

# Risk Management in the Exchange Fund Account

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- *In managing the Exchange Fund Account (EFA),\* the Bank of Canada and the Department of Finance strive to limit the risks to which the Government of Canada is exposed in financing and investment operations that involve foreign currencies.*
- *The EFA is exposed to various types of risk: credit risk, market risk, liquidity risk, operational risk, and legal risk. The approach used to manage them collectively has allowed risk to be held at a low level.*
- *The EFA governance process involves close collaboration between the Department of Finance and the Bank of Canada. This collaboration covers management of the Account and administrative tasks. Financing and investment operations are carried out by the Bank in its role as fiscal agent for the government.*
- *The first step in managing the EFA's risks involves identifying, analyzing, evaluating, and modelling them. The second involves establishing guidelines to limit these risks, while the third ensures day-to-day adherence to those guidelines, as well as periodically proposing new risk-control mechanisms.*

rency liabilities and swaps that are used to fund them.

**T**his article follows up on a paper published in last winter's issue of the *Review*, which dealt with the Bank's management of Canada's official international reserves (De León 2000–2001). Its goal is to explain the methods that the Bank has used to analyze and model the principal risks inherent in the financing and investment operations of the EFA, and the rules put in place to manage these risks.<sup>1</sup>

Before examining the actual management of these risks, it is important to clarify the nature and the goals of the Account and to underline the unique character of the institutional framework that is used to manage the government's official international reserves.

## **The Nature and Goals of the EFA**

In many countries, the official international reserves are owned by either the central bank alone or by both the central bank and the government. For example, in Denmark and Switzerland, the reserves belong to the central bank, whereas in the United States they are split between the Federal Reserve and the Treasury. In Canada, these reserves belong to the government and are held in a special account at the Bank of Canada in the Minister of Finance's name. This account is called the Exchange Fund Account, and it is funded by currency swaps and direct foreign currency borrowings in international capital markets by the government.<sup>2</sup> The EFA's goals and objectives are defined in the Minister

\* In the context of this article, the term "Exchange Fund Account" is used to describe the liquid foreign currency assets held in the EFA and the foreign cur-

1. This analysis is part of a larger effort to analyze and manage the risks associated with the transactions carried out by the Bank of Canada in its role as fiscal agent for the federal government. In addition to direct EFA investment and financing operations, these transactions include the EFA's securities-lending operations and sale and repurchase agreements, as well as the management of gold stocks (options and loans), the government's Canadian-dollar debt and the Receiver General's cash balances.

of Finance's annual report to Parliament on the operations of the Account for 2000 (Finance Canada 2001, p. 1).

Since risk management is one of the major considerations underlying the various operations of the EFA, it is useful to review the fundamentals and specific features of its management regime.

## Managing the EFA's Risks: Principles, Internal Governance, and Rules

One of the fundamental principles of sound financial management is the maintenance of a balance between the desired return and the risk level: the return-risk relationship. Every organization establishes this relationship as a function of its financial goals and its preferences in matters of risk. In the case of the EFA, the stated objective is to protect the reserves against risk while minimizing the net cost of carry and maintaining adequate liquidity in various currencies. Box 1

2. For more information on the government's currency swap operations, see Kiff, Ron, and Ebrahim (2000-2001).

shows how these principles influence the various entities responsible for managing the Account.

Sound risk management also implies the implementation of an appropriate governance process. To achieve this, the decision-making framework and the roles of the different stakeholders have been well defined and adapted to the governance, organizational, and operational framework of the EFA (see Chart 1 and Appendix).<sup>3</sup> This framework provides for direction, accountability, and reporting of activities related to the management of the EFA consistent with best practices.

