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# Bank of Canada Review

Winter 2008–2009



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## Chargex

*David Bergeron, Curator, Currency Museum*

The story of Chargex in Canada originates with the establishment of BankAmericard in the United States. In 1958, the Bank of America launched BankAmericard in response to the public's growing demand for credit following the post-World War II economic boom. While the credit card program of several American banks, including the Bank of America, suffered from growing pains early on, it was the vision of Dee Hock, the founder of Visa International, that changed BankAmericard's fortunes. In 1968, Hock persuaded the Bank of America to sell its credit card program to form a company called National BankAmericard Incorporated (NBI), owned by a conglomerate of chartered banks. To further expand its network, NBI began issuing licences for BankAmericard in other countries, such as Japan, the United Kingdom, and Canada.

Impressed with the success of BankAmericard in the United States, the Canadian Imperial Bank of Commerce purchased a licence from NBI to market the card in Canada. A co-operative venture was formed with the Royal Bank, the Toronto-Dominion Bank, and the Banque Canadienne Nationale to ensure the success and profitability of the program. The name "Chargex" was chosen from over 1,000 entrants, following a public contest to name the new card.

The first cards, issued in 1968, adopted the familiar gold, white, and blue colour scheme of BankAmericard. Devoid of any computer technology, the cards simply carried the issuing authority's name at the top, along with the Chargex logo and the cardholder's

name, account number, and signature. On the back were the terms governing the use of the card. Only in 1978 was the magnetic stripe, developed by IBM, added to Chargex cards. The Bank of Nova Scotia began to issue Chargex cards in 1973, and the Mouvement Desjardins du Québec followed suit in 1980.

In 1974, with a rapidly expanding network and customer base, international licence holders of BankAmericard, including Chargex, chartered the International Bankcard Company (Ibancor) to manage BankAmericard operations outside the United States. To reflect the international scope of the company, its members felt that a new name was needed. Following another competition in 1976, the company's name was changed to Visa, which would be recognizable in many languages, easy to pronounce, and easy to remember. In Canada, the new name and logo were phased in over a couple of years, until Visa replaced the Chargex brand.

Since the launch of Chargex, Visa Canada (along with its principal rival, MasterCard) has dominated the credit card industry in Canada. There are currently 64.1 million Visa and MasterCard credit cards in circulation in Canada, with Visa holding about 72 per cent of market share. Although the days of Chargex are long gone, credit cards are here to stay.

The artefacts on the cover are part of the National Currency Collection of the Bank of Canada.

Photography by Gord Carter

# The Role of Dealers in Providing Interday Liquidity in the Canadian-Dollar Market

Chris D'Souza, *Financial Markets Department\**

- *Dealing institutions operating in foreign exchange markets not only provide liquidity throughout the trading day, they are key participants in providing interday liquidity.*
- *Part of the compensation dealers receive for holding undesired inventory balances derives from the information they receive through customer trades.*
- *Evidence presented in this article suggests that Canadian dealers are more likely to provide interday liquidity to foreign, rather than Canadian, financial customers, since foreign financial flows can be more informative about future movements in the exchange rate.*
- *A statistical relationship is revealed between the supply of liquidity provided by non-financial firms and that provided by dealing institutions across time, and across markets.*
- *When customer trades are informative, dealers manage risky positions across spot and forward markets. By operating in both markets, dealers can provide liquidity in one market, while partially hedging that risk in the other.*

In financial markets where trading is dispersed and immediacy is desirable, it is important to understand how liquidity is provided, and who provides it.<sup>1</sup> An illiquid or poorly functioning foreign exchange (FX) market, for example, imposes additional transactions costs on companies engaged in international trade or involved in foreign investment and funding activities. As well, it may hinder the speed with which information is reflected in the exchange rate.

Although intraday liquidity in FX markets is provided by dealers who stand ready to buy and sell foreign exchange at their posted bid/ask quotes throughout the trading day, it is commonly assumed that dealing institutions hold only limited interday (overnight) FX positions.<sup>2</sup> Bjønnes, Rime, and Solheim (2005) present preliminary evidence that while the burden of interday liquidity provision falls on non-financial participants, dealing institutions provide some liquidity interday, and continue to do so over several days or weeks.<sup>3</sup> This article examines the circumstances in which dealing institutions in the U.S.-dollar/Canadian-dollar FX market hold interday positions, and the manner in which they off-load these positions over time, across related markets, and across participants.<sup>4,5</sup>

1. Typically, a liquid financial market is characterized as one in which traders can rapidly execute large transactions with only a small impact on prices.

2. Transactions are not always executed at these quotes. Other factors, such as the size of a trade, may influence the transacted price.

3. Lyons (1995) and Bjønnes and Rime (2005) illustrate that dealers do not usually hold open positions for a significant period of time.

4. The U.S.-dollar/Canadian-dollar FX market is the sixth-largest currency market in the world (BIS 2007). USS/Can\$ will hereafter be used to represent the exchange rate or FX market.

5. Empirical research analyzing the behaviour of individual traders may not reflect the norm across all trading desks.

\* The research reported in this article is summarized from a working paper written by the author (D'Souza 2008).



The article begins with a brief discussion of the possible sources of information relevant to the value of the exchange rate and of the link between information and liquidity provision. This is followed by a short description of a strategic trading model of the FX market and a list of testable implications associated with the provision of interday liquidity. A description of the data employed in the study is then offered. The methodology used to uncover the relationship between the positions of participants and the level of the exchange rate is discussed in the results section, followed by evidence of interday liquidity provided by individual participants. The article concludes with a summary of the findings.

## Information Flows and Participants in FX Markets

Access to information about the future direction of the exchange rate can be extremely valuable in the FX market, where the daily turnover of trades is valued in trillions of dollars.<sup>6</sup> Yet one important characteristic that distinguishes FX trading from trading in equities, for example, is the lack of trade transparency available to the market. Individuals and firms that need to buy and sell foreign exchange typically trade with dealers on a bilateral over-the-counter basis.<sup>7</sup> These trades are only known to the two counterparties involved in the transaction.<sup>8</sup> FX dealers, acting as market-makers, observe a large fraction of these trades over the course of the trading day.

Dealers may choose to hold an open (and risky) position arising from a customer trade because such trades provide valuable information about future movements in the exchange rate.<sup>9</sup> In particular, if order flow is measured as the volume or number of buy orders relative to sell orders, observing an excess quantity of net buy (sell) orders for the Canadian dollar, for example,

suggests that market participants as a whole have a positive (negative) sentiment about the future prospects of the Canadian dollar.<sup>10</sup> Dealers may use this information as part of their own trading strategy.

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*Dealers may choose to hold an open (and risky) position arising from a customer trade because such trades provide valuable information about future movements in the exchange rate.*

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Cheung and Wong (2000), in survey evidence, find that dealing banks list a larger customer base and better order-flow information as two sources of comparative advantage. Evans and Lyons (2007) and Osler (2008) have suggested that customer trading in the FX market is a valuable source of relevant information about macroeconomic exchange rate fundamentals. At a more disaggregated level, certain trades in the FX market have been found to be more informative than others. Several studies, including Fan and Lyons (2003); Froot and Ramadorai (2005); and, Osler, Mende, and Menkhoff (2007) find the trades of financial firms to be more informative than those of non-financial firms. D'Souza (2007) finds that dealers operating from the largest FX commercial centres in the world—London and New York—are also asymmetrically informed. Dealers domiciled in these locations observe a disproportionate share of international capital flows, attributed to the number and influence of portfolio managers located there.

Not all relevant information in the FX market is associated with macroeconomic variables, however. Cao, Evans, and Lyons (2006) illustrate how dealers can use private information about their own inventories as a profitable avenue for speculation, since any undesired inventories must be absorbed elsewhere in the marketplace. This has direct implications for the supply of liquidity in the FX market. In particular, providing liquidity to customers affords dealers an opportunity to speculate and profit on future movements in the exchange rate. Each dealer will know his or her own

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6. Barker (2007) discusses the evolving structure of the FX market.

7. Dealers are the individual traders in financial institutions, i.e., the big banks in Canada. Although the terms market-maker, dealer, and intraday liquidity provider are used interchangeably, in this article the term “dealer” will primarily be used to refer to financial institutions rather than to individual traders.

8. While searching for the best available dealer quotes, individuals and firms may also reveal to other dealers in the market their intention to buy or sell FX.

9. A bid/ask spread is also applied to compensate for inventory risk. O'Hara (1995) describes how dealers can manage their inventories by adjusting their bid/ask quotes.

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10. Evans and Lyons (2002) demonstrate that order flow predicts future foreign exchange returns. Hasbrouck (1991a,b) and Brandt and Kavajecz (2004) find similar evidence in equity and fixed-income markets, respectively.

customer orders through the course of the day, and will try to deduce from the order flow the net imbalance in the market.<sup>11</sup>

Since dealers have a comparative advantage in acquiring order-flow information as a result of their private dealings with customers, they balance the inventory risk associated with providing liquidity against the expected higher returns generated from informed speculation.

## Market Microstructure Models

Market microstructure models focus on the trading behaviour of individual participants in the FX market and on the institutions in the market. The strategic trading models of Lyons (1997, 2001) and Cao, Evans, and Lyons (2006) provide a number of testable hypotheses associated with the provision of liquidity in FX markets. The most interesting aspect of these models is that they incorporate many realistic features of the market, including the fact that dealers recognize that their individual trades can affect the level of the exchange rate, and will consequently take speculative positions based on their private information.

Given that the catalyst for all trading is customer demand for liquidity, multiple rounds of quoting and trading are built into each model to demonstrate how the private information of dealers is revealed to the wider market over time. Specifically, consider a dealer who has just purchased U.S. dollars from a customer and feels confident that this is a source of private information. Suppose that the trade is judged to reflect fundamental information; say, that the Canadian dollar will depreciate relative to the U.S. dollar in the future. The dealer will begin to sell Canadian dollars in interdealer trading. But each time a trade is negotiated with another dealer, information that was initially private is passed on to another market participant, who will then update its trading strategy accordingly. As the initially private information becomes public, and hence less valuable, dealers must adjust the timing of their trades so as to capitalize on the private information of their customer trades.

A final round of trading occurs between dealers and liquidity suppliers. Suppliers may include any or all types of participants in the FX market, including the trading desks of financial institutions, as long as each

participant is sufficiently compensated (in terms of higher returns) for the risky inventory position they take on at the end of the day.

In the Cao, Evans, and Lyons model, speculation in interdealer trades is not related to macroeconomic fundamentals, but to inventory information.<sup>12</sup> Customer-dealer trade flows serve as the main source of private information collected by dealing banks when forecasting the future level of the exchange rate. In particular, these trades help dealers forecast the overall inventory position in the market. With this information, dealers can then determine the return required by liquidity providers for bearing exchange rate risk.

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*Customer-dealer trade flows serve as the main source of private information collected by dealing banks when forecasting the future level of the exchange rate.*

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The qualitative predictions of the model are similar with and without fundamental macroeconomic information:

1. Dealers speculate on the future direction of the exchange rate using the private information learned from their trades with customers.
2. Dealers speculate and hedge positions across time.
3. Dealing institutions in FX markets provide interday liquidity if adequately compensated for risk.

In FX markets, the customers of dealers are the financial and non-financial firms that are the end-users of foreign exchange for settling imports or exports, investing and borrowing overseas, hedging cross-currency business transactions, or speculating. In aggregate, each type of customer order flow may be

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11. Dealing banks also learn about market-wide order flow from brokered interdealer trades.

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12. See O'Hara (1995) for a comparison of the inventory and information approaches in microstructure theory.

an important source of information that accrues to individual dealers. If inventory information is the only factor that influences the level of the exchange rate, then all customer trades should be treated similarly by dealers. The analysis below distinguishes between various types of customer flows so that comparisons can be made in terms of the level of liquidity provision.

## Data

The primary source of data is the Bank of Canada's daily report on foreign exchange volume, which provides details about FX trading flows, both purchases and sales, across all dealing financial institutions operating in Canada.<sup>13</sup> The analysis covers the five-year period between 2 October 2000 and 30 September 2005, or more than 1,250 daily observations.<sup>14</sup> US\$/Can\$ spot closing rates, and 10-year and 3-month interest rate spreads between Canadian and U.S. government bond yields are also examined. Since the foreign exchange rate is quoted as the number of Canadian dollars per U.S. dollar, a rise in the exchange rate represents a depreciation of the Canadian dollar.

Trading is disaggregated by FX market (spot and forward) and by dealers' trading partners.<sup>15</sup> Trading flows are reported in Canadian dollars and include trading against all other currencies.<sup>16</sup> Net flows, calculated as purchases less sales, are categorized according to customer type: commercial-client business (CC) includes all transactions of resident and non-resident non-financial customers; Canadian-domiciled investment-flow business (CD) accounts for

transactions of non-dealer financial institutions located in Canada, regardless of whether the institution is Canadian-owned; foreign-domiciled investment business (FD) consists of all transactions of financial institutions located outside of Canada, including FX dealers, pension funds, mutual funds, and hedge funds; central bank trades (CB) are those of the Bank of Canada. Participants are grouped in this manner to distinguish between trade-related and capital-related flows. Net interbank transactions are approximately zero when aggregated across reporting dealers.

An examination of the daily net flows and the currency positions of each type of participant shows that, at any point in time, positions are equal to the cumulative sum of all past net flows. The flows and positions of dealers ( $D_t$ ) are calculated as follows:

$$D_t = - (CC_t + CD_t + FD_t + CB_t). \quad (1)$$

Descriptive statistics are presented in Table 1. On average, CC flows and FD investment flows are larger and more volatile than CD investment flows, while dealer flows (D) are just as volatile as CC and FD flows. Not surprisingly, commercial clients, on average, purchase Canadian dollars, while FD financial institutions sell Canadian dollars.<sup>17</sup> The magnitude of the means and medians associated with spot and forward flows suggests that foreign institutions do not utilize the forward market as intensively as domestic participants, such as Canadian dealers and commercial clients.<sup>18</sup>

Panel 2 presents the correlations between participant flows in spot and forward markets, individually and combined. There is a strong negative correlation between CC customers and FD institutions (combined market: -0.673, spot market: -0.421, forward market: -0.257); between FD institutions and dealing institutions in spot markets (-0.698); and between CC customers and dealing institutions in forward contract markets (-0.623). Together, these correlations may indicate that while commercial clients are the ultimate source of liquidity to FD institutions, the process is intermediated through dealers. For example, dealers might initially provide liquidity to FD institutions in

13. The report is coordinated by the Bank and organized through the Canadian Foreign Exchange Committee (CFEC). Over the sample period studied, most FX trades in Canada were handled by the top six banks: Bank of Montreal, Canadian Imperial Bank of Commerce, Banque Nationale, Royal Bank of Canada, Scotiabank, and the Toronto Dominion Bank. Trades may or may not be initiated by traders working directly for an FX desk.

14. The disaggregated data employed in this analysis are not available to market participants. Reporting institutions obtain some statistical summaries of the volume aggregates from the Bank of Canada, but only with a considerable lag.

