BANK OF CANADA
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Bank of Canada Oversight Activities for Financial Market Infrastructures

2017 Annual Report

APRIL 2018

Executive summary

Financial market infrastructures (FMIs) are a critical component of the financial system. They support economic activity by providing a platform to transfer funds and settle transactions. Since financial transactions are concentrated in these FMIs, they are also a potential source of risk to the financial system. The Bank of Canada oversees those FMIs that have the potential to pose significant risk to ensure that the risk is adequately controlled.

The *Bank of Canada FMI Oversight Activities 2017 Annual Report* (the Annual Report) outlines how the Bank fulfills its mandate for oversight of designated FMIs.[1] The Annual Report outlines key issues about the safety and soundness of designated FMIs. It also specifies the Bank's expectations on the risk-management enhancements to be pursued by designated FMIs in 2018. Oversight of designated FMIs contributes to the Bank's broader mandate of promoting the stability and efficiency of the Canadian financial system.

Designated FMIs have substantially improved their risk-management practices throughout 2017 to address the expectations the Bank outlined in the 2016 Annual Report. As part of an ongoing process, the Bank has identified further enhancements to pursue in 2018.

This report also discusses initiatives performed by the Bank that are related to FMI risk management. Of note, in 2017, the Bank made significant contributions to an FMI resolution regime for Canada and helped develop international standards relevant for FMIs. The Bank also conducted research that deepens the understanding of FMI-related issues and the Bank's oversight function. The Bank will continue its efforts in 2018.

[1] These include payment clearing and settlement systems for oversight by the Governor of the Bank under the *Payment Clearing and Settlement Act* (PCSA).

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1. The Bank's approach to oversight of financial market infrastructures

Financial market infrastructures (FMIs) play an important role in enhancing the stability of the financial system. Their services are critical because they allow for the exchange of funds and other financial assets. By doing so, FMIs allow individuals and firms to safely and efficiently purchase goods and services, invest in financial assets and manage financial risks.

Given their central and critical role, FMIs require strong risk-management practices and must be resilient to shocks. These are necessary to ensure FMIs are available to facilitate financial transactions at all times.

Under the *Payment Clearing and Settlement Act* (PCSA), the Bank of Canada (the Bank) can designate FMIs as having the potential to pose systemic or payments system risks in Canada.[2] The Bank is responsible for oversight of these designated FMIs. Oversight helps ensure that they adequately control risk and continue to provide benefits to the Canadian financial system in a safe and efficient manner.

As part of its risk-based approach to oversight, the Bank uses this document to report on its oversight priorities as well as the risk-management expectations for designated FMIs.

Section 2 of this report describes the progress made by the designated FMIs on the Bank's risk-management expectations for 2017, while section 3 outlines new expectations for them to pursue going forward. Section 4 examines the Bank's priorities for its own activities.

[2] The federal Minister of Finance must agree that designation is in the public interest. See the glossary in Appendix 2 for a full definition of systemic and payments system risk.

The Bank's risk-management standards

The Bank maintains its own Risk-Management Standards for Systemic FMIs and Risk-Management Standards for Prominent Payment Systems (PPSs). These serve as benchmarks for the risk-management practices of these systems.[3] See **Box 1** for a description of the designated FMIs and the risk-management standards that apply to them.

Box 1: Designated financial market infrastructures

	Systemic FMIs	Prominent payment systems
Domestic designated FMIs	• LVTS • CDCS • CDSX	• ACSS
Foreign-domiciled designated FMIs	• CLS Bank • SwapClear	—
Risk-management standards	Risk-management standards for systemic FMIs	Risk-management standards for PPSs

The Bank of Canada's Risk-Management Standards for Designated FMIs adhere to the Principles and Key Considerations of the CPMI-IOSCO *Principles for financial market infrastructures* (PFMIs). The PFMIs establish minimum expectations for risk management for systemically important FMIs to preserve and strengthen financial stability.[4, 5] In 2017, CPMI-IOSCO released guidance on CCP resilience, clarifying PFMI expectations for central counterparties in certain areas.

[3] For more details, see the Bank of Canada's Risk-Management Standards for Designated FMIs and the Criteria and Risk-Management Standards for Prominent Payment Systems.
[4] CPMI-IOSCO refers to the Bank for International Settlements' Committee on Payments and Market Infrastructures (CPMI) and the International Organization of Securities Commissions (IOSCO).
[5] For more details, see the CPMI-IOSCO's web page on the principles for financial market infrastructures.

To provide clarity on certain aspects of the PFMIs in the Canadian context, the Bank has published supplementary guidance to support its risk-management standards.

In addition to its standards for FMIs that have the potential to pose systemic risk to the Canadian financial system, the Bank developed standards in 2016 that apply to designated prominent payment systems (PPSs) that are not systemically important but are nonetheless central to the Canadian economy.[6] The Criteria and Risk-Management Standards for PPSs incorporate elements of the PFMI but are proportional to the level of risk present in a PPS, which is relatively less than that found in a systemic FMI.

Ensuring that the systemically important FMIs observe these standards is a key component of the Bank's oversight mandate.

A risk-based approach to oversight

The designated FMIs, listed in **Table 1** and described in further detail in Appendix 1, include both domestic and foreign-domiciled FMIs that are central to the Canadian financial system.

The Bank's primary FMI oversight activities involve monitoring and evaluating risk in the designated FMIs to ensure that risk is being adequately controlled. These

Table 1: Financial market infrastructures designated for Bank of Canada oversight

LVTS	The Large Value Transfer System is an electronic funds transfer system operated by Payments Canada that settles large-value and time-critical payments.
ACSS	The Automated Clearing Settlement System is a retail payment system operated by Payments Canada that clears cheques and electronic items, such as pre-authorized debits, direct deposits and Interac debit payments.
CDCS	The Canadian Derivatives Clearing Service is a central counterparty operated by the Canadian Derivatives Clearing Corporation that clears transactions in all derivatives trades on the Montréal Exchange as well as certain fixed-income securities, repurchase agreements, OTC equity derivatives.
CDSX	CDSX is a system operated by the Canadian Depository for Securities Limited that consists of a securities settlement system, a central securities depository for equities and fixed-income securities, and a central counterparty service for eligible Canadian exchange-traded and OTC equities.
CLS Bank[1]	CLS Bank is a global payment system for the settlement of foreign exchange transactions, including those involving the Canadian dollar.
SwapClear[1]	SwapClear is an LCH clearing platform for interest rate swaps and other OTC interest rate derivatives denominated in multiple currencies, including the Canadian dollar.

[6] The ACSS is currently the only designated FMI that is a PPS.

