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Behaviour in the Canadian large-value payment system: COVID-19 vs. the global financial crisis

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The Large Value Transfer System

The Large Value Transfer System (LVTS) is Canada's electronic funds transfer system for large-value and time-critical payments. Owned and operated by Payments Canada, the LVTS processes payments in real time with certainty that the system will settle at the end of the day. LVTS payments include transactions of financial institutions and their clients as well as Bank of Canada payments. In dollar terms, the LVTS settles most of the payment value transacted in Canada every day. In 2019, it processed transactions equivalent to Canada's annual gross domestic product every 10 days, or about $189 billion across 40,000 payments per day.

The LVTS has two tranches that participants can choose from when submitting a payment:

- Tranche 1 (T1) payments are fully collateralized.
- Tranche 2 (T2) payments are based on bilateral credit limits granted among participants, introducing inter-participant risks.

For more details about the LVTS, see **Box 1**.

Box 1: LVTS payments—Tranche 1 and Tranche 2

The Large Value Transfer System has two tranches that participants can choose from when submitting a payment—Tranche 1 (T1) and Tranche 2 (T2).

A participant can send a T1 payment as long as its net owing position from all T1 payments it sent and received does not exceed the collateral it has pledged to the Bank of Canada for T1 payments, i.e., its T1 net debit cap.

In order to make and receive T2 payments, each participant begins the day by granting a bilateral credit limit (BCL) to every other participant. This is the largest net exposure it is willing to accept vis-à-vis that participant on that day. In addition, each participant has a T2 multilateral net debit cap, which is calculated as the sum of all BCLs extended to it, multiplied by a system-wide percentage. During that day, participants can send T2 payments if their net owing bilateral positions are no greater than the BCLs that they have been granted and their total multilateral net position does not exceed their T2 multilateral net debit cap. The collateral value required to support a participant's T2 payments is based on the participant's single largest BCL granted to any other participant multiplied by the system-wide percentage. As such, T2 payments are less costly for participants in terms of liquidity than T1 payments.

For more details about LVTS, see N. Arjani and D. McVanel, "A Primer on Canada's Large Value Transfer System" Bank of Canada (March 1, 2006).

The Bank of Canada's pandemic response

The Bank of Canada has various roles in the LVTS:

- The Bank is a participant in the system, sending payments on its own behalf and on behalf of its clients, such as the Government of Canada.
- The Bank designated the LVTS as a systemically important payment system and is responsible for its oversight.
- The Bank provides intraday credit and routine overnight loans—supported by eligible collateral—to LVTS participants.
- The Bank uses the LVTS to implement its monetary policy.[1]

Shortly after the World Health Organization declared COVID-19 a global pandemic, the Bank acted to provide the Canadian financial system with liquidity through various measures in the LVTS. Key measures are listed in **Table 1**.[2] Of these key measures, the greatest source of liquidity was the **increase in LVTS settlement balances** derived from **large-scale asset purchase programs**, or quantitative easing (QE).[3] LVTS settlement balances are the LVTS participants' end-of-day multilateral net balances. When positive, the balances plus interest are paid out by the Bank the following morning through LVTS T1. In its QE program, the Bank purchases assets such as government or mortgage bonds from financial institutions, and the proceeds accumulate in LVTS settlement balances, thus providing the participants with liquidity. This QE corresponds directly to an expansion in the Bank's balance sheet because the increase in the settlement balance is essentially an increase in the variable interest liability the Bank issues in exchange for participants' assets.

The pandemic is not the first time Canada and its financial system have faced a crisis. The most recent and pronounced one is the 2008–09 global financial crisis. When responding to this earlier crisis, the Bank raised its settlement balance target only moderately in 2009 and did not engage in QE. Consequently, settlement balances were over 100 times greater in 2020 than they were during the earlier financial crisis (**Chart 1)**.

