

# **EXTERNAL REVIEW OF THE RESERVES MANAGEMENT FRAMEWORK (2002)**

By

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## **Final Report**

### **1.0 EXECUTIVE SUMMARY**

Canada's Exchange Fund Account or EFA is well managed in that its practices generally compare well with the best practices of other sovereigns and private financial institutions. Nevertheless, in the rapidly changing world of portfolio and risk management, Canada's management of its EFA needs to continually review and update its practices to meet the expectations of Canadians that it be sufficiently above the median in terms of management practices and performance. Since a goal of all external reviews is to be reasonable in page length, this external review saves much space by not dwelling on the considerable strengths of Canada's EFA management and performance by dwelling on aspects where practice could or might improve with changes or further study. The reader should bear this in mind when reading this review.

The review is based on an examination of several documents both public and private, question and answer sessions either verbally or in writing with personnel from DOF and the BoC, and a review of the literature and private communications dealing with portfolio management practices by sovereigns and private industry.

The EFA is exposed to various factor risks that can be grouped as: market risk, liquidity risk, credit risk, operational risk and legal risk. Modern risk management involves decisions aligning the net risk exposure that the EFA bears with the prudent risk positioning of the EFA.

The governing framework for management of the Canadian EFA embodies seven principles. The first principle deals with the maintenance of an appropriate level of reserve assets with sufficient liquidity. The government determines the level of reserves based on a number of factors. An evaluation of the level and its determination fall outside the scope of this evaluation. The two tiers or asset classes for the Canadian EFA and the various policies implemented to limit EFA liquidity risk exposure are consistent with external best practice.

The second principle deals with asset and liability matching designed to immunize (i.e., sterilize or achieve zero) exposure to two market risks (namely, interest rate and currency risks) by careful matching of assets and liabilities in currency and duration within term-to-maturity

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buckets. Since the EFA currently has an asset-liability gap, full currency risk immunization is not possible but has improved as the government eliminates its asset-liability gap over time. The limits implemented to control market risk are reasonable and appropriate but their underlying rationales are not transparent. Greater monitoring to determine immunization effectiveness appears needed but has had to await the implementation of the current systems upgrade.

The third principle deals with rollover or refinancing risk. Since market risk and refinancing risk are positively correlated, and this correlation is likely to increase during currency crises, maintaining a low level of refinancing risk is a goal of EFA management. Since EFA asset and liability management matches by currency and duration, the increased cost on the liability portfolio from maturity lengthening is approximately offset by the increased revenue or yield on the asset portfolio from its corresponding maturity lengthening.

The fourth principle deals with prudent credit risk management. To control credit risk, the EFA uses the evolving BIS risk-weighting approach whose appropriateness has continued to generate considerable scrutiny and debate. As one would expect, changes to investment guidelines to enlarge the investment opportunity set by permitting investment in credit instruments with lower credit ratings appear to be stimulated by specific external events but are intended to proactively address important credit policy issues. Such changes often are subsequently tempered by the imposition of collateral requirements. Insufficient evidence exists that such decisions are based on a formal quantification of their marginal impact on the returns and risks of the EFA. Nevertheless, the requirement for collateral for counterparties for credit exposure on swaps and forwards appears to be a good decision. The investment policy that permits limited EFA investment in A-rated instruments of financial institutions while simultaneously not permitting investment in higher-rated instruments of nonfinancial institutions appears to have no grounding in modern portfolio management.

The fifth principle deals with cost-of-carry minimization when it is a cost or negative net return, or cost-of-carry maximization otherwise (i.e., when it is a positive net return) consistent with the approved investment guidelines. The risk positioning of the EFA suggests an extremely low risk tolerance, and the desirability of such a low EFA risk positioning needs to be addressed. The cost-of-carry can move from being negative to zero or positive by “opportunistic” funding that exploits market inefficiencies, by using various return-enhancing strategies such as securities lending, and by bearing nonzero factor risk exposure to credit/liquidity risk. When adjusted for credit-quality differences, Libor is a useful benchmark for measuring the performance of EFA borrowings. The credit-quality adjustment to Libor is required because Libor is the borrowing rate for an A-rated borrower and not an AAA-rated borrower like the Government of Canada. The method for adjusting Libor for credit quality needs to be made more transparent.

The cost of carry as presently formulated is an incomplete metric for evaluating the performance of the EFA. As implemented, this metric is not compliant with AIMR GIPS or AIMR PPS, which have become accepted practice within the investment management community. Metrics that may be appropriate for this purpose include the dollar-weighted rate of

return as a return-only metric, and Sharpe-like metrics and the alpha metric as risk-adjusted return metrics.

The sixth principle deals with best portfolio risk management practices. Current risk assessments are moving to a total risk management approach but this movement is hampered at the EFA by the use of marking-to-market valuation methodologies that generate somewhat different values, and technical hurdles that do not facilitate the regular and consistent implementation of marking-to-market valuation methodologies. The current system upgrade should facilitate the resolution of these issues. The policies and actions taken to deal with process errors/problems associated with external service providers are not transparent. The EFA follows the practice of depending primarily upon input from market participants for program adjustment. This does not conform to best practice because it exposes the government to receiving information and advice that is self-serving.

The seventh principle deals with the protection of Canada's reputation as a borrower in international markets. Given Canada's high credit rating, it is unclear what this principle means in practice.

No formal weighting scheme appears to exist to aggregate the seven principles into a composite principles function. As a result, it is unclear how conflicting impacts are netted when actions or program changes are being considered.

## **2.0 SUMMARY OF RECOMMENDATIONS**

The major recommendations of this external review can be summarized as follows:

- The government should consider adding some minimum Euro sub portfolio liquidity requirements to the investment guidelines for the EFA.
- The government should continue to eliminate the asset-liability gap of the EFA as soon as possible, and within its expected "near future" time frame. This would allow the EFA to be more completely immunized against foreign exchange or FX risk.
- The government should estimate the sensitivities of the market value changes for the asset and corresponding liability sub portfolios for each of the three currency denominations, and conduct an attribution analysis using interest rate and currency indices at reasonably short intervals with the longer term goal of doing such on a daily basis.
- More extensive reporting of counterparties with split rating that exceed one rating notch should be considered.
- The current investment guidelines on eligible counterparties should be reviewed.
- At a minimum, a complete review of the costs and benefits of the current extremely low EFA risk positioning should be quantified and addressed in terms of its desirability.
- The term-to-maturity bucket definitions and the guidelines for in-bucket yield curve minimization should be clarified in terms of their ease of implementation.

