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Performance Measurement and Attribution of International Equity Portfolios: A Practical Model for Canadian Investors

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Thesis

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ABSTRACT

Performance Measurement and Attribution of International Equity Portfolios:
A Practical Model for Canadian Investors

Marie-Josée Lambert

The wide availability of international equity funds creates a need for evaluating international equity performance in an intelligent and appropriate way which distinguishes between funds with different missions and investment policies and practices. However, as research into international equity portfolio performance attribution is still in its infancy, there does not seem to be a general consensus on the overall framework or approach which should be taken to evaluate the performance of international equity portfolios. With a solid theoretical foundation drawn from existing research, this thesis sets out to develop a workable, intuitive and useful performance attribution and risk measurement framework for international equity portfolios. The framework presented is then used to evaluate the performance of a Canadian-based international equity portfolio yielding results which would be of particular interest to its sponsors. This thesis then gives suggestions for future research and concludes by stating that attribution and risk measurement practices for international equity portfolios are sure to become even more refined as interest in globally diversified portfolios continues to increase.

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Introduction

With rapidly growing new capital markets and economies emerging all over the world and the progressive elimination of the barriers to foreign investment, the perspective of pension plan sponsors and investment managers has become increasingly global as they begin to realise that the opportunity cost of not diversifying globally has become too significant to ignore. Along with regulatory and policy changes in the global marketplace, the growing availability of financial and foreign exchange futures contracts and over-the-counter structured products have made international diversification even more feasible.

Investment plan managers and sponsors are continually seeking to improve their information systems in order to develop better portfolio benchmarks and investment policies, quickly and accurately analyse global markets and currencies, give consistency to their global accounting systems and regulations and allow comparisons of performance among different international portfolios.

The complexity of managing allocations across various currencies, countries and securities within an international portfolio has led to the widespread practice of dividing these functions among specialists. The fact that more than one person may contribute to the overall success of an international portfolio highlights the need for a performance measurement system capable of isolating the value-added component each person brings.

International performance attribution in the context of a dynamic and competitive global environment is an important and sensitive issue, but plan sponsors often encounter a series of obstacles in the application of performance attribution to their portfolios. Very little is known about this topic as serious research in this area only began in earnest in the mid to late 1980's, and previous research had focused almost entirely on domestic performance attribution. Even today, there does not seem to be a consensus on the data requirements, tools or methods which should be used to measure the performance of international equity portfolios. Additionally, the fact that many countries do not yet have fully developed capital markets or universally accepted indices makes customising international benchmarks to reflect individual fund manager investment guidelines, objectives and styles an ambiguous and imprecise task. Also, as the

practice of investing internationally is still relatively recent, many portfolio managers have short track records which do not provide sufficient information about their performance to make attribution analysis possible.

Most existing international portfolio performance attribution systems seem to share the common goal of breaking down returns into their currency, country, asset class and security components. In order to achieve this breakdown, a benchmark portfolio is usually constructed to identify normal exposure levels for each country, asset class and security as well as to determine the normal hedging ratio used to control currency risk. The returns from an international portfolio are then compared against this benchmark portfolio in order to isolate active and passive returns due to currency, country, asset class and security selection. Although a universally accepted international performance attribution framework does not seem to exist, a few recently developed portfolio performance attribution models have been presented that seem theoretically robust and flexible, but they do not give specific and concrete instructions on their real world application and use. Surprisingly, most international performance attribution frameworks which have been proposed do not account for risk, choosing instead to concentrate uniquely on return maximisation.

Problem Statement / Research Question

As research into international equity portfolio performance attribution is still in its infancy, there does not seem to be a general consensus on the overall framework or approach which should be taken to evaluate the performance of international equity portfolios. Additionally, many of the existing approaches may be difficult or impractical to implement. This implies that globally-invested fund managers and sponsors would be hard-pressed to find a simple, intuitive, step-by-step method for measuring and attributing their international returns and associated risks.

This thesis will attempt to find an answer to these difficulties by presenting a practical framework which could be used to construct a performance attribution framework for a Canadian international equity portfolio.

Research Objectives

This thesis seeks to extend the existing body of knowledge in portfolio performance attribution by developing a workable international equity portfolio performance attribution model. The proposed model will be designed to be straightforward and practical and will be based upon a solid theoretical foundation drawn from existing research.

Although performance attribution models can be presented in any base country and currency, a Canadian perspective will be taken in the development of the model. As shown in Table 1, Canada represents less than 2.5 per cent of the global stock market capitalisation. Canadians who wish to enhance the risk versus return profile of their portfolios are becoming more and more aware of the opportunities that exist outside their home country. International diversification is essential for investors of any country who wish to take part in the growth and development of an increasingly global economy.

An actual Canadian-based international equity portfolio will be evaluated in order to demonstrate how performance attribution can be applied in an international context by separating its historical returns into currency, country, asset class and risk components. The results obtained in this exercise will be secondary to the principal objective of the thesis -- to develop a workable and useful international portfolio performance attribution model that is intuitive, adaptable and fairly straight-forward to implement. In order to achieve this, the performance attribution model will be designed to operate on a personal computer, preferably with a widely used spreadsheet application such as Microsoft Excel. This is to demonstrate that international equity performance attribution is within the reach of most investors. The success of the thesis will be defined by the ease of use of the computer model, as well as the accuracy of the information it provides.

To accomplish these objectives, previous relevant literature will be briefly reviewed, followed by the research design, methodology and data which will be used. The results of the statistical analysis will then be presented along with limitations of the study. Finally, this paper will conclude with a summary and suggestions for future research.

Literature Review

International Equity Performance Measurement and Attribution

Research on investment performance evaluation began to appear in the 1960's. Important early work in this field was done by William Sharpe, Jack Treynor and Michael Jensen. Concentrating on the two dimensions of risk and return, they presented measures which could be used to compare the relative performance of different investments adjusted for risk.

Fama (1972) pioneered the idea of further decomposing the sources of a portfolio's return into selectivity, risk and timing components using the Capital Asset Pricing Model. In his paper, Fama proposed that the overall performance of a portfolio could be divided into selectivity and risk components. He defined the return for selectivity as the difference between the return on the managed portfolio and the return on a naively selected portfolio with the same level of market risk. The risk component was the return obtained from the decision to take on more risk than the normal or benchmark portfolio. Although he claimed that the portion of portfolio returns attributable to timing was a subcomponent of the risk factor, its determination was unclear as he presented more that one method for its computation.

A few years later, Brinson and Fachler (1985) introduced a system for decomposing international equity portfolio returns into their country and stock selection components. The authors believed that any performance measurement system should be based on an appropriate benchmark. For their analysis, they modified a Capital International Perspective (CIP) Index to make it a better fit for the objectives and policy constraints of the portfolio they were evaluating. They proceeded to create a two-dimensional model in order to isolate the active and passive returns due to country and stock selection. They also included a cross product factor to account for residual returns. By subtracting indexed, or passive, returns from active returns, a component breakdown table could be made which would present international equity performance information in a concise and simple format. As this was probably the first research paper to approach the topic of international equity performance attribution, the authors acknowledged that they had not addressed the issues of risk measurement, market timing or currency management, and suggested that more research should be done in these areas.

Brinson, Hood and Beebower (1986) noticed that investment and pension funds employing more than one manager experienced difficulties in delineating responsibility for each manager's performance contribution to the fund. This prompted Brinson et al to develop a framework that could be used to identify the source of a portfolio's excess returns. They proposed that investment strategy could be easily measured by decomposing excess returns into investment policy, market timing and security selection components. Using data from 91 large U.S. pension plans over a ten-year period beginning in 1974, they found that investment policy, or the normal long-term portfolio, explained on average 93.6 per cent of total return variation. The average plan lost 66 basis points per year for market timing and lost an additional 36 basis points for security selection. Because active management cost the average plan 1 per cent per year, Brinson et al highlighted the need for careful and systematic attention to investment policy. Concentrating entirely on the returns achieved by the portfolio managers, this new approach to performance attribution did not evaluate the inherent risk of the portfolios as it was assumed that the managed portfolio would have the same level of risk as the comparison benchmark.

A test for market timing ability was proposed by Cumby and Modest in 1987. Cumby and Modest added refinements to the Henriksson-Merton test for market timing ability, which has the following assumptions: that a portfolio manager's ordinal rankings of alternative investments are available, actual and predicted return probabilities are constant over time and the probability of a correct forecast for an investment is independent of the magnitude of its realised returns. The Henriksson-Merton test uses a contingency table to present the joint, marginal and conditional probabilities for a correct forecast (see Figure 1). For market timing ability to be found, the sum of the two conditional probabilities of a correct forecast must exceed one. Cumby and Modest extended the Henriksson-Merton test to include situations where the conditional probability of a correct forecast depends on the magnitude of subsequent realised returns.

In 1991, Brinson, Singer and Beebower updated and expanded upon their 1986 study. Their new study used data from 82 large U.S. pension plans over the 1977 to 1987 period. Confirming their original findings, investment policy explained 91.5 per cent of the variation in

quarterly total plan returns. Not only was the contribution of active management to total returns not statistically different from zero, active management appeared to have increased the overall risk. Brinson et al stated that their analysis lacked precision because of certain limitations. In addition to equity and fixed income instruments, some funds carried an "other" asset class which was allocated to the equity and fixed income classes on a proportional basis. Because the "other" asset class usually represented a small fraction of the total portfolio, they claimed that it did not materially affect the results of the study. Also, since policy, or benchmark, portfolios were inferred from the long-term average asset class weights of the portfolios, it was unclear if these actually represented the real benchmarks for these portfolios. Lastly, the study was limited by the fact that it was impossible to determine the performance and investment style of individual managers and it did not incorporate the use of futures and options into its analysis. The authors suggested that two new components, internal and external risk positioning, could account for changes in portfolio risk characteristics attributable to allocating actively into and out of cash and cash-equivalent assets but their data did not allow them to perform this analysis.

In 1991, Allen proposed a performance attribution system for global equity portfolios. Recognising that global portfolio returns were a result of the returns earned on each country's securities as well as their currency movements, Allen provided a framework for quantifying the impact of seven different types of decisions on the total return for an international equity portfolio:

1. The choice, at the policy level, of the unhedged dollar-denominated index against which the active equity manager is measured.
2. Security selection decisions by the active manager within each country.
3. Overweighting or underweighting of a country relative to the index based on the country's expected equity returns.
4. Overweighting or underweighting of a country relative to the index based on the country's expected currency returns.
5. Purchases and sales executed during the period which include dealer spreads and add a transaction cost which is not reflected in the index.

6. The choice, at the policy level, of the benchmark percentage of the portfolio that is to be hedged passively against currency fluctuation.
7. Active decisions in the currency forward markets that cause the portfolio's return to deviate from that of the passively hedged benchmark.

Using monthly data from the ABC Global Equity Management Company over an unspecified time period, Allen showed that for a 50% passively hedged equity portfolio the choice of the unhedged benchmark was the single biggest factor influencing total return. He then described how each of the other six factors had only marginally affected total portfolio return. Allen's model was one of the earliest international performance attribution systems, but he did not describe how to create international benchmarks or explain how he arrived at the benchmark weights used for the countries and their securities. Also, he did not address the issue of portfolio risk. Overall, however, Allen's paper provided an approach upon which more detailed research could be done.

Bostock and Woolley (1991) developed a framework for analysing international equity returns in common-currency terms that separated changes in the underlying characteristics of international equity investments from changes in the markets' valuation of these characteristics. They defined the underlying characteristics for each equity investment as two value-based parameters, growth in real earnings and income (or dividend yield). They also split the markets' valuation of international equity returns into two fundamental parameters, change in the price / earnings ratio and real exchange rate change. The authors used real, or net of inflation, returns because they argued that inflation exaggerates local nominal price changes, making local market returns non-comparable, and depreciates local currencies, making nominal exchange rate changes non-comparable. Using equity market data from the Morgan Stanley Capital International indexes spanning a twenty-year period from 1969 to 1989, Bostock and Woolley found that value-based returns (growth in real earnings plus income yield) were similar across various countries. The authors felt that this result was consistent with the purchasing power parity theorem and should hold in the long term as markets become even more integrated over time and price / earnings ratios across countries converge. They claimed that the evaluation of

international equity returns would eventually be a function of growth in real earnings and dividend yield. Although Bostock and Woolley's model was not specifically designed for international portfolio performance attribution, their model helped draw attention to the importance of inflation, price / earnings ratios, earnings and currency exchange rates on international returns.