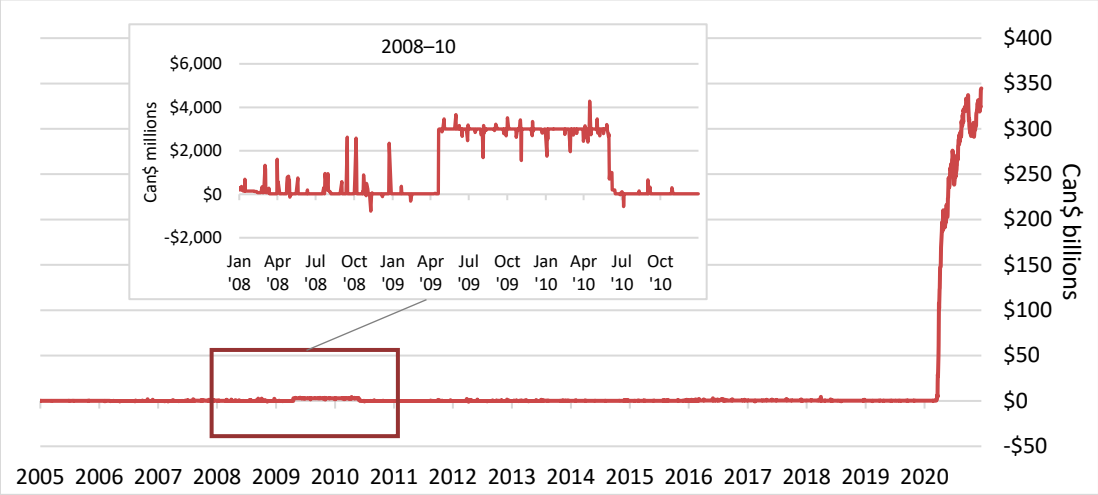
[1] For more information, see "A Primer on the Implementation of Monetary Policy in the LVTS Environment," Bank of Canada (June 2010).
[2] See the Bank's website for a full list of its policy responses.
[3] See "Our COVID-19 response: Large-scale asset purchases" for a description of the Bank's large-scale asset purchase programs.

Table 1: Key Bank of Canada policy responses to COVID-19

Policy	Date(s)
Lowering the target for the overnight rate	• March 4, 13 and 16, 2020
Introducing large-scale asset purchase programs	• March 16, 2020
Adjusting and stopping the settlement balance target	• March 17, 18 and 23, 2020
Relaxing LVTS collateral concentration limits	• March 17 and 18, 2020

The Bank's asset purchases and next-day settlement balance payouts were the key drivers in total value sent through the LVTS (**Chart 2**). The total daily value of LVTS payments peaked on September 30, 2020, with a value of $622 billion, which is nearly 1.6 times the average daily value in 2020. Apart from the Bank's large settlement balance payouts, the total volume and value of payments sent by the other participants showed little change over the period from March 2020 to December 2020 relative to the beginning of 2020. This is comparable to what was observed during the 2008–09 financial crisis, when volume and value sent by participants did not change significantly either.

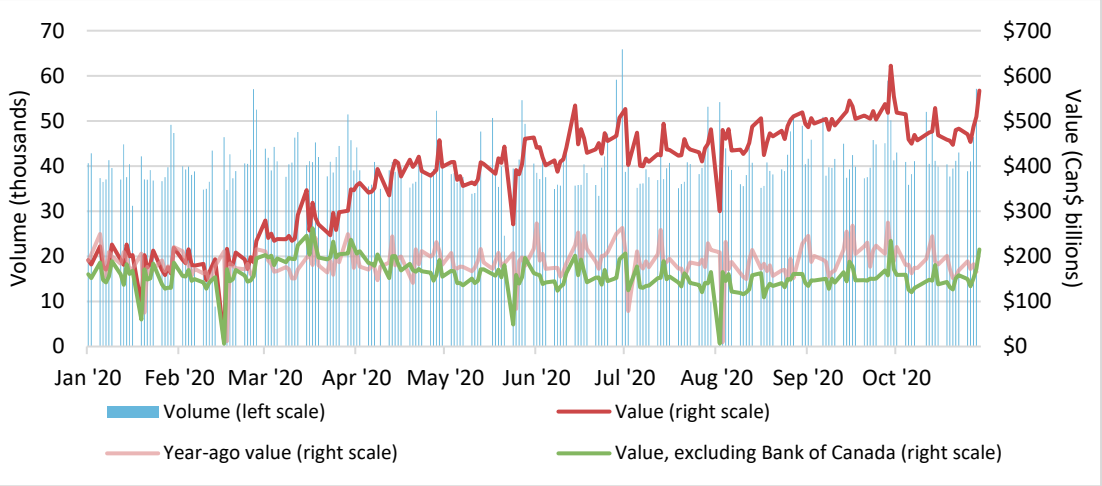
Chart 1: Following the Bank of Canada's COVID-19 response, LVTS settlement balances in 2020 were over 100 times larger than during the 2008–09 financial crisis



