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Upgrading the Payments Grid: The Payoffs Are Greater Than You Think

Introduction

On the morning of November 21, 1985, officials at the Federal Reserve Bank of New York received a routine phone call from staff at a large bank they supervised. The call informed them that they were still preparing their settlement accounts from the day before and would not be in position to process transactions until later that morning. The New York Fed officials were not too concerned, since such delays happened occasionally. It was only later in the day that they realized the gravity of the situation. The financial institution in question was $30 billion in the red; that's billion with a "b."[1]

This extraordinary situation was caused by a computer glitch the day before that had impaired the bank's internal payments processes. That glitch meant it was unable to receive payments for securities it had bought on behalf of clients. By the end of the day, signs of liquidity pressures on the wider interbank market were developing, and the Fed had to lend $23.6 billion to this bank through its discount window. At the time, that was by far the largest loan of its kind. The loan was necessary to avoid the possible failure of what was then one of the largest banks in the United States, which likely would have spread the stress throughout the entire financial system.

[1] H. M. Ennis and D. A. Price, "Discount Window Lending: Policy Trade-offs and the 1985 BoNY Computer Failure," Federal Reserve Bank of Richmond Economic Brief 15-05 (May 2015).

I would like to thank James Chapman, Paul Chilcott, Grahame Johnson, Paul Miller and Ron Morrow for their help in preparing this speech.

Of course, there is a significant difference between the internal systems of any one bank and the wider payments infrastructure that supports the financial system as a whole. But I'm recounting this story because it clearly highlights the link between payment systems and financial stability, the topic I want to touch on today.

This is a timely subject since, as you well know, our payment systems are showing their age. While they are constantly being upgraded and still function, technology is changing rapidly and improving, offering better and smoother ways to move funds. We've got to keep pace. The good news is that our conference host, Payments Canada, which operates our core large-value and retail payment systems, is making steady progress on a modernization plan.[2] The goal is to develop a payments system that is fast, flexible and secure, one that will be fully aligned with global regulatory standards and that will become a platform for future innovations. This modernized system will certainly lead to gains in payment efficiency. It will also strengthen the stability of our financial system. While problems such as the one I just described are rare indeed and have never occurred in Canada, we still need to be vigilant and keep improving our systems.

Because the Bank of Canada is responsible for promoting the efficiency and stability of the financial system, which includes oversight of our core payment systems, we are working closely with Payments Canada on the modernization plan. Our staff of experts is providing input at all levels. I have confidence that with the collaboration of the Bank, financial institutions and other stakeholders, the modernization program will help strengthen the stability and efficiency of our financial system.

Today I want to focus on the payoff from payments modernization for financial stability, a benefit that is often overlooked. I'll set the stage by discussing the main risks that participants in payment systems may face. Against this background, I will focus on designs for payment systems that address those risks as well as the demand for greater efficiency. I will conclude by discussing why this is important for the Bank's conduct of monetary policy.

Risky Business

Let me start by taking you back again to 1985, the year that computer glitch occurred. As a fan of the Montréal Canadiens, that year is memorable because the Habs were midway through their 23rd Stanley Cup win, with a rookie named Patrick Roy in the net.

Payments Canada's retail payment system, the Automated Clearing Settlement System (ACSS), was also in its rookie year. This system still processes some 30 million retail transactions a day. Payments cleared in ACSS are then settled on a multilateral net basis the next day in our Large Value Transfer System (LVTS).

Despite its age, ACSS still performs reliably. So did Patrick Roy, but he retired in 2003.

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[2] See Payments Canada, Modernization.

The LVTS, which was introduced in 1999, is also showing its age. It is the core of Canada's national payments system. Transactions in the LVTS ultimately settle on the books of the Bank of Canada at the end of the day.[3]

Modernizing our core payments infrastructure is long overdue. Payments Canada has set out a roadmap for modernization that includes changes to both LVTS and ACSS and the introduction of real-time retail payments. This is an ambitious goal, but Payments Canada has developed a necessary and credible staffing plan to achieve it. In addition, Payments Canada has hired the services of a well-established consulting firm with expertise in payments to manage the complexity of this process, which will take several years to complete.

While this is a costly project that will affect industry participants as well as the Bank of Canada, given that we are a direct participant in LVTS, the modernization process will nonetheless bring our payment systems in line with state-of-the-art systems introduced abroad. Indeed, recent joint research by Payments Canada and the Bank of Canada documented that 19 countries have made major changes to their core payment systems since 2004.[4]

These countries faced challenges similar to those we are now confronting. For one, adopting new technologies can be daunting. Given the rapid pace of technological change, designing with an eye to the future is critical. Modern systems must be flexible and adaptable. For example, newer systems are modular in nature, meaning that specific functions are built into separate modules.

Although both of our core payment systems have been upgraded several times since their respective launches, their legacy architecture often makes it difficult to introduce new features that would facilitate a more modern approach to risk management. They were written in COBOL, an old, inflexible programing language that is no longer used except in legacy systems, which makes maintaining or changing our systems difficult.