Claiming that most existing approaches to performance attribution produced distorted results because they didn't account for the element of risk, Ankrim (1992) proposed a new risk-adjusted performance attribution system for equity portfolios. Ankrim felt that existing methods used for measuring performance were flawed in their assumption that risk would be perfectly captured by a well-selected benchmark. In instances where the benchmark was not perfectly matched to the portfolio's risk level, there would be a tendency to over-reward risky managers and to under-reward more conservative ones. In order to correct this situation, Ankrim incorporated Fama's (1972) beta into his model to measure the relative riskiness of a fund toward its benchmark. After having calculated the alpha or Jensen risk-adjusted return to control for risk, excess returns could be restated into an allocation effect, a selection effect and an interaction effect. With beta as its measure for risk, this model was designed for domestic equity portfolios. Difficulties arise in Ankrim's model for mixed asset or international portfolios, where a single-factor proxy for risk is difficult to define.

William F. Sharpe (1992) proposed an alternative way to measure management style and performance. Using a factor model composed of the returns of twelve mutually exclusive and exhaustive asset classes, Sharpe defined the return attributable to style as the sum of the twelve terms and the return attributable to selection as the equation's residual component. Sharpe was then able to reconstruct the investment fund's normal portfolio by examining the weight given each of the asset classes. Because the model required only realised fund returns to establish the typical exposures of the fund to various asset classes, Sharpe believed it to be an efficient and cost-effective tool which could be used to supplement other more detailed methods. The use of easily available external information to infer internal information is the strength of Sharpe's model but it is also its weakness as any results obtained must be interpreted with great

care and reservation.

Arguing that not enough attention was being paid to the active management of currency exposure for international portfolios, Ankrim and Hensel (1994) added currency returns to the international equity performance attribution model that had been proposed by Brinson and Fachler (1985). Their new model added a currency forward premium and a measure for active currency management to the original three factors (country selection, security selection, and an overall effect for interaction). In instances where portfolios were less than fully hedged as part of an active currency management decision, currency returns were partitioned into a forward premium and a currency surprise premium for the exposed position. These factors could then be compared against a benchmark portfolio's normal currency hedge exposure. Positions taken by the portfolio manager which deviated from the benchmark's normal currency exposure could then be evaluated on a country by country basis to determine if the manager had shown the ability to capture positive returns from surprise changes in exchange rates. To determine the impact of currency on total returns for international equity portfolios, Ankrim and Hensel collected monthly data from January 1978 to December 1990 for 133 non-U.S. equity portfolios and used the MSCI EAFE Index as their benchmark. They found that although the currency effects combined explained between 40 and 80 basis points per year of total returns, the currency surprise factor accounted for the most of the variation from period to period. The authors did note, however, that their model did not address the problem of risk measurement and attribution, the difficulties involved in defining a benchmark portfolio, or the possible distortion of international performance data over time.

Frustrated with the overall lack of consistency and integration between international portfolio performance attribution systems, Karnosky and Singer (1994) proposed a general unified framework for analysing the effects of market allocation, currency management and security selection on global portfolios. By focusing primarily on the practical application of international portfolio performance attribution systems, the authors hoped to provide investment fund sponsors and managers with the necessary tools to improve international equity portfolio management. As in the well-known CAPM, Karnosky and Singer's model evaluates risky assets

by their risk premiums relative to a riskless asset. Their approach attempts to pinpoint the actual contribution of market and currency strategies by treating each one separately. Global assets are evaluated according to their local-currency return premiums and optimal currency exposures are identified by comparing global cash returns expressed in the home currency of the portfolio. Using the attribution grid developed by Brinson et al. (1991), the return contributions due to active market and currency decisions are then isolated (see Figure 2). The first grid separates active and passive returns due to market and security selection and the second separates active and passive returns due to currency and hedging selection. Market selection refers to the portion of returns which can be attributed to the active and passive allocation of the international portfolio into various countries. Security selection refers to the portion of returns which can be attributed to the active and passive choice of securities within each country. Currency selection parallels market selection in that it deals with the net exposure of the portfolio to various currencies. Similarly, hedge selection parallels security selection as it is a measure of the portfolio manager's skill for applying hedging and derivative instruments to achieve the currency exposure for each country.

Although Karnosky and Singer felt that their model could be easily and practically applied for any global portfolio, in reality, difficulties could quickly be encountered. The authors focused entirely upon the maximisation of returns regardless of risk because they felt that risk considerations were an implementation issue (Karnosky and Singer, page 6, footnote 2). Plan sponsors and managers would need to find their own methods for measuring and analysing risk, a difficult and complex task essential for the evaluation of risk - return performance. Additionally, the examples provided in their paper do not specify the time period used for the return calculations; whether it is for a month, a quarter or a year is unclear. The authors state that multi-period attribution analysis requires adjustments for changes in active weights and returns over time, but even with the adjustments, results can be misleading or even completely off mark. Unfortunately, no suggestion is made as to what would constitute an appropriate time frame. Overall, Karnosky and Singer's paper was successful in its attempt to gather existing knowledge on the process of international performance attribution into a logical and consistent

framework which could be refined with more study.

Surprisingly, much of the research done on the subject of international portfolio performance attribution devotes very little attention to the definition and measurement of country risk. Obtaining a true measure for risk is difficult because many of the world's countries do not have developed capital markets which are necessary inputs to the construction of risk measures such as the CAPM beta. Erb, Campbell and Viskanta (1996) proposed an approach for measuring country risk: the country credit ratings published by *Institutional Investor's* semi-annual survey of bankers. They believed that country credit ratings had the advantage of simultaneously incorporating political and expropriation risk, inflation, exchange rate volatility and controls, the nation's industrial profile, economic viability, sensitivity of global economic shocks and other sources of risk. Even more importantly, they felt that country credit ratings were forward-looking, as opposed to traditional risk measures which are usually based upon historical data. Using credit rating data for 47 different countries, the authors graphed the risk - return results for each country. Confirming their hypothesis that credit ratings should incorporate country risks, they found that the reward per credit risk was similar across all countries, developed and emerging. This alternative method for calculating country risks has the advantage of being intuitive and practical with readily available data.

Using an approach that measures the actual dispersion of returns by differentiating between upside and downside variability, Wilfred Vos (1997) developed a system for ranking mutual funds. Vos designed his system to compensate for what he considered as three weaknesses in current risk measurement approaches. First, he felt that standard deviation was flawed as a risk measure because mutual fund returns are often asymmetric. Second, the standard practice of time-weighting returns creates returns that are often end-date sensitive. Lastly, risk-averse investors do not perceive gains and losses of similar sizes equivalently. The variables in Vos' system include mean return, standard deviation, kurtosis, skewness, the sum of the losses and gains, the frequency of positive and negative returns, expected loss and quartile analysis. These variables serve as inputs into a ranking system that measures the best risk versus return performance.

The information ratio is often used by plan sponsors to rank the historical risk-return performance of fund managers with their peers. Goodwin (1998), sensing confusion in the industry over this ratio, clarified its derivation and uses. According to Goodwin, the information ratio is the ratio of the average excess returns over the standard deviation of excess returns of an active portfolio versus its benchmark. Used to gauge a portfolio manager's special skills or market-timing ability, this ratio is an extension of the Markowitz mean - variance model, which states that the mean and variance of returns are sufficient statistics for measuring the performance of an investment portfolio. Goodwin presented four ways to annualise the information ratio, along with the advantages and disadvantages for each method. He also described how to measure the ratio's statistical significance with the use of *t*-statistics. Finally, he warned that the information ratio should be used with the understanding that it is only a tool to gauge the risk-return performance of managers against their peers or an appropriate benchmark. The information ratio does not provide information which could be used for making asset allocation decisions, does not take into account the risk tolerance of the investor, is based on historical information which may not be a good predictor of future performance, is sensitive to the benchmark used and can be calculated and presented in a variety of ways.

Benchmarks for International Equity Portfolios

Well-constructed benchmark portfolios are essential inputs to most performance attribution frameworks, but research on this subject is in its early stages, with a variety of approaches being advanced. There is a definite consensus however, that the choice of a benchmark or normal portfolio represents one of the most important decisions in performance measurement systems as it can easily make returns seem more or less favourable than they should be.

This was demonstrated by Lehmann and Modest (1987) when they examined the returns of 130 U.S. domestically-invested mutual funds from January 1968 to December 1982 to see if their relative performance was sensitive to the benchmark selected. After having tested the mutual fund returns against a variety of benchmarks using the Jensen measures, the Treynor-Black appraisal ratios, the CAPM and the APT, they found that the mutual fund rankings were very sensitive to the method used to construct the benchmarks. The authors explained that two obstacles made it difficult for the different benchmark measures to have similar rankings for the funds: disagreement on the appropriate way to quantify risk and errors in inference that arose when funds actually outperformed the market. They stressed that among the most significant issues in performance measurement are the determination of what constitutes the normal or benchmark portfolio and how to deal with fund managers who seem to obtain consistently superior results by their outstanding market timing abilities or by having access to information not commonly available to the market. They highlighted the fact that these complex and sensitive issues must be addressed when constructing and using a model for evaluating investment fund performance and risk.

Another excellent starting point in the development of benchmark portfolios can be found in Bailey, Richards and Tierney (1990). They defined an investment benchmark as the passive representation of a manager's investment process or, alternatively, the prominent financial characteristics that the manager's portfolio would exhibit in the absence of active investment judgements. They believed that a useful benchmark should be jointly designed and accepted by the sponsors of the portfolio and their investment managers. In order to accurately reflect the

investment process, a good benchmark would be unambiguous, investable, measurable, appropriate, reflective of current investment opinions and specified in advance. The authors claimed that benchmarks could facilitate the assessment of portfolio managers and allow plan sponsors a framework with which to develop an effective investment program for the whole investment fund.

Rennie and Cowhey (1990) discussed some of the issues which should be addressed in the design and use of benchmark portfolios. When constructing a benchmark portfolio, sponsors should take into account the fund's objectives and investment style. For example, using a benchmark portfolio with growth characteristics to evaluate a growth manager would be more meaningful than using the S&P 500 as a performance standard. Sponsors should also determine how to treat cash positions and transaction costs. Because cash tends to have a negative impact on portfolio returns over the long run, they suggested that benchmark portfolios always be fully invested. Cash positions held in managed portfolios would therefore be considered active asset allocation decisions. Transaction costs should be included if portfolio turnover is high and they represent a significant portion of the benchmark value. Benchmark portfolios should also be rebalanced as required to keep them in line with their overall objectives and investment style, but the frequency with which benchmarks are rebalanced should take transaction costs into consideration. The portfolio's cash flows should be monitored as they can affect the performance of the fund versus its benchmark. Finally, fund sponsors should understand that constructing meaningful benchmark portfolios is costly in terms of the time and effort required, and that they should be prepared to monitor and adapt the benchmark as required over time. Rennie and Cowhey concluded by saying that benchmark portfolios are an effective tool when they are the result of a co-operative effort between the fund sponsors and the fund managers.

Tierney and Winston (1991) presented a method for defining a manager's style through the use of a graph. They claimed that a style graph can distil the amount of information about a manager's style to a few numbers which can be grasped quickly and intuitively. Building a style graph requires two sets of style points. These could be small- and large-capitalisation and value- and growth- oriented corner points, for example. By using filters to plot portfolios on this graph,

the implied style of the portfolios can be compared to their mission or benchmark. A manager who claims to be small-cap value-oriented should plot in that sector of the graph. This approach helps define a portfolio manager's style or normal portfolio, but does not give any indication of the portfolio's performance.

Bailey (1992) cautioned investment fund sponsors and managers that some benchmarks are better than others, and that all parties involved in the performance attribution process insist on using high quality benchmarks. He believed that poor benchmarks promote inefficient manager and asset allocations thereby increasing the likelihood of negative performance results. The author felt strongly that good benchmarks should satisfy the following criteria:

1. have a high coverage of assets held in the portfolio (at least 80%)
2. exhibit low portfolio turnover (at most 20% to reflect an active portfolio manager style)
3. maintain active positions that are mostly positive in securities with attractive returns
4. maintain reasonable investable position sizes (position weights which can be realistically achieved by the portfolio manager, given the size of the portfolio)
5. have less active risk than the market portfolio (the benchmark should screen out random noise associated with factors unrelated to the manager's investment style)
6. explain a large portion of the portfolio's actual extra-market return (return net of its market component) due to the strong relationship between style and overall portfolio performance
7. exhibit insignificant extra-market return correlation between the benchmark and the portfolio's performance versus the benchmark (if the portfolio beta relative to the benchmark is equal to one, the value-added by the portfolio manager over the benchmark should be a result of active investment decisions which are uncorrelated with the passive benchmark)
8. show similar style exposures between the portfolio and the benchmark (show similar profiles of capitalisation and value or growth).

