

Reports address specific issues in some depth. The report in this issue of the Financial System Review discusses the decision not to designate the Automated Clearing Settlement System as a systemically important system, as well as some of the research contributing to that decision.

## Systemic Risk, Designation, and the ACSS

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**C**learing and settlement systems operate virtually unnoticed in our daily lives and yet are crucial to a well-functioning financial system and economy. By creating tight linkages between financial institutions they also provide a way to transmit risk. Therefore, if not well designed, some clearing and settlement systems have the potential to pose a serious risk to the financial system.

Because of their importance, the Bank of Canada is responsible, under the Payment Clearing and Settlement Act (PCSA), for identifying and designating for its oversight those systems that are seen to have the potential to pose a systemic risk (Goodlet 1997). Three systems are currently designated under the PCSA, and the Bank of Canada has recently examined a fourth, the Automated Clearing Settlement System (ACSS), to assess whether it too should be designated.

The first part of this note sets out the framework within which an assessment of the risks posed by the ACSS took place. This is the basis on which the Governor formed the opinion that the ACSS does not currently pose systemic risk to the financial system and, hence, that it need not be designated at this time. The second part describes the model used for the analysis of risk exposures in the ACSS. The results of this work were an important contributing factor to the decision not to designate the system.

### Designation and the PCSA

The Governor of the Bank of Canada may designate under the PCSA those clearing and settlement systems that could be operated in such a way as to pose systemic risk.<sup>1</sup> Once a system has been designated under the Act, the Bank of Canada is responsible for its regulatory over-

sight, and the system is expected to meet minimum standards set out by the Bank to control systemic risk. These standards currently incorporate those advocated by the Bank for International Settlements (BIS) in its *Core Principles for Systemically Important Payment Systems* (BIS 2001).

The PCSA defines systemic risk in the context of clearing and settlement systems as the risk that the inability of one participant to meet its obligations to the system could cause

- other participants in the system to be unable to meet their obligations when due;
- financial institutions in other parts of the Canadian financial system to be unable to meet their obligations when due; or
- the clearing and settlement system's clearing house or the clearing house of another clearing and settlement system to be unable to meet its obligations when due.

Determining whether a clearing and settlement arrangement could have such serious implications for the financial system can be quite difficult. There are, however, certain characteristics that would make a system more likely than others to pose such a risk.

The larger the payments processed by a system, the larger the potential exposures for participants. Therefore, systems that process mainly large-value (often called wholesale) payments come under particular scrutiny. The size of the potential exposures relative to participants' capital is also important, since this will largely determine whether participants can absorb the potential exposures. As well, those systems that play a central role in supporting transactions in either the financial markets or in the economy more broadly come under particular scrutiny, since a failure

1. The Minister of Finance must also be of the opinion that such designation is in the public interest.

within such a system could have broader implications for the financial system.<sup>2</sup>

Three systems are currently designated under the PCSA. The Large Value Transfer System (LVTS) is an electronic funds-transfer system used especially for large-value and time-critical payments. The average daily value of all payments in 2002 (to November) was \$114 billion. The Debt Clearing Service (DCS) clears and settles debt securities, and the CLS Bank settles foreign exchange transactions. Both the DCS and the CLS Bank are not only integral to financial markets, but also process very large transactions. The DCS processes approximately \$100 billion to \$150 billion per day, and the CLS Bank processes approximately US\$400 billion per day. All three designated systems are explicitly linked such that the smooth functioning of each is essential to the smooth functioning of the overall financial system. For example, payment obligations arising from the settlement of debt securities and foreign exchange transactions are cleared and settled through the LVTS. Clearly, all three systems are systemically important in the Canadian financial system.

Over the past year, the Bank of Canada has examined a fourth payments system, the Automated Clearing Settlement System, to determine whether or not it too should be designated under the PCSA.

## The Automated Clearing Settlement System

The ACSS is a multilateral net settlement system owned and operated by the Canadian Payments Association (CPA). It is an uncollateralized system that does not provide its participants with real-time information or real-time, risk-control tools to manage their exposures each day. Participants in the ACSS are therefore exposed to both liquidity and credit risk on a daily basis.