Finally, sound risk management requires not only that the risks be expressly identified and contained by clear operational rules, but also skilled personnel and adequate computer support. This is why the Risk-Management Unit was created in 1997 in the Bank of Canada's Financial Markets Department. Overall, the results obtained in managing the risks of the EFA are consistent with the guidelines of the International

3. For more information on EFA governance, see De León (2000-2001).

### Box 1

## Principles Governing the Management of the EFA

### General

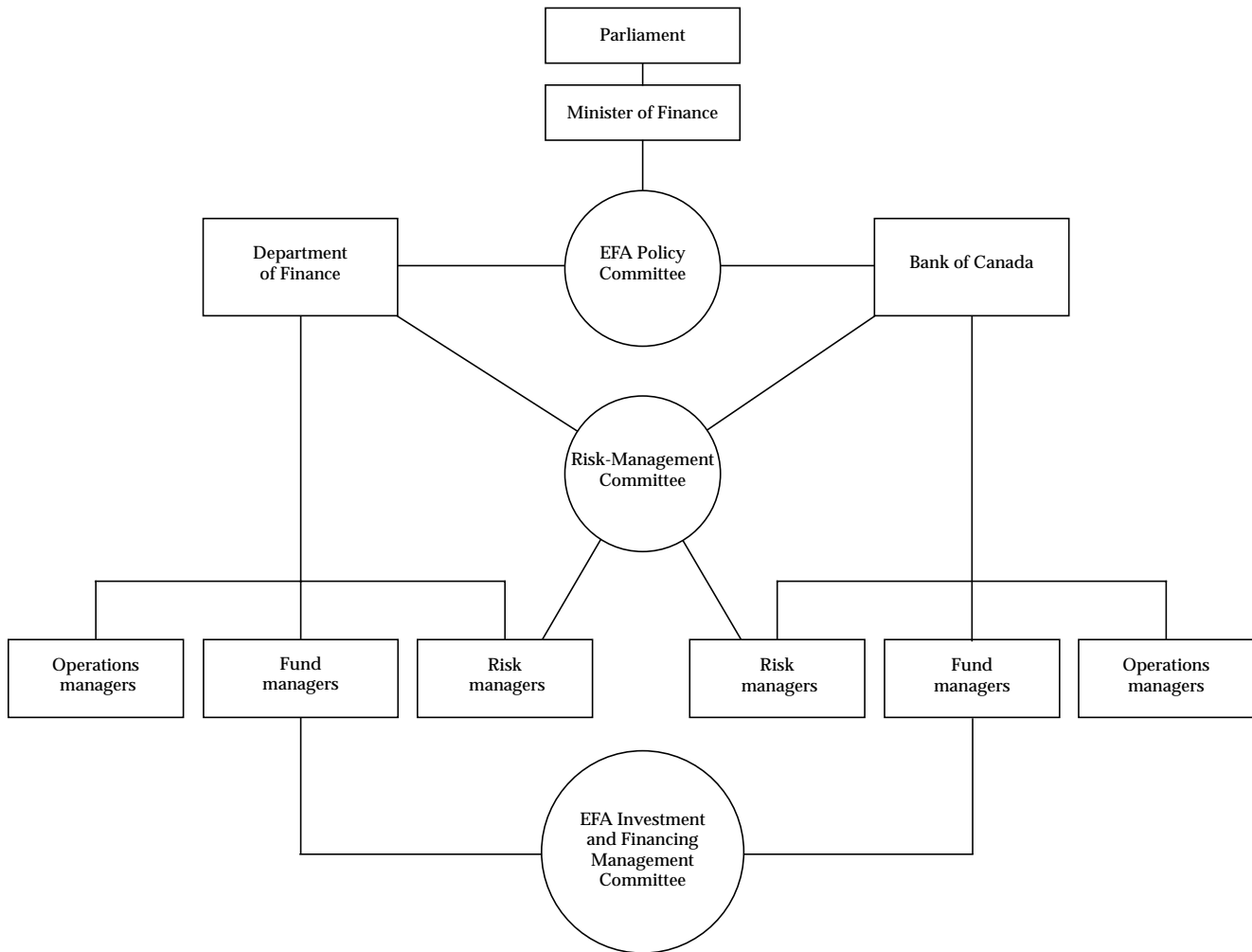
- The reserve assets and the liabilities that fund them are managed like portfolios, using an approach integrating many of the principles applied by financial institutions in the private sector, especially the prudent management of risk.
- In the case of assets, considerable attention must be paid to their liquidity, quality, and diversification, as well as to credit ceilings set for the counterparties.
- In the case of liabilities, the same attention must be paid to methods for raising capital, diversification of the investor clientele, the costs of the different sources of financing, and the maturity profile of the commitments.
- Exemplary risk-management practices must be applied.