Source: Bank of Canada

Last observation: October 30, 2020

Chart 2: Settlement balance payouts have more than doubled the total daily value sent through the LVTS, while total daily volume has remained stable



Source: Large Value Transfer System

Last observation: October 30, 2020

Collateral policy changes

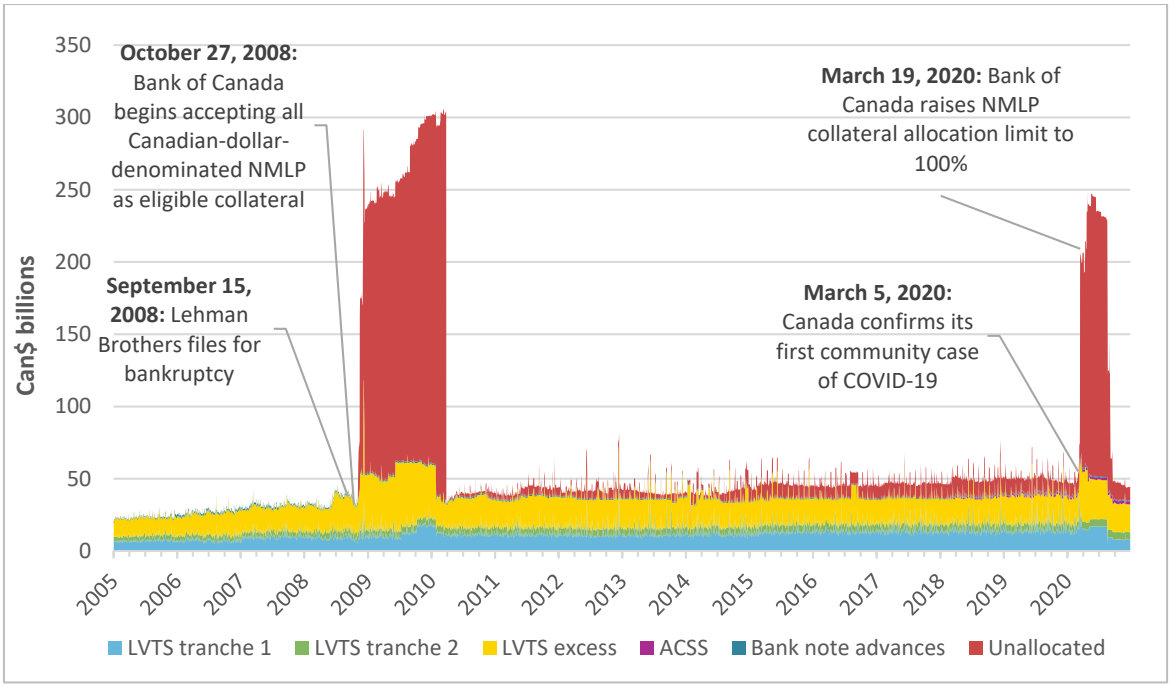
Participants pledge collateral to the Bank's High-Availability Banking System (HABS) for payment credit in either T1 or T2 of the LVTS.[4] Typically, the Bank applies margins to assets pledged as collateral based on their risk factors. It then places concentration limits on the percentage of a participant's total collateral value permitted for each asset type.[5] In normal times, the limit imposed on non-mortgage loan portfolios (NMLP) as a collateral instrument is 20 percent. However, following the initial community spread of COVID-19 in Canada, the Bank increased this limit to 40 percent on March 17, and then again to 100 percent on March 19, 2020. The additional value received from NMLP collateral yielded dramatic increases in the total asset value of collateral pledged to HABS, most of which was held as excess LVTS collateral.

The policy of accepting NMLP was first used in the financial crisis a few weeks after the failure of Lehman Brothers. **Chart 3** shows that in late October 2008, the Bank introduced NMLP as eligible LVTS collateral from which participants could receive 100 percent of their total collateral value. The additional value granted to NMLP as a collateral instrument resulted in the total collateral value to HABS increasing more than four times in just a few months. Lessons learned from this experience helped inform the Bank's collateral policy response in 2020. The financial crisis had demonstrated the effectiveness of relaxing the NMLP collateral value limit to alleviate liquidity constraints. Since the Bank had done it before, it was able to employ this tool quickly at the onset of the financial stress in early 2020.