[1] Foreign-domiciled designated systems

activities focus on assessing the risk-management practices of the designated systems through the review of proposed changes to their operations, rules and procedures, as well as periodic audits and inspections.[7]

The Bank's oversight of FMIs is conducted in close collaboration with FMI operators and relevant authorities, such as the Department of Finance Canada, provincial regulators and, in the case of the foreign-domiciled designated FMIs, cooperative oversight arrangements led by the Bank of England and the Federal Reserve System.[8]

The Bank applies a strategic, risk-based approach to its oversight of designated FMIs, including an annual cycle of setting risk-management expectations for designated FMIs to pursue. In determining the risk-management expectations for each FMI, the Bank considers whether the FMI's risk controls meet the Bank's risk-management standards. The Bank also considers the materiality of the concern, the likelihood of the risk materializing and the FMI's capacity to make changes, which helps the Bank prioritize these expectations. This approach allows for more focused efforts in areas that the Bank considers most relevant to the safety and soundness of the FMIs and the broader financial system. It also facilitates continuous improvement.

Recent changes to the *Payment Clearing and Settlement Act*

The PCSA was recently amended to strengthen the Bank's ability to identify and respond to risks at an FMI in a proactive and timely manner[9]. Two main changes were made to support this objective: broadening the Governor's power to issue a directive and explicitly allowing the Governor to approve or disapprove significant changes made by a designated FMI. Despite these changes, the Bank will continue to first rely on well-established and successful working relationships with the FMIs to address risk concerns before making use of the expanded power to disapprove of rule changes or issue directives.

[7] See the Bank's Guideline Related to Bank of Canada Oversight Activities Under the *Payment Clearing and Settlement Act* for an overview of the Bank's oversight activities.
[8] These cooperative relationships are supported by agreements that the Bank has entered with the relevant authorities.
[9] See the amendments to the Payments Clearing and Settlement Act in Bill C-63.

Broader ability to issue a directive

Before the PCSA amendments, the Governor could issue a directive to require a designated FMI to either take an action, or cease an action, only if the Governor was of the opinion systemic risk or payments system risk was being, or was likely to be, inadequately controlled. This power has now been expanded to allow the Governor to issue a legally binding directive at an earlier stage, when a risk is developing, rather than waiting until systemic or payments system risk is imminent.[10] In addition, the list of potential scenarios that could result in systemic or payments system risk has been expanded to include the design of the system, the ownership of the system, aspects of organizational structure or corporate governance related to risk management, and the management or operation of the FMI.

In conjunction with broadening the Governor's directive power, the PCSA explicitly requires that any entity that is issued a directive (e.g., the operator of a designated FMI) be given the opportunity to explain why it believes risk is adequately controlled before a directive is issued.[11]

Ability to approve significant changes to a designated financial market infrastructure

Before these amendments, the Bank was notified of significant changes a designated FMI planned to make that could affect its risk profile. This notice gave the Bank the opportunity to raise any concerns about potential risks before a change was implemented. However, at that time the Bank could not explicitly disallow a significant change that created serious risk concerns without the use of a directive and had to rely on its working relationships with FMIs to address any risk concerns. The Bank's new authority to disallow significant changes at an FMI provides greater certainty that the risks associated with FMIs will be prudently and appropriately managed.

[10] The Governor can now issue a directive if the Governor is of the opinion that systemic risk or payments system risk could be inadequately controlled.
[11] This opportunity to make representations is only suspended when allowing for them would reduce the effectiveness of the directive. In effect, a temporary directive could be issued without giving the FMI operator this opportunity if the risk concern is time-sensitive.

2. The Bank's expectations for the designated domestic financial market infrastructures

The Bank works directly with the domestic designated FMIs to ensure that they adequately control their risks. As part of this effort, every year, the Bank identifies enhancements related to risk management that are most relevant to the safety and soundness of the FMIs and the broader financial system. These risk-management expectations are established following a rigorous process. The process identifies gaps where FMIs were not fully observant of the Bank's risk-management standards. Changes to the business environment and best practices in risk management, including the development and evolution of international guidance that supports the PFMIs, were also identified as part of this process.

This section discusses the performance of the domestic designated FMIs against the expectations set for them in last year's Annual Report. These include both expectations pertinent for all the domestic systemic FMIs and specific expectations for each designated system to pursue in 2017. This section is organized as follows:

- 2.1. Expectations common to all domestic designated FMIs
- 2.2 Expectations for TMX's FMIs
- 2.3 Expectations for Payments Canada's FMIs

2.1 Common risk-management expectations for domestic designated financial market infrastructures

Certain risk-management expectations set by the Bank are intended for all the domestic designated FMIs to pursue. These actions support the observance of the Bank's Risk-Management Standards for Systemic FMIs and Prominent Payment Systems.

The common expectations from last year were for the FMIs to finalize their recovery plans and make progress on cyber security action plans. In 2018, the Bank expects all the domestic designated FMIs to pursue further enhancements to cyber security.

Common expectations 2017	Common expectations 2018
• Ensure recovery plans are finalized and in place early in 2017 • Continue ongoing enhancements to cyber security action plans	• Conduct table-top exercise exploring recovery time from a cyber event • Address cyber security action plans arising from third-party assessment

2.1.1 Maintain recovery plans

Recovery plans ensure that FMIs can continue to offer their critical payment clearing and settlement services as a going concern, even in times of extreme but plausible financial stress. In Canada, recovery plans are required for both systemic FMIs and PPSs under the respective risk-management standards that the Bank maintains for these systems. In 2016, the designated FMIs developed recovery plans that were finalized and implemented in early 2017.

The FMIs are also expected to annually review the recovery plans and amend them as needed. In addition, the FMIs have performed the first annual tests of their recovery plans in 2017, as required under the CPMI-IOSCO guidance *Recovery of Financial Market Infrastructure*. These tests provide insight into improvements that may be needed. The FMIs will incorporate lessons learned from these tests into the revised version of the 2018 plan.

2.1.2 Ensure cyber resilience

Cyber security requires ongoing vigilance, monitoring and enhancements to processes, controls and procedures to effectively respond to new and evolving cyber threats. While the Bank's expectations regarding cyber risk management are derived from the PFMIs and informed by the CPMI-IOSCO cyber guidance, best practices for meeting these standards continue to change as threats and technology evolve. The Bank recognizes cyber threats as an important source of risk, as discussed in the November 2017 Bank of Canada *Financial System Review*.[12]

Throughout 2017, the designated FMI operators continued to implement their cyber security action plans—plans that were developed following a cyber security self-assessment in 2015. In the case of TMX systems, most remediation from the 2015 self-assessment has been completed. In addition, TMX was subject to an independent assessment, which found that TMX has made important improvements to its cyber security posture since 2015. The independent assessment also identified scope for further enhancements. The TMX is

[12] Financial System Review, November 2017.

completing remediation to both the 2015 self-assessment and 2018 independent assessment by mid-2018. Payments Canada made significant progress on its cyber security action plan. An independent assessment of Payments Canada's cyber security posture will be completed in 2018.

