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THE ROLE OF THE S&P/TSX COMPOSITE INDEX CONSTITUENTS IN TRACKING THE CANADIAN EQUITY MARKET

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Abstract

In this study, we examine whether flexibility in a stock's addition to and deletion from the S&P/TSX Composite Index enhances its ability to act as a performance benchmark and represent the Canadian equity market. In May 2002, the first major change happened to the TSE 300 Index when it was converted to S&P/TSX Composite Index. Consequently, with the new inclusion criteria, the number of the Index's constituents were no longer forced to be exactly 300. This study utilizes data from the 1992-2011 sample period in order to compare the Index's two functions before and after the change.

Our results suggest that the Index's returns better replicate the equity market's returns after May 2002 because the committee was able to add higher performing stocks and delete the poorly performing ones. Furthermore, the Index represents the equity market better after the change mainly due to the higher capitalization of the survived stocks.

Keywords: Index performance, S&P/TSX Composite Index, TSE 300 Index, addition/deletion events

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1. Introduction

1.1. Background and Motivation

The Toronto Stock Exchange 300 Index (TSE 300), launched in January 1977, is a market-value weighted Index comprised of the 300 largest traded stocks selected carefully from the Toronto Stock Exchange based on policies and criteria established by the Index Committee. Major Indices, such as Standard & Poor's 500 (S&P 500) and TSE 300, fulfill several functions, including serving as a performance benchmark and representing the equity market for professional investment managers. In order to act as a suitable performance benchmark, the Index's performance should closely replicate the Canadian equity market performance. In order to represent the Canadian equity market, the TSE 300 needs to capture a high percentage of the market capitalization of the Canadian equity market.

In May 2002, the management of TSE 300 was taken over by Standard & Poor's and TSE 300 was renamed to the S&P/TSX Composite Index. This was the first major change to the TSE 300 since 1977, and the transition was phased in over six months. The TSE 300 Index committee was forced to maintain the number of the Index's constituents at 300 even though there were several small capitalization stocks in the Index. For instance, the bottom 100 stocks of the TSE 300 represented less than 3% of the Index (Bloom & Blackwell, 2002). The main consequences of the change were the implementation of new inclusion criteria and the fact that the Index was no longer required to have exactly 300 constituents[1]. It is one of the few Indices that does not have a fixed number of stocks. Also, additions and deletions changed from occurring on an annual basis to a quarterly basis. As such, from June to December 2002, the

[1] Glenn Doody, director of Canadian index services for Standard & Poor's, said, "The changes will address two main functions of a good benchmark - it must be investable and it must be representative of a fund manager's portfolio. Given that many fund managers limit their investments to companies in the top two-thirds of the Index, these changes ensure that the Index will serve Canadian investors well" (Bloom & Blackwell, 2002).

number of stocks in the Index dropped to 232. For example, 23, 30, and 13 stocks were voluntarily removed by the committee in June, September, and December 2002, respectively. Standard & Poor's also announced a new classification procedure for industrial sectors which dropped the number of sectors from fourteen to ten. Another important change in the S&P/TSX Composite Index was the inclusion of Income funds[2] in the Index, beginning December 2005.

The changes in the Index policy and other criteria raise the question of whether or not the new makeup of the Index has affected its ability to perform its dual roles: acting as a performance benchmark, and representing the equity market.

We discuss the changes to the TSE 300 in detail in the following sub-sections: the number of the Index's constituents; sector categories; periodicity of Index revisions; and eligibility and maintenance criteria.

1.1.1. The number of Index constituents

The TSE 300 Composite Index was comprised of 300 large cap common equities from 14 different sectors. Beginning May 2002, the number of Index constituents changed from a fixed number to a floating Index. Hence, the Index committee is not forced to add a stock right after the deletion of one, or to delete a stock after the addition of one. As Figure 1 shows, the number of the Index's constituents varies after the transition of the Index to S&P/TSX Composite Index. After the introduction of the new Index, the number of Index's constituents varies from a low of 211, in 2009, to a high of 278 in 2005. As noted above, in December 2005 income trusts were qualified for inclusion in the S&P/TSX Composite Index. Seventy-three income funds were

[2] "Income funds are mutual funds, ETFs or any other type of fund that seek to generate an income stream for shareholders by investing in securities that offer dividends or interest payments. The funds can hold bonds, preferred stock, common stock or even real estate investment trusts" (Investing Answers, 2015).

added to the Index in December 2005. This increased the number of firms in the Index to a high of 278.

