

# Managing Operational Risk in Clearing and Settlement Systems

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**C**learing and settlement systems (CSS) are a key part of the financial infrastructure. They allow financial institutions (and, indirectly, their clients) to exchange payments, settle securities transactions, and finalize the transfer of funds involved in foreign exchange transactions. CSS consist of networks of interconnected elements—central operators of the systems, their participants, and their settlement agents.<sup>1</sup>

Awareness of operational risk in CSS has increased greatly in recent years. Operational problems, such as a computer breakdown, at any one of these key elements have the potential to disrupt the system as a whole and to negatively affect financial stability.

Recent advances in methodologies for managing operational risk at individual financial institutions can be used to develop a framework for managing this risk in systemically important Canadian CSS.<sup>2</sup> Strong risk management requires, among other things, sound corporate governance and internal controls, reliable formal and informal policies and procedures, good contingency planning, and skilled and knowledgeable people. The methods discussed here could enhance these core aspects of risk management.

Operational risk in CSS is defined as the risk resulting from inadequate or failed internal processes, problems in computer systems, human error, or from external events related to any element of these systems. The focus is on the

consequences of operational problems for financial stability. The trend to globalization, the increased concentration of many financial transactions in a single institution or system, and the increasing complexity of financial instruments are all altering the nature and composition of operational risk and have exacerbated the consequences of severe events. For example, the terrorist attacks of 11 September 2001 severely disrupted the settlement of U.S. government bond transactions and spilled over to payments systems and financial markets. This illustrated the linkages and dependencies among various parts of CSS and highlighted the serious consequences that extreme external events can cause for the financial system.

## Systemically Important Canadian CSS

Canada has a number of systems for settling payments, securities, and other transactions. Two domestic settlement systems are central. The first is the Large Value Transfer System (LVTS) for the exchange of large-value or time-sensitive payments. The second is the securities settlement system called CDSX. Another important system is the CLS Bank. The CLS Bank, which is incorporated in New York, settles foreign exchange transactions, including those involving the Canadian dollar.<sup>3</sup> Because of their systemic importance for financial stability, the Bank of Canada has oversight responsibility for the functioning of these systems.<sup>4</sup> One element

1. This note draws on a recent Bank of Canada Working Paper, McPhail (2003).
2. Systemic risk refers to spillover effects where the inability of one financial institution to fulfill its payment obligations in a timely fashion in a clearing and settlement system results in the inability of other financial institutions to fulfill their obligations in that clearing and settlement system or in other systems.

3. For more information on the LVTS, see the Bank of Canada's Web site at <http://www.bankofcanada.ca>. For information on CDSX, see McVanel in this issue, (p. 59). For more information on the CLS Bank, see Miller and Northcott (2002a, 2002b).
4. Oversight responsibility for the CLS Bank is shared with other central banks whose currencies are included in CLS. The Federal Reserve in the United States is the lead overseer for the CLS Bank.

of this responsibility is to promote their reliable and secure operation. In addition to its oversight responsibilities, the Bank also provides a number of essential services to CSS. For example, it is the banker for CDSX and for the CLS Bank's Canadian-dollar operations. It is also the settlement agent for the LVTS. The Bank provides liquidity to system participants and collateral-administration services to direct participants in the LVTS. The Bank is also a participant in the LVTS and CDSX.

## A Methodology for Managing Operational Risk in CSS

A method of measuring operational risk for individual financial institutions, called the Loss-Distribution Approach, can be adapted for CSS.<sup>5</sup> The Loss-Distribution Approach captures three elements of risk: the differing degrees of severity that may be associated with a particular type of operational problem, the likelihood of experiencing each of these degrees of severity when such a problem occurs, and the frequency of this type of problem. In the context of CSS, the severity of an operational problem is defined in terms of its impact on financial stability.