[4] Participants also pledge collateral to the HABS for other purposes, such as for bank note advances and Automated Clearing Settlement System collateral requirements.

[5] Full details on assets eligible for LVTS collateral as well as their respective margins are available on the Bank's website.

Chart 3: Following the Bank's collateral policy changes in March 2020, the increase in collateral value pledged to HABS was proportional to that during the financial crisis



Note: LVTS is Large Value Transfer System; ACSS is Automated Clearing Settlement System; NMLP is non-mortgage loan portfolio.

Source: Large Value Transfer System Last observation: December 31, 2020

Impact on payment timing

The timing of payments sent into the LVTS might be a potential indicator of liquidity stress: a sudden shift to sending payments later in the day might indicate that participants are experiencing more difficulties in sourcing the required liquidity. The evolution of COVID-19 in Canada presents three distinct periods in 2020 in which to observe the impact on payment timing:

- the "business as usual" period (January 1 to February 15)
- the initial spread of COVID-19 and associated period of market stress (February 16 to March 17)
- the period of long-term equilibrium brought about by the Bank's policy responses (March 18 to May 1)

Overall, payment times became considerably later as pressures resulting from COVID-19 mounted and then fell back significantly after the Bank's interventions. The average time that payment value was sent in January 2020 was 12:38;[6] it was 12:57 in the first half of March

[6] The average time is calculated as the value-weighted average payment time = $\frac{\sum_{t=1}^{1} t x_s(t)}{\sum_{t=1}^{1} x_s(t)}$, where x_s = payment s value and t = time. Payments made by the Bank of Canada are excluded from this calculation.

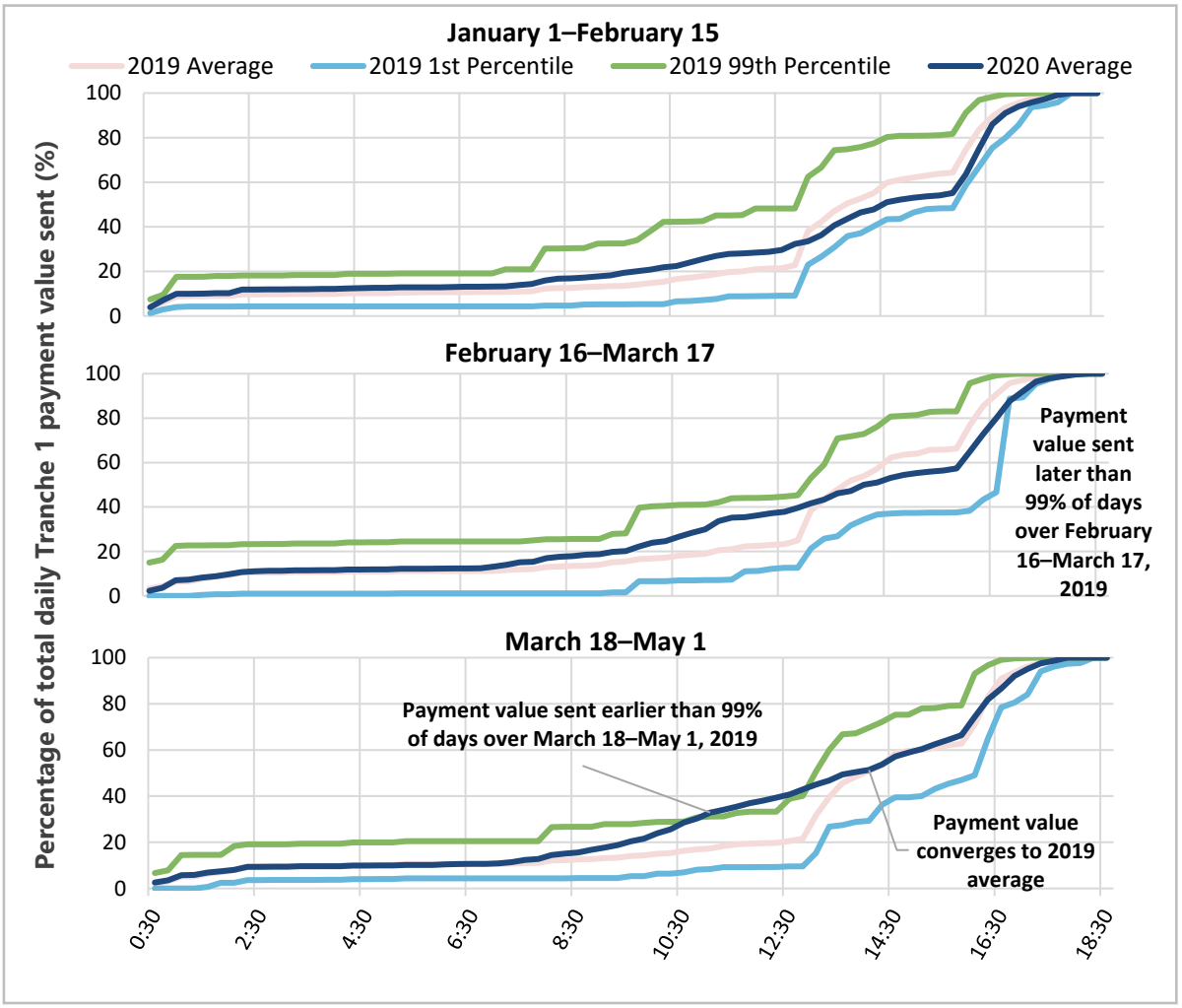
during the financial market stress. In mid-March, following the Bank's QE and interest rate and collateral policy changes, the average time fell continuously to as early as 12:05 in August 2020. In particular, T1 payments were made earlier in the day (**Chart 4**). From January 1 to February 15, the timing of payments roughly followed the same pattern as in 2019.[7] However, amid the global proliferation of COVID-19 cases and the associated market stress during the second period, LVTS participants began sending payments earlier than usual before midday and later than usual after midday. From 16:30 onward, participants sent payment value later than almost 99 percent of days in the same period of 2019, which could indicate difficulties sourcing liquidity near the end of the day.[8] Payments sent earlier than usual before midday may be the result of the Bank lowering its policy rate on March 3, 2020. Several LVTS advances were taken shortly after this change, which may have accompanied additional overnight lending between participants that was repaid early the next morning.[9] In the third period, following the Bank's policy interventions, participants began paying earlier throughout the day. After 13:30, payment value patterns match almost exactly those over the same period in 2019—indicating that the policy measures likely alleviated the end-of-day liquidity pressures experienced between mid-February and mid-March. The chief measure contributing to this shift is likely the significant growth in settlement balances from QE and, to a lesser extent, the relaxation of the NMLP collateral value limit. This is because participants did not assign a significant amount of this additional collateral value to the LVTS (see **Chart 3**).