- Any funding performance evaluations relative to Libor should be based on Libor explicitly (and not implicitly) adjusted for the yield spread between benchmarks of A-rated instruments and instruments with a rating equivalent to that of Canada for a term-to-maturity equivalent to the issue being evaluated.
- While DOF and the BoC are studying the use of additional metrics to measure the performance of the EFA internally, this process needs to be accelerated. Several risk-adjusted CoC-types of performance measures should be developed, and EFA performance standards should become compliant with those of AIMR-GIPS and AIMR-PPS.
- The government should determine an appropriate target CoC based on the amount of factor risk exposure that it is willing to bear in the EFA.
- The RMU should continue to move towards a fully integrated approach to risk management, and accelerate its work towards including the impact of market stress on liquidity and credit spreads when assessing the impact of market risk on the market values of assets and liabilities.
- The government should consider the establishment of two committees for its debt management, including the EFA. The market committee should consist of industry practitioners to advise on operational issues, and the strategic committee should consist of banking and finance practitioners, economists, academics and investors to advise on the key principles and strategies of the debt issuing policy.
- The EFA should review its marking-to-market procedure, including the methods of doing so and the frequency at which assets and liabilities are simultaneously marked-to-market.
- Internal procedures for monitoring and addressing process errors/problems associated with transactions executed by external service providers need to be reviewed, and the implementation of the “penalty box” concept needs to be considered.
- The technical hurdles associated with the end-of-month pricing of assets and liabilities need to be addressed.
- An attempt should be made to formalize a composite principles function for the EFA that clearly specifies the relative importance of each individual principle in this composite function and how the individual principles are combined.

The implementation of a number of the above recommendations has become possible with the recent implementation of a system upgrade.

### **3.0 ABBREVIATIONS**

The following abbreviations are used throughout this report:

- BoC: Bank of Canada
- CDN: Canadian Dollar
- CoC: Cost of Carry
- DOF: Department of Finance
- DoJ: Department of Justice
- EFA: Exchange Fund Account

- FX: Foreign exchange or foreign currency
- MPM: Modern Portfolio Management
- RMC: Risk Management Committee of the Bank of Canada and Department of Finance
- RMU: Risk Management Unit at the Bank of Canada
- RWE: Risk-weighted exposure to credit risk
- USD: United States Dollar

## 4.0 INTRODUCTION

A number of changes have occurred in Canada's reserve management framework and practices in recent years. First, the Canadian Government has increased the target and actual level of foreign currency reserves due to large flows in foreign currency markets, to provide liquidity for the government's operating needs in foreign currencies, and to better align practice in Canada with other comparable sovereigns. Second, the Canadian Government has managed the foreign currency reserve assets and the liabilities financing those assets on a portfolio basis using an integrated asset/liability management approach, based on many of the same principles used by private sector financial institutions.<sup>2</sup>

The EFA portfolio is exposed to the following five factor risks:

- Market risks, or the risks of losses arising from adverse movements in market prices or market rates (e.g., interest or exchange rates).
- Liquidity risks, or the risks arising from the cost or inconvenience of unwinding a position within a specified time period, or alternatively, the time period needed to obtain a specific realized value from unwinding a position.
- Credit risks, or the risks of loss arising from the failure of a counterparty to make a promised payment or from a credit downgrade of the counterparty.
- Operational risks, or the risks arising from the failure of internal systems or the people who operate them or by external events that are not controllable by the entity.
- Legal risks, or the risks arising from contracts being unenforceable if, for example, a counterparty defaults.

The government needs to decide on what risk exposures it faces, on what risk exposures it wants to bear, and on how the government should alter the risk exposures it faces so that they match the risk exposures the government wants to bear. This is best done in an integrated asset and liability or A&L management framework that includes the use of derivative financial instruments. Most of the current derivative usage by the EFA involves the use of long-term interest rate and cross-currency swaps on the liability side. This usage has facilitated the procurement of cost-effective funding and/or permitted liability management flexibility.

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<sup>2</sup> A&L management was recommended in: Lawrence Kryzanowski, Evaluation of the management of the funding of the Canada foreign reserve account, November 30, 1995.

For the Canadian EFA, important portfolio management considerations include asset liquidity and quality, diversification and credit limits with counterparties on the asset side, and include the use of diversified sources of raising funds from a diversified investor base as well as the cost of different sources of funds and the maturity profile on the liability side. Furthermore, interest rate and currency risks are immunized to the extent possible, and credit risk is prudently managed.

Given the fundamental changes in Canada's reserve management framework, this review provides a high-level or more macro assessment of how these changes conform to finance theory and "industry" best practices. Thus, this review has two major objectives:

1. To assess the appropriateness of various principles of the management framework of the Government of Canada's foreign exchange reserves, and
2. To assess the efficacy of the procedures that the Government of Canada uses to implement and benchmark the implementation of the EFA management framework principles.

## 5.0 THE ASSESSMENT

The governing framework for the management of Canada's foreign exchange reserves embodies various principles. As extracted from the *Exchange Fund Account Annual Report 2001*, these principles include:

- Maintenance of an appropriate level of reserve assets with sufficient liquidity – a sufficient amount of high-quality, highly-liquid foreign exchange reserve assets should be available for general foreign-currency or FX liquidity for the government, and for possible intervention in the FX market to promote orderly conditions in the Canadian dollar;
- Asset-and-liability matching – foreign reserves should be managed to ensure, as much as is possible, that the assets match the liabilities in currency and duration;<sup>3</sup>
- Roll-over-risk – a prudent maturity structure and profile should be maintained to limit refinancing needs within the context of liquidity requirements;
- Prudent credit risk management – credit risk should be managed prudently through diversification of the EFA asset portfolio, with appropriate use of credit ratings, counterparty limits and collateral support;

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<sup>3</sup> In this review, we ignore the legal distinction that the government is the sole creditor of the EFA since EFA funding is through "advances" from the Consolidated Revenue Fund, and that the government incurs foreign currency liabilities to fund these advances (Michel Rochette, Risk management in the Exchange Fund Account, *Bank of Canada Review*, Winter 2001-2002, 29).

