Policy and Infrastructure Developments

Introduction

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

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

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

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

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

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

The CLS Bank: Managing Risk in Foreign Exchange Settlements

Paul Miller and Carol Ann Northcott

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

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

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

Foreign Exchange Settlement Risk

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

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

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

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

The CLS Bank

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

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

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

Risk Management in the CLS Bank

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

Types of Risk

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

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

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

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

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

The CLS Bank and the Canadian Financial System

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

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

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

Conclusion

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

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

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

Kim McPhail and David Senger

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

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

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

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

How Does a Liquidity Drain Occur?

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

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

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

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

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

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

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

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

Table 1

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

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

this reduces the collateral requirements of LVTS participants.

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

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

The Potential Impact on the LVTS of Participant Outages

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

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

How Does the CPA Limit the Consequences of Participant Outages?

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

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

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

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

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

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

Understanding Intraday Payment Flows in the Large Value Transfer System

Lindsay Cheung

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

Data

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

Intraday Pattern

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

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

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

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

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

Volume

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

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

Value

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

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

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

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

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

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

Chart 1a Hourly Payments Volume

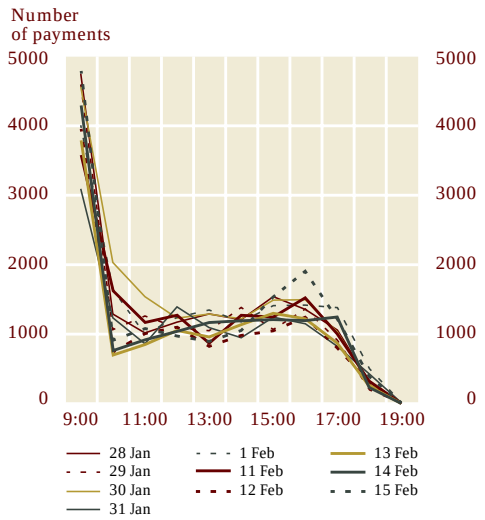


Chart 1b Cumulative Payments Volume

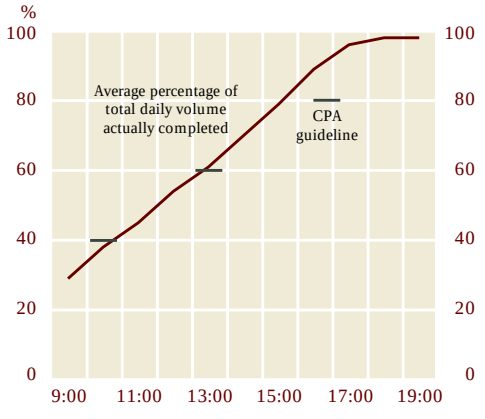


Chart 2a Hourly Payments Value

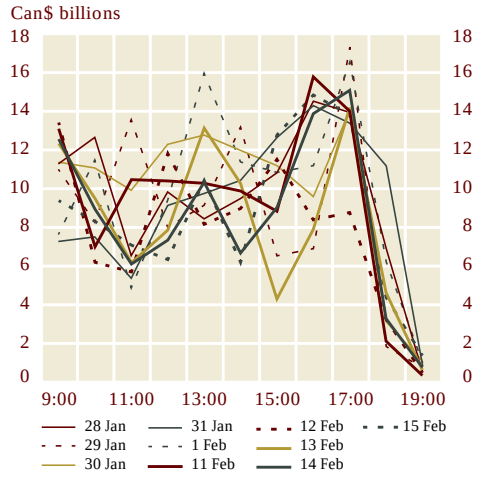


Chart 2b Cumulative Payments Value

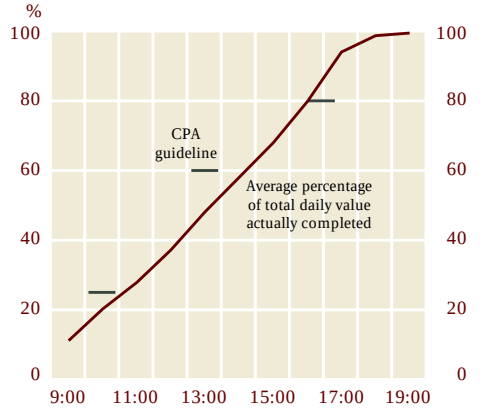


Chart 3a Impact of 11 September on Hourly Payments Volume

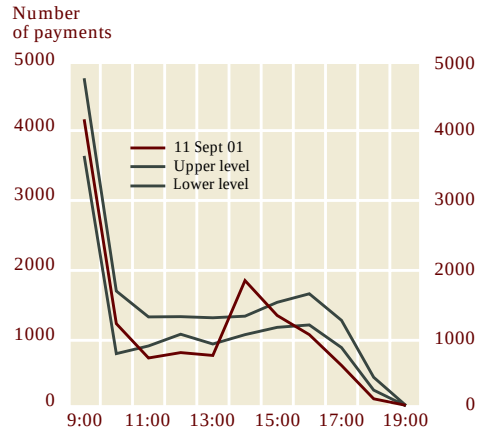
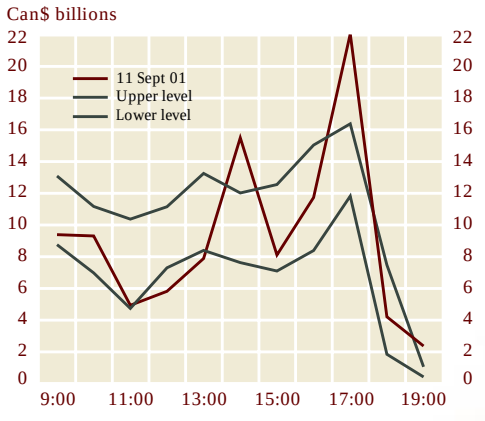


Chart 3b Impact of 11 September on Hourly Payments Value



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

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

Average Value per Payment

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

Assessing the Impact of 11 September 2001

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

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

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

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

Summary and Future Research

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

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