[7] The two "kinks" just after 12:30 and just before 16:30 correspond to the beginning of the CLS same-day settlement and the end of the CDSX security settlement windows, respectively. CLS same-day settlement was discontinued in July 2019.

[8] This is only one potential explanation. Other internal decisions by participants may explain the unusual payment timing over this date window.

[9] This is only one potential explanation. Other unobserved factors may explain the shift to earlier morning payments.

Chart 4: Increased settlement balances alleviated end-of-day liquidity pressures and likely induced participants to submit their Tranche 1 payments earlier in the day



Source: Large Value Transfer System

Last observation: May 1, 2020

LVTS stress indicators

A halt in LVTS payments, for any reason, would have a systemic impact on overall economic activity and would affect the stability of the Canadian financial system. Chapman, Gofman and Jafri (2019) propose three indicators to assess systemic risks in payment systems: rejected and delayed payments, the proportion of T2 transactions, and intraday bilateral credit limit (BCL) adjustments. In this section, we examine these indicators to evaluate the stress experienced in the LVTS throughout the COVID-19 pandemic and compare them with the experience during the financial crisis. While in both crises equity markets fell and short-term funding conditions tightened comparably, the financial stress during the onset of the pandemic is distinct from the late 2008 financial turmoil in several ways:

- At the start of the COVID-19 stress period, the financial health of institutions was robust.
- Real economy concerns spread to the financial system (the reverse of what happened during the financial crisis).
- Government assistance initially flowed to households rather than to financial institutions.

Nonetheless, comparing these crises furthers our understanding of both LVTS participants' payment behaviour in unprecedented times and the efficacy of policies deployed during the two crises. Our findings suggest that in contrast to the 2008–09 financial crisis, the early stages of the COVID-19 pandemic in 2020 did not see increased levels of stress in LVTS participants.