In his conclusion, Bailey predicted that as investment fund sponsors and managers become more sophisticated, they will demand higher quality benchmarks that will respond to the criteria

he proposed.

Tierney and Bailey (1995) discussed the methods which could be used by plan sponsors to determine the appropriateness of the benchmarks used in the evaluation of investment fund results. The authors stressed the importance of measuring a portfolio manager's skill as opposed to style, which could be passively reflected by a benchmark. They stated that two properties, which they coined benchmark orthogonality properties, should always be respected for benchmarks. The first property is a function of the manager's investment style and the benchmark constructed to reflect that style, and states that the manager's value-added component should be uncorrelated with the performance of the benchmark. The second property ensures that the manager does not have any advantage or disadvantage over the rest of the market by stating that the performance of the value-added component should be uncorrelated with the performance of a market proxy. This means that for a well-constructed benchmark, the manager's value-added performance relative to the benchmark or a broad market index should be unrelated. Portfolio returns can then be broken down into their market, investment policy and portfolio manager contribution components.

Empirical Research on the Performance of International Equity Funds

Noticing the lack of research on the performance of international mutual funds, Cumby and Glen (1990) examined the monthly returns of fifteen U.S.-based internationally diversified mutual funds for a six-year period starting in 1982. The Jensen measure and Grinblatt and Titman's positive period weighting measure were used to determine the performance of each fund against two different benchmarks: the Morgan Stanley world index, and a combination of the Morgan Stanley world index and an equally weighted Eurocurrency portfolio. Cumby and Glen found no evidence of superior performance for any of the mutual funds in their sample. Since return was measured by total global performance, it was not possible to identify the contributions made from superior policy decisions, country selection and timing abilities. The results of this study depend on the assumption that the fifteen mutual funds were well diversified internationally, but some of the funds may have had different missions or areas of interest thus making the funds non-comparable. This flaw was unavoidable due to the lack of historic data on international mutual funds at the time this paper was written.

In 1991, Eun, Kolodny and Resnick compared the monthly returns of 19 U.S.-based international funds from 1977 to 1986 to the S&P 500 Index, the Morgan Stanley Capital International (MSCI) World Index and an index of U.S. multinational firms that they created. Using the Sharpe, Treynor and Jensen measures, the authors found that the international mutual funds would have allowed U.S. investors to diversify risk internationally with the exception of multinational corporations which were found to behave like domestic firms. Although most of the funds outperformed the S&P 500 Index, they did not outperform the MSCI World Index. Finally, international mutual funds were not found to be a good hedge against expected U.S. inflation. The authors did not really address the issue of performance attribution so it was difficult to identify the funds which had superior market allocation, security selection or timing skills. Also, the limited number of mutual funds in the study made comparisons between funds difficult as most had completely different missions and areas of investment.

In 1994, Droms and Walker (1994) took advantage of the growing amount of empirical data on the investment performance of international equity funds to extend the body of

knowledge in this field. Two sets of annual data for U.S.-based international equity funds were examined: four funds for a twenty-year period starting in 1971, and thirty funds for a six-year period starting in 1985. The performance results from these data sets were compared to three different benchmarks: the S&P 500 index, the EAFE index and the Morgan Stanley World index. Using the Jensen, Sharpe and Treynor measures, the authors found that in the context of the capital asset pricing model, excess risk-adjusted rates of return were not attainable from investing in a broad cross-section of international mutual funds. These results did not hold as well when the EAFE index was used as the benchmark measure although the authors suggested that this may be due to the fact that the S&P 500 is a major component of the World index but is excluded from the EAFE index. As in the previous two articles, the method used by Droms and Walker did not allow them to isolate return components or adjust their benchmarks for funds which had different missions and investment policies.

Research Design & Methodology

An extensive literature review of portfolio performance attribution research has shown that no one research paper responds exactly to the objectives of our proposed thesis. Consequently, Karnosky and Singer's 1995 performance attribution model will be used for performance measurement and attribution, the information ratio as defined by Goodwin in 1998 will gauge the risk-return performance of the manager, Cumby and Modest's 1987 model will test for market timing ability and Vos' 1997 framework will incorporate overall risk considerations into the analysis.

Karnosky and Singer's monograph was particularly useful for the purposes of this thesis as it brought much of the existing body of knowledge on international performance attribution into a coherent framework. Their framework makes it possible to evaluate the performance of a international portfolio manager by separating the manager's value-added contribution into its market (country), security (choice of securities within each country) and currency management (use of hedging or derivatives to manage foreign exchange exposures) components. It is important to note that if the total value-added returns by the portfolio manager were ranked by country, the country rankings obtained with this method would be the same irrespective of the base currency used. In Karnosky and Singer's approach, the return from a global portfolio, R, in terms of a base currency, n, is defined as

$$R_n = \sum [w_i (r_i - c_i) + v_i (k_i - c_i)] + \sum \delta_i (c_i + \varepsilon_{n,i})$$

subject to

$$0 \leq \sum w_i \leq 1$$

$$\sum (w_i + v_i) = 1$$

$$\delta_i = (w_i + v_i + h_i)$$

$$\sum \delta_i = 1$$

where

r_i = return from the noncash assets (equities) of country i, in local-currency terms,

c_i = return from country i Eurodeposits, in local-currency terms,

k_i = return from country i strategic cash (if held in Eurodeposits, $k_i = c_i$),

$\varepsilon_{n,i}$ = rate of change in the base currency for a given currency i exchange rate,

w_i = weight of country i noncash assets,

v_i = weight of country i cash held as strategic cash,

δ_i = weight of currency i and

h_i = the portion of the portfolio that is converted (hedged or cross-hedged) to currency i.

Strategic cash refers to holdings which are invested in short-term, highly liquid investments such as Eurodeposits for strategic or operational purposes. Although it means that the portfolio is less than fully invested, strategic cash gives the portfolio manager the liberty to take advantage of investment opportunities as they arise. Strategic cash also serves as a reserve for settling pending transactions as well as a temporary investment vehicle for large incoming flows which the manager chooses not to invest immediately for timing or supply reasons. In Karnosky and Singer's approach, strategic cash differs from cash (c_i) which represents the risk-free Eurodeposit rate. Only where the portion allocated to strategic cash is invested in Eurodeposits is $k_i = c_i$. Otherwise, k_i represents the return for the instrument used to invest the strategic cash such as Eurodeposits, treasury bills, short bonds, bankers' acceptances or term deposits.

Currency exposure is evaluated separately from the market decision because it can be actively managed through various strategies such as direct and cross-hedging between currencies, forwards, futures and options. In Karnosky and Singer's framework, currency management is considered equivalent in all respects to the management of global cash portfolios, where currency allocation is a function of maximising global cash returns, with all returns expressed in the home currency of the portfolio. This implies that in order to optimise returns in an international equity portfolio, it may be necessary to have different weights assigned to the market and currency exposures of each country. In cases where the portfolio manager is restricted from hedging or using derivative instruments, the framework still provides

information on how the total performance of the portfolio would have been affected had the currency exposure been managed optimally.

The following equations describe each of the elements used in calculating performance attribution for a global portfolio. References are also made to the quadrants found in Figure 2 which presents Karnosky and Singer's framework in the form of two grids separating the active and passive returns due to market and security selection components and currency and hedge selection components. Equations 1, 4 and 8 from the Karnosky and Singer framework have been modified after discussing problems in applying the original equations with Mr. Karnosky. Equation 1, active market selection, was modified to include the local market return premium term in the strategic cash portion of the equation. Equations 4 and 8 which total the market and currency components respectively were modified in order to index the country returns for the return of the passive index.

1. Active market selection
   M(II) - M(I)
$$\sum_i \left\{ w_i - \bar{w}_i \left[(\bar{r}_i - \bar{c}_i) - RP \right] \right\} + \sum_i \left\{ v_i - \bar{v}_i \left[(\bar{r}_i - \bar{c}_i) - RP \right] \right\}$$

2. Security selection
   M(III) - M(I)
$$\sum_i \left[\bar{w}_i (r_i - \bar{r}_i) \right] + \sum_i \left[\bar{v}_i (k_i - \bar{c}_i) \right]$$

3. Market cross-product
   M(IV) - M(III) - M(II) + M(I)
$$\sum_i \left[(w_i - \bar{w}_i)(r_i - \bar{r}_i) \right] + \sum_i \left[(v_i - \bar{v}_i)(k_i - \bar{c}_i) \right]$$

4. Market total
   M(IV) - M(I)
$$\sum_i \left\{ \left[w_i (r_i - \bar{c}_i) + v_i (k_i - \bar{c}_i) \right] - \left[\bar{w}_i (\bar{r}_i - \bar{c}_i) \right] + \left[RP(\bar{w}_i - w_i) \right] \right\}$$

5. Active currency selection
   C(II) - C(I)
$$\sum_i \left\{ (w_i + v_i + h_i) - (\bar{w}_i + \bar{v}_i + \bar{h}_i) \left[(\bar{c}_i + \bar{\varepsilon}_i) - C \right] \right\}$$

6. Hedge selection
   C(III) - C(I)
$$\sum_i \left[(\bar{w}_i + \bar{v}_i + \bar{h}_i)(c_i - \bar{c}_i) \right]$$

7. Currency cross-product
   C(IV) - C(III) - C(II) + C(I)
$$\sum_i \left\{ (w_i + v_i + h_i) - (\bar{w}_i + \bar{v}_i + \bar{h}_i) \right\} (c_i - \bar{c}_i) \}$$

8. Currency total
   C(IV) - C(I)
$$\sum_i \left\{ (w_i + v_i + h_i)(c_i + \bar{\varepsilon}_i) \right] - \left[(\bar{w}_i + \bar{v}_i + \bar{h}_i)(\bar{c}_i + \bar{\varepsilon}_i) \right] + \left[C(\bar{w}_i - w_i) \right] \}$$

where

RP = aggregate passive benchmark local-currency return premium,

C = aggregate passive benchmark Eurodeposit return, in base-currency terms,

and letters with a bar over them indicate passive benchmark weights and returns.

In the case of a global portfolio where there is no currency hedging or strategic cash, these equations are simplified with k_i, v_i and h_i = 0. Where there is no currency hedging, Karnosky and Singer also suggest to combine the market cross-product with security selection to reduce the level of complexity, with little effect on the final attribution results. This would be done by substituting the passive market weights with active market weights (Karnosky and Singer, page 37, footnote 15).

The information ratio is a measure of the average excess return per unit of volatility in excess return. To apply this ratio to an international equity portfolio, base-currency Canadian dollar returns of the portfolio and the benchmark will be used. In the simplest case, Goodwin defines the information ratio as:

$$IR = \frac{\overline{ER}}{\hat{\sigma}_{ER}}$$

where

$$\overline{ER} = \frac{1}{T}\sum_{t=1}^{T} ER_t = \frac{1}{T}\sum_{t=1}^{T}(R_{Pt} - R_{Bt})$$

$$\hat{\sigma}_{ER} = \sqrt{\frac{1}{T-1}\sum_{t=1}^{T}(ER_t - \overline{ER})^2}$$

and

IR = information ratio,

ER_t = excess return of the portfolio over the benchmark,

$\hat{\sigma}_{ER}$ = standard deviation of excess returns from the benchmark,

R_{Pt} = return of the portfolio over period t,

R_{Bt} = return of the benchmark over period t.

Once the information ratio is calculated, a t-statistic is calculated to test for statistical significance:

$$t - Statistic = \sqrt{T} * IR$$

Information ratios are usually annualized to facilitate comparison using the following four most common methods: arithmetic, geometric, continuously compounded and frequency-conversion. The first three methods use monthly or quarterly data to compute the ratio, whereas the frequency-conversion method calculates the ratio directly from annualized data. Although the arithmetic method is the most popular, Goodwin stated his preference for the frequency-conversion method which he claimed would provide the exact information ratio that would be calculated if returns were observed only annually.