This is important because payment systems are exposed to various forms of risk. For instance, a payment may fail to settle because an institution is unable to fully meet its financial obligations when the payment is due or at any time in the future, thus posing credit risk. As we saw in the example of the bank with the computer glitch, operational risk can trigger gridlock in payment systems. Payments are also associated with liquidity risk, which arises because an institution may find itself temporarily short of funds to make a payment at the time needed. More broadly, because participants in certain payment systems are interconnected, systemic risk can arise when the inability of one institution to

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[3] For more detailed background information on ACSS and LVTS, see Canada's major payment systems.

[4] M. Tompkins and A. Olivares, "Clearing and Settlement Systems from Around the World: A Qualitative Analysis," Bank of Canada Staff Discussion Paper 2016-14 (June 2016).

settle a payment produces a domino effect, or financial contagion, by triggering a similar inability at other institutions.

Financial contagion is intimately related to the risk of market failures and externalities in certain payment systems. A bank that defaults or experiences a technical failure will not bear the costs of these events on its own. Other financial institutions will also be affected. Such externalities can lead to decisions that are suboptimal from a social perspective. If left to the private market alone, both theory and experience show that the resources devoted to the safety of payment systems may be less than is socially warranted, raising potential operational, liquidity and credit risks. To guard against this possibility, central banks are typically mandated to operate or to oversee their country's main payment systems.

An important aspect of designing payment systems is developing infrastructure that can appropriately address these sorts of credit, liquidity, systemic and operational risks. In addition, because of their systemic importance, high-value payment systems, like the LVTS, must be particularly designed to ensure their safety and resilience.

The Architecture of High-Value Payment Systems

Now that I've alarmed some of you by enumerating the principal risks, let me reassure you that the Bank of Canada has in place strict risk standards that Canada's core payment systems must meet. Payment systems have also evolved through the years to mitigate these risks.

In high-value payment systems, this evolution reflects the fact that increasingly large sums are transacted every day. In our LVTS, $175 billion is now processed daily. So one of the big concerns for central banks is the potential for payment systems to put financial stability at risk through the exposures that participants might have to each other. In response, many central banks have adopted real-time gross settlement (RTGS) systems. These systems eliminate credit risk between participants by requiring the final and irrevocable settlement of each payment.

In contrast, deferred net settlement (DNS) systems are typically designed so that payments are settled periodically on a net basis, typically at the end of each day. Credit risk still arises in DNS systems because an institution may fail between the time a payment is made and the time it is settled. As a result, in most jurisdictions the main large-value payment system operates as an RTGS, although many retail systems and even other, secondary wholesale systems may operate on a DNS basis (as in the United States, for example). Research conducted at the New York Fed a few years ago shows that while only 3 countries had RTGS systems in 1985, 20 years later that number had increased to 90.[5]

However, as is typical in economics, there are trade-offs, in this case between credit and liquidity risks. Because each payment must be settled on a gross

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[5] M. L. Bech and B. Hobijn, "Technology Diffusion within Central Banking: The Case of Real-Time Gross Settlement," *International Journal of Central Banking* (September 2007): 147–181.

basis, RTGS systems are costly in terms of liquidity. An institution needs to have the necessary funds on hand, or must be able to borrow them, before it can make a payment. If the cost of liquidity is high, financial institutions have an incentive to delay making payments, waiting until they, in turn, receive payments from other institutions. Therefore, to avoid the possibility of gridlock in these systems, the central bank typically offers direct participants free, though fully collateralized, intraday liquidity.

While credit risk is higher in DNS systems, the liquidity requirements are lower, since payments are settled on a net instead of a gross basis. Over time, however, hybrid systems that combine the best of the RTGS and DNS systems have emerged to achieve a better trade-off between credit and liquidity risks.

Our existing LVTS has a unique hybrid framework. As in DNS systems, payments are settled on a net basis at the end of each day, thus economizing on liquidity needs. But the system also shares features with an RTGS framework, since payments are final and irrevocable. The finality of payment is achieved through a pool of collateral from participating institutions that covers the single largest possible default. A residual guarantee from the Bank of Canada fully protects against any remaining credit exposures. The Bank's guarantee is akin to disaster insurance, since the probability that more than one of our large financial institutions will fail on a given day is, of course, extremely remote.

This design has the benefit of providing payment finality in a collateral-efficient manner, although at the cost of the public sector bearing a contingent liability. While this approach was appropriate at the time the LVTS was created, international experience has shown that other hybrid systems can also provide efficiencies and finality without the need for a public sector backstop. We envisage that the new high-value payment system that will be deployed as part of the modernization plan will be a fully collateralized, defaulter-pays system. While we are ready to consider different designs consistent with this vision, an RTGS system with liquidity-saving mechanisms may provide a relatively simpler and well-tested framework.

What About Efficiency?

Naturally, end-users of payment systems care not only about the resilience and security of the system, but also about its efficiency. The desire for greater efficiency is particularly acute for retail payments. Customers are more demanding than in the past. They are looking for more convenient and cheaper access to financial services that are well integrated with the rest of their online activities.

We have seen an explosion of innovations that are making it easier and faster for parties to exchange payments both at the point of sale and online. PayPal, Interac e-Transfer and Apple Pay are among the new innovations that are quickly becoming familiar modes of payment.