15. Spot transactions are those involving the receipt or delivery of exchange on a cash basis or in one business day; forward transactions are those involving receipt or delivery of foreign exchange in more than one business day. A forward contract is an agreement between two parties to buy or sell an asset at a specified future point in time. Since FX swaps consist of both spot and offsetting forward contract legs, they are not used in the analysis.

16. In 2005, more than 96 per cent of all spot, forward, and FX swap trades among reporting banks in Canada included the Canadian dollar in at least one leg of the transaction (CFEC 2006). In general, most trades take place in the US\$/Can\$ market.

17. This is consistent with Canada being a net exporter, with merchandise trade typically invoiced in U.S. dollars.

18. The Bank of Canada does not use the forward contract market in its operations.



**Table 1**  
**Trade Flows in Spot and Forward Markets**

**Panel 1**

**Net Daily Trade Flows**

	Participant category				
	Commercial client flows (CC)	Canadian-domiciled investment flows (CD)	Foreign-domiciled investment flows (FD)	Central bank flows (CB)	Dealer flows (D)
Total trades across markets					
Mean	153.86	-12.39	-104.62	-5.72	-6.17
Median	150.70	-11.40	-103.90	0.00	-18.60
St. dev.	463.14	229.01	532.39	17.29	402.69
Minimum	-2,447.80	-1,202.80	-2,439.90	-173.07	-1,976.30
Maximum	2,247.10	920.90	2,313.90	0.00	5,766.70
Spot market trades					
Mean	97.49	-46.74	-90.79	-5.72	34.27
Median	94.70	-27.50	-106.10	0.00	24.90
St. dev.	289.81	167.69	489.70	17.29	503.26
Minimum	-2,185.90	-2,738.10	-2,546.00	-173.07	-1,961.20
Maximum	1,469.70	714.10	1,903.80	0.00	2,616.80
Forward contract market trades					
Mean	56.36	34.35	-13.82	-	-90.34
Median	42.40	27.00	-8.50	-	-72.20
St. dev.	338.17	200.99	181.21	-	464.57
Minimum	-2,539.10	-987.40	-1,272.00	-	-5,335.40
Maximum	2,068.50	2,707.70	1,408.40	-	1,779.00

**Panel 2**

**Correlations**

	Participant category				
	Commercial client flows (CC)	Canadian-domiciled investment flows (CD)	Foreign-domiciled investment flows (FD)	Central bank flows (CB)	Dealer flows (D)
Correlation across markets					
CC	1.0	-	-	-	-
CD	-0.038	1.0	-	-	-
FD	-0.673	-0.327	1.0	-	-
CB	0.153	0.015	-0.158	1.0	-
D	-0.252	-0.069	-0.262	-0.005	1.0
Spot market trades					
CC	1.0	-	-	-	-
CD	-0.050	1.0	-	-	-
FD	-0.421	-0.103	1.0	-	-
CB	0.112	0.010	-0.135	1.0	-
D	-0.174	-0.215	-0.698	0.027	1.0
Forward contract market trades					
CC	1.0	-	-	-	-
CD	0.060	1.0	-	-	-
FD	-0.257	-0.029	1.0	-	-
CB	-	-	-	-	-
D	-0.623	-0.468	-0.258	-	1.0

Note: Net daily trades flows (per participant) = purchases – sales (Can\$) Spot transactions = receipt or delivery on a cash basis or in one business day; forward transactions = receipt or delivery in more than one business day

St. dev. = standard deviation

Sample: 2 October 2000–30 September 2005

Number of daily observations: 1,255

the spot market. Later, they may turn around and demand liquidity from commercial clients in the forward contract market.

Estimated long-run relationships between the positions of market participants and the exchange rate are identified in the next section. The analysis uncovers the length of time that dealers are willing to accept an undesired risky position from each type of customer, and the expected returns demanded for holding these inventories. The positions of market participants across spot and forward FX markets are also examined

to better understand the overall determination of interday liquidity.

## Results

This section empirically examines the role of each participant in providing interday liquidity to the FX market. The following question is addressed: When a trade is initiated by a particular type of investor, who holds the offsetting position at the end of the day, at the end of the week, or at any time further into the future? Empirical time-series methods are employed

to uncover the dynamic relationship between participant positions and the exchange rate.<sup>19</sup> In particular, the analysis seeks to determine the length of time that dealers are willing to accept an inventory position from each type of customer and the expected returns dealing institutions demand for holding these inventories.

Impulse-response functions provide a convenient way to analyze the time-varying dimensions of liquidity provision, given the interdependent nature of participants' inventories and the exchange rate. An impulse-

response function traces out the response of a variable of interest to an exogenous "shock." For example, an unexpected customer trade not only affects dealer inventories (D) but may also, over time, affect the inventories of other participants operating in the market.<sup>20</sup> The reactions of the exchange rate and each participant's inventory to an unexpected purchase of Canadian dollars by commercial (CC) clients, CD financial customers, and FD financial customers are documented in Table 2. Negative values are associated with decreases in the Canadian-dollar position of each participant, or alternatively, with the provision of liquidity. In the case of the exchange rate, negative values correspond to an appreciation of the Canadian dollar.

The reaction of the long-run exchange rate to each shock reflects the fundamental information content of

19. Estimation of vector error-correction models (VECM) is discussed in the Appendix and in Hamilton (1994) and Johansen (1995). Unit-root tests are performed on all variables included in the model. In all cases, the null hypothesis of a unit root cannot be rejected at the 5 per cent significance level. Trace-test statistics are employed to determine the number of cointegrating relationships. Results indicate the presence of two cointegrating vectors. A number of coefficient restrictions are imposed on the estimated model, reflecting the institutional considerations of the Canadian FX market, the implications of the theoretical model, or the statistical significance of the estimated coefficients. In the absence of FX intervention, the Bank of Canada has chosen FX trading levels to have little or no impact on the exchange rate. In both cointegrating vectors identified, coefficient estimates on CB are also set to zero.

20. Impulse-response functions associated with the reaction of each variable to shocks in the positions of each customer type are computed from the estimates of the VECM. Generalized impulse-response functions are calculated rather than orthogonalized responses, since the ordering of variables can be an important factor. See Pesaran and Shin (1998).

**Table 2**  
**Impulse-Response Functions**

Impulse	Accumulated response	Number of days after impulse					
		2	5	10	20	40	100
CC	CC	346.86*	380.67*	373.81*	355.31*	322.85*	247.67*
	CD	-9.57	-27.80	-28.37	-27.75	-23.98	-9.43
	FD	-21.60	-38.97	-40.34	-37.34	-32.34	-21.57
	CB	-0.29	-0.34	-0.40	-0.37	-0.31	-0.18
	D	-315.38*	-313.55*	-304.69*	-289.84*	-266.21*	-216.47*
	log(e)*10 <sup>-3</sup>	0.231*	0.251*	0.202	0.120	0.006	0.000
CD	CC	-101.30*	-131.27*	-144.31*	-157.89*	-159.78*	-116.54*
	CD	215.16*	196.88*	168.48*	128.51*	87.56*	55.83
	FD	-11.00	7.18	13.91	21.79	27.80	24.86
	CB	-0.10	0.17	0.28	0.35	0.40	0.34
	D	-98.27*	-72.96*	-38.37	7.22	44.00	35.50
	log(e)*10 <sup>-3</sup>	-0.093	-0.064	-0.033	-0.069	-0.100	-0.103
FD	CC	-234.50*	-308.89*	-334.89*	-374.31*	-445.84	-617.57*
	CD	-98.58*	-106.65*	-103.55*	-97.10	-83.59	-47.42
	FD	516.04*	590.75*	599.46*	605.38*	615.67*	639.85*
	CB	0.30	0.83	1.05	1.14	1.27	1.56
	D	-183.25*	-176.03*	-162.07*	-135.11*	-87.50*	-23.58
	log(e)*10 <sup>-3</sup>	-0.054*	-0.089*	-0.167*	-0.305*	-0.541*	-1.080*

Note: Impulse-response functions are presented subsequent to a "shock" in each trade-flow variable. Generalized impulse-response functions are described in Pesaran and Shin (1998). An asterisk (\*) is used to indicate responses that are statistically significant at the 5 per cent level. Bootstrap methods with 200 replications are employed to calculate standard errors (Efron and Tibshirani 1993). Sample: 2 October 2000–30 September 2005.

CC = commercial-client flows; CD = Canadian-domiciled investment flows; FD = foreign-domiciled investment flows; CB = central bank flows; D = dealer flows; log(e) is the logarithm of the US\$/Can\$ exchange rate.

each type of trade (Hasbrouck 1991a). FD purchases of Canadian dollars are associated with an appreciation of the Canadian dollar. Consistent with other findings in the literature, the market interprets net purchases by foreign financial customers as an indication that the dollar is undervalued. Purchases of Canadian dollars by Canadian-domiciled financial institutions (CD) also tend to lead to an appreciation of the Canadian dollar, but this is not statistically significant at any horizon. While CC trades have a statistically significant (and positive) impact on the exchange rate for at least five days after the initial shock, results indicate that these customers must pay liquidity suppliers—especially dealing institutions—for supplying this service. Overall, unlike FD trades, CC and CD trades are not found to be informative about the long-run future value of the exchange rate.

The impulse-response functions suggest that dealers provide considerable liquidity services to commercial clients. While CD and FD clients also take offsetting positions (for up to 40 business days), the magnitudes of these positions are substantially smaller and not statistically significant. In contrast, in response to a CD impulse, CC customers are the predominant liquidity provider. Dealing institutions only provide liquidity for up to five days. Subsequent to an FD trade shock, both commercial clients and dealers provide significant levels of liquidity, though commercial clients dominate in this role. CC customers increase their supply of liquidity over time as dealers reduce their inventory-risk exposure.<sup>21</sup> These results are qualitatively similar to those of Bjonnes, Rime, and Solheim (2005). In particular, non-financial customers are found to provide liquidity to financial customers, both foreign and domestic.

Acting as intermediaries in the FX market, dealing banks have another important source of comparative advantage in the provision of interday liquidity. Financial institutions operate across asset markets with correlated returns. Naik and Yadav (2003) find that market intermediaries in U.K. bond markets actively use futures to hedge changes in their spot exposure. Drudi and Massa (2001) demonstrate that dealing banks participating in the Italian Treasury bond market exploit private information by trading in both primary and secondary markets and take advantage of differences in trade transparency between

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21. There is little evidence of statistically significant liquidity provision by any participant subsequent to a CB shock.

those markets. The Cao, Evans, and Lyons (2006) model can be further extended to include correlated assets. The model would allow for hedging, as well as informed speculation, across markets and over time, as long as differences existed in the speed with which order-flow information is made public.

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*Acting as intermediaries in the FX market, dealing banks have another important source of comparative advantage in the provision of interday liquidity.*

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The positions of each participant in FX spot and forward contract markets are also examined. Individual participants may use one market more than the other in their regular business operations. The statistics presented in Table 1 suggest that FD financial customers trade mostly in spot markets, while CC customers operate across both markets. The correlation between the spot and forward trade flows of market-making dealing institutions is large and negative. Dealer institutions acting as market-makers in both markets can reduce their inventory risk exposure in one market by having an offsetting position in another market.

In Chart 1, impulse-response functions associated with the positions of commercial clients and dealers in both spot and forward markets are plotted subsequent to a shock in the spot position of FD financial customers.<sup>22</sup> These trades are typically informative about future movements in the exchange rate. After an FD trade shock, dealers manage a short Canadian-dollar position in the spot market and a long Canadian-dollar position in the forward market.<sup>23</sup> The positions are not symmetrical. Dealers hold a larger negative position in the spot market. These institutions may attempt to use the information learned from FD trades in the spot market while taking a partially offsetting, or hedged, position in the forward market.

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22. In line with the results presented earlier, test statistics indicate the presence of two cointegrating vectors in a specification that includes a deterministic trend in each cointegrating vector.

23. Dealing institutions use foreign exchange swaps (a combination of a spot and a forward trade) and domestic and international money market positions to hedge their exposure to exchange rate movements.

In contrast, CC customers, who are not privy to the information content of FD flows, provide ample levels of liquidity across total spot and forward markets. Over time, as dealers reduce their overall exposure, commercial clients increase their positions. In Chart 2, similar impulse-response functions are plotted subsequent to a trade shock in the spot position of CD financial customers. Results are considerably different. Dealers hold nearly offsetting positions across spot and forward markets. They sell Canadian dollars in the spot market and buy Canadian dollars in the forward market. The two positions are nearly identical in absolute value and not statistically different from zero over time. Commercial clients increasingly provide liquidity in both spot and forward markets over time.

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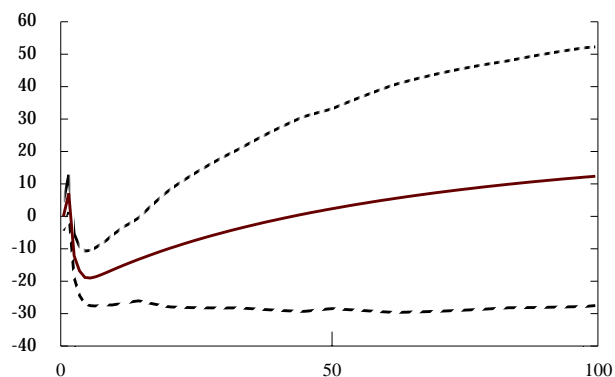
*Dealer institutions acting as market-makers in both markets can reduce their inventory risk exposure in one market by having an offsetting position in another market.*

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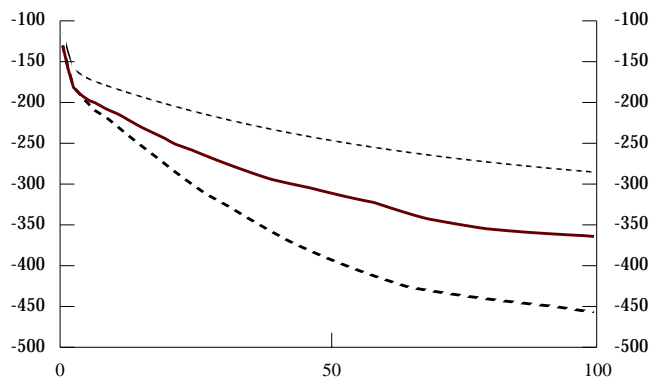
Dealers are well suited to provide interday liquidity in correlated markets. Depending on the information content of trades and the demands for liquidity in individual markets, dealers may speculate across markets while simultaneously providing liquidity.