- Cost-of-carry – the difference between the interest paid on the government’s foreign currency liabilities used to fund EFA assets and the interest earned on those assets, if negative, should be minimized;
- Best portfolio risk management practices – best practices with regard to risk management should be applied in the overall management of the EFA; and
- Reputation protection – borrowing activities in foreign currencies (e.g. Global bonds and medium term notes) to fund EFA assets should be conducted so as to maintain Canada’s reputation as a successful borrower in international capital markets.

Before proceeding, it is necessary to define what is meant by a positive and a negative cost-of-carry or CoC in this evaluation. A positive CoC is used to refer to a situation where the EFA earns a return (i.e., the total cost or total rate of return incurred on the liability portfolio is less than the total revenue or the total rate of return earned on the asset portfolio). A negative CoC is used herein to refer to a situation where the EFA incurs a cost (i.e., the total cost or total rate of return incurred on the liability portfolio is more than the total revenue or the total rate of return earned on the asset portfolio).

We now proceed to an assessment of how each individual principle is implemented, and then continue with an assessment of how they are jointly implemented.

### 5.1 Maintenance of an Appropriate Level of Reserve Assets with Sufficient Liquidity

Management of the Canadian EFA is based on the principle that an appropriate level of reserve assets with sufficient liquidity should be maintained to facilitate possible intervention in the foreign exchange market to promote orderly conditions in the Canadian dollar when, and if, required. Many sovereigns, such as the U.S. and France, embrace this principle. In some countries, such as the U.S., the continued existence of a Currency Stabilization Fund is a hotly debated issue. Based on historical experience, an EFA has proven to be a very useful instrument for the promotion of orderly markets for the Canadian dollar.

The existence of an EFA is appropriate and necessary in Canada, and the appropriate level of reserve assets is determined independently of EFA asset and liability management and is based on a number of considerations. Issues dealing with whether or not the current level of reserve assets is appropriate and how the appropriate level is determined are beyond the scope of this evaluation.

Liquidity risk reflects the risk that the government cannot meet its operational and/or contingency cash requirements, or it cannot service its debt payments. The latter is generally referred to as rollover or refinancing risk. To maintain asset reserves of sufficient liquidity and to limit liquidity risk, the EFA liquid reserves are divided into two tiers or asset classes. The liquidity tier or asset class is the proportion of liquid reserves that must be held in highly liquid,

USD-denominated assets to fund FX liquidity requirements and intervention activity. Investments in this tier consist of highly rated, USD-denominated, marketable, short-term assets (under one year), such as discount notes and bank deposits. The CoC for the liquidity tier is expected to be negative. The investment tier or asset class consists of the remaining portion of liquid reserves that is invested in a “diversified” portfolio of high-quality assets whose primary goals are asset-liability matching and cost-of-carry minimization within prudent risk and investment standards. The CoC for the investment tier can be negative, zero or positive depending upon the levels of exposures of the EFA to various factor risks.

Policies implemented to limit liquidity risks of the EFA include:

- The securities issued by counterparty  $i \leq 10\%$  of EFA liquid assets, except for bonds issued by sovereign governments and their direct agencies issued in their “home” currency.
- Assets that cannot be sold or redeemed prior to maturity  $\leq 15\%$  of EFA liquid assets.
- The outstanding par value of the security issued by an eligible counterparty must be at least USD 500 million.
- A maximum maturity is specified for various types of investments, such as 3 months for securities having no secondary market (such as commercial deposits).

These policies correspond to external best practices. Some concern has been expressed about the lack of formally defined liquidity requirements for the EFA’s Euro sub portfolio. Given the growing importance of this sub portfolio, it is **recommended** that the government should consider adding some minimum Euro sub portfolio liquidity requirements to the investment guidelines for the EFA.

## 5.2 Asset-and-liability Matching

Since 1997, the government follows an A&L management framework to manage market risk exposure to currency and interest rate risks by matching assets and liabilities in currency and duration within maturity buckets.

Although the long-term goal is to have a zero net investment position in the EFA where the market values of assets ( $MV_A$ ) and of liabilities ( $MV_L$ ) are approximately equal (i.e.,  $MV_A \approx MV_L$ ), such presently is not the case primarily due to FX intervention and IMF commitments in 1998. Since  $MV_A < MV_L$ , the EFA may be viewed as being underfunded using the parlance of pension fund management or as having a net short position using the parlance of modern portfolio theory or as having an imbalance or shortfall as in the documents reviewed. However, given that the EFA is only a subportfolio of Canada’s total debt portfolio and any shortfall of foreign-denominated assets over foreign-denominated liabilities is merely held in CDN-denominated assets, it is better to view the asset/liability imbalance in the EFA as an asset-

liability gap. The government plans to eliminate this asset-liability gap soon. It has made considerable progress in doing so by implementing a program of USD asset purchases in FX markets. It is **recommended** that the government eliminate the asset-liability gap of the EFA in the near future as per present expectations.

To minimize the net impact of the asset-liability gap in the EFA, the USD liabilities that exceed USD assets have very short maturities, and thus, very low durations. While this facilitates A&L management, it could have a potentially adverse impact on the implementation of a laddered maturity structure to manage the level of roll-over risk in the EFA portfolio. Also, virtually all of the government's foreign currency market risk continues to be related to this asset-liability gap of the EFA. To illustrate, a 6% appreciation would increase the  $MV_L$  by about CDN 0.767 billion in mid-year 2002.

Since duration and currency matching only immunizes the portfolio against small and parallel shifts in the yield curve, two forward-looking techniques for testing the net market value impact on assets and liabilities of A&L matching also are implemented and reported on a monthly basis. Sensitivity stress testing examines the impact of standardized movements in one or more market risk factors, such as a parallel yield shift change of 100 basis points. Scenario stress testing examines the net market impact of a major market event, such as the announcement of an impending sovereign default.

To control overall market risk, limits are imposed on the currency composition and types of eligible investments for the EFA. The limits include:

- Investments must be denominated in one of three eligible currencies, namely, the USD, Euro and Yen.
- The weight for each currency-denominated asset category reflects their funding and investment opportunities and the USD-denominated asset category  $\geq 50\%$ .

These limits are reasonable, although it is not clear whether or not they have been determined based on a rigorous analysis. The three currencies are the most liquid of those available, and the weighting for the USD reflects the current role of the USD as the prime reserve currency, and the fact that intervention to support the CDN dollar has historically been undertaken through US dollar transactions.