The Henriksson-Merton test for market timing as described by Modest and Cumby will be used to evaluate the international equity portfolio manager's market timing abilities for each country. This test for market timing requires that the return of an investment be compared to an alternative investment over a given time period. In the context of an international equity portfolio, the return for a given country stated in local market return premium terms will be compared to the return which could be earned by buying the benchmark, or the aggregate local market return premium. Comparing local market returns for the portfolio against local market returns earned by the benchmark for a given country would not test market-timing on a country level, because it is not possible to buy the benchmark on a country-by-country basis. Over-weighting a country relative to the benchmark is only profitable when the local market return premium for the portfolio is higher than for the benchmark and vice versa.

Using monthly returns for the portfolio and the benchmark, the values needed as inputs for the Henriksson-Merton test described in Figure 1 will be calculated in the following way for each country:

1. $R^*(t)$: Monthly local-currency return premium for the portfolio.
2. R(t): Monthly aggregate passive benchmark local-currency return premium.
3. N_1: the number of times $R^*(t) - R(t) \geq 0$ over the time period.
4. N_2: the number of times $R^*(t) - R(t) < 0$ over the time period.
5. n_1: the number of times $R^*(t) - R(t) \geq 0$ and there is an increase in the fund's weighting of the country relative to the preceding month.

6. n_2: the number of times $R^*(t) - R(t) < 0$ and there is a decrease in the fund's weighting of the country relative to the preceding month.

These values will then be divided by the total number of time periods to obtain the probability factors found in Part A of Figure 1. Finally, a test will be done for each country to determine if $p_1(t) + p_2(t)$ exceeds one indicating market timing ability. The confidence level of this p-statistic was calculated using a formula found in Park and Switzer (1996) and McIntosh and Dorfman (1992).

Although Vos' framework was designed for ranking the performance of mutual funds, it will be adapted to the needs of this paper in order to compare the return and risk performance of an international equity portfolio versus its benchmark. Total monthly rate of return data will be used on an unadjusted (not annualized) Canadian dollar basis for both the benchmark and the international equity portfolio. The risk analysis will be done at the overall level of portfolio returns, but plan sponsors can easily use the same approach to extend the analysis to a country by country basis if they require a greater depth of information. The statistical work which will be done in this framework includes plotting the rate of return distribution and calculating mean, standard deviation, kurtosis, skewness, as well as expected loss and quartile analysis.

Data

The data used for the analysis was provided by one of Canada's largest pension funds. This fund has over $30 billion in assets allocated into domestic and foreign money market, fixed income, equity and real estate holdings. The contact at the pension fund confirmed that performance measurement was complicated for foreign investments and that their own internal models were still being refined. An interest was expressed for any framework or suggestions which this thesis could bring, but anonymity was requested for the purposes of this paper. The pension fund divides its assets amongst several external fund managers and uses the custody, accounting and analytics of State Street Corporation to keep track of its investments and fund managers. Foreign equity investments represent about 18% of total holdings and are split into more than one portfolio.

Monthly data for the period starting in October 1992 and ending in September 1997 was supplied by State Street for a portfolio invested in European equities which had grown from $145 million to over $341 million. This growth was due to a combination of new cash inflows and returns earned on the portfolio over that time. The portfolio was managed by the same individual over the data period. Having as an objective to beat the FT Europe Index by at least 50 basis points, the investment policy of the portfolio did not allow the manager to use derivatives or currency hedging, but did give the manager the discretion to leave a portion of the fund in cash. The data supplied by State Street included monthly returns by country quoted on a local basis and on a Canadian basis, as well as monthly fund weights. Following AIMR (Association of Investment Management and Research) standards, the data was stated net of trading costs, commissions and taxes, and assumed that dividends, interest and capital gains were reinvested. State Street also forwarded data on the portfolio's benchmark index, the FT Europe Index, which assumes no currency hedging and a fully invested position.

In this example, the choice of the passive benchmark was straightforward as the portfolio manager's objective was to beat the FT Europe Index. The criteria for good benchmarks according to Bailey, Richard and Tierney (1990) are met in this case: the FT Europe Index is unambiguous, investable, measurable, appropriate, reflective of current investment opinions and

was specified in advance. The weights assigned to each country by the portfolio manager seem to reflect the benchmark, but only close scrutiny of the actual security purchases within each country would give a clear indication of the type of securities purchased within each country (i.e. small-cap versus large-cap, value versus growth stocks). This data was unfortunately unavailable. The most noticeable difference between the portfolio and the benchmark is the significant weight assigned to the United States by the portfolio manager, while the FT Europe Index has no US holdings. This issue was raised with the State Street analyst who explained that as the portfolio increased in size, the funds were temporarily invested in US cash until investment opportunities arose.

Therefore, the portion of the portfolio that was invested in the US was treated as strategic cash (in Karnosky and Singer's framework, weighting is v_i with a return of k_i). As strategic cash was held only in the US, a separate line labelled "US Cash" will be included in the performance and attribution tables.

Because the data provided was for a portfolio in which the portfolio manager was restricted from hedging or using derivatives, the analysis is simplified (in Karnosky and Singer's framework, $h_i = 0$). Performance attribution in this context relates to the overall net market / currency exposure of the portfolio, not in the methods used to achieve this exposure.

All of the performance data used in the analysis is time-weighted and value-weighted. The exchange rate return was extracted from the return data on the FT Europe Index supplied by State Street with the following formula:

$$\Delta FX = \frac{1 + BIRR}{1 + LIRR} - 1$$

where

ΔFX = rate of change between countries

$BIRR$ = base internal rate of return (in this example, Canada is the base country)

$LIRR$ = local internal rate of return.

The exchange rate of return data was easy to extract because both local and base rate of return data was supplied by State Street, but the same data could have been obtained directly from a

source such as Reuters. Fund weights are simply the average of fund balances by country over the specified time periods. One-month monthly Euro rates were supplied by Reuters Canada.

All of the analytical work and statistical analysis was done on Microsoft Excel, a spreadsheet program readily available to all investors. Links and arrays from the source data into the end-result tables allow the user to input new data and update the tables with a minimum amount of time and effort. Excel is a powerful application which can be linked to databases containing the relevant information, allowing the performance attribution tables to be updated automatically. With modern PC spreadsheet programs, attribution and risk analysis of complex international equity portfolios is definitely within the reach of fund sponsors and investors.

Statistical Results and Analysis

Tables 2 to 7 show the rate of return information for the FT Europe Index and the portfolio from October 1992 to September 1997. Table 2 gives the information on a five-year basis and Tables 3 to 7 give it on an annual basis starting in October 1992. The tables are split into cash, passive (FT Europe Index) and actual portfolio returns. The returns for each country were restated into Canadian base currency returns by adding the exchange rate of return for the Canadian dollar to the local returns. The local market return premiums were calculated by subtracting the Eurodeposit return from the market return in local terms for each country. The totals were then calculated by value-weighting and summing the returns for each country. Examining the Canadian dollar base returns shows that over the five-year period the portfolio manager obtained a return of 20.78%, below the FT Europe Index which returned 21.66%. This information was used to create Tables 8 through 11, which summarise the performance and attribution data for the FT Europe Index and the European equity portfolio.

The portfolio manager's active contribution to the portfolio is allocated into its market, security and currency components by country and year in Table 8. The active contribution could have been allocated into even more factors if the portfolio had been hedged or had strategic cash holdings. An example calculation of the market, security and currency components for Austria over the five-year period can be found in Figure 3.

An examination of the attribution numbers makes it clear that the portfolio manager's inferior returns were due to poor market selection. This was largely due to the large percentage of the portfolio invested in US cash which cost the portfolio manager 1.41% in overall returns, mainly because of the negative market return premium in that country. Closer examination would be necessary to judge the extent to which the US investments were a necessary operational by-product of the increasing size of the portfolio over the five years under study. If this was the case, the portfolio manager's poor performance due to large US cash holdings could have been unavoidable. If the portfolio manager had actively managed the currency exposure of the portfolio, this table would make it possible to evaluate the success of the currency strategies used as well.

The portfolio manager's average over- and under-weighting of each country on a yearly and a five-year average basis is given in Table 9. The averages reveal that the portfolio manager seems to have made investment choices that deviated from the Index. For example, a large portion of holdings were held in US funds, with England and Belgium significantly under-weighted and the Netherlands over-weighted. The portfolio manager also seems to have kept the weights for each country relatively stable over the five-year time period. Notable exceptions are France, which had relatively large swings from one year to the next, England, whose weighting was progressively increased over the time period, and Norway and the U.S. whose weightings were decreased. Because the portfolio manager did not hedge foreign exchange exposure, the currency weight patterns are identical to the market weights. If the currency weights had been different, another table giving the details for currency weights would have been provided.

Tables 10 and 11 use the information from the previous tables to show the overall performance and attribution results of the foreign equity portfolio on a component and country-by-country basis. Tables 10 and 11 could be presented as a report to fund sponsors, allowing them to easily identify the areas of under- and over-performance of the fund. The other supporting tables could then be used to add depth for the areas of interest.

Table 10 describes the market performance for the European equity portfolio by attributing it into the returns obtained by the FT Europe Index and the value added by the portfolio manager for the market, security and currency selection components. With a return of 20.78% for the portfolio over the five years, 0.88% below the benchmark FT Europe Index, the portfolio manager does not seem to have met the goal of exceeding the FT Europe Index by 50 basis points. However, the value-added by the portfolio manager was not consistent over the time period and ranged from a high of 5.38% to a low of -10.21%. Only in three of the five years reviewed did the portfolio manager exceed the 50 basis point target. Closer inspection of the table does not show consistency in value-added performance for market or security selection, although the portfolio manager seems to have been skilled at security selection. Since the currency component of the portfolio was not actively managed, the value-added numbers

represent the performance due to currency with weights identical to the market weights. If the portfolio manager had chosen the same market weights as the benchmark index, the currency value-added to performance would have been zero.

The performance information is presented another way in Table 11, which separates value-added performance by country. Again, the portfolio manager did not achieve consistently superior returns for any one country, although he seems to have obtained relatively favourable returns for Germany and Italy, and negative returns for the U.S. and England. Germany had the largest range of returns, with a low of -4.06% and a high of 9.12%. Table 11 should be used in conjunction with Table 10 for the information to be even more meaningful. The outstanding performance achieved in Year 1, for example, can be quickly traced to good security selection in France and Germany for that year. Table 8 could also be consulted to confirm these conclusions if necessary.

To measure the amount of skill or special insight of the manager, the information ratio was calculated on the base-currency returns for the portfolio and the Index. The ratio was annualised using the four different methods described by Goodwin and all yielded similar results. Because of this, only the arithmetic method will be described below because it is the easiest to calculate and approximates the other methods closely. The prefix *A* is added to the terms to differentiate arithmetic from the simple ratio terms. For a portfolio with monthly returns over five years:

$$\overline{AER} = 12 * \overline{ER}$$

and

$$\hat{\sigma}_{AER} = \sqrt{12} * \hat{\sigma}_{ER}$$

therefore:

$$AIR = \frac{\overline{AER}}{\hat{\sigma}_{AER}} = \frac{12 * \overline{ER}}{\sqrt{12} * \hat{\sigma}_{ER}} = \sqrt{12} * IR$$

and

$$t - Statistic = \sqrt{60} * IR$$

The arithmetic information ratio was calculated to be -0.21 and had a t-statistic of -1.65 which is well below the 95 percent critical value of 1.645 with 59 degrees of freedom, indicating no statistical significance. The portfolio manager does not seem to have exhibited special skill or knowledge that would have enabled him to outperform the benchmark.

The Henriksson-Merton test for market timing ability was applied for each country over the five-year time-period, with the results presented in Table 12. Austria, Ireland and the US are not included in the table as Austria and Ireland were not held by the fund, and the Index had no US investments, making the issue of market timing irrelevant for these countries. The sum of $p_1(t)$ *and* $p_2(t)$ does not exceed one for any of the countries, although France and the Netherlands seem to have achieved stronger results that the other countries. Confidence levels calculated for each p-statistic were not statistically significant, indicating no market timing ability on the part of the portfolio manager. These results are consistent with the performance attribution returns obtained with the Karnosky and Singer framework which also indicate that the portfolio manager's market or country selection abilities added negatively to the portfolio's returns.