Rejected and delayed payments

In the LVTS, a payment is rejected if it does not pass the risk controls within the tranche it was sent in (see **Box 1**).[10] Payments larger than $100 million, i.e., "Jumbo" payments, that do not pass the risk controls are placed into a queue. As soon as the required liquidity arrives (either through incoming payments or through pledging additional collateral if a T1 payment or an increase in the BCL if a T2 payment), queued Jumbo payments will be released and processed as so-called delayed payments. If, however, the queueing time exceeds the maximum queuing time, they will ultimately be rejected.

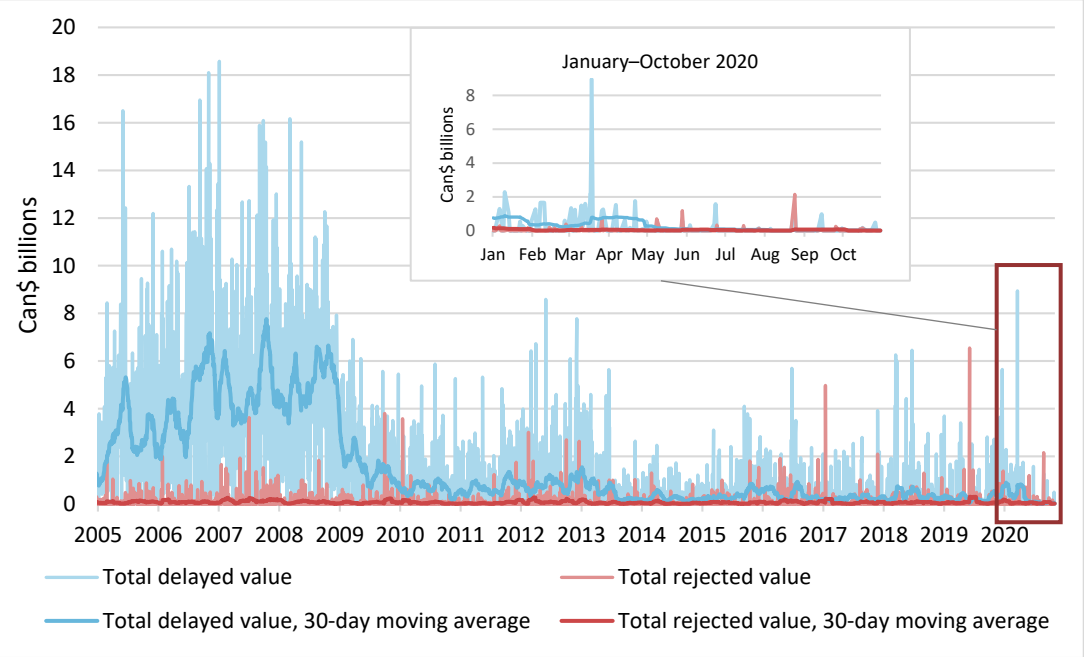
Payments rejected because they do not pass risk controls may not always signal stress on their own. However, multiple rejections during a day for one or more participants or a significant high-value payment rejection could be a sign of liquidity stress. Even delayed payments could signal potential liquidity stress for individual LVTS participants, and an accumulation of delays could eventually result in system-wide liquidity stress. **Chart 5** shows the total value and the 30-day moving average of value rejected and delayed for failing to meet risk controls (rejections and delays caused by other reasons are excluded). In 2007, the LVTS experienced the largest number of both rejected (652) and delayed (2,119) payments, with the rejections accounting for $39 billion in value. In that same year, the average daily values of rejected and delayed payments were $151 million and $4,870 million, respectively.

As of October 30, the LVTS had experienced in 2020 only 122 payments rejected due to liquidity constraints and 82 delayed payments. The rejected payments totalled approximately $9 billion, and the average daily values of rejected and delayed payments were $41 million and $218 million, respectively. These numbers and values are considerably lower than during the financial crisis. The increase in delayed payments in March 2020 could be related to

[10] Payments can also be rejected for other reasons, for instance, if they do not meet formatting requirements. In this note, we focus only on rejections due to not passing the risk controls. All other rejections are removed from our analysis.

COVID-19; however, the impact is negligible when compared with the 2005–09 period. In terms of rejections, the average value of rejected payments remained stable over 2020 and is consistent with the trends observed over the past 10 years. This suggests that LVTS participants did not experience high levels of stress in 2020.

Chart 5: The average values of rejected and delayed LVTS payments remained stable during 2020



Note: This chart shows the annual total number of rejected and delayed payments as a result of not passing the risk-control tests. Rejections also include payments that were rejected after being delayed.

