly returns in 16 national stock markets and examine the influence of 10 key macroeconomic variables.³ They conclude that the public news components of these observable variables contribute little to variations in world stock markets. Rather, there is a dominant unobservable (i.e., non-public) factor driving international returns. They interpret the common factor as an index of “investor sentiment,” suggesting a degree of market irrationality. Other studies also find that public news about macroeconomic variables has little cross-market impact; e.g., Karolyi and Stulz (1996), Connolly and Wang (2003).

If public news about macroeconomic variables is not responsible for the comovements, could some “market friction” be responsible? One potential friction is asymmetric information. Information is asymmetric when some investors have superior (private) information about the

2. In a “rational” market, prices fully and accurately reflect all available information. Markets are “integrated” when there are no barriers to trade in financial assets between countries.
3. In a factor model, the expected returns on a large number of stocks are explained by a much smaller number of variables.

returns on assets in their own country. The standard view is that these “sophisticated” agents are either insiders in a company or obtain the private information about the firm by analyzing public information in a superior manner. When sophisticated agents trade, their private information is (partially) revealed to the market, causing revisions in asset prices. Trading based on private information could thus be a potential cause of the comovements in international stock returns if the agents had superior knowledge about the common macroeconomic factors that price equities in many countries. But the economic origins of such private information remain unexplored. Indeed, Goodhart and O’Hara (1997) wonder, “in the international context, how could private information be expected to have a global impact?”

One possible answer to this question is that sophisticated investors could have superior information about future macroeconomic factors that will affect both U.S. equity prices and interest rates. This private information about U.S. macroeconomic factors would likely be useful in making trades in stocks around the world. The large size of the U.S. economy and the links between U.S. and foreign firms suggest that U.S. macroeconomic conditions are likely to have a global impact. Indeed, if international equity markets are integrated, then private information about U.S. factors will give informed agents superior knowledge about the global factors that price stocks in many countries (Albuquerque, Bauer, and Schneider 2003). Thus, it is likely that the private information of sophisticated investors trading in (liquid) U.S. markets will help explain the cross-section of international equity returns.⁴ This article therefore addresses the question of whether both public and private news about U.S. macroeconomic factors could help explain comovements in international stock markets.

Methodology

In our paper, we test the potential cross-market effect of trading on private information by looking at information revealed in two U.S. markets.

4. Another source of such global private information is the trading floors of large banks. Traders see customer order flows in many markets around the world. This superior knowledge of global demand conditions would be useful for the firm’s proprietary traders.

The first is the Eurodollar futures market that trades on the Chicago Mercantile Exchange. The Eurodollar futures contract is considered to be the most liquid exchange-traded money-market instrument in the world. Traders use the market to hedge against, and speculate on, future movements in the Eurodollar interest rate (the rate on U.S.-dollar deposits in banks outside the United States). We look at holding-period returns on and trades in the six-month Eurodollar futures contract.

The second market is the S&P 500 Exchange Traded Fund (ETF), known by its acronym as the SPDR (Spider), which began trading on the AMEX in 1993.⁵ This fund is designed to track the performance of the S&P 500 Index, a broad index of U.S. stocks. The SPDR is a very liquid security; in mid-2003, the fund had over US\$37 billion in assets under management, with an average daily trading volume totalling US\$4 billion.

We examine the impact on foreign stock markets of public and private news originating in these two U.S. markets. We wish to observe the prices of foreign stocks at the same time that we observe prices in the two U.S. markets. To do this, we use foreign ETFs. Barclays Global Fund Advisors manage “iShares” that trade on the AMEX. They are baskets of foreign stocks put together to track the performance of foreign market indexes compiled by Morgan Stanley Capital International. We also use the ETFs of 12 other countries (Germany, Japan, the United Kingdom, Switzerland, Canada, France, Netherlands, Hong Kong, Spain, Sweden, Australia, and Italy). These countries were selected because they have developed equity markets and ETF data that are available over the sample period.

5. ETFs are shares of a portfolio of stocks that trade continuously on an exchange and are designed to closely track the performance of a specific index. Managers of ETFs may buy either all the stocks in the index or a sample of stocks to track the index. Market participants are able to create and redeem shares in an ETF when its market price differs from the value of its underlying index. This ability to “open” the funds at any time ensures that ETFs trade near their net asset value. Elton et al. (2002) conclude that the SPDR closely tracks the S&P 500 Index, since the difference between the two is less than 1.8 basis points per annum.

Our analysis proceeds in two steps. In the first, we obtain public and private information shocks in the two U.S. markets by adapting techniques from the microstructure literature (primarily Hasbrouck 1991). Our analysis relies on the use of high-frequency data to obtain better estimates of the impact of news on prices. We use regression analysis to remove the impact of short-run microstructure effects from the high-frequency price and trade data. The residuals from these regressions represent (noisy measures of) public and private information shocks occurring in U.S. markets.