Going forward, strengthening cyber security, including the ability to detect and manage cyber risks, will remain a top priority for all FMIs. In 2018, the Bank expects the designated FMIs to conduct table-top exercises with the Bank to examine how they would respond to, and recover from, a major cyber attack. The results of the table-top exercises will allow the Bank and the FMIs to identify issues that could affect their cyber resilience and take the necessary measures to address them. Of note, these table-top exercises will inform the next steps for meeting the two-hour recovery time objective established in the CPMI-IOSCO cyber guidance for FMIs.

Payments Canada will meet the expectation of conducting a table-top exercise by participating in an initiative led by the Bank. The purpose of this exercise will be to develop and test integrated plans for the recovery of the wholesale payments ecosystem in the event of a cyber attack. This initiative involves the main participants in the wholesale payments system. It covers cyber scenarios that include loss of connectivity to the payments infrastructure by a significant participant or the corruption of payments-related data.

2.2 Expectations for TMX financial market infrastructures

The TMX Group is the owner of both the Canadian Derivatives Clearing Corporation (CDCC) and the Canadian Depository for Securities Limited (CDS). Throughout 2017, CDCC and CDS achieved many milestones, such as enhancing their default-management practices and commencing a systems modernization project. In this section, we discuss the expectations the Bank has for these systems. The risk-management expectations that apply to both systems are discussed in section 2.2.1. We then discuss the expectations applicable to CDCC (section 2.2.2) and CDS (2.2.3).

2.2.1 Common expectations for the Canadian Derivatives Clearing Corporation and the Canadian Depository for Securities Limited

Given their common owner, CDCC and CDS have some shared policies and procedures. TMX is undertaking a project to update the technology underlying its clearing platform and the financial risk-management system.

Implement the new risk-management system and undertake other systems modernization initiatives

The TMX Group is undertaking a project to update the technology underlying its clearing platform and the financial risk-management system. The overall objective is to improve and enhance risk management by replacing aging technology, reducing the requirement for manual processes and strengthening the risk models. The project is also expected to provide CDCC and CDS with greater flexibility in their clearing and risk-management systems, thereby better future-proofing their systems against evolving standards and requirements. This modernization is a multi-year project with the CDCC risk-management system being implemented in January 2019 and other components of the project targeted for later in 2019.

Monitor staffing and enhance succession planning

CDCC and CDS are integrating parts of their operations. This has led to numerous changes in organizational structure and staffing. In addition, the major modernization project under way is expected to be a significant draw on resources. Both organizations will therefore need to closely monitor and manage staffing to ensure that the changes in structure and the major modernization project do not give rise to undue risk. The Bank also expects CDCC and CDS to improve their succession planning to enhance their ability to respond in the event of the departure of key staff.

TMX expectations 2017	TMX expectations 2018
Common CDCC and CDS • No common expectations identified	**Common CDCC and CDS** • Implement the new risk-management system and undertake other systems modernization initiatives • Monitor staffing and enhance succession planning • Strengthen business continuity management • Implement enhancements stemming from international guidance on resilience
CDCC • Make progress on a new risk-management system • Strengthen credit and liquidity stress testing • Improve management of risk models • Review liquidity arrangements • Enhance CDCC's default-management framework	**CDCC** • Strengthen credit and liquidity stress testing • Explore tools to manage settlement behaviour in the fixed income clearing service • Enhance CDCC's default-management framework
CDS • Enhance liquidity risk management • Ensure sufficient pre-funded resources under extreme scenarios • Enhance default-management framework • Modernize clearing and risk systems	**CDS** • Complete enhancements for liquidity risk management • Complete enhancements to ensure sufficient financial resources under extreme market conditions

Strengthen business continuity management

As part of its risk-based oversight, the Bank periodically performs inspections into the FMIs' practices in certain areas. In 2016 and 2017, the Bank performed an inspection of business continuity management at the TMX premises. This exercise helped the Bank identify several important improvements that CDCC and CDS will make to their business continuity management.

First, CDCC and CDS's disaster recover testing has consistently occurred at the same time of day. This is insufficient for testing the ability to provide procedures and manage operational events late in the day. The Bank therefore expects CDCC and CDS to begin varying the timing of their disaster recovery testing.

Second, the TMX Group has established a new policy on outsourcing risk management, requiring an assessment be performed on critical service providers. This requirement will help TMX Group understand the risks posed by these providers as well as the mitigants that have been put in place. CDCC and CDS have not yet completed these assessments. The Bank expects CDCC and CDS to complete these assessments in 2018 and remediate any issues of concern that the assessments uncover.

Finally, the operations groups supporting CDSX and the Canadian Derivatives Clearing Service (CDCS) have been moved within the TMX Group as part of a broader reorganization. It is important that TMX Group provides assurances that it will support CDSX and CDCS to meet minimum operational standards (e.g., service availability) now that they are incorporated in the parent company. The Bank expects that, in 2018, CDCC and CDS will document these minimum conditions in a legally binding service level agreement that ensures continuity of operations under a wide range of conditions, including recovery or resolution.

Implement enhancements stemming from international guidance on resilience

CPMI-IOSCO recently developed guidance on the resilience of central counterparties (CCPs). This guidance provides additional clarity on aspects of the PFMI for CCPs. Following the release of this guidance in July 2017, CDCC and CDS conducted a self-assessment and developed a remediation plan. This plan will be implemented in 2018 or, if technological enhancements are needed, as part of the modernization initiative in 2019.

2.2.2 Other expectations for the Canadian Derivatives Clearing Corporation

CDCC made good progress on all the priorities identified by the Bank last year. Key achievements include working with the TMX Group to complete the development of requirements for its new risk-management system and developing a model risk-management policy. In addition, the rules for introducing direct clearing for certain buy-side firms in CDCC's repo clearing service were completed and testing is under way for the onboarding of four pension plans in 2018. In this section, we discuss the progress CDCC made in 2017 and the Bank's expectations for 2018.

Strengthen credit and liquidity stress testing

The Bank's Risk-Management Standards for Systemic FMIs calls for systemically important CCPs to conduct daily stress testing of their liquidity and credit exposures. These stress tests are performed to ensure, with a high degree of confidence, that CDCC credit and liquidity coverage targets are met on an ongoing basis.