### Specific

- To ensure liquidity and to facilitate general intervention operations, the EFA must hold sufficient high-quality liquid assets.
- The spread between the interest paid on funds raised by the government to finance the EFA's assets and the interest earned on those assets must be minimized.
- Foreign exchange reserves must be managed so that, as much as possible, assets and liabilities are matched both in terms of currencies and durations.
- A prudent structure and profile of maturities must be maintained to limit refinancing requirements.
- Foreign currency borrowing that finances the EFA's reserves must be conducted in a manner that protects Canada's reputation as a "successful borrower" in international capital markets.

Chart 1

**Structure of EFA**



Monetary Fund (IMF) and with the performance of other major industrialized countries (IMF 2000, 2001).

**The EFA Balance Sheet**

From the legal and accounting perspectives, the EFA is an autonomous entity with its own asset base. But examination of the official balance sheet published in the Minister of Finance’s report for the year 2000 reveals that its sole liability is “Advances” from the Consolidated Revenue Fund. This is because the Account was originally created through an advance from the government, which also funds it (and is, in the final analysis, its only creditor). Nonetheless, the government regularly incurs foreign currency liabilities, the value of which must always be assessed against its foreign currency investments. Table 1 sets

out the foreign currency investments and foreign currency liabilities of the Government of Canada to fund the EFA, in the form of a balance sheet.

As the table shows, the EFA’s investments and liabilities are denominated in three currencies, the U.S. dollar, the euro, and the yen. These investments make up the so-called liquid reserves of the EFA, and they are recorded at par value. Risk analyses and the day-to-day management of the EFA are conducted on the basis of either the market value or, when the market value is unknown, an estimate of fair value.

The table shows that, on 31 December 2000, assets and liabilities in euros and yen were more or less matched, but liabilities in U.S. dollars exceeded the corresponding assets by US\$6.8 billion. This situation arose largely as a result of foreign exchange intervention

**Table 1****The EFA's Investments and Liabilities on 31 December 2000**

US\$ millions, par value

| Currency    | Assets | Liabilities |
|-------------|--------|-------------|
| U.S. dollar | 20,730 | 27,512      |
| Euro        | 6,674  | 7,245       |
| Yen         | 506    | 492         |
| Total       | 27,910 | 35,249      |

Source: Finance Canada 2001, Table 4, p.10.

Note: These values differ from the entries in Table 12 of the *Bank of Canada Banking and Financial Statistics*, which are expressed at market value. That table also contains data on gold holdings, special drawing rights, and the reserve position in the IMF, which are not discussed in this article.

and important commitments to the IMF in 1998. This imbalance, which reached about US\$13.2 billion at its widest point, has been gradually reduced through a program of U.S.-dollar acquisitions—designed to equalize assets and liabilities denominated in that currency—implemented jointly in 1998 by the Department of Finance and the Bank of Canada (Finance Canada 2001).

## Types of Risk

### Credit Risk

The term “credit risk” refers to the possibility that a counterparty to an EFA investment operation will renege on a commitment or declare bankruptcy. In the case of a private corporation, non-repayment of debt may result from bankruptcy or dissolution; in the case of a sovereign counterparty, from a moratorium on repayment of external debt, the institution of exchange controls, or repudiation. Credit risk also covers financial losses caused by a downgrading of the counterparty's credit rating if the portfolio is defined at market value.

To measure exposure to credit risk, the approach currently used is that recommended to international banks by the Basel Committee on Banking Supervision (Bank for International Settlements 1988, 1994, 1995).<sup>4</sup> This approach yields a risk-weighted exposure (RWE). Using the RWE formula, the actual exposure for each type of product is calculated each day using fair value, which is then broken down by counterparty. Finally, the potential exposure for derivatives used in managing market risk is added. The results of these computations for the EFA are presented in Table 2, which shows a breakdown of RWE in June 2001.