Credit risk is assumed throughout the day because while value is credited to client accounts, final settlement does not occur until the next day. But this value may not be received, either because of insufficient funds in the account on which the payment item was drawn or, more importantly, because a participant in the ACSS defaults on its obligation to the system.

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2. For more details on these considerations, see Bank of Canada (1997).

In the event that a participant does default on its obligation, other participants (the “survivors”) face a credit exposure on two fronts. First, they are exposed for the value already deposited in client accounts, which will now not be received from the defaulter. The larger the value they expected to receive, the larger this exposure. Second, survivors may be required to pay additional value to ensure that the system completes settlement.<sup>3</sup>

Participants face liquidity risk on a daily basis because of uncertainty in determining their multilateral net position in the ACSS. This uncertainty is exacerbated in the event of a participant default.

In the ACSS, therefore, it is the survivors that are exposed if a participant defaults, which creates the potential for systemic risk.

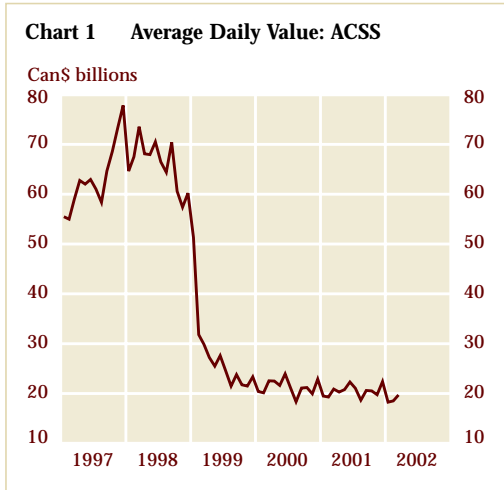
## The Designation Decision

In conducting its review of the ACSS, the Bank of Canada examined the ACSS and the broad environment in which it operates to determine whether the ACSS has the potential to pose a systemic risk. The main considerations were the role of the ACSS in financial markets, the size of exposures taken on by participants in the system, and whether such exposures were manageable.

Prior to the introduction of the LVTS in February 1999, the ACSS was the only system to clear and settle interbank payments. At that time, it would have been considered to have the potential to pose a systemic risk. It processed a very high volume of large-value payments, leading to substantial exposures for participants. It was also crucial to financial markets, since it processed payment obligations arising from foreign exchange transactions and from the settlement of debt and equity securities. Once the LVTS began operations, payment obligations from foreign exchange transactions and from the settlement of debt securities in the Debt Clearing Service immediately moved to this well-risk-

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3. These exposures result from ACSS rules, which require the defaulter to return (unwind) certain payments to other ACSS participants and which stipulate how any shortfall is allocated among survivors. The recovery of value from client accounts and from the estate of the defaulting participant will reduce losses from these exposures. These issues are discussed further in the second part of this article.



proofed system. This greatly reduced the ACSS's importance to financial markets.

The migration of payment obligations arising from the settlement of foreign exchange and debt securities transactions to the LVTS greatly contributed to the substantial decrease in the value of payments processed through the ACSS (see Chart 1). Other wholesale payments have also migrated, with the result that the ACSS is becoming increasingly characterized by the high volume of small payments that it settles. This has led to a great reduction in the exposures taken on by participants. This trend is further underpinned by the CPA's active support for the continued migration of wholesale payments. Indeed, the CPA recently announced a cap on the value of payments that can be processed through the ACSS. This cap is set at \$25 million. It is expected that once this cap is put in place in February 2003, the value of payments in the ACSS, and hence potential exposures, will decrease further.

With the decrease in exposures brought on by migration to the LVTS, it is believed that participants' exposures in the ACSS are now small relative to their capital. This judgment was reached largely on the basis of research done within the Bank, which used a model of the ACSS to estimate potential exposures using actual data from the system. This work is discussed in the second part of this report.