CDCC will be making several enhancements to its credit and liquidity stress-testing frameworks in 2018, including by developing a more comprehensive set of historical and theoretical stress scenarios for each type of risk.

Explore tools to manage settlement behaviour in the fixed-income clearing service

In 2017, CDCC conducted analysis that indicated that participant behaviour, rather than volume, is the primary driver of settlement congestion in CDCS.[13] CDCC has been successful so far in addressing participants' discipline concerning the timing of payments through moral suasion. There is scope, however, for CDCC to consider additional enforcement tools to ensure the ongoing sufficiency and robustness of its liquidity arrangements.

The Bank expects CDCC to explore additional enforcement tools that would foster discipline more directly by the end of 2018. This would ensure the effective management of liquidity risk and mitigate the frequency and duration of settlement congestion.

Enhance the default-management framework for the Canadian Derivatives Clearing Corporation

In 2017, CDCC improved the default-management process by establishing formal delegation arrangements for senior management. This was done in response to the Bank's 2016 in-depth review of CDCC's default-management process. CDCC also enhanced its default-management framework by introducing bidding incentives into the auction process. This new auction framework, which was developed as part of the project to bring buy-side participants into the repo clearing service, must be tested as part of CDCC's 2018 default simulation. These changes will ensure that CDCC can take timely action to contain losses and liquidity pressures in the event of participant default, while continuing to meet its obligations.

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[13] Settlement congestion (or gridlock) occurs for CDCS when CDCC reaches its intraday credit limit and is unable to settle buy transactions. During settlement gridlock, CDCS transactions do not settle until securities held in its inventory are sold, freeing up intraday credit and allowing CDCS transaction settlement to continue.

2.2.3 Other expectations for the Canadian Depository for Securities

CDS made good progress against the Bank's expectations in 2017. Some projects were delayed, however, and will be completed in 2018. In this section, we discuss the progress CDS made in 2017 and the Bank's expectations for 2018.

Enhance liquidity risk management

In 2017, CDS developed a framework to monitor its liquid resources across all services and over multiple days. It also developed mechanisms to act promptly to increase available liquid resources if ongoing monitoring reveals they are insufficient. Based on this framework, CDS is increasing the size of its liquidity facility and is ensuring it has dynamic resizing capabilities. Because of these enhancements, the facility fully reflects liquidity needs in normal market conditions for all services other than the New York Link (NYL) service.

CDS is required to hold sufficient liquid resources to meet its obligations in the event the participant that would generate the largest payment obligations defaults under stressed conditions. The Bank expects CDS to design more comprehensive stress-testing scenarios to assess liquidity under this kind of condition in order to meet this requirement.

CDS is also working on better measuring its liquidity requirements stemming from the NYL. The NYL service allows Canadian participants to access a US-based CCP, the National Securities Clearing Corporation (NSCC). To provide this service, CDS is a participant in NSCC and provides indirect access to the CDSX participants that participate in NYL. As an NSCC participant, CDS guarantees the obligations of the Canadian participants. In its role, CDS pledges collateral, which it collects from the Canadian participants, to NSCC. Since CDS acts as a guarantor of obligations, CDS maintains additional liquid resources in Canada, which it also collects from Canadian participants, to allow it to meet its NSCC obligations if one of the Canadian participants enter into default. These liquid resources are sufficient to manage a default under normal market conditions. However, it is not clear that they would be sufficient in stressed market conditions. Therefore, during 2017, CDS began to analyze the risks associated with the NYL and sought more detailed information from NSCC. CDS has committed to completing the analysis and resizing their liquidity facility to ensure sufficient liquid resources in stressed market conditions by the end of the first quarter of 2018.

Ensure sufficient pre-funded resources under stressed conditions

The Bank's standards require CCPs to hold pre-funded resources sufficient to cover the single largest credit exposure (referred to as a "cover-one" requirement). CDS's equity CCP service (called continuous net settlement, or CNS) has met this requirement.

CDS had been determining the amount of pre-funded resources needed to cover 99.5 per cent of losses observed through stress testing. In 2017, CDS revised its approach to cover 100 per cent of potential losses. To achieve this objective, CDS developed a tiered funding model where the resources that participants must contribute vary across the quarter. This variation depends on known market fluctuations, and the amount of resources are commensurate with the risk that each participant brings to the CCP. This new model was implemented in October 2017, following approval by the Bank and CDS's provincial regulators, meaning CNS now meets the cover-one requirement.

Enhance the default-management framework for the Canadian Depository for Securities

In the event of a default, CDS would need to close out the positions of the defaulter. In such a situation, CDS would need to employ a specialist broker to provide these services. In 2017, CDS pre-arranged several specialist brokers for this purpose. Having several brokers available mitigates the risk that the defaulting participant is the specialist broker itself.

CDS is also working to ensure that those settlement agents that are not participants in the Large Value Transfer System (LVTS) have sufficient liquidity to support their payment obligations arising from the default event.

2.3 Expectations for Payments Canada systems

Payments Canada owns and operates two designated FMIs: LVTS and the Automated Clearing Settlement System (ACSS). In this section, we discuss the expectations the Bank has for these systems. There are some risk-management expectations that apply to both systems, which are discussed in section 2.3.1. We then discuss the specific expectations applicable to LVTS (section 2.3.2) and to ACSS (section 2.3.3).

2.3.1 Common expectations for the Large Value Transfer System and the Automated Clearing Settlement System

Payments Canada achieved several milestones over the past year with respect to payments modernization. These include an ambitious, multi-year initiative that will completely replace ACSS and LVTS and the introduction of a new, faster retail payments system. Payments Canada also completed its disaster recovery enhancement (DRE) project, started in 2016. The DRE project moves LVTS and ACSS toward near-continuous operations and improves their overall resiliency.

In 2018, Payments Canada will continue to focus on advancing modernization initiatives, enhancing its enterprise risk management (ERM) framework, and monitoring the effectiveness of its human resource strategy to ensure it remains successful.

Payments Canada expectations 2017	Payments Canada expectations 2018
Common ACSS and LVTS • Make progress on the payments modernization initiative	**Common ACSS and LVTS** • Continue progress on payments modernization • Enhance enterprise risk-management framework • Monitor human resource strategy
LVTS • Make progress on the payments modernization initiative and ensure the resilience of the existing LVTS platform • Monitor liquidity risk	**LVTS** • No new priorities specific for LVTS identified
ACSS • Collateralize credit exposure • Review and enhance contingency procedures	**ACSS** • Enhance default management

Progress on payments modernization

Given its importance to the broader payments ecosystem, modernization is a top priority for both Payments Canada and the Bank. It requires extensive collaboration and coordination among participants, industry stakeholders and authorities. The Bank is closely involved in all stages of this transformative initiative given the many different functions it performs for Canada's core payment systems, including overseer, participant, provider of liquidity, and provider of settlement accounts and services.