As the table illustrates, the overall credit risk of the Account's operations is minimal, given the high proportion of the RWE allocated to organizations rated

AAA by Standard & Poor's, Moody's, Fitch IBCA, and Dominion Bond Rating Service.

To limit the credit risks inherent in EFA operations, there are restrictions on the types of counterparties and on the types of transactions that the EFA may undertake with these counterparties. Under this system, the credit rating serves not only to determine the choice of counterparties, but also the magnitude of the credit risk allowed.

Among the ceilings implemented, some are specific, while others are more global. Overall, the ceilings generally vary according to the counterparty's category (sovereign government, public institution, supranational organization, commercial financial institution) and credit rating. Furthermore, they consolidate all the transactions undertaken with any given counterparty, they take into account actual and potential exposure in the case of certain derivatives, and the term and type of transactions involving the eligible counterparties. Specific ceilings ensure that risk is spread among the counterparties, especially those in the private sector, while global ceilings provide for a

**Table 2****Breakdown of Risk Exposure in the EFA on 29 June 2001**

(Following BIS 1988, 1994, and 1995 methodology)

US\$ millions

| Category of counterparty and weighting coefficient                                   | Unweighted exposure | Risk-weighted exposure | Allocation of risk      |
|--|---------------------|------------------------|-------------------------|
| OECD-member sovereign states and their fully guaranteed agencies (0%)                | 14,060              | 0                      | 74% in AAA<br>26% in AA |
| Other agencies of OECD-member sovereign governments and supranational entities (20%) | 11,500              | 2,300                  | 98% in AAA<br>2% in AA  |
| Private financial institutions of OECD-member countries (20%)                        | 4,485               | 897                    | 5% in AAA<br>95% in AA  |

4. These guidelines were set out in publications of the Basel Committee on Banking Supervision (Bank for International Settlements 1988, 1994, 1995). The 1988 guidelines set capital requirements for international banks at a level consistent with the credit risk associated with balance-sheet transactions. In 1994 and 1995, modifications were made to cover derivatives. Globally, this approach allows the estimation of actual exposure based on market value, to which potential exposure for derivatives is added. This latter risk is estimated using projection factors recommended in the 1995 guidelines. The total obtained by this method is then weighted by a risk factor varying between zero per cent for risks associated with securities issued in the domestic currency by OECD-member sovereign states and their fully-guaranteed agencies, 20 per cent for other agencies of OECD-member sovereign governments, supranational institutions, and private banks of OECD-member countries, and 100 per cent for other private sector organizations. Examples of these computations can be found in Kiff, Ron, and Ebrahim (2001).

similar dispersion of risk among broad categories of counterparties.

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Other methods of limiting credit risk include: bilateral netting agreements with the counterparties in the case of swaps and forward foreign exchange contracts; a system of collateral for transactions involving certain derivatives (to be established soon) allowing for a further decrease in associated credit risk; and a more thorough analysis of the credit risk presented by various entities (subsidiaries, brokerage houses, etc.) connected to a single counterparty.

### **Market Risk**

The term “market risk” refers to fluctuations in the values of securities arising from changes in interest and exchange rates. In the case of the EFA, market risk has two sources: non-matching and partial matching of assets and liabilities. When assets and liabilities are matched by term and currency, this risk is low, because the impact of interest rate and exchange rate fluctuations on both assets and liabilities will cancel each other out.

Fund managers in the private sector begin by establishing benchmarks from which they deliberately assume market risk in order to increase the yields from their investments. In the EFA, foreign reserves are managed to ensure, as much as possible, that the assets match the liabilities in currency and duration. In this way, market risk is minimized. Indeed, matching is an integral means of managing market risk for the EFA. This goal has been met for the euro and the yen, but not completely for the U.S.-dollar portfolio (Table 1).<sup>5</sup>

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5. The goal of matching assets and liabilities is pursued for each currency and for each maturity group; i.e., 0 to 6 months, 6 to 12 months, 18 months to 2 years, 2 to 3 years, 3 to 4 years, 4 to 5 years, 5 to 7 years, 7 to 9 years, and 9 to 10 years.