After having examined the portfolio manager's returns, it is important to determine if the level of risk in the portfolio was similar to that of the FT Europe Index. Figure 4 graphs the rate of return distribution for the Index and the Fund. A cursory look at this graph shows that both the portfolio and the Index have rate of return distributions that seem to follow a normal distribution, with the portfolio having more data points near the mean.

Table 13 lists a variety of summary statistics for the FT Europe Index and the portfolio. It is important to notice that the two sets of data approach the normal distribution, but not quite. For data to be normally distributed, kurtosis and skewness would have to approach zero, with the mean, median and mode equal to the same value. The statistics indicate that although the portfolio has a lower mean than the Index, it has a lower standard deviation of returns, but with lower kurtosis and similar skewness. Both funds have the same frequency of positive returns, with the portfolio having a higher minimum return attained. Expected loss is calculated by multiplying the frequency of negative returns by the minimum return. In this analysis, the

portfolio has a higher expected loss. The sum of all losses is very similar for both funds, but the Index has a higher maximum return and sum of all gains. What these statistics seem to indicate is that the portfolio has a narrower distribution of returns and was less volatile than the Index.

Portfolio Performance Summary

The portfolio manager does not seem to have achieved his target of outperforming the FT Europe Index by 50 basis points. Karnosky and Singer's framework showed that value-added returns earned by the portfolio manager were erratic from year to year, with the portfolio manager demonstrating poor market selection and weak security selection skills. The portfolio manager seems to have had positive security selection only in Germany and Italy. The US cash holdings weighted down the returns for the portfolio by 1.41% over the five-year period. The information ratio as defined by Goodwin also found that the portfolio manager exhibited no special skills or knowledge that would have enabled him to outperform the benchmark. Finally, the results for the Henriksson-Merton test for market timing ability did not seem to indicate market timing ability on the part of the portfolio manager. These findings are consistent with the Vos framework for risk measurement of the portfolio, which found that the portfolio's average monthly return was below that of the benchmark.

Plan sponsors interested in further enhancing the performance of this portfolio could investigate the causes for the return disparities and fluctuations obtained in some of the countries, particularly Germany, France, England, Italy and the United States. If it is found that the portfolio manager is more skilled in certain countries, and relatively weak in others, then remedial measures could be instituted such as limiting the portfolio manager only to the countries in which the portfolio manager excels.

Limitations of the Study

Karnosky and Singer's framework rely on a passive index to evaluate the returns achieved with active management. The passive index, or benchmark, used should closely reflect the investment goals and policies of the portfolio as was discussed in a previous section of this paper. Finding an appropriate benchmark is fairly straightforward in developed economies, but can become next to impossible in undeveloped and emerging countries. Much of the latest research on international performance measurement focuses on this topic. For this reason, the framework used in this paper was designed for measuring the performance of portfolios invested in countries with known benchmark indices only.

Risk analysis done on the international equity portfolio is generally done at the quantitative level. It does not usually incorporate qualitative risk considerations such as sovereign or country-specific risks. These risks are assumed to have been incorporated into the Eurodeposit and currency returns of each country by the markets. More research would be needed to determine if country credit ratings by recognized rating agencies such as Standard and Poor's could be used to translate qualitative ratings into quantitative data which could be incorporated into a performance attribution framework.

At the data level, timing of intramonth changes in strategies was ignored and beginning-of-month weights were used to reflect asset allocations throughout the month. This may result in performance statistics that are not completely accurate, but for the purposes of this paper, it is assumed that any differences would be slight. Also, using average weights and returns across multiple valuation periods can be misleading by masking active market and currency changes that occurred during the period. Karnosky and Singer point out that these average weights and returns should be viewed only as rough indications of portfolio strategy during the period, becoming more tenuous as the attribution horizon lengthens.

Using time-weighted data creates returns that are end-date sensitive. More data would have been necessary to test the sensitivity of the time period used. Also, the attribution could have been done for shorter time periods, such as quarterly or monthly, instead of on a yearly basis. This would have added even more depth to the performance analysis, but the primary

purpose of this paper was only to demonstrate a workable attribution framework.

The data supplied by State Street was for a one-manager European equity portfolio. The performance attribution framework used in this paper could have been applied to an even greater level of complexity, such as multiple managers, asset classes and hedging and derivative instruments. Also, the study was done for a five-year period, which may not be long enough to evaluate the returns of countries whose economic cycles happen to be longer than five years.

Conclusion and Suggestions for Future Research

This research paper set out to develop a workable, intuitive and useful performance attribution and risk measurement framework for international equity portfolios. Karnosky and Singer's 1994 international performance attribution framework was used to evaluate the performance of a European equity portfolio at a market, currency and security level. Vos' 1997 risk measurement framework was adapted to provide information on the overall level of risk of the portfolio. The results yielded valuable information which could be used by plan sponsors to further improve upon the overall performance of the portfolio.

An extensive literature review revealed that there is still much to be done on this topic which is still in its infancy. More guidance is needed on the design of benchmarks for undeveloped and emerging countries. Without good indices or benchmarks with which to compare the performance of international equity portfolios, the frameworks discussed in this paper cannot be used with reliability.

Also, more complex data incorporating various hedging and derivative strategies as well as multiple managers and asset classes could be obtained to create an even more informative performance attribution and risk measurement framework. It might also be of interest to investigate the performance and risk of the portfolio at the security level for each country to identify if the portfolio manager is obtaining higher returns by investing in higher yielding but higher risk securities than the index.

Work could also be done to improve upon the risk measurement aspect of international equity portfolios. Research on this topic is close to non-existent, and is very much needed in a world where ordinary investors are increasingly diversifying their portfolios globally.

Performance attribution in international equity portfolios is a relevant, timely and necessary issue which should be addressed by plan sponsors and serious investors of international equity funds. The wide availability of international equity funds and fund managers creates a need for evaluating the performance of these funds in an intelligent and appropriate way which distinguishes between funds with different missions and investment policies and practices. As interest in globally diversified portfolios continues to increase, performance

attribution and risk measurement practices for these portfolios are sure to become even more refined.

Figure 1: Henriksson-Merton Test for Market timing Ability

A) Contingency Table

		Actual Returns: $R^*(t) \geq R(t)$	Actual Returns: $R^*(t) < R(t)$	
Predicted returns	$R^*(t) \geq R(t)$	$p_{11}(t)$	$p_{12}(t)$	$p_{1.}(t)$
	$R^*(t) < R(t)$	$p_{21}(t)$	$p_{22}(t)$	$1-p_{1.}(t)$
		$p_{.1}(t)$	$1-p_{.1}(t)$	

$$p_1(t) = \frac{p_{11}(t)}{p_{.1}(t)}$$

$$p_2(t) = \frac{p_{22}(t)}{1 - p_{.1}(t)}$$

If $p_1(t) + p_2(t) > 1$, market timing ability seems to have been demonstrated.

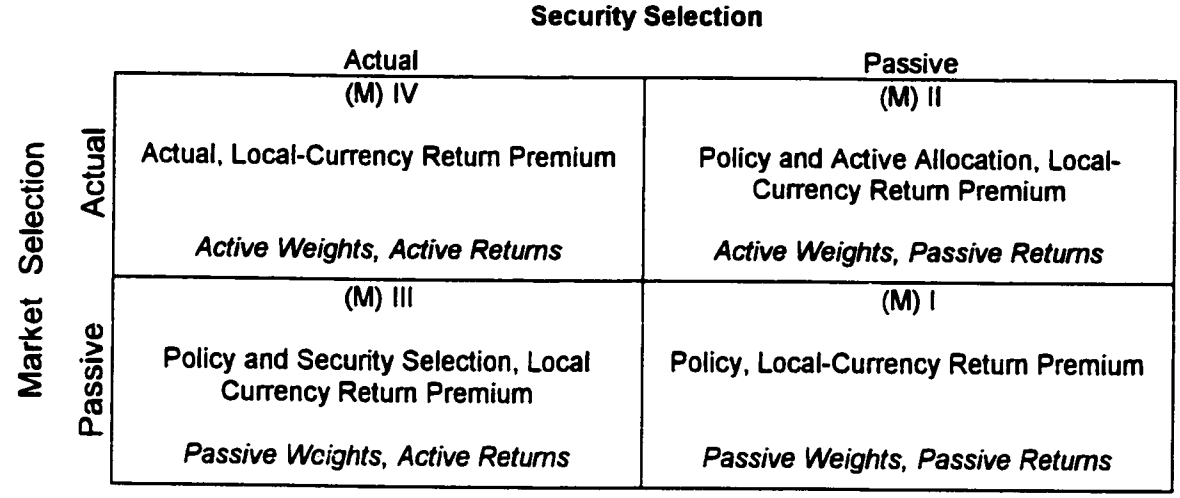
$R^*(t)$ = return on first instrument over time t,
$R(t)$ = return on second instrument over time t,
$p_{ij}(t)$ = joint probability than an observation will belong to the ith row and jth column
$p_{i.}(t)$ = marginal probability that an observation will belong to the ith row
$p_{.j}(t)$ = marginal probability that an observation will belong to the jth column
$p_1(t)$ = probability of a correct forecast given $R^*(t) \geq R(t)$
$p_2(t)$ = probability of a correct forecast given $R^*(t) < R(t)$

B) Implementation Using Number of Outcomes

		Actual Returns: $R^*(t) \geq R(t)$	Actual Returns: $R^*(t) < R(t)$
Predicted returns	$R^*(t) \geq R(t)$	n_1	$N_2 - n_2$
	$R^*(t) < R(t)$	$N_1 - n_1$	n_2
	Totals	N_1	N_2

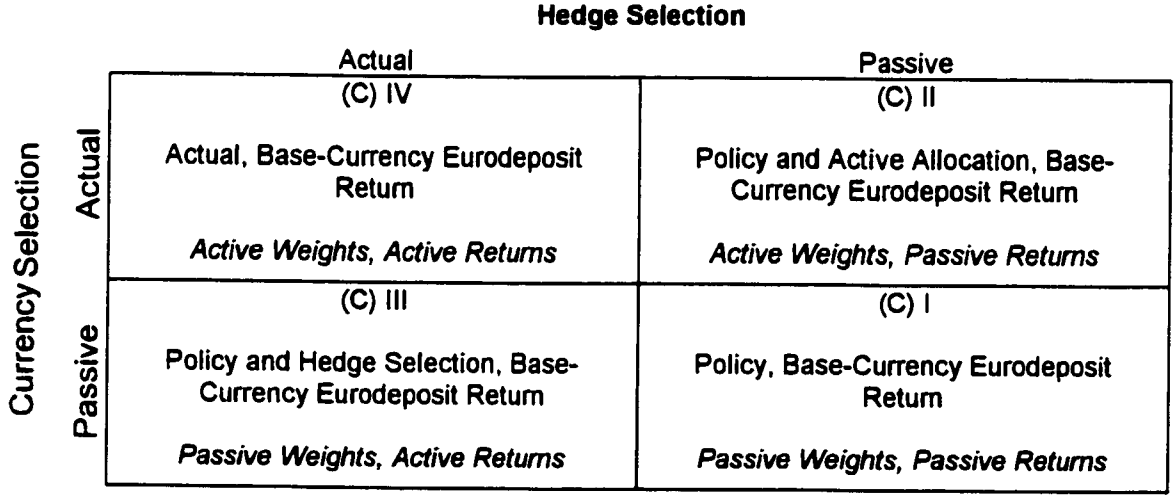
N_1 = number of outcomes with $R^*(t) \geq R(t)$
N_2 = number of outcomes with $R^*(t) < R(t)$
n_1 = number of correct forecasts that $R^*(t) \geq R(t)$
n_2 = number of correct forecasts that $R^*(t) < R(t)$

Figure 2: Framework for Global Portfolio Return Attribution



Active market returns ascribable to:

Market selection	M (II) - M (I)
Security selection	M (III) - M (I)
Other	M (IV) - M (III) - M (II) + (M) I
Total	M (IV) - M (I)



Active currency returns ascribable to:

Currency selection	C (II) - C (I)
Hedge selection	C (III) - C (I)
Other	C (IV) - C (III) - C (II) + (C) I
Total	C (IV) - C (I)

Figure 3: Example Calculation of Market, Security and Currency Attribution Components