**Chart 1**  
**Responses to an FD Shock in the Spot Market**

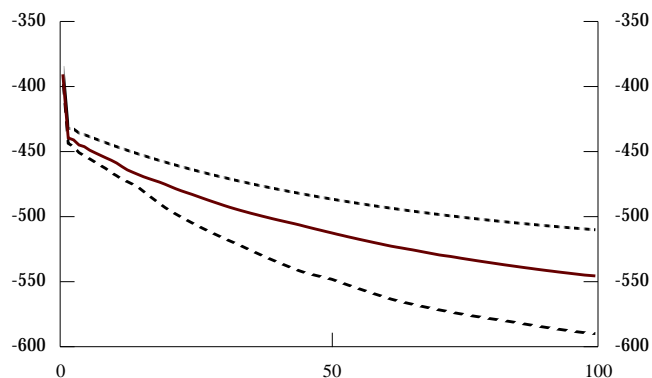
**Response of CC (spot)**



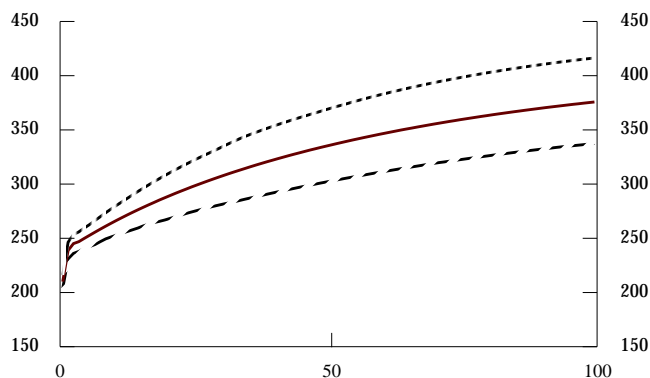
**Response of CC (forward)**



**Response of D (spot)**



**Response of D (forward)**



Note: The dotted lines represent the upper and lower bounds associated with 95 per cent confidence intervals. Bootstrap methods with 200 replications are employed to calculate standard errors (Efron and Tibshirani 1993). CC = commercial-client flows; D = dealer flows; FD = foreign-domiciled investment flows.

Overall, results suggest that the relationship between the positions of commercial clients and market-makers, and the role played by dealers in interday liquidity provision, has been understated. There is considerable evidence that not all customer trades are equal. In particular, market-makers are quick to provide liquidity to FD customers, possibly in an attempt to capture any fundamental information contained in these trades. Over time, dealers will off-load their positions to commercial clients as the information becomes stale, or as the risks associated with holding these undesired balances becomes too costly.

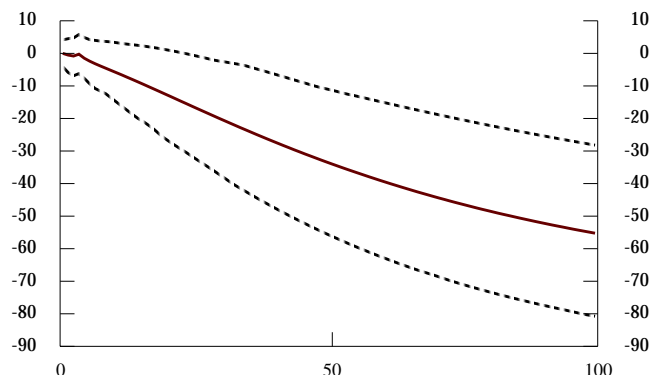
## Conclusion

Our current understanding of interday liquidity provision in FX markets is incomplete. In the past, anecdotal and empirical evidence based on the datasets of individual participants has suggested that dealers in the FX market are not involved. This is not the case for Canadian financial institutions operating in the U.S. dollar-Canadian dollar market. With a finer disaggregation of trades than provided in previous research, both in terms of the types of customers that trade with dealers and a breakdown of positions across spot and forward contract markets, additional insight is gained about why, when, and how dealing financial institutions provide liquidity services.

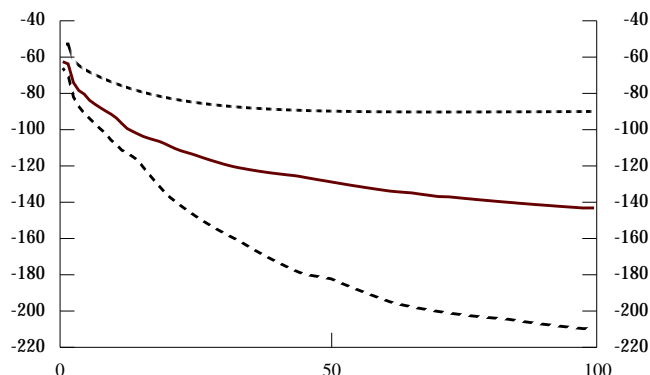
Chart 2

### Responses to a CD Shock in the Spot Market

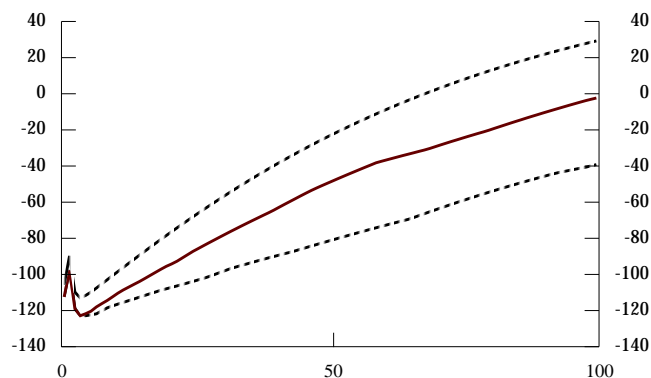
#### Response of CC (spot)



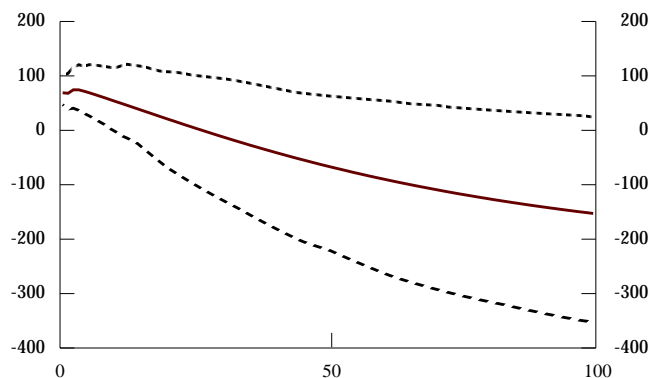
#### Response of CC (forward)



#### Response of D (spot)



#### Response of D (forward)



Note: The dotted lines represent the upper and lower bounds associated with 95 per cent confidence intervals. Bootstrap methods with 200 replications are employed to calculate standard errors (Efron and Tibshirani 1993).  
 CC = commercial-client flows; CD = Canadian-domiciled investment flows; D = dealer flows.



Dealers use their own customer trades as a source of private information that imparts a temporary opportunity to make higher expected returns. Once the private information has been acted upon or becomes stale, dealers attempt to off-load their undesired positions to other participants in the market. Unlike domestic financial customer trades, dealers find foreign-domiciled financial customer trades to be informative about future movements in the exchange rate. Results presented in this article suggest that, when trades are more informative, dealers act more aggressively in the provision of liquidity. Consistent with Bjønnes, Rime, and Solheim (2005), there is ample evidence of a long-run relationship between the financial and non-financial customers of dealers in the demand and supply of liquidity. This article finds that market-making firms intermediate between these two participants over periods of time longer than a single day.

Taken together, these results suggest that the role of dealers in the provision of interday liquidity should not be discounted. While Bjønnes, Rime, and Solheim find support for the view that non-financial firms are the main providers of liquidity, the findings reported here suggest that dealing institutions act as interday intermediaries in the overall search process, and they may hold on to risky positions for longer periods of time than suggested by the existing literature. The overall results support arguments by Stulz (1996) and

Froot and Stein (1998) that the amount of hedging will depend on a firm's comparative advantage in bearing risk. In the FX market, a dealing institution's source of comparative advantage stems not just from its capacity to bear risk, but also from its role as intermediary in the interday market and its ability to observe customer and market-wide order flow.

Dealing banks operating in the FX market have many potential sources of comparative advantage that provide them with incentives to hold risky interday positions. For example, dealing institutions have in the past negotiated bilateral quoting agreements in order to guarantee access to minimum amounts of liquidity throughout the day. Electronic trading platforms such as EBS and Reuters now provide dealers with this kind of insurance.<sup>24</sup> Currently, non-market-making participants in the FX market do not have direct access to these electronic brokers. Further, since financial institutions allocate risk capital strategically across correlated business lines and have a larger capital base, they may have a higher tolerance for risk than other market participants. D'Souza and Lai (2006) illustrate how market-making is influenced by the risk-bearing capacity of a dealer, which is itself determined by the amount of risk capital allocated to the activity.

24. These platforms also reduce search costs while ensuring anonymity.

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## Appendix: Empirical Methodology

Many financial time series contain a unit root. In this article, for example, there is very little evidence that participant inventories or exchange rates revert to some long-run equilibrium level. If a linear combination of two or more non-stationary series is stationary, the time series are said to be cointegrated. The linear combination can be interpreted as a long-run-equilibrium relationship among the variables involved.

A vector autoregression (VAR) is a linear specification in which each variable is regressed against lags of all variables.<sup>1</sup> Let  $z_t$  denote the vector of variables,

$$z_t = [c_{1t} \dots c_{mt} \ r_t], \quad (1)$$

where  $c_{it}$  is the inventory position of the  $i$ 'th customer type (where  $i = 1 \dots m$ ) and  $r_t$  is the exchange rate level at the close of trading on day  $t$ . The VAR specification can be written as:

$$z_t = A_1 z_{t-1} + A_2 z_{t-2} \dots + A_p z_{t-p} + v_t, \quad (2)$$

where  $p$  is the maximum lag length, and  $v_t$  is a column vector of serially uncorrelated disturbances with variance-covariance matrix  $\Sigma$ . It is possible to rewrite the VAR as a vector error-correction model (VECM):

$$\Delta z_t = \Pi y_{t-1} + A_1 \Delta z_{t-1} + A_2 \Delta z_{t-2} \dots + A_{p-1} \Delta z_{t-(p-1)} + v_t. \quad (3)$$

Granger's representation theorem asserts that if the coefficient matrix  $\Pi$  has reduced rank associated with the  $r$  equilibrium relationships, then there exist matrices  $\alpha$  and  $\beta$  each with rank  $r$  such that

$\Pi = \alpha\beta'$  and  $\beta'y_t$  is stationary. Johansen's method is used to estimate the matrix  $\Pi$  from the unrestricted VAR.

The VECM model captures the dynamic relationships between all variables, including any long-run relationships. Impulse-response functions represent the expected future values of  $z_i$  conditional on an initial disturbance,  $v_t$ , and can be computed recursively from equation (3):

$$E[z_{it} + z_{it+1} + \dots + z_{it+T} | v_t].$$

The long-run impact of a shock in each type of customer trade on cumulative exchange rate returns is a measure of the information content of that customer trade. The effect of a trade shock initiated by customer type  $j$  on customer  $i$ 's FX position provides a summary estimate of the degree to which participant type  $i$  is a liquidity provider to  $j$  over time:

$$E[c_{it} + c_{it+1} + \dots + c_{it+T} | v_{jt}].<sup>2</sup>$$

1. See Hamilton (1994) for a complete discussion.

2. Generalized impulse-response functions are calculated (Pesaran and Shin 1997).

# Merchants' Costs of Accepting Means of Payment: Is Cash the Least Costly?

Carlos Arango and Varya Taylor, Currency Department\*

- *Merchants face a variety of costs and benefits from accepting different payment methods.*
- *A Bank of Canada survey of more than 500 merchants revealed that merchants find cash the least costly payment method, compared with debit and credit cards.*
- *Using the survey results and other sources, this article investigates the perception that cash is the least costly by calculating the variable costs of accepting a transaction.*
- *The findings reported here show that debit cards are actually the cheapest for our base-case scenario, which assumes a transaction value of \$36.50. A sensitivity analysis provides the transaction values for which cash is less expensive than debit cards.*
- *Although the survey results are not statistically representative at a national level, they provide insight into the costs to merchants of accepting various methods of retail payment. Further work on both costs and benefits could help policy-makers better understand the determinants of retail payment efficiency.*

Most merchants in Canada give consumers the option of paying for the goods and services they provide by cash, debit card, or credit card. In a competitive sales environment, merchants may feel compelled to meet consumer demand for payment options. On the other hand, some merchants may find that accepting various payment methods can have a positive impact on their sales and on the efficiency of their operations. When merchants provide greater payment choice, consumers can decide which payment method to use, depending on their preferences and perceptions of the costs and incentives associated with each.<sup>1</sup> By accommodating consumer choice, however, merchants are subject to costs and benefits that are unique to each payment method. Many of these costs, such as the transaction fees applied to card payments, are explicit to the merchant, while others, such as the labour costs associated with handling cash, are less obvious.

Understanding the costs and benefits of different means of payment is of interest to the Bank of Canada, since the Bank is the country's monetary authority responsible for issuing bank notes and for meeting Canadians' demand for cash. Ideally, the Bank would like to assess the efficiency of cash relative to other payment methods from the perspective of all participants in the payments system, which includes consumers, merchants, financial institutions, and the Bank itself. As a step towards meeting this ambitious objective, the Bank has chosen to focus on the cost implications of retail payments to merchants. The merchants' perspective is particularly important

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1. A discussion of retail payments in Canada and the results of a survey on consumer payment habits and perceptions is provided in Taylor (2006).

because the costs they incur from accepting payments are significant not only to their own businesses, but also to the overall costs of retail payments to society. Recent media articles have highlighted merchants' concerns about the costs of retail payments, and various research has indicated that they pay more for retail payments than any other participant in the payments system.<sup>2</sup> Thus, examining the costs to merchants is an important contribution to understanding the overall efficiency of retail payments.

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*Most merchants perceive cash as the least costly form of payment and, in comparison, find debit cards only moderately costly and credit cards the most costly.*

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Accounting for the costs and, to a greater extent, the benefits of retail payments to merchants is no easy task. Data on merchant fees and labour costs, which vary significantly by merchant, are not readily accessible, nor is the actual value derived from the benefits of retail payments, since it is difficult to measure. One method of obtaining information is through surveys. In 2006, the Bank of Canada commissioned a survey of over 500 merchants on their accepted means of payment. Along with questions on payment preference and perceptions of risk and reliability, merchants were asked how costly they find cash, debit cards, and credit cards. They were also asked to report on some of their actual costs. A key finding of the survey is that most merchants perceive cash as the least costly form of payment and, in comparison, find debit cards only moderately costly and credit cards the most costly.<sup>3</sup>

The perception that cash is the least costly for merchants deserves closer examination, for at least two reasons. First, it is possible that merchants in the survey underestimate the full costs of accepting cash, since they may overlook the labour and other costs

associated with handling cash. Second, perceptions and actual costs could vary by type of merchant. Larger merchants, for instance, might prefer card payments over cash because of the efficiencies that can be derived from electronic card processing. They may believe that this efficiency is a return on the investment in the technology necessary to accept card payments. Smaller merchants, however, may find the set-up costs of card processing too costly to their business, and may prefer cash over cards.

In this article, we investigate merchants' perception that cash is the least costly means of payment by calculating the variable costs per transaction involved in accepting payments, using the survey results and other sources. In addition, we perform a sensitivity analysis by varying the transaction value and show that cash and credit cards become more expensive as the value of the transaction increases. We then estimate threshold transaction values for which cash is cheaper than debit cards for three different debit card fees.