To minimize market risk associated with interest rate fluctuations in the case of non-matching or incomplete

matching, EFA fund managers start by matching assets and liabilities with the longest terms. Since total liabilities in U.S. dollars exceed the corresponding assets, this matching has been only partial; i.e., only in the long and medium term.

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Furthermore, since the EFA was created to give the federal government access to liquid foreign currency, the analysis of risk managers focuses on potential changes in the market value of the EFA’s assets and liabilities. Since variations in these values are often caused by significant events in financial markets, the Risk-Management Unit develops scenarios to measure and limit this aspect of market risk. For these purposes, they sometimes use traditional methods and, in some instances, apply “extreme value” theory.<sup>6</sup>

The so-called traditional scenario approach is generally developed on the basis of observation and qualitative analysis of past events; for example, the Asian crisis of 1997–98, the Russian debt restructuring in 1998, and the collapse of U.S. Long-Term Capital Management in 1998. This approach allows for the development of scenarios on the basis of real events, but it is difficult to assign probabilities, and thus requires judgment in estimating the probability of similar events that are likely to affect the value of the Account’s investments.

Scenarios based on extreme value theory are derived from the historical distribution of the probability of

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6. The Bank’s staff consider the scenario method more suited to evaluating the EFA’s market risks than the Value-at-Risk, or VaR, method recommended by the Basel Committee. Indeed, this latter approach was developed for managing trading accounts, and it generally relies on past values of volatility indexes and correlation coefficients, which unfortunately do not hold during periods of pronounced volatility in financial markets.



significant events.<sup>7</sup> For example, the numbers shown in Table 3 correspond to some plausible scenarios (at a given level of confidence) for shocks affecting the Canada-U.S. exchange rate on a single day. For example, the single-day variation of the Canadian dollar vis-à-vis the U.S. dollar over the past five years was 1.36 per cent in only 0.1 per cent of the cases observed. These statistics allow us to assess the results of statistical sensitivity tests.

**Table 3**  
**Extreme-Shock Scenarios Affecting the Canada-U.S. Exchange Rate Between 1995 and 2000**

| Probability of occurrence (per cent) | Largest single-day depreciation observed (per cent) |
|--------------------------------------|---|
| 5.0                                  | 0.72  |
| 2.5                                  | 0.89  |
| 1.0                                  | 1.16  |
| 0.1                                  | 1.36  |

It should be noted that, compared with other floating currencies, the Canadian dollar is relatively stable: it rarely fluctuates more than one per cent over the course of a single day.

### Liquidity Risk

Liquidity risk has two aspects. The first deals with the ability to sell certain assets at the appropriate moment. This is crucial, since fund managers must be able to sell assets at fair value and obtain payment immediately through the settlement system. Since the purpose of the EFA is to provide general foreign currency liquidity for the government and to promote orderly conditions in the foreign exchange market for Canadian dollars, it must be in a position to rapidly sell securities and obtain liquid money to deal with extreme market swings.

Moreover, various policies have been adopted to limit liquidity risk. In keeping with these rules, the securities in which the EFA invests—eligible securities

7. For more information on extreme value theory, see Bensalah (2000). This approach essentially tries to model extreme events.

denominated in U.S. dollars, euros, or yen—must be very liquid. First, given that the market for securities issued by the U.S. government and its many agencies is considered the most liquid in the world, and that the U.S. dollar is generally used in the Account's foreign exchange operations, the share of U.S. dollars in the EFA's liquid assets has been fixed at a minimum of 50 per cent. Also, the outstanding par value of such securities must be at least US\$500 million, and must be issued by eligible counterparties. This rule must always be respected, whether the investments are in long- or short-term securities. Moreover, the Account may not hold more than 10 per cent of the securities issued by any one counterparty—a restriction which, incidentally, is found in various laws and regulations, especially those applying to the securities industry and private pension plans. Finally, the total amount of securities unredeemable before maturity, for which there is no secondary market, cannot exceed 15 per cent of the Account's liquid assets.