How the weights are set based on funding and investment opportunities is unclear. On a non-risk-adjusted basis, one would expect the weights to be set so that the CoC is equal across currency-denominated asset categories. Since credit risk matching is not part of the A&L management of the EFA, the weights should actually be set so that the risk-adjusted CoC in the form of a Sharpe-like measure is equal across currency-denominated asset categories.

To determine immunization effectiveness, a time-series of the marked-to-market values of the three currency-denominated sub portfolios on both the asset and liability sides for the EFA need to be captured on a regular frequency (at least monthly and preferably weekly or daily).

Little (if any) ongoing marking-to-market currently is being done on the liability side of the EFA. Thus, it is **recommended** that the estimated sensitivities of the market value changes for the asset and corresponding liability sub portfolios for each of the three currency denominations should be estimated, and an attribution analysis using interest rate and currency indices should be conducted.

### 5.3 Rollover Risk

Rollover or refinancing risk is the risk that maturing debt instruments cannot be refinanced at rates or conditions that are acceptable to the borrower. Since market risk and refinancing risk are positively correlated, and this correlation is likely to increase during currency crises, maintaining a lower level of refinancing risk is a goal of the Government. Rollover risk is minimized by lengthening the maturity of the liability side of the EFA by substituting the use of long-term debt for short-term debt. Minimizing rollover risk on the liability side tends to increase the financing cost of the liability portfolio since the term structure is generally upward sloping. However, since EFA asset and liability management matches by currency and duration, the increased cost on the liability portfolio from maturity lengthening should be offset approximately by the increased revenue or yield on the asset portfolio from its corresponding maturity lengthening. Policies implemented to limit rollover risk include:

- Current EFA liabilities (i.e., those maturing within a year)  $\leq \frac{1}{3}$  EFA assets

### 5.4 Prudent Credit Risk Management

Credit risk currently is managed through diversification of the EFA asset portfolio given the limited subset of individual issuers on the approved list of eligible investments. Credit risk also is managed by the appropriate use of credit ratings, counterparty limits, netting arrangements and collateral support.

To control credit risk, the RMU uses an approach based on the BIS 1988 Basel Accord and subsequent amendments, where all non-derivative exposures are risk-weighted by entity type. The BIS Accord “add on” approach is used to calculate potential exposures for derivative transactions. This approach yields a risk-weighted exposure or RWE by effectively weighting all nominal exposures according to the nature of the counterparty, instrument type, and term-to-maturity (the latter for derivative instruments only). The problem with this approach is that it assigns a zero risk weight to direct and guaranteed obligations of OECD government agencies even if they are rated AA+, AA or AA-.

The 1999 changes to the investment guidelines for the EFA permitted investment in AA-rated sovereign bonds (e.g., of such European sovereigns as Belgium, Spain, Portugal and Italy), and in counterparties with AA-ratings from two of five designated rating agencies (namely, Moody’s, S&P, Fitch IBCA, DBRS and CBRS which was later purchased by S&P) with one being either Moody’s or S&P. This split-rating treatment of counterparties appears to be reasonable provided that the difference in ratings is only one rating notch. The rating changes

were expected to reduce the CoC of the EFA by between 5 to 10 basis points or USD 12 to 24 million annually. The change appears to be motivated at least partially by the desire to ensure that one large Canadian bank could continue to participate in EFA transactions. The recent recommendation to continue to hold securities issued by Japan in the EFA in the case that Japan is further downgraded to below AA- also appears to be stimulated by specific external events. While both of these events stimulated changes in investment guidelines, government documents indicate that the changes were intended to proactively address important credit policy issues.

It is **recommended** that more extensive reporting occur for counterparties with split ratings that exceed one rating notch.

To control credit risk at the portfolio level, ceilings are stipulated for each counterparty category (sovereign government, public institution, supranational organization, and commercial financial institution) and credit rating, and by counterparty on a consolidated basis. Other methods for managing credit risk are entity-specific credit analysis, bilateral netting arrangements for swap and forward FX contracts, and a system of collateralization for derivative transactions.

Restricting eligible private-sector counterparties for investment purposes to financial institutions has little apparent grounding in modern portfolio management and would appear to have material adverse return-risk consequences. The rationale for treating two otherwise identical investment opportunities differently just because the counterparty behind one opportunity is a financial institution has not been enunciated and needs to be made transparent. Furthermore, the rationale for allowing investment in quality ratings of A- just because the counterparty is a financial institution and not allowing investment in quality ratings of AA+ or higher just because the counterparty is a nonfinancial institution, all else held equal, does not conform to the basic tenets of modern portfolio theory. Thus, it is **recommended** that the current investment guidelines on eligible counterparties be reviewed.

The government's recent move towards the greater reliance on collateral for its EFA asset holdings is designed to minimize credit exposure, and is justified by the argument that it is consistent with best practices in risk management. The requirement that counterparties put up collateral when their credit exposures on swaps and forwards exceed given levels will ensure that actual exposure to a counterparty remains capped at the indicated limit rather than grow as the government's mark-to-market exposure on swaps grows. As noted by the government, the threshold sizes are "toward the generous end of market practice and should not be an issue". This change towards greater collateralization should reduce both actual and potential credit risk exposure without much impact on returns. However, since the probability of obtaining a positive CoC and the magnitude of the CoC primarily are determined by the magnitude of the positive net credit risk exposure of the EFA, actions such as moving a large proportion of uncollateralized short-term USD deposit investments to collateralized repurchase (repo) agreements has both a material benefit and cost.<sup>4</sup> Government documents indicate that while it will reduce the EFA's

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<sup>4</sup> Repros are another tool for EFA portfolio management that offer flexibility and high liquidity.

credit exposure to FIs, bearing lower credit risk also will reduce the return earned by the EFA on these investments.

A rationale for taking collateral is to offset the impact of lowering the minimum credit quality for FIs so as to accept some USD exposure to A-rated FIs. The change was made to further diversify credit risk across FI counterparties and to help improve the CoC of the EFA.<sup>5</sup> Government documents indicate that a by-product of the change was that it also allowed an A-rated FI to conduct foreign reserve business with the EFA. The net impact of both requiring collateral and easing FI credit quality standards is probably a wash at best.