## **Retail Payment Methods: The Costs and Benefits to Merchants**

Merchants face a variety of costs and benefits from accepting cash, debit cards, and credit cards. These costs may be fixed or variable (i.e., depend on the value or volume of transactions), and they may be clearly expressed as fees or, less explicitly, as labour costs. The benefits are not as easy to quantify, but merchants generally value payment methods that are efficient, reliable, and secure, and that will generate sales.

### **Cash payments**

When payments are made by cash, funds are settled and received during the transaction. Merchants may thus view the liquidity of cash as a benefit because the funds are immediately at their disposal. However, cash exposes the merchant to the risk of theft, robbery, and counterfeiting, as well as the risk of human error during the exchange. Security measures (e.g., surveillance cameras and security guards), secure storage (vaults and cash registers), and investment in counterfeit-detection training are necessary fixed costs associated with cash.

The costs associated with handling cash also make it the most labour-intensive form of payment, since it requires time to prepare cash registers, reconcile cash payments at the end of the day, and prepare deposits.<sup>4</sup>

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2. For an example of a media article, see Mark Anderson, "Retail Council Leads Charge against Mounting Credit Card Fees," *Ottawa Citizen*, 24 September 2008. For examples of academic research, see the Literature Cited section on p. 23.

3. More information on the survey questions and results are provided in Arango and Taylor (2008). An executive summary of the survey results can also be found on the Bank's website at <<http://www.bankofcanada.ca>> under "Bank Notes/Survey results."

4. In recent years, technology has increased the automation of cash-handling and reconciliation procedures.



Smaller merchants may have their employees deliver cash deposits to the financial institution, while larger merchants often require armoured transportation services to make deposits on their behalf. In addition to labour costs, financial institutions charge fees for cash deposits, cash withdrawals, and coin ordering. These fees are set by the merchant's financial institution according to the package of services provided. Merchants may also wait a few days before making cash deposits at their financial institution, and it may be one to two business days before their account is credited. They therefore incur an opportunity cost from not earning interest on their cash holdings in registers and vaults or while it is in transit.

### **Card payments**

Unlike with cash payments, merchants require payment-processing services from a financial institution or a third party when they accept debit cards or credit cards. (In this role, the financial institution or third party is known as an "acquirer.") Merchants often rent point-of-sale (POS) terminals from an acquirer and pay for maintenance and upgrades, although some of the larger retail chains, such as department stores, own POS terminals and customized software. In addition to the fixed costs related to POS terminals, merchants pay a monthly fee for the communication lines used to connect to the card networks.

In terms of variable costs, merchants incur a set fee for every debit card transaction and a percentage fee for every credit card transaction. The credit card fee, known as the merchant's discount rate, is applied to the total value of the transaction. In addition to the discount rate, some merchants pay a flat transaction fee and face a minimum monthly charge if their credit card fees do not reach a certain threshold.

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*Merchants incur a set fee for every debit card transaction and a percentage fee for every credit card transaction.*

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Card-payment finality takes place by means of a clearing and settlement process. With debit cards, authorization via the customer's personal identification number (PIN) ensures that the consumer has sufficient funds available at the time of sale. The funds are

debited from the customer's account in real time and transferred to the merchant, usually by the next business day. In the case of fraudulent activity, the card issuer usually absorbs the loss, since authorization relies more on the technology than on the merchant.

Compared with cash and debit cards, credit cards offer the least payment finality because of the consumer's deferred payment advantage and limited liability against fraud. Though merchants receive funds within one to two business days, consumers have a certain number of days to dispute a credit card transaction, whether because of an unresolved dispute with the merchant or because of a fraudulent claim (i.e., the card was used without the cardholder's consent). In these cases, the transaction will be reversed through a chargeback, the value of which is deducted from the merchant's account by the acquirer while the dispute is under review. Merchants have a limited number of days to provide information in their defence (i.e., to prove that they followed proper procedures). These chargebacks can be costly to merchants, who are charged for the process and risk losing the transaction funds.

Despite the costs of card payments, merchants may benefit from the increased efficiency of electronic processing, since less labour is required for card payments than for cash. In fact, debit cards can actually help merchants reduce the costs of holding cash through the cash-back option, which allows consumers to withdraw cash at the point of sale. The main advantage of accepting card payments, however, is that it gives consumers access to credit or their bank account, enabling them to make purchases that might not have occurred otherwise. Satisfying consumer demand for payment options and using loyalty or reward programs along with card payments is especially important when the merchant is operating in a competitive environment. In fact, as more merchants accept a particular payment method, consumer use of the method will increase as well, which can further enhance the opportunity for sales.

### **Survey Methodology and Results**

The objectives of the Bank of Canada's 2006 survey of merchants on their accepted means of payment were (i) to consider how merchants perceive retail payments, (ii) to estimate the share of transactions represented by each payment method, and (iii) to assess the costs of accepting different retail payment methods. The research firm that conducted the survey held

telephone interviews with more than 500 merchants across Canada between March and May 2006. The merchant representatives were senior employees familiar with the payment methods accepted.

Although the sample is relatively small, it was stratified by firm size (number of employees), region, and subsector to reflect the diversity of the retail sector. The structure of the merchant's business (i.e., chain, franchise, or independent stores) was also considered. Because most merchants in Canada operate as independent small businesses, roughly half of the sample consisted of small merchants. As well, three-quarters of the businesses surveyed are independently owned and operated.<sup>5</sup> The survey included a variety of subsectors (e.g., gas stations, grocery stores, restaurants, and general merchandise stores), but excluded merchants who did not have a physical store and were hypothetically unable to accept all three payment methods (cash, debit cards, and credit cards). Merchants who only sell goods and services over the Internet, for example, were excluded from the survey. It should be noted that the overall margin of error is relatively high, at +/- 4.4 per cent, with 95 per cent confidence. Generalizations made for a particular size, region, or subsector are subject to even greater error. The refusal rate was 46 per cent, which is not unusual for this type of survey.

Table 1 shows that the typical retail outlet represented by the survey median has annual sales of \$625,000 and consists of only one POS terminal and eight employees. Table 2 shows the corresponding results at a firm level, where merchants reported on all outlets combined. The much larger dispersion (standard deviations) at the firm level reflects the fact that even though the retail sector is characterized by small independent merchants, a large share of aggregate retail sales is dominated by merchants with large-scale operations. A breakdown of annual sales by

**Table 1**  
**Merchant Characteristics per Outlet (2005 figures)**

Per outlet	Median	Mean	Standard deviation
Total annual sales (thousands \$)	625	2,661	5,949
Number of employees	8	21	30
Point-of-sale terminals	1	3	3

5. Independent merchants represented 55 per cent of retail activity in 2006 (Statistics Canada 2008); 72 per cent of merchants have fewer than 10 employees (Retail Council of Canada 2004).

**Table 2**  
**Merchant Characteristics for All Outlets (2005 figures)**

All outlets	Median	Mean	Standard deviation
Total annual sales (thousands \$)	896	10,100	50,200
Cash (%)	25	29	23
Debit card (%)	30	28	16
Credit card (%)	30	33	21
Number of employees	10	1,477	8,739
Point-of-sale terminals	2	228	2,481

Note: The breakdown of annual sales by payment method excludes the results for cheques and self-labelled credit cards. The median results on payment method shares do not sum to 100 per cent because they are independently calculated for each payment method.

payment method shows that cash, debit card, and credit card transactions are evenly represented.

The survey results show that acceptance of cash, debit cards, and credit cards is fairly high, since 89 per cent of respondents accept all three. The smallest merchants (measured by number of employees or by sales volume) are the least likely to accept card payments. Of those who do not accept debit cards, 52 per cent indicate set-up and processing costs as the main barriers. Merchants who do not accept credit cards cite lack of consumer demand (29 per cent) and costs (16 per cent) as the main barriers. Interestingly, acceptance of debit cards is practically uniform across subsectors, but credit card acceptance varies by subsector. Cash acceptance is close to 100 per cent.

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*Merchant preferences are influenced  
by their perceptions of cost,  
reliability, and risk.*

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When asked which payment method they prefer their customers to use most often, 53 per cent of respondents said debit cards. In comparison, 39 per cent favoured cash, and only 5 per cent favoured credit cards. Presumably, merchant preferences are influenced by their perceptions of cost, reliability, and risk.<sup>6</sup> Compared with other payment methods, debit cards are rated as the least risky (42 per cent rate debit

6. Merchants were asked for their perception of reliability in terms of the ease and dependability of processing a transaction, and of risk in terms of counterfeiting, theft, or fraud.

cards as “not at all risky”). Cash is seen as the least costly (63 per cent rate cash as “not at all costly”) and the most reliable (67 per cent rate cash as “totally reliable”). In contrast, credit cards are seen as the most costly (24 per cent rate credit cards as “very costly”) and the least reliable.

Based on the costs reported in the survey, merchants pay around \$40 a month (per terminal) for their banking and payment-processing services, which may include cash services, card processing, terminal leasing, and other related services.<sup>7</sup> Merchants who receive payment-processing services from a third-party payment processor, and not a financial institution, pay around \$35 a month (per terminal). The median fee per transaction for debit cards in the survey is 12 cents, and the median discount rate for credit cards is 2 per cent of the value of the transaction (Table 3).<sup>8,9</sup>

**Table 3**  
**Transaction Fees**

	Median	Lowest quartile	Highest quartile
Debit card fee (\$)	0.12	0.07	0.25
Credit card fee (%)	2.00	1.75	2.50

## The Variable Costs of Accepting Retail Payments

To make a per transaction comparison of the costs to merchants of accepting the three retail payment methods, we calculate the variable costs of accepting cash, debit cards, and credit cards for a transaction value of \$36.50, which is the median value of cash transactions reported in the survey.

While the survey data provided valuable input into these calculations, we rely on additional sources of information to calculate the variable costs. To gather

7. Among those who accept credit and/or debit cards, approximately half said that they lease their POS equipment, and 24 per cent said they own the equipment; the rest either did not know or did not respond.

8. We find that the survey results on debit card fees may be higher than the anecdotal information available on the Internet. For example, merchants may receive lower rates if they belong to a trade association.

9. The results reported for credit card rates are based on an average credit card discount rate calculated for each merchant, judging by the credit cards they accept at their stores.

more data on the costs of processing cash, for example, we interviewed 35 respondents as a follow-up to the survey. It was also difficult to obtain survey data on fixed costs, which explains why we are unable to include set-up, overhead, and equipment costs in the calculations. We exclude as well the cost of using armoured vehicles for cash transportation (again, owing to lack of data). Lastly, we assume that the cashier wage applies to all labour costs, even though a bookkeeper’s wage could be more appropriate for some of the back-office duties.

Given the information available, our variable-cost calculations account for the following items (see Arango and Taylor [2008] for more detail):

1. The labour cost of tender time.<sup>10</sup>
2. The labour cost of cash reconciliation, deposit preparation, and deposit delivery to the bank, based on the follow-up interviews.<sup>11</sup>
3. Cash-deposit and coin-ordering fees, taken from the brochure of a major commercial bank at the time of the survey (data on the frequency and value of making deposits and coin orders are based on the follow-up interviews).
4. The per transaction fees for processing debit and credit card payments, as provided by the median survey results.
5. The cost of cash theft and of losses as a result of counterfeiting.<sup>12</sup>
6. The cost of a credit card chargeback, which is derived from Garcia-Swartz, Hahn, and Layne-Farrar (2006).
7. The opportunity cost of funds in transit, or float, based on short-term interest rates. For

10. Estimates of tender time are taken from the Dutch National Bank (Working Group on Costs of POS Payment Products 2004) as 19 seconds for cash, 26 seconds for debit cards, and 28 seconds for credit cards. These results are similar to those of a proprietary study done for the United States in 2005. Note that the tender time for cash is probably the most variable, and that tender time can change with new technology, such as contactless debit or credit cards.

11. According to the median results of the 35 follow-up interviews, a merchant takes 24 seconds per transaction to prepare and reconcile cash payments. Faster merchants can take as little as 12 seconds.

12. A survey conducted by Ipsos Reid in 2008 finds that 35 per cent of merchants face an employee theft once a year and 23 per cent face a robbery. Losses from bank note counterfeiting are calculated as the annual average value of counterfeit passes in 2004–06 divided by average total cash sales in the same period. It excludes the cost of counterfeit-detection training.

cash, we consider the time it takes for the financial institution to credit the merchant's account and the average time total cash sales remain in the store before being deposited at a financial institution.<sup>13</sup>

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*Credit cards stand out as the most costly overall because of the relatively high processing fee.*

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As reported in Table 4, the cost calculations reveal that, for a transaction value of \$36.50, debit card payments have the lowest variable costs, at 19 cents, followed by cash (25 cents), and credit cards (82 cents). Debit cards are the cheapest because the flat transaction fee is relatively low, while cash is more expensive because of the labour costs and the deposit fees (accounting for nearly 70 per cent of total cash costs). Credit cards stand out as the most costly overall because of the relatively high processing fee.

It is important to note that these calculations represent a base-case scenario that is dependent on various assumptions. In some other countries, debit card fees are based on a percentage of the transaction value

**Table 4**  
**Merchants' Variable Costs per Transaction**

Cost item	Base case for a \$36.50 transaction		
	Cash	Debit	Credit
Tender time	0.051	0.070	0.080
Deposit-reconciliation time	0.033	-	-
Deposit-preparation time	0.033	-	-
Deposit time at the bank	0.025	-	-
Payment-processing fee	-	0.120	0.730
Cash-deposit fee	0.078	-	-
Coin ordering	0.006	-	-
Theft/counterfeit risk	0.025	-	-
Chargeback	-	-	0.016
Float	0.006	0.001	0.001
<b>Total</b>	<b>\$0.25</b>	<b>\$0.19</b>	<b>\$0.82</b>

13. Merchants in the survey differ as to how frequently they deposit cash at their financial institution. Only 18 per cent of merchants deposit cash on a daily basis; 27 per cent deposit once a week, and 22 per cent twice a week. Larger merchants, measured either by sales or by transaction volume, deposit cash more frequently. However, merchants with a higher number of terminals to manage and reconcile tend to deposit cash less frequently.

rather than a flat transaction fee. Our results could change if this fee structure were implemented in Canada.<sup>14</sup>

## Why Merchants Might Think Cash Is the Cheapest

At a transaction value of \$36.50, our results based on variable costs seem to contradict the perception by merchants that cash is the cheapest method of payment. However, the ranking of payment methods by perceived costs can vary by merchant type, for the following reasons.