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Since the liquidity of investments is closely related to their maturity, there are rules governing the maximum maturity of financial securities eligible to be included in the EFA portfolio (Table 4). Also, the maturities of the government's foreign currency liabilities to fund the EFA must be spread so that no more than one-third of them are redeemed or rolled over during the upcoming year. Finally, in order to cope with any eventuality, the EFA has several other means of rapidly increasing its liquid holdings, including its short-term U.S.-dollar commercial paper program, the possession of assets denominated in euros and yen (which also have very large secondary markets), and a

Table 4

**Maximum Maturity of Financial Securities in the EFA**

| Type of investment  | Maximum maturity |
|---|------------------|
| Securities having a secondary market  | 10.5 years       |
| Liquidity-management securities issued by a private sector institution and for which there is a secondary market (e.g., commercial paper) | 1 year           |
| Securities for which there is no secondary market (e.g., commercial deposits)   | 3 months         |
| Gold lending <sup>a</sup>   | 1 year           |

a. The goal of these operations is essentially to earn income on this type of non-interest-bearing asset.

US\$6 billion line of credit with various foreign financial institutions.

**Operational Risk**

Operational risk refers to the possibility of financial losses being caused by a malfunction or crash of computer systems, by employee error or fraud, by faulty operational processes, or by external events over which the organization has no control.

In the private sector, the consequences of this risk are usually evaluated in terms of the resulting direct and indirect losses from foregone earnings. In the case of the EFA, the managers consider direct losses and factors that might have a financial impact on the operations managed by the Bank of Canada.

There are two major approaches for measuring operational risk: “top-down” and “bottom-up.” The top-down approach yields an estimate of the financial impacts of different aspects of operational risk based on calculations of losses that the organization has incurred in the past. This more actuarial approach is probably best suited to modelling substantial and infrequent losses resulting from failure of the controls in place. However, since the available data are not sufficiently reliable for the calculations this method requires, it is not widely used at this time. Several organizations are working to fill this gap.

As the name suggests, the bottom-up method follows the opposite path. It starts from the different aspects of the operations performed by the organization and integrates all operational sectors from which risks are likely to occur. In general, these sectors actively participate in identifying the sources of risks, and they

become familiar with the controls needed to remedy them. This approach is consistent with the concept of total quality management as implemented by many financial institutions, and which the Bank applies to analyzing the operational risk to which the EFA is exposed.

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In keeping with this approach, the Bank analyzes operational processes, establishes controls that are regularly reviewed, and closely monitors employee turnover and changes in the skill mix of the staff. The Bank has also developed several indicators of sources of risk and helps evaluate solutions and relevant technological applications. These include a new computer program for integrated (or “straight-through”) processing of operations. The Bank monitors the integrity of the financial data used by models and has begun to monitor back-office operations. Finally, emergency measures have been put in place to deal with extraordinary events.

**Legal Risk**

Like operational risk, legal risk has several aspects. The term refers to the possibility that duly concluded contracts do not have legal force because they are not supported by the necessary documents, do not carry the required signatures, or because one or several of the signatories does not have the appropriate signing authority. This risk also covers the situation of a private sector financial institution failing to comply with the requirements of the relevant regulatory body.

It is unlikely that a real legal risk will arise if the operation unfolds as expected. If one of the parties defaults, however, this risk takes on a whole new dimension, since it is at that moment that the courts become involved to determine whether the rights negotiated in the contracts can, in fact, be exercised.

The methods used to control this type of risk have so far resembled those used in the private sector. One essential aspect involves retaining all documentation relating to the different operations in order to be able to clarify the rights and obligations of each party as needed. For example, in the case of swap operations, the government uses and keeps the documentation standardized by the International Swap Dealers Association and closely follows its evolution.