In the second step, we use a factor model of international equity returns to evaluate the effects of the U.S. public and private information shocks on foreign equity markets.⁶ We examine how well these factors are able to explain comovements in international stock markets over holding periods ranging from one-half hour out to one week.⁷ The effects of private information will be revealed if unanticipated trades in U.S. markets are significant for longer holding periods (one day to one week). This is because unanticipated trades are a combination of random liquidity shocks plus private information. Liquidity shocks have only a short-run effect on prices, while the effect of private information is permanent.

Results

The analysis yields a number of interesting findings. The first stage of the analysis reveals that some agents have superior knowledge about future U.S. interest rates and aggregate equity market returns. This suggests that the old way of viewing private information as a “firm-specific” phenomenon is not correct; sophisticated investors can have private information about entire markets. This comes from their superior interpretation of public news.

In the second stage of the analysis, there is strong evidence of information spillover across markets. Both private and public information

shocks revealed in U.S. markets are components of the factors that model the cross-section of international equity returns. Contrary to the earlier literature, public information shocks do have an effect, because they are more precisely measured in the microstructure data than they were in the daily or monthly data. Private information shocks are also a statistically significant part of the factor. Sophisticated investors have an impact on global markets when their superior information is incorporated into international equity returns. This trading based on private information is partly responsible for the common variation in the movements of international stock markets.

An interesting finding concerning monetary policy is that unanticipated interest rate changes made by the U.S. Federal Reserve Board influence foreign stock markets. A policy-driven increase in U.S. interest rates lowers foreign stock returns. Changes in U.S. interest rates that are not associated with monetary policy are not statistically significant. Thus, changes in U.S. interest rates affect the international cost of equity capital only when they are associated with changes in monetary policy.

These shocks are quantitatively important. For example, a shock of one standard deviation to private information about future U.S. interest rates is equivalent to almost 25 per cent of the standard deviation of the total factor driving weekly returns. A similar shock to private information about U.S. equity markets is equivalent to 17 per cent of the standard deviation of the factor.

Private information can originate in two ways. Sophisticated agents, such as hedge fund managers, can conduct “top-down” analyses, where they generate private information about macroeconomic fundamentals from a superior interpretation of public information.⁸ The fundamentals could be related to either the U.S. economy or foreign economies. In either case, with integrated international markets, such information would be useful for capturing return variations in many countries.

Alternatively, order flow in U.S. markets could be acting as a “bottom-up” aggregator of diffuse

6. The factors are linear combinations of the public and private information shocks from U.S. money and equity markets.

7. Foreign stocks will also respond to news released in their home markets. Thus, the approach does not measure the effects on asset prices of all trades based on private information, but only a subset of these trades.

8. A “top-down” fund manager is an individual who has a well-developed view of the macroeconomy and uses this view to invest in many different sectors.

private information. Evans and Lyons (2004) present a model of the foreign exchange market where order flow aggregates the dispersed private information about productivity shocks in two countries. They note that while productivity shocks would occur at the level of the firm, aggregate trades by agents in the country would give a more precise estimate of the country's productivity shock for that period. They also note that agents' trades could be aggregating information about other variables at the micro level, such as money demand. Our U.S. shocks can be interpreted as money-demand shocks and real shocks arising from firm-level information. Financial firms in the United States that observe a large cross-section of customer order flows could extract such information and use it for proprietary trading. Again, with integrated markets, such U.S. information shocks would have an international effect.

Conclusion

The goal of this research is to deepen our understanding of the links between movements in the prices of foreign assets and news (public and private) originating in U.S. money and equity markets. Our first contribution is to show that some agents have private information about future U.S. interest rates and about aggregate returns in equity markets. Our second contribution is to show that this superior knowledge affects equity markets abroad. This finding gets to the core of Goodhart and O'Hara's (1997) question of how private information can have a global impact. Not only do we show that public and private information about U.S. interest rates and aggregate equity markets predicts future movements in foreign equity markets, but we also show that these are components of factors that are priced in the cross-section of international equities.

The analysis raises a number of additional questions. Are other sources of private information available to sophisticated investors? While monetary shocks are important, there may be "real" shocks related to technology or productivity that sophisticated investors observe. In addition, who are the investors who obtain this information? Is it solely American investors who have superior knowledge about American markets? It is likely that sophisticated foreign investors—such as offshore hedge funds—could also obtain this information. Finally,

does this private information affect other assets, such as foreign exchange and fixed-income markets? Answering all these questions requires further analysis.

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