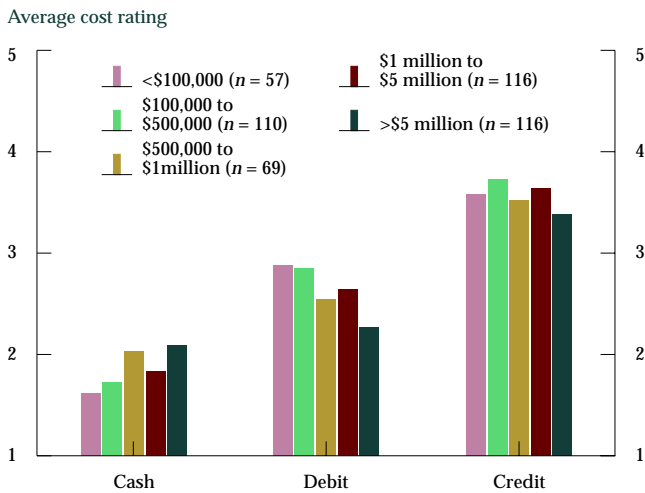
First, our calculations depend on the value of the transaction, as the results of the next section will show. Using the same survey, Arango and Taylor (2008) show that merchants who have lower average transaction values view cash as significantly less costly than debit cards and credit cards.

Second, since the back-office costs of cash are not priced explicitly, merchants—particularly those operating on a smaller scale—may not recognize the full costs of handling cash. Arango and Taylor (2008) find that, even though cash is consistently seen as the least costly of the three payment methods, merchants with higher annual sales, especially those in the highest sales category, view cash as more costly than those with lower annual sales (Chart 1a). The opposite is observed for debit cards, while no clear pattern is observed for credit cards. Similarly, Chart 1b suggests that larger chain stores tend to view cash as more costly than independent and franchise outlets (although this finding was not proven significant in previous research). Chart 1c shows how different sub-sectors also view cash as less costly than other means of payment.

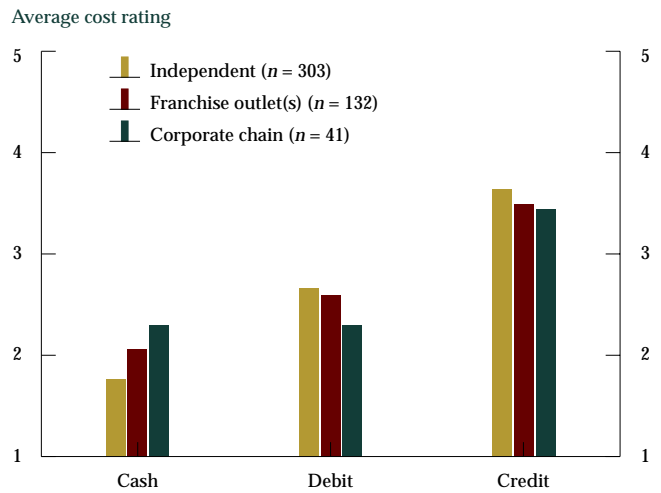
Third, Arango and Taylor (2008) show that merchants with lower transaction volumes tend to have higher fees per transaction for both debit and credit cards, suggesting that larger merchants receive a discount for their higher volumes. Not surprisingly, smaller merchants view cash as relatively less costly. To illustrate, suppose the merchant's debit card fee is higher than the 12-cent median provided for in the calculations. With a fee of 25 cents, which corresponds to the result for the highest quartile in the survey, the cost of

14. In a recent press release, the Canadian Federation of Independent Businesses expressed concern about converting debit card fees to a percentage of the transaction value. The press release is available at <<http://www.cfib.ca/research/businfo/pdf/DIN0708.pdf>>.

**Chart 1a**  
**Merchants' Perceptions of the Costs of Payment Methods by Annual Sales**

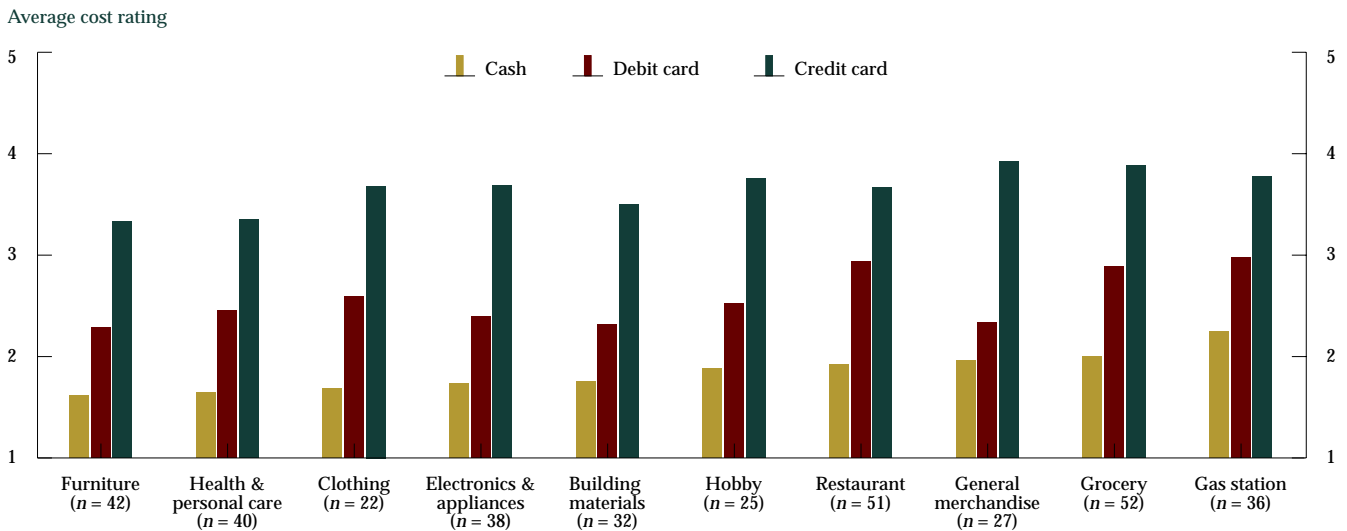


**Chart 1b**  
**Merchants' Perceptions of the Costs of Payment Methods by Business Structure**



Note: Respondents were asked to rate how costly they find cash, debit cards, and credit cards on a scale of 1 to 5, where 1 represents “not at all costly” and 5 represents “very costly.” Not all observations from the sample are included.

**Chart 1c**  
**Merchants' Perceptions of the Costs of Payment Methods by Subsector**



Note: Respondents were asked to rate how costly they find cash, debit cards, and credit cards on a scale of 1 to 5, where 1 represents “not at all costly” and 5 represents “very costly.” Not all subsectors are included.



a debit card transaction would add up to 32 cents, which is more expensive than cash.

Lastly, merchants may perceive cash as cheaper because of the higher fixed costs associated with electronic payments, which are not included in our calculations of variable costs. This may apply to smaller merchants, who would find the fixed costs per transaction more expensive, given their lower transaction volumes.

## When Is Cash the Least Costly to Merchants?

Many of the costs described above vary by transaction value. To identify the thresholds at which cash may be the least costly to merchants, we perform a sensitivity analysis by varying transaction values and card fees. For cash, we assume that all cost items increase with the transaction value, except tender time, deposit time at the bank, and coin ordering. For debit cards, only the opportunity cost of funds availability would increase with the transaction value. For credit cards, all cost items, except tender time, would increase with the transaction value.

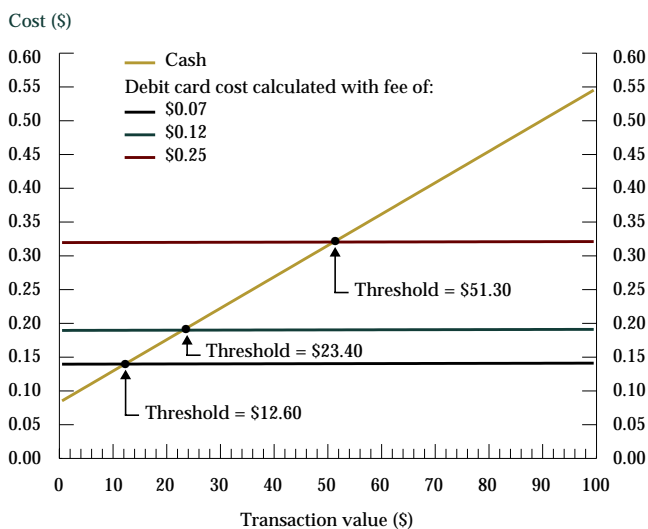
Given these assumptions, our calculations suggest that cash is cheaper than credit cards for all transaction values, even when considering a lower credit card rate of 1.75 per cent, which is the lowest quartile rate in the survey. Cash is cheaper than debit cards for transactions that are below \$12.60 for merchants who pay debit card fees as low as 7 cents; below \$23.40 for merchants who pay 12-cent debit card fees; and below \$51.30 for merchants who pay debit card fees as high as 25 cents. In other words, the cost of cash increases with the transaction value, and the threshold values between cash and debit increase as debit card fees rise. Chart 2 graphs the variable costs of cash and debit cards according to the transaction value and different debit card fees.

## Comparison with Other Studies

The cost of retail payments has been estimated for the United States (Garcia-Swartz, Hahn, and Layne-Farrar 2006), Australia (Schwartz et al. 2007), Belgium (National Bank of Belgium 2005), the Netherlands (Working Group on Costs of POS Payment Products 2004), and Sweden (Bergman, Guibourg, and Segendorf 2007). Many of these studies also estimate threshold transaction values between the variable costs of cash and debit cards. It is difficult to directly compare

Chart 2

### Threshold Transaction Values for the Cost of Cash vs. the Cost of Debit Cards



Note: The variable costs of debit cards, which include the debit card fee, the cost of the float, and the tender time, are calculated separately for debit card fees of \$0.07, \$0.12, and \$0.25.

their estimates to ours, however. First, these studies estimate the costs of each payment method to merchants, consumers, financial institutions, and the central bank (the Dutch and Belgian studies exclude consumers). By adding up the participants' costs, net of transfers, they calculate the total costs of retail payments to society.<sup>15</sup> Second, these studies differ by their methodologies and country-specific attributes, such as the rates of payment-method usage and the average transaction values upon which the estimations are based.<sup>16</sup>

Nonetheless, the threshold transaction values of the variable costs of cash and debit cards for Sweden, the Netherlands, and Belgium range from Can\$12 to \$17.<sup>17</sup> These estimates are not much higher than our threshold transaction value of \$12.60 for merchants who pay relatively low debit card rates. The fact that merchant costs represent the largest share of total costs (i.e., merchants pay more for retail payments than any other participant) in all of the studies helps to explain why our results appear to be similar.

15. To avoid double-counting, social-cost estimates do not include the fees that one party will pay to another.

16. See Koivuniemi and Kempainen (2007) for a review of different studies of retail payment costs.

17. Based on the average annual exchange rate for the year to which the estimates correspond.

## Conclusion

The 2006 survey commissioned by the Bank of Canada, while not statistically representative of the immensely diverse retail sector at a national level, does provide insight into the costs of different payment methods to merchants. This study suggests that the costs of accepting different payment methods vary significantly by merchant and transaction value. Small stores with lower average transaction values perceive cash as less costly than card payments mainly because: (i) the back-office costs of cash are relatively low; (ii) the fixed costs of card payments are relatively high; and (iii) they are more likely to face higher fees per transaction for processing card payments.

We find that debit cards are the least costly payment method for a broad cross-section of merchants because of the relatively low debit card fees per transaction. This suggests that as debit card use in Canada continues to grow, many merchants could benefit. However, the survey reports that small merchants still perceive cash as the least costly payment method and prefer cash to electronic payments at the point of sale. These findings suggest that further work on the total costs and benefits to merchants of accepting various payment methods is important for policy-makers to have a better understanding of the efficiency of retail payments systems.

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# The Market Impact of Forward-Looking Policy Statements: Transparency vs. Predictability

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*Christine Fay, Financial Markets Department, and Toni Gravelle, Financial Stability Department*

- *Transparency is now considered an essential element of an effective monetary policy framework, and a central bank's communication strategy is key to achieving this. Consequently, central banks continuously strive to improve how they communicate to financial markets and the broader public.*
- *In an effort to increase transparency, the Bank of Canada and other central banks have begun to use forward-looking policy guidance in their communications. The Bank of Canada now includes forward-looking statements in press releases accompanying interest rate decisions and in monetary policy reports.*
- *There is currently a debate over the usefulness of forward-looking statements. The empirical evidence in this article suggests that, to date, the use of forward-looking statements in Bank of Canada communications has made the Bank more predictable, but not necessarily more transparent.*

**D**isclosing more of the Bank's assessment about the outlook, including forward-looking statements about monetary policy actions, is particularly tricky and really tests the limits of transparency. Nevertheless, it is in this area that there may be the most room to increase transparency. But first, we must figure out if it would be beneficial to provide more information for market participants, firms, and individuals. More fundamentally, would it improve the effectiveness of monetary policy? And if we find that it would be beneficial, how can we convey this information so that it would be readily understood? Or more importantly, how can we convey this information in a way that will not be misunderstood? (Kennedy 2008)

It is generally accepted today that transparency is a key component of an effective monetary policy framework, and communication plays an important role in increasing transparency. Over the past few years, several major central banks have sought to further enhance their monetary policy transparency by including guidance on the policy rate in their official communications in the form of either policy-inclination statements (also known as forward-looking statements) or a policy-rate path or forecast. There is an ongoing debate, however, on the value of communicating policy-rate guidance to the public, including strong arguments for and against its use. In this article, we examine the debate from both a theoretical and an empirical standpoint.<sup>1</sup> Our empirical analysis suggests

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1. This article is based on a forthcoming working paper by the authors (Fay and Gravelle 2009).

that forward-looking policy statements in Bank of Canada communications have made the Bank more predictable, but have not necessarily helped market participants improve their understanding of the central bank's monetary policy reaction function.

## Transparency, Predictability, and Conditionality

Central bank transparency can make monetary policy more effective in three ways. First, the central bank fosters greater credibility by being clear about its objective, including how it is to be attained and the bank's ability and commitment to achieve it. Second, transparency imposes some degree of accountability through regular exposure to the central bank's views and its understanding of current and future economic activity. This exposure permits the public to assess the consistency of the central bank's actions (and its monetary policy decision-making process) with the bank's stated objective. Third, and this is the focus of this article, central bank transparency should help market participants improve their understanding of the central bank's monetary policy reaction function, allowing them to better anticipate future changes in the policy interest rate. Thus, although the central bank only has control over the short-term (overnight or policy) interest rate, since short-term and long-term rates are linked via the expectations hypothesis, the bank can use its communications to better influence long-term rates by enhancing the market's understanding of the reaction function and its views on the economic outlook. This communication would increase the effectiveness of the monetary policy transmission mechanism, the process by which expected changes in monetary policy are incorporated into the movement of other financial variables and, eventually, investment and consumption decisions, which in turn affect inflation.

The Bank of Canada, like many other central banks, has taken various measures over the years to increase transparency and to communicate its views about the economic outlook to the public. Since 1995, the Bank has published a *Monetary Policy Report* (MPR) in April and October. Beginning in 2000, this has been supplemented by a *Monetary Policy Report* (MPR) *Update*, released in January and July.<sup>2</sup> Since 1994, a press release has also been published with every decision on

2. Although the MPR *Update* is shorter than the MPR, we make no distinction between the two publications in the remainder of the text.

the policy rate. Over the years, speeches by the Governing Council (the Governor and the Deputy Governors) have provided an opportunity to impart monetary policy information to the public. Finally, in December 2000, the Bank moved to a system of eight "fixed announcement dates" (FADs) per year, thereby reducing the timing uncertainty of its policy decisions.