1. Active market selection
   M(II) - M(I)

$$\sum_i \left\{ w_i - \bar{w}_i \right] \left[(\bar{r}_i - \bar{c}_i) - RP \right\} + \sum_i \left\{ v_i - \bar{v}_i \right] \left[(\bar{k}_i - \bar{c}_i) - RP \right\}$$
$$= [(0.00\% - 0.56\%)][(11.71\% - 4.97\%) - 17.04\%] + 0$$
$$= 0.06\%$$

2. Security selection
   M(III) - M(I)

$$\sum_i \left[\bar{w}_i (r_i - \bar{r}_i) \right] + \sum_i \left[\bar{v}_i (k_i - \bar{c}_i) \right]$$
$$= 0.56\%(0.00\% - 11.71\%)$$
$$= -0.07\%$$

3. Market cross-product
   M(IV) - M(III) - M(II) + M(I)

$$\sum_i \left[(w_i - \bar{w}_i)(r_i - \bar{r}_i) \right] + \sum_i \left[(v_i - \bar{v}_i)(k_i - \bar{c}_i) \right]$$
$$= (0.00\% - 0.56\%)(0.00\% - 11.71\%)$$
$$= 0.07\%$$

2M Modified security selection
   (combines security selection and market cross-product terms)
   M(IV) - M(II)

$$\sum_i \left[w_i (r_i - \bar{r}_i) \right] + \sum_i \left[v_i (k_i - \bar{c}_i) \right]$$
$$= 0.00\%(0.00\% - 11.71\%) + 0$$
$$= 0.00\%$$

4. Market total
   M(IV) - M(I)

$$\sum_i \left\{ w_i (r_i - \bar{c}_i) + v_i (k_i - \bar{c}_i) \right] - \left[\bar{w}_i (\bar{r}_i - \bar{c}_i) \right] + \left[RP(\bar{w}_i - w_i) \right\}$$
$$= 0 - [0.56\%(11.71\% - 4.97\%)] + [17.04\%(0.56\% - 0.00\%)]$$
$$= 0.06\%$$

5. Active currency selection
   C(II) - C(I)

$$\sum_i \left\{ (w_i + v_i + h_i) - (\bar{w}_i + \bar{v}_i + \bar{h}_i) \right] \left[(\bar{c}_i + \bar{\varepsilon}_i) - C \right\}$$
$$= (0.00\% - 0.56\%)(4.97\% - 2.02\% - 4.62\%)$$
$$= 0.01\%$$

6. Hedge selection
   C(III) - C(I)

Since $(c_i - \bar{c}_i) = 0$, this equation is not used.

7. Currency cross-product
   C(IV) - C(III) - C(II) + C(I)

Since $(c_i - \bar{c}_i) = 0$, this equation is not used.

8. Currency total
   C(IV) - C(I)

Since equations 6 and 7 equal zero, same result as for equation 5.

Figure 4: Rate of Return Distributions (CDN $ Base IRR) October 1992 to September 1997

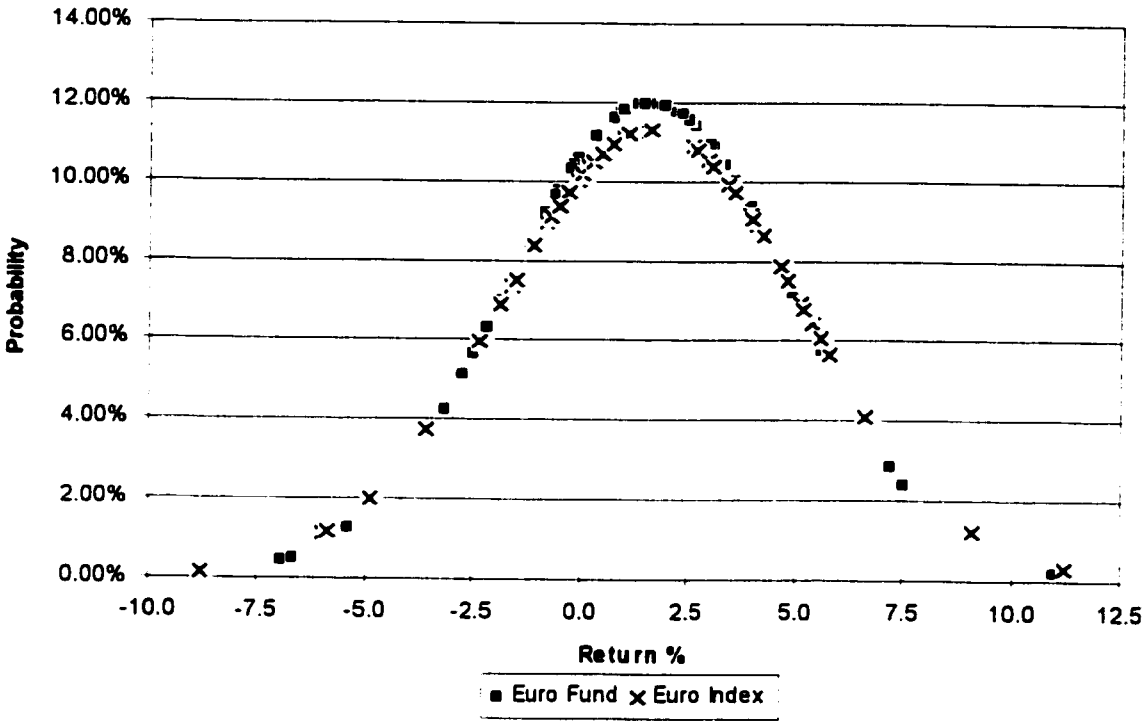


Table 1: 1996 World Stock Market Capitalisation

Country	Capitalisation (Millions)	Percentage of World Capitalisation
United States	$8,484,433	42.0%
Japan	$3,068,850	15.2%
United Kingdom	$1,740,246	8.6%
Germany	$670,997	3.3%
France	$591,123	2.9%
Canada	$486,268	2.4%
Hong Kong	$449,381	2.2%
Switzerland	$402,104	2.0%
Netherlands	$378,721	1.9%
Australia	$311,988	1.5%
All other stock markets	$3,593,551	17.8%
World	**$20,177,662**	**100.0%**

Source: International Monetary Fund's Emerging Markets 1996 Yearbook

Table 2: Rate of Return Information from October 1992 to September 1997

	Cash		Passive Returns					Actual Returns				
Country	Exchange Rate Return (vs CDN $)	Eurodeposit Return (Local)	Return on the Index (Local)	Return on the Index (CDN $)	Market Return Premium (Local)	Eurodeposit Return (CDN $)	Index Weights %	Return on the Fund (Local)	Return on the Fund (CDN $)	Market Return Premium (Local)	Eurodeposit Return (CDN $)	Fund Weights %
	A	B	C	= A + C	= C - B	= A + B		D	= A + D	= D - B	= A + B	
Austria	-2.02%	4.97%	11.71%	9.69%	6.74%	2.94%	0.56%	0.00%	-2.02%	-4.97%	2.94%	0.00%
Belgium	-2.88%	5.49%	21.48%	18.60%	16.00%	2.60%	2.63%	-3.13%	-6.01%	-8.61%	2.60%	0.06%
Switzerland	-1.24%	3.45%	26.91%	25.68%	23.47%	2.21%	9.45%	29.40%	28.16%	25.96%	2.21%	8.87%
Germany	-2.38%	5.16%	22.81%	20.43%	17.65%	2.78%	13.63%	31.63%	29.25%	26.47%	2.78%	12.80%
Denmark	-0.76%	7.42%	19.97%	19.21%	12.56%	6.66%	1.32%	10.02%	9.26%	2.60%	6.66%	1.27%
Spain	-5.97%	9.34%	33.52%	27.55%	24.18%	3.37%	3.74%	31.39%	25.42%	22.05%	3.37%	3.74%
Finland	-1.33%	5.51%	48.24%	46.92%	42.73%	4.19%	0.96%	27.02%	25.70%	21.51%	4.19%	0.61%
France	-1.82%	6.23%	16.59%	14.77%	10.36%	4.41%	12.82%	13.76%	11.94%	7.53%	4.41%	13.41%
England	0.16%	6.34%	19.93%	20.09%	13.59%	6.50%	37.40%	17.85%	18.01%	11.51%	6.50%	33.84%
Ireland	-2.80%	8.28%	31.82%	29.02%	23.53%	5.49%	0.60%	0.00%	-2.80%	-8.28%	5.49%	0.00%
Italy	-4.26%	9.76%	27.40%	23.15%	17.64%	5.51%	4.92%	49.63%	45.38%	39.87%	5.51%	3.13%
Netherlands	-1.67%	4.90%	28.62%	26.95%	23.72%	3.23%	7.35%	27.67%	26.00%	22.77%	3.23%	9.62%
Norway	-2.15%	6.19%	26.88%	24.73%	20.69%	4.04%	0.63%	15.86%	13.71%	9.67%	4.04%	1.47%
Sweden	-4.52%	7.80%	37.51%	32.98%	29.71%	3.28%	3.99%	40.84%	36.31%	33.03%	3.28%	3.28%
US Cash	2.90%	4.97%	4.97%	7.88%	0.00%	7.88%	0.00%	0.88%	3.79%	-4.09%	7.88%	7.89%
TOTAL	**-1.49%**	**6.11%**	**23.15%**	**21.66%**	**17.04%**	**4.62%**	**100.00%**	**21.87%**	**20.78%**	**15.92%**	**4.85%**	**100.00%**

Table 3: Rate of Return Information for Year 1 (October 1992 to September 1993)

	Cash		Passive Returns					Actual Returns				
Country	Exchange Rate Return (vs CDN $)	Eurodeposit Return (Local)	Return on the Index (Local)	Return on the Index (CDN $)	Market Return Premium (Local)	Eurodeposit Return (CDN $)	Index Weights %	Return on the Fund (Local)	Return on the Fund (CDN $)	Market Return Premium (Local)	Eurodeposit Return (CDN $)	Fund Weights %
	A	B	C	= A + C	= C - B	= A + B		D	= A + D	= D - B	= A + B	
Austria	-7.24%	8.01%	23.71%	16.47%	15.70%	0.78%	0.55%	0.00%	-7.24%	-8.01%	0.78%	0.00%
Belgium	-11.60%	9.06%	25.76%	14.15%	16.69%	-2.54%	2.80%	-14.68%	-26.28%	-23.74%	-2.54%	0.29%
Switzerland	-7.73%	5.68%	34.71%	26.99%	29.03%	-2.04%	8.22%	46.03%	38.31%	40.35%	-2.04%	6.04%
Germany	-7.73%	8.36%	31.61%	23.88%	23.25%	0.63%	13.67%	63.76%	56.04%	55.41%	0.63%	10.61%
Denmark	-11.12%	15.86%	34.66%	23.55%	18.80%	4.74%	1.33%	14.48%	3.37%	-1.38%	4.74%	0.98%
Spain	-19.45%	14.52%	60.06%	40.61%	45.54%	-4.93%	3.64%	44.58%	25.13%	30.06%	-4.93%	1.80%
Finland	-17.80%	9.14%	145.74%	127.94%	136.61%	-8.66%	0.46%	38.87%	21.07%	29.74%	-8.66%	0.49%
France	-10.22%	10.49%	28.39%	18.17%	17.90%	0.27%	13.41%	67.40%	57.19%	56.92%	0.27%	13.55%
England	-10.32%	6.68%	27.70%	17.38%	21.02%	-3.64%	40.78%	28.06%	17.74%	21.38%	-3.64%	32.29%
Ireland	-17.48%	17.91%	54.92%	37.44%	37.00%	0.44%	0.51%	0.00%	-17.48%	-17.91%	0.44%	0.00%
Italy	-16.67%	12.43%	88.54%	71.87%	76.10%	-4.23%	4.75%	152.05%	135.39%	139.62%	-4.23%	1.89%
Netherlands	-7.27%	7.94%	30.56%	23.29%	22.62%	0.67%	6.41%	23.34%	16.06%	15.39%	0.67%	8.59%
Norway	-13.93%	10.67%	46.08%	32.15%	35.41%	-3.27%	0.35%	58.79%	44.66%	48.13%	-3.27%	3.44%
Sweden	-29.88%	10.82%	78.68%	48.80%	67.85%	-19.06%	3.12%	61.92%	32.04%	51.10%	-19.06%	3.40%
US Cash	6.62%	3.26%	3.26%	9.89%	0.00%	9.89%	0.00%	0.42%	7.05%	-2.84%	9.89%	16.63%
TOTAL	**-10.90%**	**8.38%**	**35.51%**	**24.61%**	**27.13%**	**-2.52%**	**100.00%**	**37.90%**	**29.99%**	**30.42%**	**-0.43%**	**100.00%**