The original industry road map and high-level plan were released in 2016. Since, Payments Canada has produced a clearer vision of its final target state, which includes three distinct systems. These are a real-time gross settlement system for large-value payments (to replace LVTS), a batch retail payments system (to replace ACSS) and a new "real-time rail utility" (RTR) that will deliver funds in near real time and offer more detailed remittance information through the adoption of ISO 20022.[14]

The target state is the result of significant work undertaken in 2017 to determine the design options of each of the three systems. This included establishing the technical business requirements, risk and settlement models, and opportunities for broadening access to a wider range of payments system participants.

In 2018, Payments Canada will continue to engage the industry and authorities to solidify the design, identify the critical risks and complexities associated with the implementation of these new systems, and plan how to address them.

Enhance the enterprise risk-management framework

Payments Canada's ERM framework identifies key types of risks, such as strategic, financial and operational risks, and seeks to ensure that these risks are managed across the organization in a comprehensive and integrated way. The framework is at a mature state but is continuously reviewed to ensure it remains effective.

After reviewing the framework in 2017, Payments Canada identified areas for further improvement, such as better measures of risk and more formalized monitoring of emerging risks. Implementing these improvements will be a focus for 2018.

In addition, the management of risks arising from the modernization initiative needs to be consistent with ERM policies. Modernization is a significant project in terms of scale, scope and strategic importance. The Bank has therefore requested that Payments Canada review the specific risk-management policies and practices for modernization to ensure they are integrated within the ERM framework.

[14] Payments Canada Modernization Target State Document

Monitor human resources

The objective of Payments Canada's human resource strategy is to ensure that there is sufficient capacity to support the modernization initiative as well as meet ongoing organizational needs for core operations. In 2016, Payments Canada began a multi-year effort to significantly enhance its human resources capacity.

The Bank has asked Payments Canada to ensure it has appropriate metrics and tools to manage this growth. Specifically, given the onboarding of many new staff in a relatively short time, the Bank expects Payments Canada to monitor the integration and development of new staff to ensure they are performing at required levels. In addition, given that the planned growth in staffing will end in 2018, Payments Canada is expected to review whether the additional resources met the organizational objectives for the growth. The Bank expects that this will include a review of whether risk-management resources are sufficient and allocated appropriately across Payments Canada.

2.3.2 Other expectations for the Large Value Transfer System

In 2017, progress was made against the Bank's risk-management expectations for LVTS. In particular, Payments Canada implemented a liquidity monitoring framework with respect to throughput guidelines, which help to manage liquidity risk within the system by encouraging payment flows to occur earlier in the day. In addition, Payments Canada began collecting information on indirect participants to support the identification and monitoring of risks arising from tiered participation arrangements.[15]

With these improvements, LVTS risk management is at a mature state. As such, the focus going forward will be on modernization and the common expectations for LVTS and ACSS. The Bank does not have additional expectations specific to LVTS in 2018.

2.3.3 Other expectations for the Automated Clearing Settlement System

After ACSS was designated as a PPS in May 2016, Payments Canada assessed it against the PPS standards to identify specific areas for improvement. Many of these areas are expected to be addressed as part of the modernization initiative, in which ACSS will be replaced by a new system with enhanced risk-management

[15] Indirect participants rely on the services provided by direct participants to access the payments system. As described by the PFMI, the dependencies and risk exposures (including credit, liquidity and operational risks) inherent in these tiered arrangements can present risks to the FMI and participants themselves.

functionality. Nonetheless, Payments Canada was asked to take interim measures in some key areas to improve ACSS risk management.

Over the course of 2017, Payments Canada made progress on these interim measures. Notably, it developed an interim credit risk model (ICRM) requiring participants to pledge collateral *ex ante* to cover the single largest credit exposure with a high degree of confidence ("cover-one"). Previously, ACSS relied on an arrangement of *ex post* contributions from its surviving participants to cover losses in the event of a single-participant default. The ICRM was successfully implemented in March 2018.

Enhance default management

At the time of ACSS's designation, the Bank requested that Payments Canada review ACSS contingency procedures and develop more comprehensive testing plans, including default simulations.

In 2017, Payments Canada completed this review and implemented a more comprehensive testing program for the manual balancing procedure used in the event of a national failure of ACSS.[16] It also successfully completed a table-top default exercise, which involved Bank of Canada staff, reflecting the fact that the Bank manages the ACSS settlement accounts. The exercise was a first step in testing the revised default procedures, which were revised to reflect the ICRM.

In 2018, Payments Canada is expected to involve all direct participants in its default exercise. This will be important to ensure that participants are aware of their respective roles and obligations under the ICRM. In addition, Payments Canada is expected to incorporate the lessons learned from the 2017 exercise in the design and execution of the 2018 exercise.

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[16] A national failure of ACSS is a situation where the ACSS host computer is inoperative or the complete communications link affecting all ACSS regions has failed.

3. Risk-management priorities for foreign-domiciled designated financial market infrastructures

A co-operative approach to oversight of foreign financial market infrastructures

The Bank's oversight responsibilities include the designation and oversight of foreign-domiciled FMIs that have the potential to pose systemic risk to the Canadian financial system. As with the domestic systemic FMIs, oversight of these foreign-domiciled systemic FMIs (foreign FMIs) focuses on efforts to ensure that they are adequately controlling risk in an efficient and effective manner.

To achieve this objective, the Bank relies on co-operative oversight arrangements that take the form of oversight colleges. These colleges are led by the FMI regulator in the jurisdiction in which the foreign FMI is domiciled. Priorities for the foreign FMIs are set by these lead regulators. Through the oversight colleges, the Bank works closely with lead regulators and authorities from other jurisdictions that are participating in the co-operative oversight arrangements.

These oversight colleges help the Bank to ensure that designated foreign FMIs have appropriate risk controls in place. The oversight colleges are equivalent to the Bank's Risk-Management Standards for Systemic FMIs. Further, the Bank is to be consulted on material developments that affect these FMIs—for example, major changes to an FMI's rules. The Bank's oversight focuses particularly on Canadian-dollar-denominated activities in the foreign FMIs and the risks that the FMIs bring to their Canadian participants.