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*The Bank of Canada has taken various measures over the years to increase transparency and to communicate its views about the economic outlook to the public.*

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Recently, in line with the trend among other central banks, the Bank began to include forward-looking statements, a form of policy-rate guidance, in the FAD press releases and MPRs.<sup>3</sup> Rudebusch (2008) identifies three types of forward-looking policy guidance used by central banks. The first, "indirect signals," provides implicit information about the policy path through the use of related information, such as a balance-of-risk statement, or the presentation of a risk scenario showing the extent to which inflation would deviate from the inflation target, holding policy rates constant. The second, "direct qualitative" signals, includes the policy "bias" statements that the U.S. Federal Reserve (the Fed) used for a short period beginning in the late 1990s. This type of signal can also include phrases that signal the desired policy stance over an extended number of monetary policy meetings, such as those used by the Fed between 2003 and 2006 indicating that accommodation "can be maintained for a considerable period" or "can be removed at a pace that is likely to be measured." The final category, "direct quantitative" signals, best describes the explicit numerical projections for the policy interest rate that the central banks of New Zealand, Norway, Sweden, the Czech Republic, and Iceland have provided.

Based on these definitions, the Bank of Canada has provided direct qualitative signals to markets via the forward-looking statements that have been included

3. At the Bank of Canada, forward-looking statements have been designed to be conditional statements. That is, any statement regarding the future stance of monetary policy is based on the current state of the economy and may change as new information arrives.



in nearly all FAD and MPR press releases since July 2004. These statements typically begin with the phrase “In line with the projection” and have included wording such as “some increase in the target for the overnight rate may be required in the near (medium) term,” “the current level of the target for the overnight rate is consistent with achieving the inflation target over the near (medium) term,” or “further reduction of monetary stimulus will be required . . . over the next four to six quarters.” Recently, the Bank has also introduced balance-of-risk statements that could be categorized as indirect guidance. In addition, the Bank has provided both indirect and direct qualitative guidance in its MPRs and in speeches.

## How Much Information?

Currently, there is a debate around how much information central banks should release to the public with respect to their future intentions for the policy rate.<sup>4</sup> A potential advantage identified by Kahn (2007) and others is that guidance on the policy rate could make monetary policy more effective by better influencing medium- and long-term rates, since these are more likely to react to policy actions that are accompanied by communication about the path of future policy rates.<sup>5</sup> Another possible advantage of providing guidance is that it makes the central bank’s future decisions on the policy rate more foreseeable or, equivalently, it may reduce the degree of market uncertainty related to future monetary policy actions. This, in turn, should reduce interest rate risk premiums and thus benefit economic agents by reducing the overall cost of capital.

Kohn (2005), Issing (2005), and others have highlighted some notable disadvantages to providing guidance. First, markets might, paradoxically, place too great a weight on the guidance on the policy rate and thus not fully understand or appreciate the *conditionality* of this guidance. To be clear, markets do not necessarily perceive the guidance as being fully unconditional but as less conditional, by some amount, than intended by the central bank. Consequently, markets may focus less on their own or other relevant information in formulating their expectations of future decisions on the policy rate (i.e., the market does not do its “homework”), which may reduce the information content of market prices.

4. See Kahn (2007) for a summary, as well as Moessner and Nelson (2008).

5. To our knowledge, this hypothesis has not been directly tested empirically.

A second disadvantage related to any perceived *unconditionality* of the guidance on the policy rate is that it might cause policy-makers to be less willing to change their policy intentions in light of new information, for two reasons. First, frequent updating of the policy path might undermine the public’s confidence in the central bank’s forecasting ability. Second, policy-makers may be concerned that financial markets will overreact to a shift in policy stance or guidance, leading to excess volatility, even though the change in circumstance justifies the central bank’s reassessment of the appropriate policy action.

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*Greater central bank predictability will not necessarily imply greater monetary policy transparency, but greater transparency does, in general, imply greater predictability.*

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On the issue of central banks providing policy guidance in their official communications, it is important to note that there is a subtle difference between a communication strategy that is “transparent” and one that is “predictable” (Moessner, Gravelle, and Sinclair 2005; Jen 2007).<sup>6</sup> Conceptually, with a more predictable central bank, market participants can more easily anticipate the next policy decision (or set of policy decisions) *without* necessarily better understanding the reasons for them. A more transparent central bank, however, is one that effectively conveys to the market its monetary policy reaction function, which allows markets to better anticipate the central bank’s decisions based on a clearer understanding of the factors at play. Although policy-makers may provide policy guidance to enhance the markets’ understanding of the reaction function and, ultimately, the effectiveness of monetary policy, market participants’ focus on the guidance could reduce their incentives to update their understanding of the monetary policy reaction function and to collect and analyze new information. Moreover, if the central bank’s policy decisions made following

6. Blinder et al. (2008) make the distinction between short-term predictability (i.e., the markets’ ability to anticipate correctly the next monetary policy decision) and long-term predictability (i.e., how central bank communications help to anchor inflation expectations). Long-term predictability is related to the first motivation for enhancing transparency discussed in the text: enhancing the central bank’s credibility.

the published guidance consistently corroborate the published guidance, this will also reduce market participants' incentives and will push the market to view the guidance as less conditional (via learned behaviour). As a result, the markets' reaction to macroeconomic news could decrease.<sup>7</sup> Therefore, greater central bank *predictability* will not necessarily imply greater monetary policy transparency, but greater *transparency* (i.e. communication of information that effectively enhances the markets' understanding of the reaction function) does, in general, imply greater predictability.<sup>8</sup>

It is not clear whether the central banks that publish their target-rate paths or some other form of guidance on the policy rate are necessarily "predictable," since predictability depends on the degree of perceived conditionality (or the lack thereof) embedded in the central bank's guidance. It is possible that central banks that provide direct quantitative guidance (i.e., a policy-rate path) could be less predictable (and more transparent) than those that offer direct qualitative guidance, if the forward-looking statement is explicitly presented to be, or is implicitly perceived to be, more unconditional than the policy path. For example, central banks could indicate that the path is simply the mean or mode of a probability distribution, with confidence bands indicating the level and balance of the risks. Moreover, central banks that publish a path for the target rate could use it as a tool to animate their communication about their views of the economic outlook, and in particular how the risks to this outlook may manifest themselves, by also providing in-depth alternative scenarios and/or risks to their base-case projections for the policy rate.

Moessner and Nelson (2008) argue that the *regular* appearance of a policy-rate path in central bank communications may in itself make these communications more conditional relative to those central banks that irregularly communicate guidance in the form of direct qualitative signals, because the latter may be viewed as doing so for the tactical reason of "massaging" market expectations. The latter central banks' communication guidance may thus look more unconditional.

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7. Several researchers have termed this behaviour "rational inattention," which Sims (2003) defines as economic agents, or in this case, market participants optimally choosing what information to focus on, given that individuals have a limited capacity for processing information.

8. Many papers that examine central bank transparency study all or multiple dimensions of this concept. This article, however, focuses on only one aspect of transparency, and therefore uses a narrower definition than that employed in other work.

Nonetheless, in general, it would seem that central banks that provide direct qualitative or quantitative guidance by providing a forward-looking statement or a policy-rate path have more "work" to do to promote understanding of the conditionality embedded in their communications.

In sum, the relevant factors for measuring central bank predictability are: i) the extent to which the central bank conveys the timing and direction of future rate changes, and ii) the degree of conditionality that is explicitly embedded in, or more importantly, implicitly perceived by the market, in its communications. As highlighted by Kahn (2007, p. 40), central banks that restrict themselves to use only "balance-of-risk" statements leave "the markets to interpret any possible implication of these risks for (future) policy rates." In contrast, policy statements like the forward-looking statements used by the Bank of Canada or the guidance provided by the Fed may be perceived by market participants as more unconditional.

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*Central banks that are increasingly predictable without being more transparent should see a decrease in the reliance of financial markets on macroeconomic news to anticipate near-term monetary policy changes.*

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Empirically, central banks that are increasingly predictable without being more transparent should see a decrease in the reliance of financial markets on macroeconomic news to anticipate near-term monetary policy changes.<sup>9</sup> In the section below, we investigate whether the inclusion of forward-looking statements in Bank of Canada communications has in fact caused markets to react less to macroeconomic releases because they view the Bank's communication as less conditional, which could be an indication that the Bank has become more predictable, but not necessarily more transparent.

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9. Put another way, for central banks that are successfully more transparent, one should observe both an enhanced ability of the market to anticipate the central bank's move, measured in most cases by a reduction in the surprise component of monetary policy decisions (see Poole and Rasche 2003, for example), and either no reduction of, or a rise in, the sensitivity of market interest rates in response to macroeconomic news.

## Empirical Evidence

In our empirical work, we test whether the use of forward-looking statements has reduced perceived conditionality, thus making the central bank more predictable, but not necessarily more transparent. This would show up in two ways. First, markets would focus less on the information that surrounds the Bank's outlook. In this case, we should see longer-term market rates moving less on FADs. Second, markets would react less to macroeconomic news announcements.

We examine these issues in three ways. First, using daily data, we measure the reaction of market rates to Bank of Canada communications from 30 October 2000 to 31 May 2007, following the adoption of the FADs.<sup>10</sup> We then split our sample in two at 22 July 2004, the date at which the Bank began to consistently use forward-looking statements, to see if there is any change in the markets' reaction to these communications and, separately, to macroeconomic news announcements. Next, to control for FADs that included a forward-looking statement prior to our sample break, we measure the reaction of market rates to the FAD press release on dates where the FAD contained a forward-looking statement against those that did not.

## Methodology and Results

Several issues arise when trying to measure the markets' reaction to central bank communications.<sup>11</sup> First, not being able to quantify and systematically characterize the content of central bank communications makes it difficult to benchmark the strength or importance of the communication, as well as its direction, measured in terms of its monetary policy stance. Moreover, we cannot easily measure what markets had expected these communications to say, making it hard to assess the strength or sign of any communication surprise. Because of these issues, we do not attempt to qualitatively measure what is being said. Rather, we simply test whether markets perceived important new information in the communication, which would be reflected in higher volatility in market rates on communication dates relative to non-communication dates. Another complication is

that market participants could react to other events that occur on the same day as the release of a Bank communication, causing interest rates to change as a result. To isolate the impact of Bank of Canada communications on market rates, we run a two-stage regression model in which we first control for other market-moving news, as described below. Thus,

$$\Delta y_t = \beta_0 + \beta_1 \Delta ON_t + \beta_2 \Delta ff_t + \beta_3 \Delta ef_t + \beta_4 \Delta T2_t + \sum_{i=1}^n \alpha_i cmac_{i,t} + \sum_{j=1}^m \alpha_j usmac_{j,t} + \varepsilon_t \quad (1)$$

In equation 1, we control for other news by regressing the 1-day change in various key Canadian interest rates ( $\Delta y_t$ ) on the surprise component of Canadian policy announcements ( $\Delta ON_t$ ), the surprise component of U.S. policy announcements ( $\Delta ff_t$ ), Federal (Reserve) Open Market Committee (FOMC) communication control variables ( $\Delta ef_t$  and  $\Delta T2_t$ ) and the surprise component of macroeconomic announcements in Canada and the United States ( $cmac_{i,t}$  and  $usmac_{j,t}$ , respectively).<sup>12</sup>

Once we have controlled for these other events, we relate the unexplained variance of our interest rates (i.e., the squared residual of equation 1) to communications. We do this using the following regression equation:

$$\varepsilon_{i,t}^2 = \delta_0 + \delta_1 Vix_t + \sum_{j=1}^3 \gamma_j comm_{j,t} + \eta_{i,t} \quad (2)$$

where  $\varepsilon_{i,t}^2$  is the squared residual from equation 1 for interest rate  $i$ ,  $comm_{j,t}$  represents the  $j^{th}$  type of communication, which are modelled as dummy variables that take the value of 1 on days when there are FAD press releases, MPR releases, or speeches (i.e.,  $j = 1, 2$ , or  $3$ ) and zero otherwise. We then compare the variance of the market rates on communication days against the average variance on all non-communication days, controlling for the gradual decline in market volatility over our period of study by including the VIX index ( $Vix_t$ ).<sup>13</sup>

We run this set of equations for each of our key interest rates. These include the 3-month Canadian dealer

10. Our sample begins with the first release of the FAD schedule. We do not include the data for the three months following the September 11, 2001, terrorist attacks, owing to possible distortions in the data.

11. In terms of the methodology used to measure the markets' reaction to Bank of Canada communications, we follow Reeves and Sawicki (2007).

12. See the Appendix for more detail on these controls.

13. The VIX index is a commonly used measure of overall global financial market volatility (often referred to as the "fear gauge"). It is based on the volatility implied from a set of S&P 500 options contract prices.

offered rate (CDOR), the 90-, 180-, and 270-day constant maturity bankers' acceptance future (BAX) rates calculated from the front four BAX contracts; and 2-, 5-, and 10-year constant-maturity Government of Canada benchmark bond yields calculated from the zero coupon curve.<sup>14,15</sup>

Over the full sample (Table 1), we find that FAD press releases have a significant impact on the volatility of short- to medium-term market rates, suggesting that, on average, these statements contain important "new" information for the short- to medium-term outlook. This is not surprising, since this statement contains the policy-rate decision, the reasons behind the decision, an update of the Governing Council's view of the economic outlook, and, more recently, forward-looking policy guidance and a discussion of the balance of the risks to the outlook.

An interesting result is that market rates do not react significantly to the MPR, even though it is the main method of communicating and updating the Bank's detailed views on the current state and likely evolution of the economy (as illustrated by the statistically non-significant coefficients in column 2, Table 1). This can be explained by the fact that the MPR is published quite soon after the FAD press release. Since the two are consistent by design, the MPR may not contain much incremental market news compared with the FAD press release. Another interesting result is that speeches are found to have a significant effect on some market rates. Since speeches rarely deviate from the discussion presented in the published MPR, we did not expect markets to react significantly to speeches over our sample. To test the robustness of this result, we ran a sensitivity analysis and found that by removing only two speeches—the two that drew the largest market reaction—from our sample of 98, our results were no longer significant at the 5 per cent level, thus suggesting that, in general, speeches do not have a significant impact on market rates over our sample.

To address the issue of whether the inclusion of forward-looking statements has in fact enhanced the Bank's monetary policy transparency, we rerun these

14. The 3-month CDOR is the rate to which the BAX futures contracts settle and was found by Johnson (2003) to be a good measure of market expectations.

15. Johnson (2003) shows empirically that the front three BAX contracts are among the rates that are most representative of expectations in Canada (under 1 year). Harvey (1996) shows that changes in futures prices tend to respond more quickly than (or lead) other money market rates in their reaction to economic news. For a fuller discussion of the BAX market, see Johnson (2003) and Harvey (1996).