The Governor of the Bank of Canada is of the opinion that the ACSS does not pose a systemic risk to the Canadian financial system at this time. This is based on a broad range of considerations, including a downward trend in the value of payments in the ACSS and the commensurate decrease in the potential exposures taken on by participants in the system. Hence, the ACSS will not be designated at this time.

Nevertheless, in keeping with its responsibilities under the Payment Clearing and Settlement Act, the Bank of Canada will continue to monitor developments that may necessitate a re-evaluation of the risk potential of the system. For example:

- An important risk factor is the value of items sent through the system. The migration of value to the LVTS is expected to continue with the CPA initiative to impose a cap on individual payments processed through the

system. Were this initiative not to succeed, however, or if value were to rise in the ACSS, the system might need to be re-assessed.

- New legislation has recently opened access to the payments system to three new classes of institutions: life insurance companies, money market mutual funds, and securities brokers. The first two are constrained to be indirect clearers. The exposures in the ACSS will be re-assessed if these new entrants become an important part of the system.

## Understanding Risk in the Automated Clearing Settlement System

One factor considered by the Bank in its designation discussions was the potential size of exposures that could arise in the ACSS and whether such exposures could be successfully managed by participants. To assist the discussion, a model of the ACSS, incorporating its unique design and risk characteristics, was developed to estimate the size of exposures that could occur under various conditions. The results contributed to the Governor's assessment that the ACSS does not currently pose a systemic risk.<sup>4</sup>

### The Nature of Risks in the ACSS

The ACSS is a net settlement system that clears and settles paper-based payments (such as cheques) and certain electronic payments (such as debit card payments) in Canada. Financial institutions that are members of the CPA can participate in the ACSS as either direct or indirect clearers. Direct clearers have a settlement account at the Bank of Canada across which all obligations in the ACSS are settled. Indirect clearers access the system through a direct clearer.

A variety of payments are made every day. For example, a tenant paying rent may write a cheque drawn on an account at Bank A, which the landlord then deposits in a chequing account at Bank B. Bank B will enter the value of the cheque drawn on Bank A into an ACSS terminal.<sup>5</sup> Once all the payment items are entered

into the system, the ACSS nets the payment obligations.<sup>6</sup> Each direct clearer in the ACSS will either owe money to other participants in the system or be owed money—its multilateral net position. Obligations for payments entered throughout the day are settled by each direct clearer making or receiving a single payment equal to its multilateral net position. This is accomplished through a debit or credit to its settlement account at the Bank of Canada.

Participants in the ACSS are exposed to risk daily. Direct clearers may owe or be owed money on any given day and cannot precisely forecast which will occur. This uncertainty carries a degree of liquidity risk. Through the netting process, direct clearers extend credit to one another throughout the day. Since the ACSS does not have real-time information technology, direct clearers cannot control to whom they are extending credit during the day, nor how much, and thus are exposed to credit risk.

A default occurs in the ACSS when a participant that owes money at the end of the day cannot meet its obligation. In this event, the defaulter returns (i.e., unwinds) certain payment items to the other participants (the survivors). As a general rule, the defaulter returns items that require it to pay the survivors, while keeping items that require the survivors to pay money to it, the defaulter. Once this is done, the net positions of all direct clearers are recalculated. If the defaulter continues to owe money after the unwinding process, the amount needed to bring its position to zero (the "shortfall") is divided on a proportional basis among the survivors, based on their original dealings that day with the defaulter.<sup>7</sup> Therefore, a survivor's *final position* on the day of default comprises both its revised net position and its share of any shortfall.

4. For more information on this research and further results, see Northcott (2002).

5. Bank B *pulls* the value from Bank A—the ACSS is a "debit-pull" system.

6. This amount will include the payments entered into the ACSS by all the direct clearers for their indirect clearers as well.

7. If all items are returned by the defaulter, it would necessarily be owed funds after the unwinding process. However, certain items cannot be returned, either because they are no longer in the defaulter's possession, or because it is prohibited in the ACSS rules. Therefore, it is possible that a defaulter could continue to owe funds after the unwinding process.