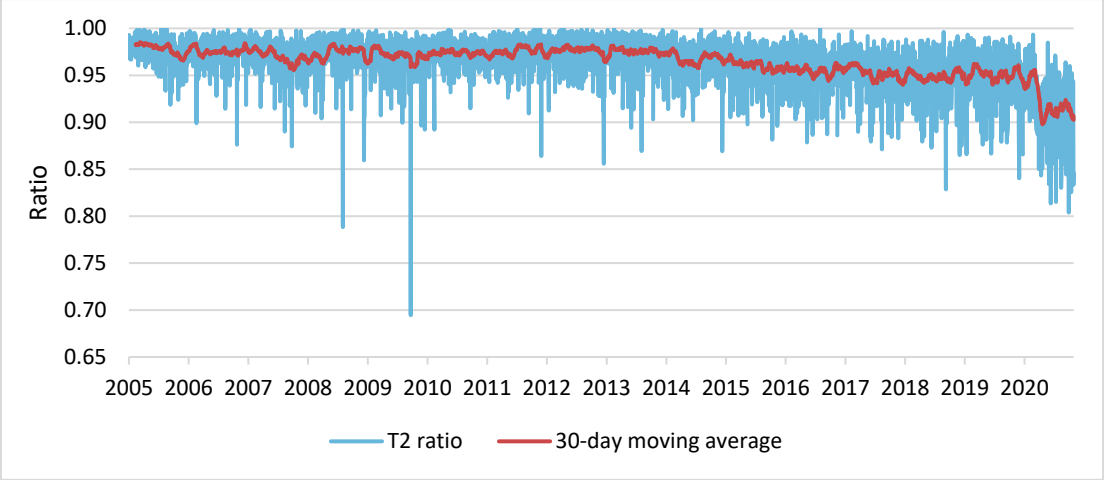
Source: Large Value Transfer System Last observation: October 30, 2020

Proportion of Tranche 2 payments

Participants' use of T1 and T2 provides insight into the availability of credit that participants have in the two tranches. This is based on the collateral they posted in T1 or their BCLs and net debit cap in T2. A sudden migration from T2 to T1 might signal a reduction in BCLs or less willingness to use T2, which would hint at a perceived increase in bilateral risk exposures. Such an abrupt shift could cause gridlocks if participants fail to meet the risk controls in T1. We therefore assess the ratio of T2 payments to all (T1 and T2) payments.

Chart 6 shows the evolution of the T2 ratio at a daily frequency. During the financial crisis, there were several sharp declines. In contrast, in 2020, the fall in the T2 ratio was more structural and maintained throughout the year. The standing BCLs did not show a structural decline (**Chart 7**), which suggests that the fall in the ratio was not due to diminishing willingness among participants to grant each other BCLs. Instead, the relative increase in T1 use seems to be the result of the Bank's changes to the LVTS collateral framework and the resulting abundance of T1 liquidity, as discussed in the section on collateral policy changes.

Chart 6: The Bank's collateral policy changes led to a shift in payments from Tranche 2 to Tranche 1



Note: This chart plots the ratio of the aggregate value of Tranche 2 to total payments (Tranche 1 and Tranche 2) on each day from January 2005 to October 2020. Payments to and from the Bank of Canada are excluded from this calculation.