Table 1

**Impact of Bank of Canada Communications on Market Volatility**

$$\varepsilon_{i,t}^2 = \delta_0 + \delta_1 Vix_t + \sum_{j=1}^3 \gamma_j comm_{j,t} + \eta_{i,t}$$

Interest rates	Fixed announcement date press release ( $\gamma_1$ )	Monetary Policy Report ( $\gamma_2$ )	Speeches ( $\gamma_3$ )
3-month Canadian dealer offered rate (CDOR)	0.772 (0.392)	5.944 (0.289)	0.261 (0.776)
90-day bankers' acceptance (BAX)	<b>14.761</b> <b>(0.001)</b>	17.014 (0.295)	6.431 (0.060)
180-day BAX	<b>24.930</b> <b>(0.004)</b>	24.463 (0.212)	<b>15.586</b> <b>(0.021)</b>
270-day BAX	<b>26.570</b> <b>(0.010)</b>	23.963 (0.234)	<b>16.241</b> <b>(0.037)</b>
2-year bond	<b>14.975</b> <b>(0.023)</b>	14.333 (0.249)	5.236 (0.177)
5-year bond	5.146 (0.283)	4.547 (0.519)	2.121 (0.460)
10-year bond	-0.251 (0.934)	-0.833 (0.863)	0.432 (0.844)

Note: Boldface indicates significance at the 5 per cent level. The  $p$ -value is shown in parentheses.

regressions over a split sample (split at 22 July 2004, the point at which forward-looking statements began being used consistently) and compare the results for each of the shorter samples with those from our full sample. We find that in the first subsample (October 2000–July 2004), a period when forward-looking statements were used inconsistently and sparingly, the FAD press releases and speeches are significant for various maturities of interest rates (consistent with our full-sample results). In the second subsample, however, except for one interest rate, no communication events are significant. These findings seem to support the idea that markets focus on the forward-looking statement and view it as a rough pre-commitment because, in contrast to our earlier results, FAD press releases are no longer significant at the 5 per cent level. However, it could also be that the reduced reaction to FAD press releases is the result of a better or increased understanding of the monetary policy reaction function of the Bank as markets became accustomed to the new FAD regime. That is, there are fewer information asymmetries between the central bank and markets about the reaction function and therefore less new



information in central bank communication. We examine the latter possibility in the following analysis.

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*These findings suggest that markets focus on the forward-looking statement and view it as a rough pre-commitment.*

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For our second test, we modify equation 2 by incorporating a cross-dummy variable that takes the value of 1 on FADs when the FAD press release contained a forward-looking statement, and zero otherwise. The coefficient on this cross dummy represents the change in the markets' reaction on FADs that include forward-looking statements relative to all FAD press statements. Thus,

$$\varepsilon_{i,t}^2 = \delta_0 + \delta_1 Vix_t + \gamma comm_{1,t} + \beta comm_{1,t} * FLS_t + \eta_{i,t}, \quad (3)$$

where  $comm_{1,t}$  takes the value of 1 on FADs and zero otherwise, while  $FLS_t$  takes the value of 1 on those FADs that include a forward-looking statement and zero otherwise. We estimate equation 3 over the full sample. The sum of the estimates for  $\gamma$  and  $\beta$  represents the average reaction of the market to FADs (i.e., the average impact on the variance of interest rates on those days) that include forward-looking statements, while the estimate for  $\gamma$  alone represents the markets' average reaction on FADs over the entire sample. If markets are ignoring information on the outlook contained in the FAD press release outside of the forward-looking statement itself, we would expect the coefficient on this additional cross-dummy variable ( $\beta$ ) to be negative and significant. We find that coefficients on the cross dummies (in each key interest rate regression) are in general negative and significant. This supports our hypothesis that the Bank of Canada has become more predictable over the second half of our sample (Table 2).

Finally, we test to see if there has been a decline in the impact of macroeconomic news announcements on changes in interest rates since the regular inclusion of forward-looking statements in the FAD press release. To do so, we create cross-dummy variables for macroeconomic news and add these variables to equation 1. The new cross-dummy variables multiply the macro-

Table 2

**Impact of Forward-Looking Statements in FAD Press Releases**

$$\varepsilon_{i,t}^2 = \delta_0 + \delta_1 Vix_t + \gamma comm_{1,t} + \beta comm_{1,t} * FLS_t + \eta_{i,t}$$

Interest rates	FAD press release coefficient ( $\gamma$ )	FAD press release cross-dummy coefficient ( $\beta$ )
3-month Canadian dealer offered rate (CDOR)	2.631 (0.098)	<b>-3.875</b> (0.021)
90-day bankers' acceptance (BAX)	<b>22.098</b> (0.001)	-15.633 (0.060)
180-day BAX	<b>41.124</b> (0.003)	<b>-34.205</b> (0.036)
270-day BAX	<b>49.141</b> (0.003)	<b>-46.766</b> (0.016)
2-year bond	<b>26.548</b> (0.019)	-23.285 (0.070)
5-year bond	13.558 (0.104)	-16.551 (0.078)
10-year bond	3.889 (0.437)	-7.979 (0.180)

Note: Boldface indicates significance at the 5 per cent level. The  $p$ -value is shown in parentheses.

economic news variables by a dummy that takes the value of 1 over the period from 22 July 2004 to 31 May 2007, and zero otherwise. Equation 1 is modified slightly to include these additional variables, as follows:

$$\Delta y_t = \beta_0 + \beta_1 \Delta ON_t + \dots + \sum_{i=1}^n \alpha_i cmac_{i,t} + \sum_{i=1}^n \gamma_i cmac_{i,t} * Dum_t + \varepsilon_t, \quad (4)$$

where  $Dum_t$  takes the value of 1 during the period from 22 July 2004 to 31 May 2007, and zero otherwise. If markets understand the central bank's reaction function better (less well), Canadian macroeconomic news cross-dummy tests should yield significant positive (negative) coefficients ( $\gamma_i$ ) as market participants react more (less) fully to new domestic economic information as it arrives. We find that for all key interest rates, the majority (11 of 14) of the Canadian macroeconomic surprise cross dummies ( $\gamma_i$ ) were negative, suggesting that markets reacted less to Canadian macroeconomic releases in the second half of our sample,



thus lending further support to our increased-predictability hypothesis.<sup>16</sup>

## Conclusion

Our analysis provides some indication that the recent inclusion of guidance on the policy rate may not yet have yielded an improvement in market participants' understanding of what key economic information goes into the Bank of Canada's interest rate decisions. Indeed, our study suggests that forward-looking statements—even though they have been designed to be conditional—have made the Bank's decisions on the policy rate more predictable but have not necessarily enhanced the markets' understanding of the Bank's monetary policy reaction function.

As with any empirical study, however, there are some important caveats. First, there are issues related to the smaller sample size. By largely focusing on the second half of the sample, we reduce the number of FAD communications and in turn likely reduce the robustness of our empirical methodology. There are also a number of issues related to the different economic environments between the first and second half of the full sample; for instance, there are only a few policy turning points over our full sample and none in the second half of the sample, the period when forward-looking statements were consistently used. As such, there is less uncertainty as well as fewer macroeconomic shocks and news to react to, possibly contributing to some of our second-half results in which macroeconomic variables become less important movers of interest rates. As well, empirical work suggests that the pre-existing shape of the yield curve at the time of the communication will affect how markets react to news along the yield curve.

Another related caveat is that the sample period in which the forward-looking statements were consistently included in FAD press releases is one where there has not been a sharp change in the Bank of Canada's view about the economic outlook for inflation. Moreover, the Bank of Canada stressed in its communications during this period that it does not react to any one macroeconomic shock or surprise. The smaller reaction of market rates to macroeconomic news in the second half of our sample may reflect, in part, the market's better understanding of how the

16. Several of these negative cross dummies were also significant at the 5 per cent level. As well, of the few cross dummies with positive coefficients, none was significant at the 5 per cent level.

Bank of Canada reacts to the accumulation of macroeconomic data. Consequently, instead of reacting substantially to one-off macroeconomic shocks, there is a more gradual shift in policy-rate expectations from market participants, who have an accumulation of data that we are unable to control for in our methodology.

Finally, using data at a daily frequency may also affect our results because it is not possible to control for all other shocks hitting the market on the same day. Further study at an intraday trading frequency might yield different answers.

That said, there is general agreement among central bankers that issues relating to the incorporation of conditionality and uncertainty around this form of policy guidance remain. The debate focuses on the weighting of the risks versus the benefits of guidance on the policy rate, and the various views on how conditionality can be incorporated into the communications strategy. Consequently, a full spectrum of communications strategies is employed in determining how much of the policy outlook to reveal. These strategies range from not including policy guidance except by being more explicit about how perspective changes in key macroeconomic variables will affect the balance of risks to the central bank's outlook to regularly publishing a forecast for the policy rate. There may be no "ideal" communications strategy that sufficiently mitigates the risk that markets perceive a lack of conditionality and uncertainty surrounding the published policy guidance.<sup>17,18</sup> In deciding to provide policy signals or guidance, however, it should be remembered that the goal is to enhance markets' understanding of the central bank's typical monetary policy reaction function, rather than the more narrow aim of increasing markets' ability to predict future monetary policy actions. By adjusting its communications strategy in this way, the central bank will be better placed to achieve the desired increase in monetary policy transparency that should enhance the effectiveness of the monetary policy transmission mechanism.

17. Walsh (2008) argues that there is a related distinction, between *better* and *more* central bank information about its economic outlook, in which *better* information is always found to be welfare improving while *more* has an ambiguous effect on welfare.

18. Research by van der Cruysen, Eijffinger, and Hoogduin (2008) shows that there is likely to be an optimal intermediate degree of central bank transparency beyond which markets might: i) start to attach too much weight to their forecasts, or ii) become confused by the large and increasing amount of information they receive.

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## Appendix: Description of Controls

We calculate the surprise component of macroeconomic announcements using the following formula:

$$mac_{i,t}^u = \frac{(X_{i,t} - X_{i,t}^e)}{\Omega_i^x}, \quad (1)$$

where  $X_{i,t} - X_{i,t}^e$  are the actual minus the market expected value of the  $i^{th}$  macroeconomic release on day  $t$ , and  $\Omega_i^x$  is the sample standard deviation of surprises for the  $i^{th}$  macroeconomic release. This is set to zero on days where no macroeconomic announcements are made.

Financial market expectations or forecasts of the macroeconomic data release used in calculating the surprise component are provided by Bloomberg surveys conducted before each announcement. We include in our study the subset of independent macroeconomic surprise variables that were significant at the 5 per cent levels over our sample.

Among Canadian releases, this includes releases on both the core and headline consumer price indexes, and on employment and the gross domestic product, housing starts, the Ivey purchasing managers index, leading indicators, manufacturing shipments, and retail sales. The U.S. macroeconomic surprise variables that we find significant at the 5 per cent level include core consumer price inflation, gross domestic product, hourly earnings, industrial production, the Institute for Supply Management (ISM) index, non-farm payrolls, the core and headline producer price indexes, the trade balance, and the unemployment release.

Canadian policy surprises are calculated as the 1-day change in the 1-month bankers' acceptance rate on Canadian monetary policy decision days. This is set to zero on non-policy days.

U.S. policy surprises are calculated using the following formula:

$$\Delta ff_t^u = [D/(D - d)] \cdot \Delta ff1_t, \quad (2)$$

where  $D$  is the total number of days in the month,  $d$  is the day of the month of the Federal Open Market Committee (FOMC) decision, and  $\Delta ff1_t$  is the change in the futures rate on the day of the policy decision (including inter-meeting actions). We set this equal to zero on non-policy days.

To control for the impact of FOMC communications on Canadian rates, we will include the 1-day change in the second eurodollar futures contract as well as the 1-day change in the on-the-run 2-year Treasury on dates of FOMC press releases, testimonies, and minutes.

# Conference Summary: International Experience with the Conduct of Monetary Policy under Inflation Targeting

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**T**he Bank of Canada's annual research conference, held in July 2008, examined central banks' experiences with the conduct of monetary policy under inflation targeting. Since the introduction of inflation targeting by New Zealand in 1990, and the formal adoption of inflation targets by the Bank of Canada in 1991, inflation targeting has become a popular monetary policy framework. For Canada, inflation targeting has contributed to keeping total CPI inflation very close to 2 per cent, on average, since 1991. The reduction in inflation, coupled with an explicit commitment to keep inflation low, stable, and predictable, has helped to anchor inflation expectations close to the 2 per cent inflation target as well. Since other countries that have introduced inflation targeting have had similar experiences, inflation targeting is often credited as a monetary policy framework that can keep inflation low and stable, and thus contribute to sound and stable macroeconomic performance.<sup>1</sup>

The purpose of the Bank of Canada's 2008 conference was to review the international experiences with inflation targeting in more detail by bringing together central bankers from various inflation-targeting and non-inflation-targeting countries around the world. The conference consisted of two special lectures and several sessions, and concluded with a panel discussion. The opening John Kuszczak Memorial Lecture, given by Carl Walsh, provided a systematic overview of the international experience with inflation targeting.<sup>2</sup> It was followed by sessions focused on i) how

inflation targeting can manage external shocks, ii) various ways in which monetary policy decisions are taken, and iii) the issues of transparency and communication. The sessions all followed the same format: a distinguished scholar presented a paper outlining the key issues, which was then discussed by a panel of (mostly) central bankers, who responded to the paper by sharing experiences or methodologies from their central bank. The keynote address, which was delivered by Frederic Mishkin of the Board of Governors of the U.S. Federal Reserve System, outlined possibilities for further enhancements to the Fed's communication policy. A closing panel considered options for the future of inflation targeting.

## **John Kuszczak Memorial Lecture: Inflation Targeting—What Have We Learned?**

The John Kuszczak Memorial Lecture, which opened the conference, was given by Carl Walsh of the University of California at Santa Cruz, who reviewed the international experience with inflation targeting. Since the introduction of inflation targets by New Zealand nearly 20 years ago, more than 20 developed and developing nations have adopted a program of inflation targeting. Walsh argues that the experience with inflation targeting has typically been very positive, given that no central bank has ever moved away from

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1. Conference papers will be published in a forthcoming issue of *International Finance*.

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2. This lecture is funded by the Bank of Canada in memory of our esteemed colleague, John Kuszczak, who died in 2002.

it (except to join a monetary union). Testing for the statistical benefits of inflation targeting is not straightforward, however. Among industrialized countries, for example, the main difference between inflation targeters and non-inflation targeters is that inflation expectations are better anchored under inflation targeting. Yet, better anchoring of inflation expectations does not translate into statistically different levels of inflation, volatilities of inflation, or differences in rates of output growth. From a research perspective, this presents a puzzle: Economic research typically emphasizes the importance of well-anchored inflation expectations, which should translate into less-volatile output and inflation. For this reason, a cornerstone of modern economic modelling in central banks is a strong emphasis on inflation expectations.