Table 4: Rate of Return Information for Year 2 (October 1993 to September 1994)

	Cash		Passive Returns					Actual Returns				
Country	Exchange Rate Return (vs CDN $)	Eurodeposit Return (Local)	Return on the Index (Local)	Return on the Index (CDN $)	Market Return Premium (Local)	Eurodeposit Return (CDN $)	Index Weights %	Return on the Fund (Local)	Return on the Fund (CDN $)	Market Return Premium (Local)	Eurodeposit Return (CDN $)	Fund Weights %
	A	B	C	= A + C	= C - B	= A + B		D	= A + D	= D - B	= A + B	
Austria	7.47%	5.61%	4.67%	12.14%	-0.95%	13.09%	0.55%	0.00%	7.47%	-5.61%	13.09%	0.00%
Belgium	8.26%	6.48%	8.70%	16.96%	2.22%	14.74%	2.64%	0.00%	8.26%	-6.48%	14.74%	0.00%
Switzerland	11.40%	4.39%	6.08%	17.47%	1.69%	15.79%	9.15%	9.11%	20.51%	4.72%	15.79%	7.38%
Germany	6.12%	5.83%	4.78%	10.90%	-1.05%	11.95%	13.76%	72.03%	78.14%	66.20%	11.95%	13.56%
Denmark	8.79%	7.01%	1.73%	10.52%	-5.29%	15.80%	1.39%	-2.09%	6.70%	-9.10%	15.80%	1.00%
Spain	2.70%	8.61%	3.34%	6.04%	-5.27%	11.31%	3.69%	4.61%	7.31%	-4.00%	11.31%	3.36%
Finland	20.07%	5.57%	36.56%	56.63%	30.99%	25.64%	0.88%	-3.28%	16.79%	-8.85%	25.64%	0.78%
France	10.44%	6.24%	-5.49%	4.95%	-11.72%	16.68%	13.23%	-36.32%	-25.88%	-42.56%	16.68%	15.34%
England	6.46%	5.43%	3.02%	9.47%	-2.42%	11.89%	37.99%	8.32%	14.78%	2.89%	11.89%	32.79%
Ireland	9.20%	6.10%	16.11%	25.30%	10.01%	15.30%	0.55%	0.00%	9.20%	-6.10%	15.30%	0.00%
Italy	2.35%	8.75%	13.94%	16.29%	5.19%	11.10%	5.36%	6.14%	8.49%	-2.61%	11.10%	3.92%
Netherlands	10.08%	5.53%	7.12%	17.20%	1.59%	15.61%	7.11%	12.28%	22.36%	6.75%	15.61%	7.92%
Norway	5.63%	5.66%	11.50%	17.13%	5.85%	11.28%	0.41%	19.23%	24.86%	13.57%	11.28%	2.32%
Sweden	8.70%	7.75%	9.60%	18.30%	1.85%	16.45%	3.28%	-3.53%	5.17%	-11.27%	16.45%	2.54%
US Cash	-0.28%	4.06%	4.06%	3.77%	0.00%	3.77%	0.00%	-1.13%	-1.42%	-5.19%	3.77%	9.07%
TOTAL	**7.68%**	**5.93%**	**4.06%**	**11.64%**	**-1.87%**	**13.51%**	**100.00%**	**9.17%**	**16.11%**	**3.43%**	**12.68%**	**100.00%**

Table 5: Rate of Return Information for Year 3 (October 1994 to September 1995)

	Cash		Passive Returns					Actual Returns				
Country	Exchange Rate Return (vs CDN $)	Eurodeposit Return (Local)	Return on the Index (Local)	Return on the Index (CDN $)	Market Return Premium (Local)	Eurodeposit Return (CDN $)	Index Weights %	Return on the Fund (Local)	Return on the Fund (CDN $)	Market Return Premium (Local)	Eurodeposit Return (CDN $)	Fund Weights %
	A	B	C	= A + C	= C - B	= A + B		D	= A + D	= D - B	= A + B	
Austria	9.54%	4.75%	-9.04%	0.50%	-13.79%	14.29%	0.57%	0.00%	9.54%	-4.75%	14.29%	0.00%
Belgium	9.70%	5.09%	13.21%	22.91%	8.12%	14.79%	2.65%	0.00%	9.70%	-5.09%	14.79%	0.00%
Switzerland	12.57%	3.44%	20.99%	33.56%	17.54%	16.01%	9.47%	21.85%	34.43%	18.41%	16.01%	9.14%
Germany	9.49%	4.85%	8.08%	17.57%	3.23%	14.35%	13.63%	-0.57%	8.93%	-5.42%	14.35%	15.36%
Denmark	10.89%	6.48%	3.55%	14.44%	-2.93%	17.37%	1.37%	18.64%	29.53%	12.17%	17.37%	1.13%
Spain	4.82%	9.13%	8.67%	13.49%	-0.46%	13.95%	3.71%	16.81%	21.63%	7.69%	13.95%	4.62%
Finland	14.60%	5.84%	31.40%	46.00%	25.56%	20.44%	1.23%	36.69%	51.29%	30.85%	20.44%	0.19%
France	8.28%	6.67%	-0.01%	8.26%	-6.69%	14.95%	13.27%	-13.19%	-4.92%	-19.87%	14.95%	6.99%
England	0.81%	6.56%	20.23%	21.04%	13.67%	7.37%	36.18%	20.84%	21.64%	14.28%	7.37%	33.45%
Ireland	4.29%	6.25%	21.40%	25.69%	15.15%	10.54%	0.62%	0.00%	4.29%	-6.25%	10.54%	0.00%
Italy	-1.63%	10.12%	-5.61%	-7.24%	-15.73%	8.49%	5.11%	5.66%	4.02%	-4.46%	8.49%	3.43%
Netherlands	9.56%	4.73%	17.52%	27.08%	12.79%	14.29%	7.48%	20.20%	29.77%	15.48%	14.29%	9.21%
Norway	8.96%	5.71%	13.94%	22.91%	8.24%	14.67%	0.70%	5.39%	14.36%	-0.31%	14.67%	1.10%
Sweden	10.98%	8.65%	33.15%	44.12%	24.50%	19.62%	4.01%	40.00%	50.98%	31.36%	19.62%	3.56%
US Cash	11.86%	6.12%	6.12%	17.99%	0.00%	17.99%	0.00%	0.01%	11.87%	-6.12%	17.99%	11.80%
TOTAL	**5.86%**	**6.20%**	**14.04%**	**19.90%**	**7.84%**	**12.06%**	**100.00%**	**12.56%**	**19.10%**	**6.45%**	**12.65%**	**100.00%**

Table 6: Rate of Return Information for Year 4 (October 1995 to September 1996)

	Cash		Passive Returns					Actual Returns				
Country	Exchange Rate Return (vs CDN $)	Eurodeposit Return (Local)	Return on the Index (Local)	Return on the Index (CDN $)	Market Return Premium (Local)	Eurodeposit Return (CDN $)	Index Weights %	Return on the Fund (Local)	Return on the Fund (CDN $)	Market Return Premium (Local)	Eurodeposit Return (CDN $)	Fund Weights %
	A	B	C	= A + C	= C - B	= A + B		D	= A + D	= D - B	= A + B	
Austria	-5.63%	3.36%	7.98%	2.35%	4.63%	-2.28%	0.60%	0.00%	-5.63%	-3.36%	-2.28%	0.00%
Belgium	-5.86%	3.50%	23.61%	17.76%	20.11%	-2.36%	2.60%	0.00%	-5.86%	-3.50%	-2.36%	0.00%
Switzerland	-7.31%	2.10%	25.51%	18.20%	23.41%	-5.21%	10.60%	23.19%	15.87%	21.08%	-5.21%	11.96%
Germany	-5.67%	3.59%	21.46%	15.79%	17.87%	-2.08%	13.52%	17.61%	11.95%	14.03%	-2.08%	12.63%
Denmark	1.55%	4.49%	15.08%	16.63%	10.59%	6.04%	1.26%	-13.96%	-12.40%	-18.45%	6.04%	1.24%
Spain	-3.00%	8.57%	29.64%	26.64%	21.07%	5.56%	3.77%	33.47%	30.46%	24.90%	5.56%	4.86%
Finland	-5.69%	4.05%	-11.91%	-17.61%	-15.96%	-1.64%	1.02%	-25.27%	-30.96%	-29.32%	-1.64%	0.84%
France	-3.80%	4.47%	23.97%	20.18%	19.50%	0.67%	12.58%	43.53%	39.73%	39.06%	0.67%	13.35%
England	-0.12%	6.37%	17.09%	16.97%	10.72%	6.25%	35.59%	14.19%	14.07%	7.82%	6.25%	33.62%
Ireland	0.10%	5.54%	27.02%	27.12%	21.48%	5.64%	0.66%	0.00%	0.10%	-5.54%	5.64%	0.00%
Italy	7.10%	10.06%	0.60%	7.70%	-9.45%	17.16%	4.65%	31.80%	38.90%	21.74%	17.16%	3.52%
Netherlands	-5.83%	3.17%	29.56%	23.73%	26.38%	-2.65%	7.77%	38.99%	33.16%	35.81%	-2.65%	11.89%
Norway	-2.68%	5.23%	12.67%	9.99%	7.44%	2.54%	0.82%	4.60%	1.92%	-0.62%	2.54%	0.48%
Sweden	5.79%	7.46%	15.36%	21.15%	7.90%	13.25%	4.55%	25.48%	31.26%	18.01%	13.25%	3.73%
US Cash	-2.96%	5.70%	5.70%	2.73%	0.00%	2.73%	0.00%	0.80%	-2.16%	-4.89%	2.73%	1.90%
TOTAL	**-2.28%**	**5.20%**	**19.86%**	**17.58%**	**14.66%**	**2.92%**	**100.00%**	**23.56%**	**20.95%**	**18.47%**	**2.48%**	**100.00%**

Table 7: Rate of Return Information for Year 5 (October 1996 to September 1997)

	Cash		Passive Returns					Actual Returns				
Country	Exchange Rate Return (vs CDN $)	Eurodeposit Return (Local)	Return on the Index (Local)	Return on the Index (CDN $)	Market Return Premium (Local)	Eurodeposit Return (CDN $)	Index Weights %	Return on the Fund (Local)	Return on the Fund (CDN $)	Market Return Premium (Local)	Eurodeposit Return (CDN $)	Fund Weights %
	A	B	C	= A + C	= C - B	= A + B		D	= A + D	= D - B	= A + B	
Austria	-12.38%	3.17%	36.78%	24.40%	33.61%	-9.21%	0.53%	0.00%	-12.38%	-3.17%	-9.21%	0.00%
Belgium	-12.59%	3.41%	38.32%	25.73%	34.91%	-9.18%	2.48%	0.00%	-12.59%	-3.41%	-9.18%	0.00%
Switzerland	-12.39%	1.66%	51.74%	39.35%	50.08%	-10.73%	9.79%	51.70%	39.31%	50.03%	-10.73%	9.86%
Germany	-12.34%	3.27%	54.32%	41.98%	51.05%	-9.07%	13.60%	19.93%	7.59%	16.66%	-9.07%	11.83%
Denmark	-11.60%	3.67%	52.27%	40.67%	48.60%	-7.93%	1.24%	40.86%	29.26%	37.19%	-7.93%	2.01%
Spain	-12.61%	6.04%	82.11%	69.50%	76.07%	-6.57%	3.86%	66.04%	53.43%	60.00%	-6.57%	4.07%
Finland	-12.31%	3.08%	84.33%	72.02%	81.24%	-9.22%	1.19%	141.05%	128.74%	137.96%	-9.22%	0.75%
France	-11.69%	3.42%	43.24%	31.55%	39.81%	-8.27%	11.59%	43.47%	31.78%	40.05%	-8.27%	17.80%
England	4.88%	6.67%	33.96%	38.84%	27.29%	11.56%	36.48%	18.76%	23.65%	12.09%	11.56%	37.02%
Ireland	-7.76%	6.13%	43.48%	35.72%	37.34%	-1.63%	0.69%	0.00%	-7.76%	-6.13%	-1.63%	0.00%
Italy	-10.46%	7.51%	64.54%	54.08%	57.03%	-2.95%	4.73%	101.35%	90.89%	93.84%	-2.95%	2.91%
Netherlands	-12.72%	3.20%	65.33%	52.61%	62.13%	-9.52%	7.98%	46.63%	33.91%	43.44%	-9.52%	10.51%
Norway	-6.94%	3.80%	57.25%	50.31%	53.45%	-3.14%	0.88%	0.00%	-6.94%	-3.80%	-3.14%	0.00%
Sweden	-11.33%	4.43%	63.44%	52.11%	59.02%	-6.91%	4.97%	101.91%	90.58%	97.49%	-6.91%	3.19%
US Cash	-0.02%	5.75%	5.75%	5.73%	0.00%	5.73%	0.00%	4.39%	4.37%	-1.36%	5.73%	0.04%
TOTAL	**-5.80%**	**4.76%**	**48.04%**	**42.23%**	**43.28%**	**-1.05%**	**100.00%**	**37.82%**	**32.02%**	**33.15%**	**-1.12%**	**100.00%**

