

Understanding Intraday Payment Flows in the Large Value Transfer System

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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:

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.

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.

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 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

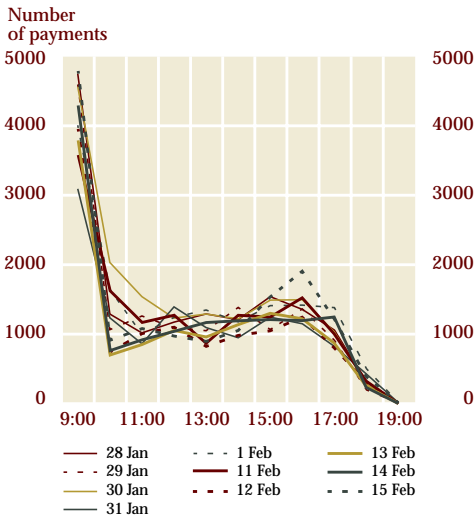


Chart 1b Cumulative Payments Volume

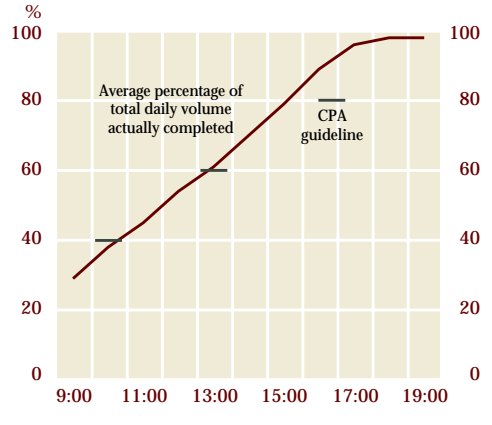


Chart 2a Hourly Payments Value

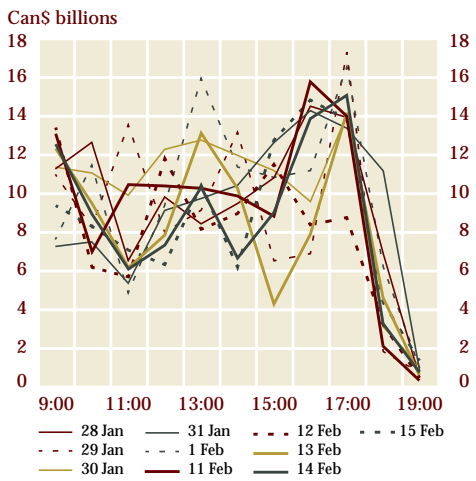


Chart 2b Cumulative Payments Value

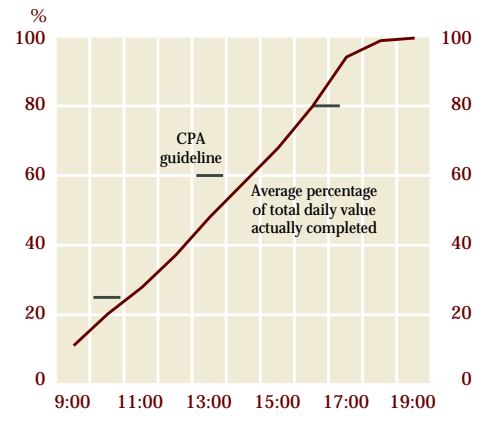


Chart 3a Impact of 11 September on Hourly Payments Volume

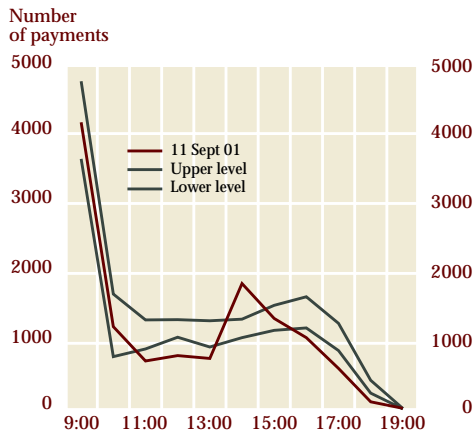
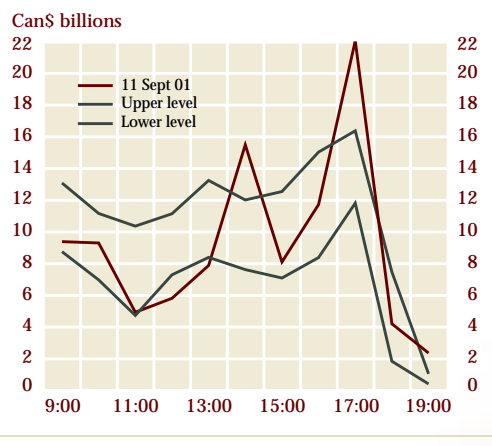


Chart 3b Impact of 11 September on Hourly Payments Value



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.