The government's modification to the standard market practice of doing repos via a pure tri-party agreement is consistent with the government taking a small amount of risk so that the CoC is a small, single-digit positive number in terms of basis points. To avoid the credit risk normally encountered by a dealer obtaining the collateral each morning and returning it each afternoon, the government has proposed a modified tri-party agreement where the collateral is not returned to the dealers each morning. This ensures that the government continuously holds the collateral during the term of the repo. According to internal calculations, this additional risk reduction has a cost of about 2 basis points (or USD 0.4 million) on a USD 2 billion repo program.

## 5.5 Performance Measurement Including the Cost-of-carry

As defined earlier, a positive (negative) CoC refers to a situation where the EFA earns a return (incurs a cost). In other words, a positive (negative) CoC refers to a situation where the total cost or total rate of return incurred on the liability portfolio is less (more) than the total revenue or the total rate of return earned on the asset portfolio of the EFA. To minimize misinterpretation in the remainder of this section, it is important to reiterate that the government's objective is to minimize the CoC when it is negative and maximize the CoC when it is positive, where both formulations of the objective are achieved in a manner that is consistent with approved investment guidelines.

### 5.5.1 *Some basics*

Two of the fundamental principles of modern portfolio management or MPM are the attainment of the best return-risk relationship, and the positioning of the portfolio owner on that return-risk relationship in order to attain the highest level of satisfaction for the owner.

It is well known in MPM that the attainment of the best return-risk relationship is inversely related to how severely the set of allowable investment opportunities is restricted. This is the reason why restrictions on the investment options permitted for managed portfolios such as pension funds have progressively been relaxed from strict guidelines explicitly specifying narrow allowable asset mix ranges and quantitative tests of individual equity quality such as the

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<sup>5</sup> Annual Report to Parliament on the Operations of the Exchange Fund Account by the Minister of Finance ... 2001, 4.

4% earnings/dividend test to the more permissive or flexible prudent portfolio standard for pension fund portfolio investment. As a result, most private-sector portfolios have abandoned the “interior decorator” approach to investment policy guidelines.

The evolution towards greater investment flexibility of the EFA has lagged that in the private sector by a considerable extent.<sup>6</sup> A notable shift occurred in October 1999, when changes to the EFA investment guidelines increased the investment opportunity set available to the EFA by permitting a “broader range” of acceptable investments.<sup>7</sup> This shift was designed to move the mix on the asset side from investments in sovereign issues to higher-yielding fixed-income securities of lower but still high quality and liquidity (so-called spread products).<sup>8</sup> In addition, government documents suggest that the desire to ensure that at least one major bank would once again be eligible for EFA deposits was a desirable by-product of implementing the change. However, much of the benefits of this change in the investment opportunity set are progressively being offset by the requirement that the spread products be collateralized. Of course, such credit enhancement merely transforms a higher-yielding fixed-income security of lower but still high quality and liquidity to a lower-yielding fixed-income security of higher quality.

With regard to risk positioning on the best attainable set of portfolios with different returns and risks, the EFA has always been positioned so that it bears minimal total risk while being market-neutral in terms of interest-rate risk and currency risk (with the exception of the net liability position for currency risk). Most of its total risk arises from its exposure to a minimal level of credit risk. This risk-positioning behavior suggests that the level of risk tolerance of the government when setting the level of EFA risk positioning is extremely low (slightly above zero) on a scale of zero to 10. A further but gradual and small increase in risk-positioning for tier II assets seems prudent, since it can be accomplished without the establishment of an in-house credit analysis function. At a minimum, it is **recommended** that the costs and benefits of such a low EFA risk positioning should be quantified and addressed in terms of its desirability.

### 5.5.2 *Implementation*

Carrying cost minimization is achieved by seeking to maximize the return on EFA assets while minimizing the gap between the dollar durations of the asset portfolio and the liabilities of the EFA at the overall level and for nine term-to-maturity buckets. The buckets are: 0 to 6 months, 12 to 18 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.

According to government documents:

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<sup>6</sup> No evidence was found that the correlations (unconditional or conditional) among investments on the eligible list, and between those on the eligible list and those not permitted have been examined in making any of these decisions for the EFA.

<sup>7</sup> Jacobo De León, The Bank of Canada’s management of foreign currency reserves, Bank of Canada Review, Winter 2000-2001, 17.

<sup>8</sup> Annual Report to Parliament on the Operations of the Exchange Fund Account by the Minister of Finance ... 2001, 13.

Compliance testing the within-currency term to maturity “bucket” criteria is a bit more complicated than was envisaged when they were put in place, and some of the buckets may in fact be too narrowly defined. ... Nevertheless, even though it can be difficult to achieve perfect bucket matching, the portfolio managers are expected to make best efforts.

The documents go on to note that “the guidelines do not indicate what is meant by in-bucket yield curve risk minimization” although such guidelines exist.

The above suggests two potential problems. First, if reasonable bucket matching is not possible given the existing bucket definitions, these definitions should be revisited so that they can be realized within some specified margin of error. Second, guidelines should not exist if risk control does not understand how they can be operationalized from a measurement and control purpose. Thus, any ambiguity in guidelines from the perspective of the RMU needs to be revisited so that any ambiguity can be removed.

It is **recommended** that the term-to-maturity bucket definitions and the guidelines for in-bucket yield curve minimization be clarified in terms of their ease of implementation.

### 5.5.3 *Some reasonable expectations for EFA performance*

If the EFA had no asset-liability gap as will be the case in the near future, then its net gross return would be approximately zero if it was managed to be market, interest and credit/liquidity risk neutral (fully immunized) and the investment and funding markets are efficient. In other words, before accounting for market frictions such as issue and trade costs, the return earned on the asset side of the EFA portfolio would on average equal the cost incurred on the liability side of the EFA portfolio in an efficient market (a so-called wash). In such a world, the net or all-in return earned on the asset side of the EFA portfolio would on average be less than the net or all-in cost (negative return) incurred on the liability side of the EFA portfolio. Thus, in such a world, the differential net return or CoC is expected to be negative.