## Measuring Risk Exposures in the ACSS

The unwinding of payments and the allocation of a shortfall enable the defaulter, and thus the system, to complete settlement. These actions also expose survivors to liquidity pressures and credit losses. One approach to measuring these exposures is discussed below.

The immediate settlement concern is one of liquidity—whether survivors can meet their final positions on the day of default, thereby allowing the ACSS to complete settlement. Moreover, after the unwinding process, participants are subject to a liquidity “surprise,” since they may owe more funds or be due less funds than they had anticipated. If a survivor owes funds, it must find the liquidity to cover the (larger-than-expected) obligation. Therefore, its *settlement liquidity exposure* is equal to its obligation to the system.<sup>8</sup> If a survivor is owed funds, and so does not pay into the system, its settlement liquidity exposure is zero.

Survivors’ *credit exposure* appears on two fronts: the value of payment items sent to the defaulter that are unwound plus their share of any shortfall. Potentially, the survivor has deposited funds into clients’ accounts for which it will not receive value from the defaulter because of the unwinding process. From our previous example, Bank B may have deposited the funds into the landlord’s account expecting to receive the funds from Bank A. But, if Bank A defaults and the cheque is returned to Bank B, Bank B may realize a loss if it cannot recover the value from the landlord’s account. Credit exposure is reduced if the survivor can recover value from clients’ accounts and if it can recover some of its credit loss from the estate of the defaulting institution.

These two exposures, liquidity and credit, contribute to the possibility of systemic risk—the risk that the inability of one participant in the payments system to meet its payment obligation will cause other participants to be unable to meet their obligations. In the context of the ACSS, an important factor in assessing systemic

risk rests on the size of survivors’ exposures following an initial default and whether such exposures can be managed.

## Estimating the Potential for Systemic Risk in the ACSS

A model of the ACSS that incorporates its design and risk characteristics was developed to estimate the potential for systemic risk (contagion). An initial participant default is simulated in the model using bilateral payments data from the ACSS. Liquidity and credit exposures for the survivors are calculated based on assumptions regarding the following three factors, which are set at the beginning of the simulation and reflect a particular state of the world:

- the proportion of payment items received by the defaulter that are returned to the survivors in the unwinding process
- the proportion of value that a survivor can recover from client accounts, following the unwinding process
- the proportion of a credit loss that survivors can eventually recover from the estate of the defaulting institution

To determine whether there is contagion within the context of the model, a rule is used to define when a survivor “fails” because of the initial default. The rule used is that a survivor subsequently defaults (a “knock-on” default) if its credit and liquidity exposures resulting from the unwinding process and allocation of a shortfall are both larger than its ability to cover them (see Box 1). Assumptions regarding two factors pertaining to survivors’ ability to cover exposures are made at the beginning of the simulation:

- the proportion of a survivor’s Tier 1 capital that can be used to cover the credit exposure
- the proportion of a survivor’s liquid assets that is available to cover a liquidity exposure

If there is a knock-on default, a further unwinding takes place, and the process continues until all the remaining survivors can cover their exposures. Systemic risk is measured as the number of knock-on defaults experienced for a given initial default.

This process is carried out using each direct clearer that is initially in a net debit position as the initial defaulter. The simulation can then be

8. *Settlement liquidity exposure* is defined here as the amount the survivor must cover in order to allow the ACSS to settle. It does not consider liquidity pressures that the participant may have outside of the ACSS because of the default.

performed changing the five assumptions to reflect different states of the world (see Box 2).

## Data and Results

For each of the 231 days in the data set (August 2000 to June 2001 inclusive), the bilateral value of items sent between each of the 12 direct clearers in the ACSS is used to determine credit and liquidity exposures. Over this period, the average daily value of items sent through the ACSS was \$20.6 billion.

To determine a participant's ability to cover a liquidity exposure, a portfolio of liquid assets is constructed from monthly or quarterly balance sheet data. To determine its ability to cover a credit exposure, Tier 1 capital (as reported to the Office of the Superintendent of Financial Institutions) is used.