This section discusses the performance of the foreign-domiciled designated FMIs against the priorities set for them in last year's Annual Report. Further details are also provided on the plans for the two designated systems for the work to follow during 2018. This section is organized as follows:

- 3.1. Priorities for LCH SwapClear
- 3.2 Priorities for CLS Bank

3.1 Priorities for LCH SwapClear

SwapClear is a global system operated by LCH for the central clearing of over-the-counter (OTC) interest rate derivatives denominated in multiple currencies, including the Canadian dollar. The Bank is involved in the oversight of SwapClear through participation in the LCH Global College, organized and administered by the Bank of England. The Bank of Canada also participates in the LCH Crisis Management Group, designed to provide a framework for authorities to plan the orderly resolution of LCH.

3.1.1 Strengthening LCH risk management in 2017

Over the course of 2017, LCH continued to strengthen operational risk management, including cyber risk. LCH Ltd.'s governance was also enhanced, with changes made to board structure, composition and functioning to improve the effectiveness of the Board's challenge function. Finally, LCH, along with CME and Eurex, participated in a multi-CCP default-management fire drill to identify potential issues in the event of a default of a hypothetical material joint clearing member.

During the past year, the Bank of England conducted reviews of LCH's outsourcing arrangements and business continuity management. It also began a review of LCH's ERM framework and identified several areas for improvement. The Bank of England and LCH Global College also assessed LCH's proposal to clear foreign exchange (FX) options. This initiative, which has been approved by regulators, is expected to launch in early 2018.

3.1.2 Risk management of LCH operations in 2018

The Bank of England supervises LCH to ensure that it fully observes the PFMIs. In line with this objective, FMI supervisory priorities for the Bank of England in 2018 include cyber security and IT resilience, as well as CCP financial resilience.[17]

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[17] *The Bank of England's supervision of financial market infrastructures — Annual Report* (covering the period 23 February 2017 – 20 February 2018).

Through the LCH Global College process, the Bank will continue to focus its oversight efforts to ensure that the FMI's risk-management frameworks do not adversely affect the Canadian participants in the SwapClear service. This includes assessing any significant changes arising from LCH's introduction of new products and services as well as LCH's response to other relevant developments (e.g., Brexit).

3.2 Priorities for CLS Bank

CLS Bank provides a global payment system for the settlement of FX transactions, including those involving the Canadian dollar. CLS Bank is supervised and regulated by the US Federal Reserve Board and is overseen by the CLS Oversight Committee, which is composed of central banks, including the Bank of Canada.

The Federal Reserve Board requires CLS Bank to meet the risk-management standards prescribed in Regulation HH (12 C.F.R. Part 234). These standards are based on and generally consistent with the PFMIs.

3.2.1 Strengthening CLS Bank risk management in 2017

In 2017, CLS Bank continued to focus on its overall risk management of its core FX settlement service through various initiatives. For example, CLS Bank implemented its enhanced liquidity-risk-management framework to ensure complete coverage of a single nostro agent failure,[18] focusing on the short positions of a nostro agent and its clients.

3.2.2 Monitoring new developments at CLS Bank

CLS Bank has been active in the development of new products and services to provide innovative solutions to the broader FX market.

A new CCP settlement session for cleared FX products is expected to be launched in early 2018, starting with LCH and Eurex. This service aims to reduce settlement risk and will offer netting efficiencies to the benefit of participating CCP clearing members.

CLS also intends to launch CLS Net, an automated bilateral netting service in 2018 (pending regulatory approval) for the submission of certain FX products for 140 currencies through traditional SWIFT[19] channels or distributed ledger technology (DLT). These FX trades would settle bilaterally and thus outside the core CLS settlement service.

[18] Nostro agents send and receive payments to CLS Bank through a domestic high-value payments system on behalf of other settlement members.
[19] Society for Worldwide Interbank Financial Telecommunication

3.2.3 CLS Now

Another initiative that is of interest to the Bank is CLS Now. This new service, slated for late 2018 (pending regulatory approval), is intended to replace the existing Americas same-day settlement session and offer same-day settlement for currency pairs that include Canadian dollars, US dollars, British pound sterling, euros and Swiss franc (as part of the initial launch).

4. The Bank of Canada's activities

In addition to ongoing monitoring of the risk-management practices of designated FMIs, the Bank is involved in several activities that are broadly related to its oversight. These activities are described in this section as follows:

- 4.1. Developing a resolution regime for financial market infrastructures
- 4.2 Contributing to international efforts

4.1 Developing a resolution regime for financial market infrastructures in Canada

The Bank's oversight activities include actions to promote the stability of the Canadian financial system. Despite these efforts, an FMI could, in theory, face circumstances so severe that it is unable to continue providing its critical functions to the Canadian financial system. Under such a scenario, arrangements to resolve the FMI would be needed. Over the course of 2017, the Bank and financial sector authorities advanced the development of a resolution regime for the domestic designated FMIs—a multi-year initiative that will continue to be a priority for the Bank in 2018.

Federal authorities have completed work on the policy framework for the regime. The main elements of the framework are the scope of the regime, powers and tools required by an FMI resolution authority, and governance arrangements. The Bank is now advancing other aspects of this work. One aspect is to develop arrangements for how the Bank will co-operate with provincial securities commissions both in planning for and, if ever required, executing the resolution of an FMI.

Canada's FMI resolution regime is being developed in line with international guidance from the FSB under its *Key Attributes of Effective Resolution Regimes for Financial Institutions*.[20] Progress is also keeping pace with ongoing international dialogue on developing FMI resolution regimes, in particular with elements discussed under the FSB's Resolution Steering Group and its working-level Cross-border Crisis Management Group for FMIs—two forums in which Canadian authorities actively participate.

[20] More information, including the FSB's Key Attributes publication, is available at the FSB website.

4.2 Contributing to international efforts

The Bank participates on several international committees that seek to develop, promote and uphold international risk-management standards for systemically important FMIs. Discussions in these forums and any resulting international guidance directly shape the risk-management standards that the Bank maintains for Canada's designated FMIs.

Through its participation on CPMI-IOSCO and the FSB, the Bank contributed to international guidance on resilience, recovery, resolution and distributed ledger technology (DLT) in 2017.

In July, CPMI-IOSCO issued guidance on the resilience of central counterparties.[21] The guidance clarifies the PFMI's expectations for CCPs on governance, credit and liquidity stress testing, margin, and contributions of financial resources to losses.

CPMI-IOSCO also revised guidance on the recovery of FMIs.[22] This guidance provides clarifications in four areas: (i) operationalization of recovery plans, (ii) replenishment of financial resources, (iii) non-default-related losses, and (iv) transparency with respect to recovery tools and how they would be applied. Finally, the Bank contributed to the FSB's development of guidance on how authorities should implement the FSB's *Key Attributes of Effective Resolution Regimes* in resolution arrangements for CCPs.[23] The guidance sets out powers for resolution authorities to maintain the continuity of critical CCP functions, details on the use of loss allocation tools, and steps authorities should take to establish crisis management groups for relevant CCPs and develop resolution plans.