The following techniques can and are used by the EFA to move the differential net return towards a positive (or greater positive) value:

- The use of what is referred to as an “opportunistic” funding approach that exploits market inefficiencies when funding the EFA.<sup>9</sup> These opportunities can be expected to be quite limited in high-grade debt markets in which Canada issues its debt obligations.
- The engagement in return-enhancement strategies on the asset side of the EFA such as a securities lending program. While the current program adds a material six basis points to the CoC calculation, the added returns from these types of strategies are limited.
- The EFA investment portfolio can be managed so that it is not neutral or fully immunized to all factor risks. Currently, the EFA investment portfolio bears a net positive exposure

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<sup>9</sup> Chapter 8, Report of the Auditor General of Canada – April 2000, 8-9.

to credit/liquidity risk, and to currency risk (the latter due to the asset-liability gap of the EFA). This investment management strategy has the most potential to be the major determinant of the differential net return actually earned on the EFA.

The performance of EFA fundings has typically been evaluated in terms of the consistency of achieving sub-Libor yields at issue without *explicitly* specifying the amount of negative spread or discount from Libor that one would expect for such issues a priori. While common practice is to use the London Interbank Offer Rate or Libor as a benchmark or reference rate, Libor is commonly described as follows:<sup>10</sup>

This reference rate is generally regarded as the borrowing rate for an A-rated borrower. Borrowers with better quality credits, such as AAA- or AA-rated firms, have the ability to borrow at rates below LIBOR. Those with lesser credit quality than an A-rating, such as BBB or BB, borrow at rates above LIBOR.

Since Canada has had a S&P FX credit rating higher than A since at least 1975 (see Table 1), a reasonable a priori expectation is that any EFA fundings involving say Canada Bills since 1975 would be at a negative spread from Libor, that this negative spread would widen as Canada's credit rating relative to an A-rating improved all-else-held-equal.<sup>11</sup> Thus, in the future, it is **recommended** that any funding performance evaluations relative to Libor should be based on an explicit (and not implicit) adjustment to Libor for the yield spread between benchmarks of A-rated instruments and instruments with a rating equivalent to that of Canada for a term-to-maturity equivalent to the issue being evaluated.

#### 5.5.4 *Current metric used to measure EFA performance*

The only metric used to measure the performance of the EFA is the cost-of-carry or CoC. CoC is the return from an investment portfolio after accounting for all-in financing costs, trade costs and incidental expenses but not fixed operating costs. Thus, CoC is dependent on both sides of the balance sheet.

For 2001, the estimated CoC for the entire EFA portfolio is 6 basis points. With regard to the currency-denominated sub portfolios, the substantially higher CoC of 22 basis points on the Euro sub portfolios compared to the 0 and 4 basis points CoC on the Yen and matched USD sub portfolios reflects the comparative funding and investment opportunities in the Euro market. The proportion of outstanding liabilities and corresponding assets has increased markedly to reflect the relative CoC differences across currencies. However, one question still remains unanswered. Specifically, if the estimated CoC is a good measure of performance, then why was the EFA fund not managed in a more "opportunistic" posture over this period?

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<sup>10</sup> Jonathan Batten and Warren Hogan, 2002, A perspective on credit derivatives, *International Review of Financial Analysis* 11, 259.

<sup>11</sup> Thus, one should not attribute much significance per se to the observation that Canada Bills consistently achieved sub-Libor yields at issue over the 1994-1998 period, or that the spreads widened after October 1996, as appears to be the case in Boothe and Reid (1999), 12.

### 5.5.5 Critique of the currently used performance metric and suggested alternatives

The current CoC used to measure the performance of the EFA is not consistent with best practices in the private sector, and does not even meet the Global Investment Performance Standards (GIPS) of the Association for Investment Management and Research (AIMR) or the AIMR Portfolio Presentation Standards (AIMR-PPS) formally adopted in 1993.<sup>12</sup> The AIMR-PPS have become the accepted practice within the investment management community. Two of the noteworthy principles of AIMR-PPS are:

- When calculating investment performance, total return, including realized and unrealized gains plus income, must be used.
- Time-weighted rates of return must be used (equivalent to dollar-weighted rates of return in the special case where no capital additions or withdrawals occur in the portfolio over the evaluation period).

In addition, AIMR also encourages managers to disclose the volatility of the aggregate composite return.

While DOF and the BoC are studying the use of additional metrics to measure the performance of the EFA internally, it is **recommended** that this process needs to be accelerated, that several risk-adjusted CoC-like types of performance measures should be developed, and that EFA performance standards become compliant with AIMR-GIPS and AIMR-PPS.

Although personnel at DOF and BoC are well versed in alternative metrics for measuring portfolio performance, some suggestions and possible avenues in which the work on new performance metrics could proceed are outlined in the appendix to this review. Implementation of some of the risk-adjusted CoC-like performance metrics proposed in this appendix would require a determination of a target CoC. Thus, it is **recommended** that the government determine an appropriate target CoC based on the amount of non-immunized factor risk that it is willing to bear in the EFA.

### 5.5.6 Securities and gold lending programs

The government contributes to CoC reduction by way of its gold loan operations and by using external securities lending managers (presently two) to manage a securities lending program for a portion of its USD assets. To illustrate, if the net revenue from the securities lending program averages USD 1.8 million annually on USD 30 billion of liquid reserves, then the contribution of this program to reducing the CoC is about six basis points.<sup>13</sup> To manage the

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<sup>12</sup> A complete discussion of these standards can be found in: *AIMR Performance Presentation Standards Handbook* (Charlottesville, Va.: AIMR, 2<sup>nd</sup> ed., 1997), and *Performance Reporting for Investment Managers* (Charlottesville, Va.: AIMR, 1991).

<sup>13</sup> Alan Andree, Bank of Canada, Benchmarking matched liquid reserves: An accounting-based methodology for calculating the cost-of-carry, November 28, 2001, 7.

risks associated with this program, the government imposes restrictions on the operation of the lending facilities (as to securities that can be lent, borrower type, eligible collateral and investment of cash collateral) and requires monthly reporting of all transactions and outstanding positions. The government should search for other return enhancement strategies that could be considered for the EFA.

## 5.6 Best Portfolio Risk Management Practices<sup>14</sup>

### 5.6.1 *Internal governance*<sup>15</sup>

Best portfolio risk management practices start with a proper structure for internal governance. The internal governance structure of the EFA (and the government's wider debt program) is a shared multi-layered structure with limited independent input or oversight. With the exception of the limited independent input/oversight, it appears to conform to best practices in the corporate world.

Top-level responsibility for ongoing EFA management is divided between the Director of the Financial Markets Division at the Department of Finance and the Chief of the Financial Markets Department at the Bank of Canada. A Policy Committee reviews developments and major policy initiatives, and provides guidance and accountability of EFA management. The Policy Committee consisting of senior officials from DOF and BoC meets semi-annually for this purpose. A Risk Management Committee (RMC) advises on risk management issues. The RMC meets quarterly, and consists of managers from DOF and BoC, including two members with no connections to EFA operations.