An index of financial instability can be created to evaluate the severity of operational problems in CSS. Because the evaluation of operational risk is qualitative, the severity of an operational problem is difficult to estimate and will require judgmental input. Operational experts can benchmark the values of this index by assigning a number from 0 to 7, for example, to assess the severity associated with specific operational problems in CSS. For example, past events such as a one-hour settlement delay of CDSX might be given a value of 2, and a lengthy intraday outage in the LVTS might be given a value of 3. A computer problem that had prevented a large LVTS participant from sending payments through the LVTS for several hours might also be given a value of 2. As operational problems occur in the future, such established benchmarks would make it easier to rank their effects on financial instability less arbitrarily. While very imperfect, such a measure can help to assess the severity associated with various operational problems as rigorously as possible.

Even a *single* operational problem (or type of problem) has the potential to be associated with differing degrees of severity, depending on the timing and duration of the problem. Once an index of financial instability has been created, this variability can be captured by considering the relationship between the likelihood (i.e., the probability) and severity arising from a *single* operational problem. This is called the loss-severity distribution. But this picture of operational risk is incomplete. That is, in addition, the *number* of such problems cannot be predicted perfectly but can be estimated (for example, by using historical data) in a frequency distribution.

Thus, for example, the severity associated with computer problems that prevent a participant from sending payments in the LVTS can vary, depending on factors such as the time of day, the length of the outage, and the size of the participant. These differing degrees of severity are captured by the loss-severity distribution, which estimates the likelihood of each of the potential degrees of severity if such a computer problem occurs. Information collected on past computer problems allows the estimation of a frequency distribution that would measure the average number and variability of these problems over a period of time. The loss-severity distribution and the frequency distribution can be combined, using Monte Carlo simulation, to form an estimate of the loss distribution that takes into account the fact that neither the severity of the outages associated with a single type of operational problem nor the number of such problems can be predicted with certainty.

Even as data on operational problems accumulate, it will be necessary to supplement data with judgment to evaluate the loss-severity distribution associated with certain types of operational problems, because problems that are extremely serious are (fortunately) very rare. The loss-severity distribution and frequency distribution, when combined to produce the loss distribution, provide an overall profile for operational risk in CSS. This profile can be monitored on an ongoing basis. If, for example, the likelihood of relatively severe outcomes arising from certain types of operational disruption appears to be higher than is appropriate, or if they appear to be occurring too frequently, steps (such as stronger risk mitigants) should be taken in order to bring the loss distribution back to

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5. For an explanation of the Loss-Distribution Approach, see BIS (1998) and Frachot, Georges, and Roncalli (2001).

a more acceptable profile. Also, as data accumulate, it should become possible to move towards developing quantitative (to supplement qualitative) coincident and leading indicators of operational risk.

## A Dynamic Approach to Managing Operational Risk

The measures described above form part of a framework for defining, identifying, measuring, controlling, and mitigating operational risk in each element of CSS—i.e., system operators, participants, and settlement agents. This framework could be applied to enhance the management of risk in systemically important systems in Canada. Strong risk management enhances financial stability.

To implement this framework successfully, additional features are required. Good management-information systems (MIS) are necessary to track operational problems in each element of the system. Analysis of these data can be used to identify trends, changes in causal factors, and useful indicators. Ongoing evaluation and updating of this information can be used to monitor and, when necessary, reassess the profile of operational risk and its potential impact on financial stability. Reliable MIS can also be used to establish performance indicators, evaluate how operations perform relative to these indicators, provide periodic reports, and disseminate this information in a timely fashion where it is needed. If successful, this dynamic process can add a strong forward-looking aspect to the management of operational risk by system operators, participants, and settlement agents.

Canada's systemically important clearing and settlement systems are owned and operated by the private sector. Thus, responsibility for controlling operational risk lies with the owners of these systems. The Bank of Canada, however, also monitors the operations of CSS on an ongoing basis and is implementing the type of framework discussed in this article as a monitoring tool. Furthermore, as a supplier to these systems of the essential services described earlier, the Bank of Canada must also have an effective and forward-looking internal process to manage changing sources of operational risk.

## References

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