The Bank also contributed to the CPMI report *Distributed Ledger Technology in Payment, Clearing and Settlement*, which was published in February 2017. This report aims to assist in reviewing and analyzing the use of DLT in FMIs with a focus on the implications of the technology for efficiency and safety and for the broader financial market.

Finally, the Bank has been actively involved in CPMI-IOSCO efforts to monitor implementation of the PFMI. The Bank has contributed to an assessment of how CCPs have implemented the PFMI globally. The assessment examines recovery planning, coverage of financial resources, and liquidity stress testing for a sample of 19 CCPs.[24] Canadian authorities, including the Bank, have also been subject to a review of Canada's implementation of the PFMI assessment. The focus of that assessment is whether, and to what degree, the legal, regulatory and oversight frameworks, are complete and consistent with the PFMI. The Bank welcomes the

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[21] *Resilience of Central Counterparties (CCPs): Further guidance on the PFMI*
[22] *Recovery of Financial Market Infrastructures—Revised Report*
[23] *Guidance on Central Counterparty Resolution and Resolution Planning*
[24] Forthcoming at the CPMI website.

feedback that this review will provide in 2018. The results of the assessment will be examined, and the Bank will consider implementing changes to its framework if necessary.

4.3 Researching and monitoring trends in the financial market infrastructure landscape

The Bank's oversight activities include research into areas of FMI risk management and financial stability.

In 2017, Bank oversight staff conducted research into risk mutualization in recovering and resolving a CCP.[25] This research examines the effectiveness of requests for additional cash contributions from participants as a CCP recovery tool, and whether they are likely to change participant behaviour, such as the optimal contract size. This research has several interesting findings, including that defaults on the requests for additional cash are more likely when there is no resolution regime in place, and that CCPs over-relying on cash calls could face greater challenges. The paper also establishes a theoretical foundation for the existence of a dedicated FMI resolution regime and makes recommendations about the optimal point of entry into resolution.

Bank researchers also explored using extreme value theory to quantify the risk of extreme but plausible circumstances (tail risk) in the ACSS.[26] The analysis finds that tail risk has been increasing from 2002 to 2015, with a slower rate of growth toward the end of the period. This analysis informs an understanding of the amount of collateral that would be needed to protect against extreme exposures.

In addition, in collaboration with Payments Canada, R3[27] and several Canadian commercial banks, the Bank participated in a collective initiative, called Project Jasper, to build and test an experimental DLT-based wholesale payment system.[28] Project Jasper explored the technical and policy implications of such a system, including whether it could meet international risk-management standards. The project showed that wholesale payments could be successfully settled on certain

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[25] R. Raykov. "Risk Mutualization and Financial Stability: Recovering and Resolving a Central Counterparty," *Journal of Financial Market Infrastructures, Feb. 2018, 6(2/3).*

[26] H. Perez Saiz, B. Williams and G. Xerri. 2018. "Tail Risk in a Retail Payment System: An Extreme-Value Approach." Bank of Canada Staff Discussion Paper 2018-2.

[27] R3 is a fintech company that has developed the distributed ledger platform that was used in this project.

[28] A summary of Project Jasper is available at the Bank of Canada website. In addition, Payments Canada has a white paper describing Project Jasper. An opinion piece discussing Project Jasper is available by The Globe and Mail.

DLT-based systems, including a liquidity-saving mechanism, while meeting the international standards considered.

One of the main lessons from this experiment is that the DLT currently available may not provide an overall net benefit to the operator. This is because core wholesale payment systems already function quite efficiently. There may, however, be net benefits for the broader group of payment system participants and the entire financial system in terms of savings from reduced back-office reconciliation or increased functionality, for example. In 2018, the Bank, Payments Canada and TMX Group will continue to collaborate with Project Jasper to introduce the clearing and settlement of exchange-traded equities and derivatives using the central bank cash-on-ledger model.[29] This ongoing work is an opportunity to research further the ability to settle multiple assets on the same distributed ledger and explore potential ways to modernize the securities settlement process. In addition, the Bank will join with Payments Canada and the Monetary Authority of Singapore to investigate cross-currency payments using central bank money on a distributed ledger.

[29] See Payments Canada announcement on project Jasper.

Appendix 1 | Overview of Designated Financial Market Infrastructures

LVTS (Payment System | Designated Systemic FMI 1999)

The Large Value Transfer System (LVTS) is a Canadian electronic funds-transfer system operated by Payments Canada that settles large-value and time-critical Canadian-dollar payments.

Measure	2015	2016	2017
Daily average value settled	$171 billion	$175 billion	$173 billion
Daily average volume settled	32 thousand	34 thousand	36 thousand
Daily average collateral pledged	$38 billion	$38 billion	$37 billion
Number of direct participants	17	17	17

CDSX (Securities Settlement System, Central Securities Depository, Central Counterparty | Designated Systemic FMI 2003)

CDSX is a Canadian system operated by the Canadian Depository for Securities Limited (CDS) that consists of a securities settlement system, a central securities depository and a central counterparty service for Canadian exchange-traded and over-the-counter (OTC) equities.

Measure	2015	2016	2017
Daily average value of equity and fixed-income securities cleared and settled	$478 billion	$493 billion	$541 billion
Daily average volume of equity and fixed-income securities cleared and settled	1.7 million	1.8 million	1.7 million
Average value of securities held at the central securities depository	$4.6 trillion	$5.1 trillion	$5.4 trillion
Number of direct participants	99	97	95

CDCS (Central Counterparty | Designated Systemic FMI 2012)

The Canadian Derivatives Clearing Service (CDCS) is a Canadian central counterparty operated by the Canadian Derivatives Clearing Corporation (CDCC) that clears transactions in certain fixed-income securities, OTC repurchase agreements (repos), OTC equity derivatives and all derivatives traded on the Montréal Exchange.

Measure	2015	2016	2017
Daily average value of OTC repos cleared	$22 billion	$27 billion	$27 billion
Daily average notional value cleared (exchange-traded derivatives)	$101 billion	$121 billion	$134 billion
Daily average notional value cleared (OTC derivatives)	$7.9 million	$9.7 million	$13.3 million
Number of direct participants	36	35	34

ACSS (Payment System | Designated Prominent Payment System 2016)

The Automated Clearing Settlement System (ACSS) is a retail payment system operated by Payments Canada that clears cheques and electronic items, such as pre-authorized debits, direct deposits and Interac debit payments.