Day-to-day portfolio management of the EFA and risk oversight and management at the BoC are the responsibilities of the Foreign Reserves Management Team and the Risk Management Unit (RMU), respectively. The RMU uses best practices to identify, analyze and model exposures to market, liquidity and credit risks, to advise on risk limits and to effect control mechanics to ensure the daily adherence to the risk limits.

The RMU uses both the traditional scenario approach and the extreme value approach to measure and control market risks. The RMU views the extreme value approach to be more suitable for risk management of the EFA since the probabilities of its scenarios are objectively determined from historical distributions of the probability of significant events.<sup>16</sup> One such example uses extreme-shock scenarios affecting the CDN-USD FX rate over say the period 1995-2000. Problems with this approach are that it tends to be sample dependent, and it may not reflect the nonzero autocorrelation that occurs between daily FX changes when aggregated over longer time periods during a crisis period.

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<sup>14</sup> Based on sources such as: Michel Rochette, Risk management in the exchange fund account, Bank of Canada Review, Winter 2001-2002, 27-36.

<sup>15</sup> In an appendix, Rochette (2001-2002, pp. 35-36) provides an excellent summary of the roles and responsibilities of the different players within the EFA.

<sup>16</sup> Rochette (2001-2002), 31.

While much of the risk assessment to date does not fully incorporate the interdependencies of the various risks, the practices of the RMU are consistent with best practices in the private sector. Nevertheless, it is **recommended** that the RMU should continue to move towards a fully integrated approach to risk management, and accelerate its work towards including the impact of market stress on liquidity and credit spreads when assessing the impact of market risk on the market values of assets and liabilities.

While the annual audit of the EFA by the Auditor General of Canada and periodic reviews of various aspects of EFA management by external third party experts are conducted, the government primarily depends upon input from market participants on major adjustments to its program. While this practice has the advantage of obtaining advice from knowledgeable practitioners, it also exposes the government to receiving information and advice that is self-serving. The Auditor General in his April 2000 report (p. 8-24) made a similar observation as follows:

We believe that the process for seeking this advice is flawed because those who provide the advice are not sufficiently independent of the process.

This probably is the reason that France created two committees to provide complete and independent advice to the government on debt management strategy.<sup>17</sup> The market committee consists of industry practitioners to advise on operational issues, and the strategic committee consists of banking and finance practitioners, economists, academics and investors to advise on the key principles and strategies of the debt issuing policy. It is **recommended** that the government should consider a similar set of committees for its debt management, including the EFA.

With regard to the people involved in the governance of the EFA, our assessment is that they are knowledgeable, sophisticated and highly committed to manage the EFA in a professional manner according to best industry practices.

### 5.6.2 *Marking-to-market*

The RMU calculates market value by discounting all asset and liability cash flows back to their present values using the appropriate interest rate swap curves. This is equivalent to assuming that all net liability flows are refinanced at Libor and that all net asset flows are reinvested. As noted in government documents, this procedure is inappropriate for calculating actual market values but may be appropriate for calculating actual market value sensitivities to (small) FX rate changes and parallel yield curve shifts. Since actual market values are available for the publicly traded instruments contained on the asset and liability sides of the EFA, market-determined values should be used whenever possible. Thus, it is **recommended** that the EFA

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<sup>17</sup> Auditor General of Canada (2000), 8-22.

review its marking-to-market procedure, including the methods of doing so and the frequency at which assets and liabilities are simultaneously marked-to-market.

### 5.6.3 *Internal reporting*

The risk management reporting of the EFA conforms to best practices. The RMU provides daily reports on the risk position of the EFA to trading staff, and monthly and quarterly reports to the RMC and the senior management of the BoC.

### 5.6.4 *Operational risk management*

To control operational risk, the RMU uses a “bottoms-up” approach to analyze and map operational processes, and establishes controls that are regularly reviewed. The RMU has developed several indicators of risk sources, and has emergency measures in place to deal with extraordinary events.

An examination of a few risk management reports indicates that:

- Staff turnover and movement was an ongoing area of concern but has stabilized at normal levels.
- There are some ongoing process errors/problems associated with transactions executed by external service providers, such as late deliveries of funds to the Fed by different institutions, failed US trades, and the non-receipt of month-end valuations required for swap valuation checks. Since no reported action against the parties that made the errors was reported, one could reach the incorrect conclusion that the EFA has no formal procedures in place to deal with such errors. While the frequency of such errors/problems is low, the procedures in place to monitor external agency relationships and/or the sanctions effected for such failures need to continue to be continually reviewed, and implementation of a “penalty box” should be considered.
- There are technical hurdles in terms of end of month pricing of assets and liabilities. These include incompatibilities between the pricing software used and electronic input data feeds and in the data format rigidities associated with some input data feeds. These hurdles should be removed with the recent system upgrade.

It is **recommended** that the internal procedures for monitoring and addressing the process errors/problems associated with external service providers, and that the technical hurdles associated with end-of-month pricing of assets and liabilities be addressed.

### 5.6.5 *Legal risk management*

The Department of Justice or DoJ advises on legal risk by, for example, identifying any potential legal risks with respect to legal documentation. The DoJ prepares and presents an annual legal risk report to the RMU and senior management of the BoC. We received little

evidence that security instrument documentation has been a problem of much importance for the EFA.

### 5.7 Reputation Protection

This appears to be a “soft” objective in that it is hard to measure and its import also is hard to determine. Given Canada’s credit rating, it appears unlikely that FX borrowings for the EFA need to be conducted in such a manner as to satisfy this objective. A presence in international capital markets probably has more importance to the successful implementation of an “opportunistic” approach to fund the EFA.

### 5.8 Management of Multiple Principles

As noted in earlier studies, no formal weighting scheme appears to exist for combining the above principles into a composite principles function for the EFA.<sup>18</sup> The weights assigned to each principle appear to change reactively (or in a dynamic fashion) over time in response to changing external conditions. Given limited progress towards the formulation of an explicit and formal composite principles function for the EFA, it is unclear how the occasional conflicting impacts on EFA principles are netted. Thus, it is **recommended** that an attempt should be made to formalize a composite principles function for the EFA that clearly specifies the relative importance of each individual principle in this composite function and how the individual principles are combined in the composite function.