Income trusts are one of the most rapidly growing segments in the Canadian marketplace. For instance, in December 2004, 175 income trusts were listed on the Toronto stock exchange with over $118 billion market capitalization. The inclusion of Income funds to the Index would make it a broader benchmark Index for the Toronto Stock Exchange (Pincus, 2005).

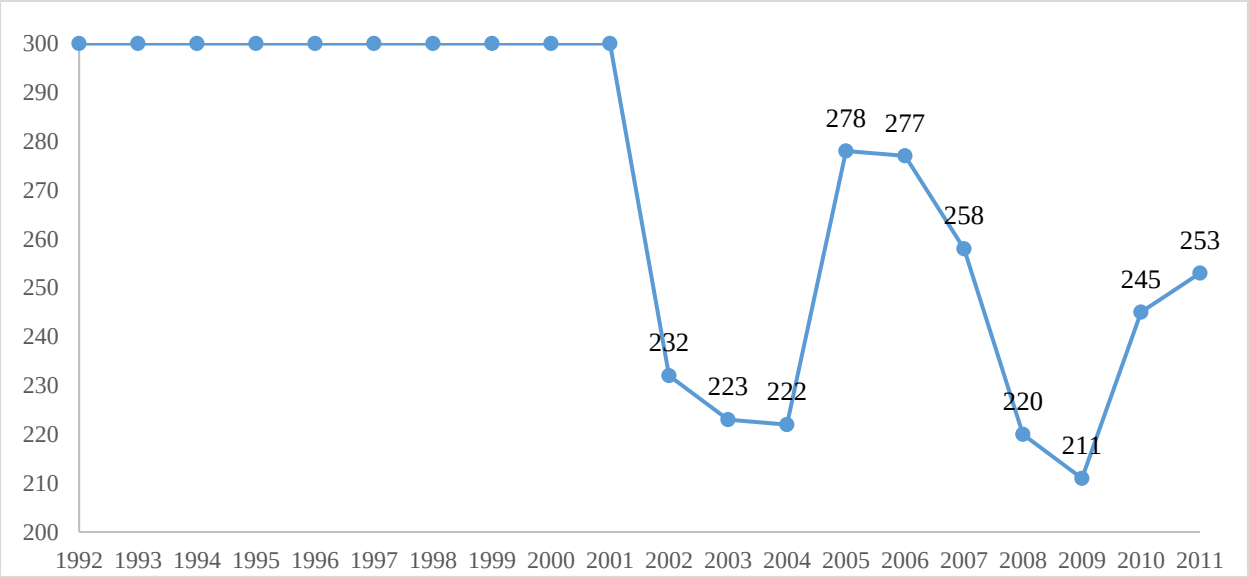

Figure 1. The number of Index's constituents over the period of 1992 to 2011.

1.1.2. Sector Categories

The TSE 300 stocks were categorized into 14 sectors. This classification system was unique to the Canadian marketplace. However, in March 2002, stocks were classified into 10 sectors based on the Global Industry Classification Standard (GICS) developed by Standard & Poor's and Morgan Stanley Capital International (MSCI). The goal of this reclassification was to allow for a better comparison of Canadian industrial sectors on a global basis. For ease of comparison, we mapped all companies before 2002 into the current GICS.

In order to investigate how sector allocation of the Index has changed over the entire sample period, the ratio of the market value of each sector to the Index's[3] and the number of the Index's constituents in each sector[4] are used to illustrate the evolution of each sector.

Figure 2 shows the changes in the monthly relative weights[5] of each sector in the S&P/TSX Composite Index for the whole sample period from 1992 to 2011. Through the substitution of old companies with new ones, some changes have occurred in the investing outlook over the twenty year period.