Table 8: Performance Attribution into Market, Security and Currency Components

Country	Year 1	Year 2	Year 3	Year 4	Year 5	Over 5 years
	Market Selection					
Austria	0.06%	-0.01%	0.12%	0.06%	0.05%	0.06%
Belgium	0.26%	-0.11%	-0.01%	-0.14%	0.21%	0.03%
Switzerland	-0.04%	-0.06%	-0.03%	0.12%	0.00%	-0.04%
Germany	0.12%	0.00%	-0.08%	-0.03%	-0.14%	-0.01%
Denmark	0.03%	0.01%	0.03%	0.00%	0.04%	0.00%
Spain	-0.34%	0.01%	-0.08%	0.07%	0.07%	0.00%
Finland	0.02%	-0.03%	-0.18%	0.05%	-0.17%	-0.09%
France	-0.01%	-0.21%	0.91%	0.04%	-0.22%	-0.04%
England	0.52%	0.03%	-0.16%	0.08%	-0.09%	0.12%
Ireland	-0.05%	-0.07%	-0.05%	-0.04%	0.04%	-0.04%
Italy	-1.40%	-0.10%	0.40%	0.27%	-0.25%	-0.01%
Netherlands	-0.10%	0.03%	0.09%	0.48%	0.48%	0.15%
Norway	0.26%	0.15%	0.00%	0.03%	-0.09%	0.03%
Sweden	0.12%	-0.03%	-0.07%	0.06%	-0.28%	-0.09%
US Cash	-4.51%	0.17%	-0.93%	-0.28%	-0.02%	-1.34%
Total Market Selection	**-5.07%**	**-0.21%**	**-0.04%**	**0.76%**	**-0.35%**	**-1.26%**
	Security Selection					
Austria	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Belgium	-0.12%	0.00%	0.00%	0.00%	0.00%	-0.01%
Switzerland	0.68%	0.22%	0.08%	-0.28%	0.00%	0.22%
Germany	3.41%	9.12%	-1.33%	-0.49%	-4.07%	1.13%
Denmark	-0.20%	-0.04%	0.17%	-0.36%	-0.23%	-0.13%
Spain	-0.28%	0.04%	0.38%	0.19%	-0.65%	-0.08%
Finland	-0.52%	-0.31%	0.01%	-0.11%	0.43%	-0.13%
France	5.29%	-4.73%	-0.92%	2.61%	0.04%	-0.38%
England	0.12%	1.74%	0.20%	-0.97%	-5.63%	-0.70%
Ireland	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Italy	1.20%	-0.31%	0.39%	1.10%	1.07%	0.70%
Netherlands	-0.62%	0.41%	0.25%	1.12%	-1.97%	-0.09%
Norway	0.44%	0.18%	-0.09%	-0.04%	0.00%	-0.16%
Sweden	-0.57%	-0.33%	0.24%	0.38%	1.23%	0.11%
US Cash	-0.47%	-0.47%	-0.72%	-0.09%	0.00%	-0.32%
Total Security Selection	**8.36%**	**5.52%**	**-1.35%**	**3.05%**	**-9.78%**	**0.15%**
	Currency Selection					
Austria	-0.02%	0.00%	-0.01%	0.03%	0.04%	0.01%
Belgium	0.00%	-0.03%	-0.07%	0.14%	0.20%	0.05%
Switzerland	-0.01%	-0.04%	-0.01%	-0.11%	-0.01%	0.01%
Germany	-0.10%	0.00%	0.04%	0.04%	0.14%	0.02%
Denmark	-0.03%	-0.01%	-0.01%	0.00%	-0.05%	0.00%
Spain	0.04%	0.01%	0.02%	0.03%	-0.01%	0.00%
Finland	0.00%	-0.01%	-0.09%	0.01%	0.04%	0.00%
France	0.00%	0.07%	-0.18%	-0.02%	-0.45%	0.00%
England	0.10%	0.08%	0.13%	-0.07%	0.07%	-0.07%
Ireland	-0.02%	-0.01%	0.01%	-0.02%	0.00%	-0.01%
Italy	0.05%	0.03%	0.06%	-0.16%	0.03%	-0.02%
Netherlands	0.07%	0.02%	0.04%	-0.23%	-0.21%	-0.03%
Norway	-0.02%	-0.04%	0.01%	0.00%	0.02%	0.00%
Sweden	-0.05%	-0.02%	-0.03%	-0.09%	0.10%	0.01%
US Cash	2.06%	-0.88%	0.70%	0.00%	0.00%	0.26%
Total Currency Selection	**2.09%**	**-0.84%**	**0.59%**	**-0.44%**	**-0.08%**	**0.23%**

Table 9: Average Market Over- and Under-Weights for the Fund

Country	Year 1	Year 2	Year 3	Year 4	Year 5	Average
Austria	-0.55%	-0.55%	-0.57%	-0.60%	-0.53%	-0.56%
Belgium	-2.50%	-2.64%	-2.65%	-2.60%	-2.48%	-2.57%
Switzerland	-2.19%	-1.77%	-0.34%	1.36%	0.07%	-0.57%
Germany	-3.06%	-0.20%	1.74%	-0.89%	-1.77%	-0.84%
Denmark	-0.35%	-0.38%	-0.24%	-0.02%	0.77%	-0.04%
Spain	-1.85%	-0.34%	0.91%	1.08%	0.21%	0.00%
Finland	0.02%	-0.10%	-1.04%	-0.18%	-0.44%	-0.35%
France	0.14%	2.11%	-6.28%	0.77%	6.21%	0.59%
England	-8.49%	-5.19%	-2.73%	-1.97%	0.54%	-3.57%
Ireland	-0.51%	-0.55%	-0.62%	-0.66%	-0.69%	-0.60%
Italy	-2.86%	-1.44%	-1.68%	-1.13%	-1.82%	-1.79%
Netherlands	2.18%	0.81%	1.74%	4.12%	2.53%	2.28%
Norway	3.09%	1.92%	0.40%	-0.35%	-0.88%	0.84%
Sweden	0.28%	-0.74%	-0.45%	-0.83%	-1.78%	-0.70%
US Cash	16.63%	9.07%	11.80%	1.90%	0.04%	7.89%

Table 10: Portfolio Performance and Attribution Summary (in base CDN dollar terms)

	Year 1	Year 2	Year 3	Year 4	Year 5	5 Years
FT Europe Index	24.61%	11.64%	19.90%	17.58%	42.23%	21.66%
Market Selection	-5.07%	-0.21%	-0.04%	0.76%	-0.35%	-1.26%
Security Selection	8.36%	5.52%	-1.35%	3.05%	-9.78%	0.15%
Currency Selection	2.09%	-0.84%	0.59%	-0.44%	-0.08%	0.23%
Total Value Added	5.38%	4.47%	-0.80%	3.37%	-10.21%	-0.88%
European Equity Portfolio	29.99%	16.11%	19.10%	20.95%	32.02%	20.78%

Table 11: Portfolio Performance and Value-Added by Country (in base CDN dollar terms)

	Year 1	Year 2	Year 3	Year 4	Year 5	5 Years
FT Europe Index	24.61%	11.64%	19.90%	17.58%	42.23%	21.66%
Austria	0.04%	0.00%	0.11%	0.09%	0.10%	0.07%
Belgium	0.14%	-0.14%	-0.08%	0.00%	0.41%	0.06%
Switzerland	0.63%	0.12%	0.03%	-0.27%	-0.01%	0.20%
Germany	3.43%	9.12%	-1.37%	-0.47%	-4.06%	1.14%
Denmark	-0.19%	-0.03%	0.18%	-0.36%	-0.24%	-0.13%
Spain	-0.57%	0.06%	0.32%	0.28%	-0.60%	-0.08%
Finland	-0.50%	-0.36%	-0.26%	-0.05%	0.30%	-0.22%
France	5.28%	-4.87%	-0.19%	2.63%	-0.62%	-0.42%
England	0.73%	1.85%	0.17%	-0.96%	-5.64%	-0.65%
Ireland	-0.07%	-0.08%	-0.04%	-0.06%	0.04%	-0.04%
Italy	-0.15%	-0.37%	0.84%	1.21%	0.86%	0.67%
Netherlands	-0.65%	0.45%	0.37%	1.37%	-1.70%	0.03%
Norway	0.67%	0.28%	-0.08%	-0.01%	-0.07%	-0.14%
Sweden	-0.50%	-0.38%	0.14%	0.35%	1.05%	0.03%
US Cash	-2.92%	-1.18%	-0.95%	-0.37%	-0.02%	-1.41%
Total Value Added	5.38%	4.47%	-0.80%	3.37%	-10.21%	-0.88%
European Equity Portfolio	29.99%	16.11%	19.10%	20.95%	32.02%	20.78%

Table 12: Henriksson-Merton Test for Market Timing

Variable	Belgium	Switzerland	Germany	Denmark	Spain	Finland	France	England	Italy	Netherlands	Norway	Sweden
N_1: $R^* \geq R$	17	29	28	29	32	27	29	24	33	34	23	35
N_2: $R^* < R$	42	30	31	30	27	32	30	35	26	25	36	24
n_1: $R^* \geq R$	1	7	8	6	14	4	16	8	10	16	2	9
n_2: $R^* < R$	7	11	13	5	8	8	12	11	3	11	7	9
$N_1 - n_1$	16	22	20	23	18	23	13	16	23	18	21	26
$N_2 - n_2$	35	19	18	25	19	24	18	24	23	14	29	15
$p_{11}(t)$	1.69%	11.86%	13.56%	10.17%	23.73%	6.78%	27.12%	13.56%	16.95%	27.12%	3.39%	15.25%
$p_{21}(t)$	27.12%	37.29%	33.90%	38.98%	30.51%	38.98%	22.03%	27.12%	38.98%	30.51%	35.59%	44.07%
$p_{12}(t)$	59.32%	32.20%	30.51%	42.37%	32.20%	40.68%	30.51%	40.68%	38.98%	23.73%	49.15%	25.42%
$p_{22}(t)$	11.86%	18.64%	22.03%	8.47%	13.56%	13.56%	20.34%	18.64%	5.08%	18.64%	11.86%	15.25%
$p_1(t)$	5.88%	24.14%	28.57%	20.69%	43.75%	14.81%	55.17%	33.33%	30.30%	47.06%	8.70%	25.71%
$p_2(t)$	16.67%	36.67%	41.94%	16.67%	29.63%	25.00%	40.00%	31.43%	11.54%	44.00%	19.44%	37.50%
$p_1(t) + p_2(t)$	0.23	0.61	0.71	0.37	0.73	0.40	0.95	0.65	0.42	0.91	0.28	0.63
confidence level	0.00%	0.04%	0.51%	0.00%	0.98%	0.00%	26.17%	0.15%	0.00%	17.31%	0.00%	0.09%

Table 13: Summary Statistics of Index and Portfolio (October 1992 to September 1997)

Statistics	FT Europe Index	Portfolio
Average Monthly Return	1.63	1.57
Standard Deviation	3.53	3.32
Kurtosis	1.22	1.01
Skewness	-0.28	-0.29
Frequency Up	73%	72%
Min Return	-8.80	-6.93
Expected Loss	-2.35	-1.96
Sum of all losses	-41.16	-41.05
Max Return	11.19	10.94
1st Quartile	3.93	3.54
Median	1.63	1.75
3rd Quartile	-0.16	-0.20
Sum of all gains	139.02	135.27

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