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<sup>18</sup> For example, see: Paul Boothe and Bradford Reid, An evaluation of Canada’s foreign currency borrowing program, February 10, 1999.

**Table 1.** Sovereign Ratings History Since 1975 – Canada

<b>Date</b>	<b>Local Currency Sovereign Credit Rating</b>	<b>Foreign Currency Sovereign Credit Rating</b>
	<b>Long Term/ Outlook/Short Term</b>	<b>Long Term/ Outlook/Short Term</b>
July 29, 2002	AAA/Stable/A-1+	AAA/Stable/A-1+
Feb. 24, 1997	AAA/Stable/A-1+	AA+/Stable/A-1+
March 3, 1995	AAA/Stable/A-1+	AA+/Negative/A-1+
Oct. 14, 1992	AAA/Stable/A-1+	AA+/Stable/A-1+
June 26, 1989		AAA/Stable/A-1+
Nov. 23, 1981		AAA/—/A-1+
June 13, 1978		AAA/—/A-1
Nov. 3, 1951		AAA/—/—

Source: Sovereign Ratings History Since 1975, Publication date: 01-Nov-02, 13:31:51 EST.

Downloaded on 17 November 2002 at:

<http://www2.standardandpoors.com/NASApp/cs/ContentServer?pagename=sp/Page/FixedIncomeNewsAnalysisPg&l=ENG&b=2&f=&s=&ig=&i=&r=3&fr=3&ft=&fs=17&fig=>.

## Appendix: Possible Suggestions and Avenues in Which the Work on New Performance Metrics Could Proceed

First, the CoC metric is an accounting-based measure much like an accounting rate of return on total assets. As an accrual accounting measure, the CoC does not reflect cash flows accurately, and can become more distorted as portfolio turnover increases and asset realizations occur at prices that differ from their book values. Reflecting amortized capital gains or losses elevates this distortion somewhat but is somewhat arbitrary. The best solution is to calculate the CoC within a total return framework using market values and actual cash flows, as is customary for investment portfolios. One such measure used to measure portfolio performance is the dollar-weighted return.

Second, as a return-only measure, the CoC does not adjust for the risk borne to earn the CoC. Practitioners use numerous risk-adjusted return measures to measure portfolio performance, such as a Sharpe-like metric. The Sharpe ratio always refers to the differential between two portfolios. As is the case of the EFA, this differential can be viewed as being a self-financing portfolio, where the first portfolio represents the acquired asset portfolio (i.e., the left-hand side of the EFA balance sheet) and the second portfolio reflects the short position taken to finance that acquisition (i.e., the right-hand side of the EFA balance sheet). As Sharpe explains it:<sup>19</sup>

Central to the usefulness of the Sharpe Ratio is the fact that a differential return represents the result of a zero-investment strategy. This can be defined as any strategy that involves a zero outlay of money in the present and returns either a positive, negative, or zero amount in the future, depending on circumstances. A differential return clearly falls in this class, because it can be obtained by taking a long position in one asset (the fund) and a short position in another (the benchmark), with the funds from the latter used to finance the purchase of the former.

The Sharpe-like metric,  $Sh$ , is given by:

$$Sh = \frac{R_A - R_L}{Risk}$$

where  $R_A$  and  $R_L$  are the returns on the asset and liability portfolios of the EFA, and  $Risk$  is the measure of risk.

The returns on assets and liabilities would be all-inclusive. To illustrate some less obvious inclusions, the return on assets would include revenues from securities and gold lending programs, and the returns on liabilities would include the costs of revolving standby credit facilities.

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<sup>19</sup> William F. Sharpe, 1994, The Sharpe ratio, *Journal of Portfolio Management*, 52.

Measures of risk include the standard deviation of  $(R_A - R_L)$ , a VaR, and a downside risk measure such as the standard deviation of  $(R_A - R_L)$  where observations with  $(R_A - R_L) \geq h$  are set to 0, and  $h$  is some target differential return (basically a cost-of-carry) such as 0 based on the risk posture of the government for the EFA.<sup>20</sup>

An alternate risk-adjusted measure of CoC-like portfolio performance that appears to have promise is the so-called Jensen metric or portfolio alpha,  $\alpha_p$ , which is given by:

$$R_A = \alpha_p + \beta_p R_L + \varepsilon_p$$

where  $\beta_p$  is the sensitivity of asset returns to liability returns, and  $\varepsilon_p$  is the error term with the usual assumed properties.

The attractiveness of the Jensen formulation is that  $\alpha_p$  and  $\beta_p$  would be expected to be zero and one, respectively, if assets are correctly priced, no trade frictions exist, and the differential returns on the assets and liabilities are fully risk factor neutral, and the factor risks are market, interest rate, liquidity and credit. If trade frictions exist and all other assumptions hold, then the risk-adjusted CoC as measured by  $\alpha_p$  is expected to be negative. If we now relax the assumption of complete immunization to all factor risks so that some positive differential exposure is present in the EFA portfolio to one or more risk factors (as is currently the case for credit and probably liquidity risk), then the risk-adjusted CoC as measured by  $\alpha_p$  can be negative, zero or positive depending upon the level of net factor risk exposure borne in the EFA. The variance of the error terms or  $\sigma(\varepsilon_p)$  can be used to measure EFA tracking error or the level of active risk in the EFA.

Whatever performance metrics are chosen, performance is best measured over periods longer than one year. Typical practice in the money management industry is to look at five-year evaluation horizons.

Another avenue that could be pursued is attribution analysis where the  $(R_A - R_L)$  are partitioned into their component sources of performance and the remainder is a measure of trader skill.<sup>21</sup>

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<sup>20</sup> For a discussion of alternative measures of risk, see Frank J. Fabozzi, Chapter 2: Alternative measures of portfolio risk, in: Frank J. Fabozzi (ed.), *Fixed Income Readings* (AIMR, 2000) and Roger G. Clarke, Alternative measures of risk, in: Peter L. Bernstein and Aswath Damodaran (eds.), *Investment Management* (Wiley, 1998).

<sup>21</sup> This is discussed in most of the leading investment books, such as: Frank K. Reilly and Keith C. Brown, *Investment Analysis and Portfolio Management* (Dryden, 6<sup>th</sup> edition, 2000).