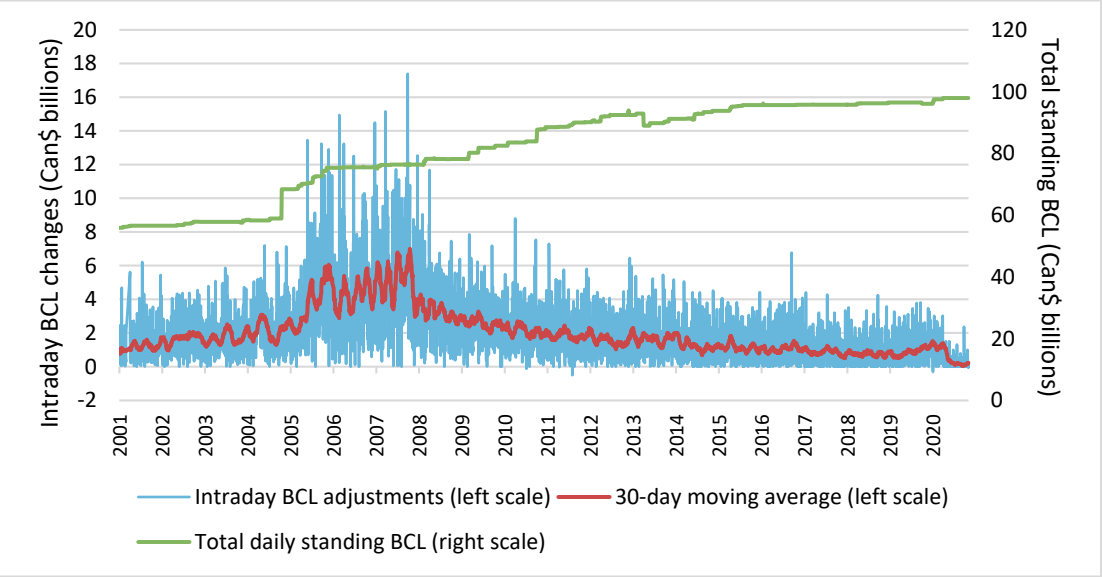
Source: Authors' calculations based on data from the Large Value Transfer System Last observation: October 30, 2020

Bilateral credit limits

In Tranche 2, participants grant each other BCLs at the beginning of the day (see **Box 1**). These BCLs are known as standing BCLs. In addition, participants can choose to temporarily adjust their BCLs during the day. Following the methodology of Chapman, Gofman and Jafri (2019), we examine the level of perceived counterparty risk in the system by assessing total intraday BCL changes (i.e., the daily differences between the total standing and end-of-day BCLs) and their 30-day moving average. If an LVTS participant fails, the surviving participants could be liable for an additional settlement obligation proportional to the largest BCL they granted to the failing participant. Therefore, if perceived counterparty risk is high, participants are likely to set standing BCLs low and then increase them during the day if needed. In that case, the intraday BCL changes would be positive and significantly higher than during normal times when counterparty risk is low. In contrast, when perceived risk of participant default is low, participants are more likely to set their standing BCLs high so they need less adjustment during the day.

Chart 7 shows the intraday BCL changes over time. The highest intraday adjustments were during 2007–08; however, the increase had already started at the end of May 2005. This suggests that, during this period, participants preferred to increase their BCLs during the day instead of setting higher standing BCLs in the morning.

Chart 7: Intraday adjustments to bilateral credit limits dropped in 2020



Note: This chart plots the daily change in bilateral credit limit (BCL) (blue) and a 30-day moving average of the daily measure (red) from January 2001 to October 2020.

Source: Authors' calculations based on data from the Large Value Transfer System Last observation: October 30, 2020

Looking at 2020, we see a distinct drop in total intraday BCL changes. It is important to note how this drop deviates significantly from the trend seen in the previous decade. In 2019, the average daily value of intraday BCL adjustments was $941 million. However, from April to October 2020, the average was only $205 million. This drop was likely driven by the Bank's collateral policy changes and the large settlement balances. These left participants flush with T1 liquidity, which likely impacted their intraday liquidity management. The rise in available T1 liquidity might have encouraged participants to send a payment through T1 instead of asking for an intraday BCL increase when their payment did not pass the T2 risk controls. This would be in line with the observations from **Chart 6** that a considerable proportion of payment value moved from T2 to T1. The fact that participants did not drop their standing BCLs demonstrates that the pandemic has not impacted the perception of counterparty risks in the system.

Conclusion

The COVID-19 pandemic has highlighted the importance of a well-functioning large-value interbank payment system, especially during a crisis. We have discussed how the behaviour in the LVTS in both the financial crisis and the COVID-19 pandemic is heavily influenced by the Bank's policy responses. These responses include flexible collateral policies for overnight advances and payment credit, as well as large-scale asset purchases that address potential liquidity constraints for financial system participants. The effect of these measures can be observed in earlier payment timing patterns and low volumes of rejected and delayed payments, as well as changes in payment tranche use and a fall in intraday BCL adjustments.

Our observations suggest that lessons learned from the 2008–09 global financial crisis in terms of the timing and effectiveness of specific Bank of Canada policy measures might have helped avoid potential liquidity stresses in the LVTS in 2020.

Reference

Chapman, J., M. Gofman and S. Jafri. 2019. "High-Frequency Analysis of Financial Stability." Working Paper (November 8).