### **Result 1: There is very limited potential for systemic risk in the ACSS.**

When the model is run under assumptions that represent a “normal” state of the world, we find no evidence of contagion over the period studied. That is, for each participant default simulated, all other participants are able to handle their exposures without subsequently defaulting (as defined in the model). More importantly, this is the case even when individual assumptions are adjusted to reflect a much more risky environment; for example, assuming there is no recovery from the estate of the defaulting institution.

Assumptions are then made in the model that consider an extraordinarily unlikely environment—an “extreme” state. Even here, on average, not even one knock-on default occurs. There is, however, the potential for contagion if certain direct clearers default on certain days, depending on the configuration of exposures. In some highly unusual cases, the initial default causes all direct clearers (excluding the central bank) to subsequently default.

### **Result 2: A uniform decrease in the value of payments sent by all participants leads to a decreased risk of contagion.**

As discussed earlier, the less payment value processed through a system, the lower the potential exposures and the lower the risk of contagion in

#### Box 1

### Defining a Contagion Threshold

To determine whether there is contagion from the initial default (i.e., systemic risk), a rule must be set that defines when a survivor “fails” because of the initial participant default.

To define such a threshold, we first define illiquidity and insolvency in the context of the model. A survivor with a liquidity exposure must have enough liquid assets available to cover the exposure in order to complete settlement in the ACSS. If the survivor's exposure is greater than its available liquid assets, it is “illiquid.” A survivor with a credit exposure must be financially sound enough to be able to withstand the credit loss while continuing to function; otherwise it is “insolvent.”

To define contagion, consider four cases. If a survivor is liquid and solvent following the unwinding process and allocation of any shortfall, it will fulfill its settlement obligation. If it is illiquid but solvent, it is assumed that the central bank will advance the funds necessary to complete settlement. If an institution is liquid but insolvent, it will complete settlement, since it will be able to meet its obligation to the system. In each of these cases, despite the default of the initial participant, the survivor is able to meet its obligation to the system. If, however, the survivor is illiquid and insolvent, it will not be able to meet its obligation to the system. Therefore, a knock-on default (contagion) occurs if, following a default and unwinding of payments, a survivor is illiquid and insolvent.

## Box 2

## State-of-the-World Assumptions

Under the “normal state,” it is assumed that survivors use 100 per cent of their Tier 1 capital to cover a credit exposure and that 50 per cent of their liquid assets are available to cover a liquidity exposure. The defaulter returns payment items representing 50 per cent of the value of the items it received, and survivors can recover 50 per cent of the returned items from client accounts. In addition, survivors recover a net present value of 75 per cent of their credit loss from the estate of the defaulting institution. From this normal state, one assumption at a time is altered to consider contagion under a variety of conditions, from benign to risky.

The “extreme state” is a worst-case world. It is assumed that survivors can use only 10 per cent of their current Tier 1 capital levels to cover a credit exposure and only 10 per cent of their liquid assets are available to cover a liquidity exposure. It is assumed that the defaulter returns all the payment items it originally received, but survivors cannot recover any of this value from client accounts. Finally, survivors cannot recover any loss from the estate of the defaulting institution. Each of these assumptions is considered extremely unlikely, let alone their occurring simultaneously.

See Northcott (2002) for more details on these assumptions.

the event of a failure. A trivial case, of course, is where the value goes to zero: a system cannot pose risk if it is not used. What is interesting, however, is how quickly risk is reduced as the value sent through the system falls. Once again, using parameters reflecting an “extreme” state, a 25 per cent decrease in the value of items sent through the system leads to a dramatic decrease in the maximum number of knock-ons that occurs from 10, the largest number possible, to 2.<sup>9</sup>

The overall results are highly encouraging, since it appears to require a confluence of extraordinary conditions for the ACSS to give rise to contagion. Given this, and given that no contagion is observed under a range of normal conditions from benign to very risky, the research supports the view that the exposures in the ACSS at this time are manageable by participants. This position is strengthened by initiatives to further migrate value to the LVTS.

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9. Since no knock-on defaults are produced under a range of normal conditions, an extreme scenario is used to demonstrate the effect of decreasing value in the system.