To be in tune with these innovations and with consumers' expectations, our modernized retail payment system will need to allow more open, but risk-based, access that will promote innovation and an improved end-user experience. Designing an efficient retail payment system that fulfills these needs and expectations is essential because the volume of transactions flowing through it is

large, putting a premium on efficiency. However, since the values of transactions in retail payment systems are relatively small, the risk that a failure of one participant would trigger financial contagion is more remote than for our large-value payment system.[6] Even so, disruptions in retail payment systems can still bring about important losses to the economy.[7] To address this risk, the ACSS was recently designated a prominent system and is now overseen by the Bank of Canada. But failure to keep pace with user expectations may lead to the adoption of alternative, potentially unregulated forms of payment that could end up posing risks to the economy as they grow over time.

Circling Back to Monetary Policy

Because of its impact on financial stability, the soundness of our payments system is also crucial for the conduct of monetary policy. Our key policy objective at the Bank of Canada is to keep inflation low, stable and predictable so that Canadians can make better economic decisions and achieve better economic outcomes. As the 2007–09 global financial crisis showed, financial stability is clearly needed to achieve this mandate. This presupposes a well-functioning payments system.

Our monetary policy decisions are partly transmitted through the economy via long-term interest rates, exchange rates and asset prices more generally. So the conduct of monetary policy depends on well-functioning financial markets. Disruptions in payment systems could ripple through financial markets and impair the transmission mechanism.

In Canada there is an even more direct and explicit link between the operation of the LVTS and the implementation of monetary policy. Some of you may remember your first “Money and Banking” course, where the central bank changed interest rates by buying or selling government securities for money, thus affecting the money supply and interest rates as a result. In practice, that’s not exactly how we implement monetary policy. Since 1999, when the LVTS was first introduced, we have been implementing monetary policy by managing the interest rates on accounts used to settle payments at the end of the day in our high-value payment system. To reinforce the target for the overnight interest rate, our main policy instrument, we use an operating band, with the deposit rate at the bottom of the band and the Bank rate—that is, the lending rate—at the top of the band. In a nutshell, settlement banks that have excess funds after all payments have been settled earn the deposit rate on those funds, which is typically 25 basis points lower than the target for the overnight rate. Meanwhile, settlement banks that are short of funds to settle their accounts can borrow from the Bank of Canada at the Bank rate, which is typically 25 basis points above the overnight rate target. The spread between the deposit and Bank rates gives commercial banks an incentive to trade with each other at an interest rate within the band, typically at the target rate in the middle of the band.

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[6] Chapman J., R. Garratt and N. Zhang, “The Bank of Canada’s Exposure to Default Risk in Canada’s Large Value Transfer System,” Bank of Canada Staff Working Paper (forthcoming).
[7] N. Chande, “A Survey and Risk Analysis of Selected Non-Bank Retail Payments Systems,” Bank of Canada Staff Discussion Paper No. 2008-17 (November 2008).

The changes that we envision to the high-value payment system will not affect our ability to implement monetary policy. We will continue to do so through the system using the target rate and the operating band. We do not expect the changes to the high-value payment system to alter our ability to control the overnight rate, which should closely track our target policy rate, as is the case today.

Given the implications for financial stability and monetary policy, we take a comprehensive view of payment systems. That means we look at modernization not only in the near term but in the long term as well. So keeping up with the latest technological advances, such as distributed ledger technology, or DLT, is imperative. While we're a long way from adopting DLT, as my colleague Senior Deputy Governor Carolyn Wilkins explained in her speech to you last June, we still want to be forward-looking and study its possible impact. Later today you'll be hearing about an experiment called Project Jasper that we have embarked on with Payments Canada and a number of Canadian financial institutions. To investigate the costs and benefits of a high-value payment system based on DLT in the interbank market, we set up a rudimentary payment system to run experiments in a lab environment. One interesting finding is the tensions that arise between the fully decentralized and transparent payment systems that DLT could provide and the requirements for confidentiality of wholesale payments. While our project is still in its infancy, there is still no better way to understand a technology's strengths and shortcomings than to work with it in a controlled setting.[8] For more information on Project Jasper, you can check out the paper we will post on our website later today.

Conclusion

Modernizing systems when technological advances and other changes in the payments environment are occurring at such a fast pace is not only challenging, it is potentially paralyzing. The fear of adopting systems that quickly become technologically obsolete is natural. However, we all know that inaction is not without costs. More importantly, the modernization process provides a truly amazing opportunity to reshape an essential part of our financial infrastructure for the benefit of all Canadians.

As I've explained, the Bank of Canada is closely involved in all aspects of this transformation. Making payments more efficient and secure will benefit all Canadians. A sound payments system is as important for the stability of the financial system as a reliable electrical grid is for the economy. And a stable financial system is essential for the effective conduct of our inflation-targeting monetary policy.

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[8] C. Wilkins, "Fintech and the Financial Ecosystem: Evolution or Revolution" (speech to Payments Canada, Calgary, Alberta, 17 June 2016).

Suggested Readings

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