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*The biggest success of inflation targeting is its emphasis on a clear focus on inflation and well-anchored inflation expectations.*

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This statistical puzzle may be explained by the difficulty of distinguishing between inflation-targeting central banks and non-inflation-targeting central banks, since the latter are adopting more and more insights and practices from inflation targeters. Thus, even though central banks such as the European Central Bank (ECB) or the U.S. Federal Reserve are not inflation-targeting central banks in a strict sense, their conduct of monetary policy has incorporated many of the insights that originate from inflation targeting. This is visible, for instance, in attempts to influence inflation expectations by announcing definitions of price stability (in the case of the ECB), or by specifying a level for inflation at the end of the projection horizon (as the U.S. Federal Reserve has done at times). In that sense, the biggest success of inflation targeting is not the reduction in the rate of inflation, which has also been achieved by other central banks with different monetary policy frameworks, but its emphasis on a clear focus on inflation and well-anchored inflation expectations.

During the general discussion, it was noted that identifying the benefits of inflation targeting might be easier for emerging markets, because the differences between inflation-targeting central banks and those

using other monetary policy frameworks are more pronounced. Various central bankers also noted that having a clear mandate and improved accountability facilitates not only communication with the public, but also the political discussion. Adoption of a formal target for inflation simply makes it easier to communicate that the central bank focuses on price stability, rather than on other goals.

## **Session 1: External Influences and Inflation Targeting**

Many small open economies that export commodities experience periods of high economic volatility, brought about by changes in the external environment. Large movements in the prices of commodities, for example, can contribute to considerable fluctuations in exchange rates. The purpose of this session was to examine how monetary policy should deal with these large and potentially persistent fluctuations in the exchange rate that are induced by changes in the price of, or demand for, commodities.

Laurence Ball's presentation, "Policy Responses to Exchange Rate Movements," explores ways to deal with sectoral reallocation of resources caused by swings in exchange rates. The main idea is that when sectoral reallocation of capital and labour is costly, policy-makers might consider dampening or smoothing the reallocation induced by *temporary* fluctuations in the exchange rate. Policy-makers need to think carefully about the source of exchange rate movements, however, because the optimal policy response might be different if the exchange rate moves in response to changes in a narrow set of commodity prices, as opposed to changes in demand for a broad basket of exports. If policy-makers were to adopt policies to smooth fluctuations in commodity prices, Professor Ball advocates the use of fiscal policy.

The paper was discussed by Mark Wynne from the Federal Reserve Bank of Dallas, Klaus Schmidt-Hebbel from the Central Bank of Chile, and Bernard Hodggets from the Reserve Bank of New Zealand. The discussants commented on the idea of smoothing sectoral reallocation. The international experience suggests that attempts to limit fluctuations in currency markets may not be very successful in practice. For example, the appreciation of New Zealand's currency between the summer of 2007 and the summer of 2008, which was fuelled by strong commodity prices, was so large that to offset the effects of the appreciation (which included benefits that occur through wealth



effects and better terms of trade) and to stabilize the sectoral composition of the economy, a very large fiscal contraction would have been required. Given that this might have entailed large distributional effects, it is not clear that such a policy is politically feasible. It was noted as well that in many cases it is not clear *ex ante* whether a shock to commodity prices or exchange rates is temporary or permanent. Identifying the persistence of changes in commodity prices or the exchange rate is important for formulating the correct policy response. If movements are temporary, smoothing fluctuations might be warranted; in the face of a permanent or very persistent currency movement, however, sectoral reallocation should not be resisted. In fact, changes to the economic structure are required to reflect the change in the external environment. Taken together, experiences from other central banks suggest that economic policies should probably be directed to facilitate adjustment, rather than to resist sectoral reallocation.

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*The international experience suggests that attempts to limit fluctuations in currency markets may not be very successful in practice.*

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## **Session 2: Monetary Policy Decision Making**

Today, more than 80 central banks take decisions in committees, and no central bank has ever replaced a committee by a single decision-maker. The structure of the monetary policy committee is part of the overall institutional framework of the central bank. The structure and composition of a committee can affect the outcome of the meeting and, possibly, the quality of its decisions. Hence, it is important to understand how different committees take decisions.

In the presentation “Making Monetary Policy by Committee,” Alan Blinder reviewed several aspects of the issue, including the benefits of committee decision making, how committees take decisions, and the different types of committees (individualistic, collegial, or autocratically collegial committees). He finds that there is no “best” way for central banks to take decisions, since very different institutional arrange-

ments may each produce good decisions. Still, by reviewing different decision-making structures, a number of conclusions can be drawn. First, to facilitate an open exchange of views, committees should not be too large. Second, not all members of a monetary policy committee need to be specialists in monetary economics, since “a fresh look by an outsider” might be helpful at times. In light of this, Professor Blinder recommends that committees should probably not be staffed exclusively by “Bank careerists.” Third, committees seem to respond just as quickly as simple decision-makers. And, lastly, the type of committee may substantially influence the Bank’s communication strategy. An individualistic committee where decisions are taken by voting may opt for a more diverse communication strategy than a collegial committee, where the emphasis on consensus is likely to shape external communications quite differently.

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*There are significant differences in how central banks take decisions.*

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The discussants for this session were Zvi Eckstein from the Bank of Israel, Francisco Ruge-Murcia from the Université de Montréal, and Paul Tucker from the Bank of England. The discussants agreed that there is no single, optimal framework for taking decisions. An interesting insight of this session is that there are significant differences in how central banks take decisions. Several issues were raised during the discussion. First, it was noted that the structure of decision making might affect committee members’ behaviour. In individualistic committees, i.e., those that do not make decisions by consensus, the information content provided by minutes might provide interesting insights. Given the uncertainty about the outcome, timely communication of committee decisions is more difficult to achieve through a detailed press communiqué after the meeting, since uncertainty about the outcome of the vote prevents drafting a very detailed communiqué in advance. Hence, minutes are likely to be the main source of information for the public. Second, voting might induce strategic behaviour. In light of the scrutiny of the financial press and potential increases in uncertainty signalled to markets, committee members might weigh carefully whether they want to signal dissent and make differences in views

public if they realize that their dissenting vote does not change the decision. Lastly, it was discussed whether committees respond to new information more sluggishly than single decision-makers. Sharing information, deliberating as a committee, and voting might introduce frictions, for example, if not all committee members react to or process new information in a similar fashion. This can imply that, in response to a changing economic environment, the committee might react more slowly than single policy-makers.

## Keynote Address

While the benefits of inflation targeting have been recognized by many central banks, political constraints may restrict the framework under which some central banks operate. For instance, central banks may not have a clear inflation target, or their political mandate might entail more than one goal, as is the case for the U.S. Federal Reserve. This session explored ways for central banks to reap some of the benefits of inflation targeting, even if they cannot move to a fully-fledged inflation-targeting regime.

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*Publishing projections helps to anchor inflation expectations, because projections help financial markets to infer future central bank actions.*

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The backdrop to the keynote address by Frederic Mishkin of the Board of Governors of the U.S. Federal Reserve System was that the Fed changed its communication policy in October 2007. The Federal Open Market Committee (FOMC) has increased the transparency of U.S. monetary policy by providing more information on individual forecasts of FOMC members and by extending the horizon for their projections from two years to three. Publishing projections helps to anchor inflation expectations because projections help financial markets to infer future central bank actions. Challenges for policy-makers can arise, however, if central banks cannot directly communicate a target value for inflation, e.g., because the central bank's mandate is not formulated in terms of a numerical target or because the central bank has more than one goal. The proposal Professor Mishkin advocated was to offer an alternate way of conveying long-

run values of variables of interest to financial markets by publishing long-run forecasts; i.e., forecasts over a horizon of 5 to 10 years—*under appropriate monetary policy*. Essentially, this indicates the desired steady-state value of, say, growth and inflation with which the central bank feels comfortable.

The general discussion emphasized the difficulty of communicating a clear goal under political constraints. Lack of a clear target introduces uncertainty about the central bank's long-run objective, and many agreed with Professor Mishkin's idea of providing long-run forecasts as a way to give markets an indication of policy-makers' views. This session also highlighted the difficulties associated with adopting a focused objective like inflation targeting when the political environment is not fully supportive.

## Session 3: Communication and Transparency

A trend witnessed in central banks over recent years is a remarkable rise in transparency. The disclosure of policy decisions and the macroeconomic analysis on which they are based has increased greatly. The objective of this session was to review the trends in central bank communication and transparency, to evaluate their relationship with inflation targeting, and to examine the effects of greater transparency and better communication.

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*There is a trade-off between providing the central bank's best view on what the likely path of interest rates will be while simultaneously expressing uncertainty around that outlook and its conditionality.*

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The presentation, "Trends in Monetary Policy Transparency," by Petra Geraats of the University of Cambridge, explains how central banks have become much more transparent, not only to increase their accountability, but also to enhance the effectiveness of monetary policy. Comparing inflation-targeting central banks with non-inflation targeters, Professor Geraats finds that inflation targeters are more transparent and have increased their levels of transparency much

faster. And, lastly, there are still significant differences in the degree of information disclosure across central banks. For instance, while the communications of some central banks are focused on explaining the rationale behind their most recent monetary policy decision, other central banks go so far as to release a projection for the future path of interest rates over the next several quarters.

Professor Geraats' presentation was discussed by Tomas Holub of the Czech National Bank, Masayoshi Amamiya of the Bank of Japan, Donald Kohn of the Board of Governors of the U.S. Federal Reserve System, and Jan Qvigstad of the Norges Bank. The discussion confirmed the notion that stark differences exist in central bank transparency and communication. The discussion focused on how to minimize uncertainty in financial markets about future actions of the central bank. While all central banks implicitly talk about future policy decisions in some form, there is a trade-off between providing the central bank's best view on what the likely path of interest rates will be while simultaneously expressing uncertainty around that outlook and its conditionality. Supplying information in the form of a projection for the future path of interest rates provides insights into the central bank's thinking. At the same time, it bears the risk of constraining the central bank from changing course in the face of new information.

To avoid confusion in financial markets, good communication is essential. The Czech National Bank, for example, has provided verbal guidance on the path of future interest rates since 2002, and began publishing a forecast for the numerical path in 2008. In their view, an important element in providing guidance to financial markets, while not constraining future actions of the central bank, is to be very open about forecast errors in terms of inflation, as well as for the interest rate path. By regularly publishing historical charts contrasting actual policy rates with the forecasted interest rates at the time the decision was taken, the Czech National Bank attempts to communicate the uncertainty surrounding the interest rate forecast. Experience from the Norges Bank indicates that since it has been making the projection of the interest rate path public, market participants seem to focus increasingly on how the central bank interprets economic news. This market behaviour is viewed as an indication of how financial markets' understanding of the central bank's reaction to macroeconomic developments has improved. As well, for each interest rate

decision, the Norges Bank discusses shocks to the previous projection, and their implications for the interest rate path (dubbed "delta analysis"). This policy has helped to guide markets as to how the previous projection of the interest rate path has been changed by economic developments. Lastly, a somewhat different approach to communicate uncertainty surrounding the economic outlook is taken by the Bank of Japan. Here, each member of the monetary policy committee is asked to provide their individual probability distribution for growth of real gross domestic product and consumer price inflation. The Bank of Japan then publishes the average of these calculations in a "risk-balance chart." This indicates how the committee as a whole views the distribution of risks for the economy.

## Closing Panel: The Future of Inflation Targeting

The closing panel featured Malcolm Edey from the Reserve Bank of Australia, Ulrich Kohli from the Swiss National Bank, John Murray from the Bank of Canada, Lars Svensson from the Sveriges Riksbank, and Bill White, formerly from the Bank for International Settlements. The topic was ways to further enhance the inflation-targeting framework. Many central banks are still searching for optimal solutions in terms of decision-making, transparency, and communication. In light of this, the closing panel was looking ahead and discussed possible innovations, both at the technical level and in communicating uncertainty.

Lars Svensson emphasized the medium-term nature of inflation targeting. He advocated a decision-making procedure that is focused on following the appropriate interest rate path to restore inflation to its target level. His view is that, taking the target inflation rate as given, the task of the monetary policy committee is to decide on the path for the output gap, and, correspondingly, how quickly inflation can be returned to the target. Viewed from this angle, the focus of the discussion becomes the anticipated path of interest rates, not the current interest rate decision. From a practical perspective, the Swedish central bank found it helpful to supply the members of the monetary policy committee with charts showing the implications of different interest rate paths on the evolution of key economic variables, such as inflation or the output gap. The committee members then vote on different scenarios generated by different interest rate paths, rather than having to vote on the path directly.

John Murray touched on many of the topics raised in earlier sessions, including, in particular, the feasibility and desirability of moving from inflation targeting to price-level targeting. In an inflation-targeting framework, past shocks to the price level are not reversed by future monetary policy actions. This means that even if inflation is kept within a tight range, the price level need not necessarily evolve along a predetermined path (depending on the shocks hitting the economy). Consequently, even if two central banks share very similar objectives in terms of inflation targets, over a longer period, their actual price-level paths can differ substantially (depending, for example, on their vulnerability to external shocks). One way to reduce this uncertainty is to adopt a framework whereby the central bank targets a path for the price level.

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*In an inflation-targeting framework, past shocks to the price level are not reversed by future monetary policy actions.*

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Malcolm Edey provided a skeptical perspective of the potential benefits of price-level-targeting. The economic benefits from inflation targeting have been substantial, and it is not clear, in his view, that the gains from moving to price-level targeting will be large. Similarly, he expressed concern that it would be hard to communicate the case for an interest rate change, based on the deviation in the price level from a path that might have been set years earlier. With central banks having made the “big gains” already, Edey is wary of putting those gains at risk by overselling the

case for what he believes are “incremental further improvements.” On this point, however, comments from the floor indicated that the gains from inflation targeting were initially widely underestimated, and that it could be the case that the gain from moving to price-level targeting might be underestimated as well.

Ulrich Kohli, representing a central bank that does not consider itself an inflation targeter, focused on the broader benefits of inflation targeting. An important accomplishment of inflation targeting is that it has highlighted the importance of a stable objective. Even if central banks do not formulate their objective in terms of an inflation target, the notion that financial markets need guidance about the central bank’s ultimate goal has had a lasting impact on non-inflation targeters. A clear framework about the central bank’s objective is crucial, particularly in the face of large economic shocks. He also noted that not all inflation targeters are equally successful in stabilizing inflation expectations in the face of large shocks. Some central banks have recently had to modify their inflation target, acknowledging that the initial target was not feasible in the current economic environment. This change risks jeopardizing the credibility of the central bank.

Bill White acknowledged the benefits of inflation targeting in keeping inflation low, but pointed out that the exclusive focus on low inflation has not prevented the build-up of financial instability. He recommends a “serious rethink” of the goals of central banks, most notably the operating paradigm of seeking price stability. White advocates integrating issues of financial stability more explicitly with the conduct of monetary policy. Many issues of financial stability need to be addressed by regulatory measures, but there is nevertheless a role for frameworks that focus on the “long-term” to avoid the build-up of unsustainable imbalances.



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