Measure	2016[1]	2017
Daily average value settled	$26 billion	$28 billion
Daily average volume settled	30 million	30 million
Number of direct participants	12	12

[1] Reporting of data begins in 2016, the first year of the ACSS's PPS designation.

CLS Bank (Payment System | Designated Systemic FMI 2002)

CLS Bank is a global payment system for the settlement of foreign exchange transactions, including those involving the Canadian dollar.

Measure	2015	2016	2017
Daily average foreign exchange settlement (total)	US$4,750 billion	US$4,820 billion	US$5,185 billion
Daily average Canadian-dollar foreign exchange settlement[1]	Can$173 billion[1]	Can$178 billion	Can$199 billion
Settlement members	66	68	69

[1] The methodology for calculating the daily average Canadian-dollar foreign exchange settlement was revised to remove data points equal to zero on Canadian holidays.

LCH SwapClear (Central Counterparty | Designated Systemic FMI 2013)

SwapClear is an LCH clearing platform for interest rate swaps and other OTC interest rate derivatives denominated in multiple currencies, including the Canadian dollar.

Measure	2015	2016	2017
Notional outstanding OTC interest rate swaps, in all currencies, as at December 31	US$251 trillion	US$252 trillion	US$292 trillion
Notional outstanding OTC interest rate swaps, denominated in Canadian dollars, as at December 31	Can$8.7 trillion	Can$9.6 trillion	Can$12.1 trillion
Number of direct participants[3]	100	104	105

Appendix 2 | Glossary of Terms

central counterparty (CCP)	An entity that interposes itself between counterparties to contracts traded in one or more financial markets, becoming the buyer to every seller and the seller to every buyer, thereby ensuring the performance of open contracts.
central securities depository	An entity that provides securities accounts, central safekeeping services and asset services, which may include the administration of corporate actions and redemptions. A central securities depository plays an important role in helping to ensure the integrity of securities issues (that is, it ensures that securities are not accidentally or fraudulently created or destroyed or their details changed).
clearing	The process of transmitting, reconciling and, in some cases, confirming transactions before settlement, potentially including the netting of transactions and the establishment of final positions for settlement. On occasion, this term is also used (imprecisely) to cover settlement. In the context of futures and options, clearing also refers to the daily balancing of profits and losses and the daily calculation of collateral requirements.
collateral	An asset or third-party commitment that is used by a collateral provider to secure an obligation for a collateral taker.
core systems	The technology, networks and data that support the operations of financial entities.
credit risk	The risk that a counterparty, whether a participant or other entity, will be unable to fully meet its financial obligations when due or at any time in the future.
cyber defences	The strategies, tools and technologies deployed by an entity to prevent, detect and recover from cyber attacks.
default	Generally, an event related to the failure to complete a transfer of funds or securities in accordance with the terms and rules of the system in question
default fund / clearing fund	A pre-funded default arrangement that is composed of assets contributed by a CCP's participants. These assets may be used by the CCP in certain circumstances to cover losses or liquidity pressures resulting from participant defaults.
designated system / designated financial market infrastructure	A financial market infrastructure designated under the *Payment Clearing and Settlement Act* for oversight by the Bank of Canada.

enterprise risk management (ERM)	A process established by an entity's board of directors, management and personnel that is applied to set strategy across the enterprise. ERM is also designed to identify potential events that may affect the entity and to manage risk so that it remains within the entity's risk appetite.
financial market infrastructure (FMI)	A multilateral system among participating institutions, including the operator of the system, used for the purposes of clearing, settling or recording payments, securities, derivatives or other financial transactions.
initial margin	Collateral that is collected to cover potential changes in the value of each participant's position (that is, potential future exposures) over the appropriate close-out period in the event that the participant defaults.
liquidity risk	The risk that a counterparty, whether a participant or other entity, will have insufficient funds to meet its financial obligations as and when expected, although it may be able to do so in the future.
payment system	A set of instruments, procedures and rules for the transfer of funds between or among participants. The system includes the participants and the entity operating the arrangement.
payments system risk	The risk that a disruption to or a failure of an FMI could cause a significant adverse effect on economic activity in Canada either by impairing the ability of individuals, businesses or government entities to make payments or by producing a general loss of confidence in the Canadian payments system.
procyclicality	The changes in risk-management requirements or practices that are positively correlated with business or credit cycle fluctuations and that may cause or exacerbate financial instability.
recovery	The ability of a financial institution, including an FMI, to resume operations after a threat to its viability and financial strength so that it can continue to provide its critical services without requiring the use of resolution powers by authorities. More specifically, in the context of an FMI, recovery is defined as the actions of the FMI that are consistent with its rules, procedures and other *ex ante* contractual arrangements to address any uncovered loss, liquidity shortfall or capital inadequacy, whether arising from participant default or other causes (such as business, operational or other structural weaknesses), including actions to replenish any depleted pre-funded financial resources and liquidity arrangements, as necessary, to maintain the FMI's viability as a going concern and the continued provision of critical services.

resolution	The set of actions that a resolution authority can take when recovery efforts have been unsuccessful or when recovery measures are deemed by the authorities to be insufficient to return the financial institution or FMI to viability.
securities settlement system	An entity that enables securities to be transferred and settled by book entry according to a set of predetermined multilateral rules. Such systems allow the transfer of securities either free of payment or against payment.
systemic risk	The risk that the inability of a participant to meet its obligations in an FMI as they become due, or that a disruption to or a failure of an FMI, could, by transmitting financial problems through the FMI, cause the following: • other participants in the FMI to be unable to meet their obligations as they become due, • financial institutions in other parts of the Canadian financial system to be unable to meet their obligations as they become due, • the FMI's clearing house or the clearing house of another FMI within the Canadian financial system to be unable to meet its obligations as they become due, or • an adverse effect on the stability or integrity of the Canadian financial system.

Appendix 3 | Abbreviations

ACSS	Automated Clearing Settlement System
CCP	central counterparty
CDCC	Canadian Derivatives Clearing Corporation
CDCS	Canadian Derivatives Clearing Service
CDS	Canadian Depository for Securities Limited
CNS	continuous net settlement
CPMI	Committee on Payments and Market Infrastructures
DLT	distributed ledger technology
ERM	enterprise risk management
FMI	financial market infrastructure
FSB	Financial Stability Board
FX	foreign exchange
ICRM	interim credit risk model
IOSCO	International Organization of Securities Commissions
LVTS	Large Value Transfer System
NYL	New York Link
OTC	over-the-counter
PFMI	Principles for Financial Market Infrastructure
PCSA	*Payment Clearing and Settlement Act*
PPS	prominent payment system
RTR	real-time rail
SOE	settlement optimization engine
SWIFT	Society for Worldwide Interbank Financial Telecommunication