## Conclusion

Efforts to manage risk in the EFA have been aimed at limiting credit risk by imposing ceilings to ensure a diversification of risk and containing exposure in terms of counterparties. Moreover, by monitoring and perfecting methods and models for evaluating credit risk, the Bank expects to be able to fine-tune its tools for analyzing and modelling the credit risks inherent

in the EFA's operations, as well as the means used to manage them.

In the area of market risk, the Bank is working on increasing the sophistication of benchmarks and developing financial scenarios for measuring the impact of market developments on the value and liquidity of the securities in the EFA. This should make it possible to develop a more integrated approach to managing market risk and to facilitate an evaluation of the net cost of carry of the EFA's reserves in light of the various goals.

Finally, it is necessary to take account of the interdependence of these risks, rather than to assume that they are independent of one another. For example, high volatility in financial markets affects the liquidity of the negotiated securities as well as the credit risk they present. Furthermore, the liquidity of these securities depends on the reliability of the settlement and payments systems, the orderly functioning of which is considered in many countries to be a responsibility of the central bank. Finally, the various legal aspects of the contracts affect the ability to exercise the rights they create and carry with them financial consequences for the different contracting parties.

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## Appendix

### Roles and Responsibilities within the EFA

#### Minister of Finance

- Approve policies governing the investment and financing activities of the EFA.
- Approve policies for managing market, credit, and liquidity risk, as well as operational and legal risks.
- Approve the EFA's investment rules (current and future activities).
- Approve risk-management rules: level of tolerance to risk and means envisioned to manage risk.
- Present an annual report to Parliament on the operations of the EFA.

#### EFA Policy Committee (Bank of Canada and Department of Finance)

- Consists of senior representatives from the Bank and the Department of Finance.
- Generally oversee the Account.
- Provides direction and accountability to major policy initiatives.
- Review EFA operations.
- Make recommendations on policy changes.
- Meets semi-annually.

#### Risk-Management Committee (Bank of Canada and Department of Finance)

- Consists of managers from the Department of Finance, the Bank of Canada, and including two representatives with no connection to the operations of the EFA, one from the Department of Finance and one from the Bank of Canada.
- Ensures that EFA operations reflect the policies, rules, and ceilings with regard to financial and operational risks.
- Plays an advisory role for the elaboration of new rules and methods of managing certain risks and of appropriate performance measures.
- Reviews the reports generated by the Risk-Management Unit.
- Meets on a quarterly basis.

#### EFA Investment and Financing Management Committee (Bank of Canada and Department of Finance)

- Consists of fund managers and representatives of the Department of Finance and the Bank of Canada.
- Evaluates investment and financing proposals developed by the fund managers.
- Ensures that investment and financing activities follow the rules in place.
- Meets on a monthly basis.

#### Fund Managers (Bank of Canada and Department of Finance)

- Execute investment and financing operations in conformity with the applicable regulations and policies.
- Develop tactics for financing and investment operations.
- Propose new investments and financing approaches.
- Participate in monthly meetings of the EFA Investment and Financing Management Committee and attend quarterly meetings of the Risk-Management Committee.

#### Risk Managers (Bank of Canada and Department of Finance)

- Identify risks.
- Develop risk-management rules in collaboration with the fund managers.
- Analyze and model risks.
- Propose measures and management techniques for overall risk inherent in current and future EFA activities.
- Monitor the EFA's credit, market, and liquidity risks on a daily basis, and ensure that the fund managers respect the rules in effect.
- Participate in the monitoring of operational and legal risks in collaboration with representatives of other departments of the Bank and other branches of the Department of Finance.

- Report to the fund managers daily, to the Government Debt-Management Committee monthly, to the Risk-Management Committee quarterly, to senior officials from the Bank of Canada and the Department of Finance semi-annually, and to the Minister of Finance annually.

### **Operations Managers (Bank of Canada and Department of Finance)**

- Verify the transactions records before their final approval.
- Confirm transactions with the counterparties.
- Approve transactions and enter the relevant information in the systems.
- Record the different aspects of the transactions.
- Effect the payments provided for and register income.
- Generate certain management reports.