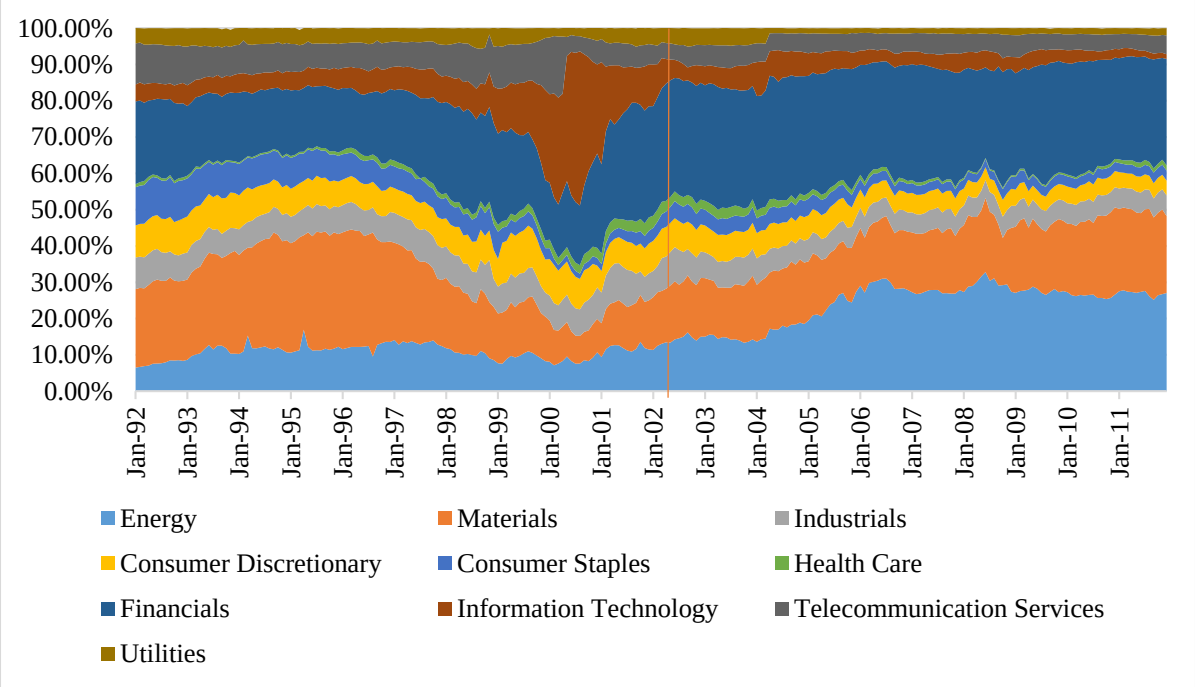

Figure 2. Market sector shares for the period of 1992 to 2011.

As we can see in Figure 2, Financials and Energy have become the largest and second largest sectors, by having 29.37% and 27.07% of the market value of the Index, respectively.

[3] The averages of relative monthly weight of each sector to the Index in each sub-period and the monthly relative weights of sectors at the beginning and end of each sub-period, i.e., from January 1992 to April 2002 and from May 2002 to December 2011, are presented in Table A1.
[4] The averages of number of the Index's constituents in each sector in each sub-period and the numbers of each sector members at the beginning and end of each sub-period are reported in Table A2.
[5] The relative weight of an Index constituent is that constituent's percentage of the total Index QMV; Relative Weight =100 x (Constituent QMV/Index QMV).

Financials has remained the largest sector in the Index for the entire sample period. Financials grew from 22.81% to a high of 33.31% in November 2005 and had almost one third of the market value of the Index over the sample period. Energy was the third smallest sector in January 2002 and has increased continually from 6.52% in January 1992 to 27.07% in December 2011. In addition, Materials was the second largest sector in January 1992 and dropped to the third largest in December 2011. Materials increased from 21.58% in January 1992 to a high of 34.14 % in August 1996. Then, it declined to a minimum of 7.7% in September 2002; however, it grew again to 21.12% in December 2011. Information Technology grew from 4.64% of the market value of the Index and peaked at 42.44% in August 2000, and then declined to a low of 1.27% in 2011. Consumer Staples, Telecommunication Services, Consumer Discretionary, Industrials, and Utilities have shrunk by 7.71%, 6.12%, 5%, 2.97%, and 2.26%, respectively. Health Care has remained the smallest sector over the entire sample period with 1% of the market value of the Index.

We can see that the Energy sector has become more dominant in the Index for the period of 2002 to 2011, with the average of 23.99% of the market value of the Index, as compared to the average of 10.85 % for the period of 1992 to 2002. In addition, the weight of the Financials sector has increased from the average of 21.31% for the period of 1992 to 2002 to the average of 30.33% for the period of 2002 to 2011. However, Materials on average had almost 20% of the market value of the index for the period of 1992 to 2002, as compared to 17.58% of the market value of the Index over the period of 2002 to 2011. Industrials, Consumer Staples, Consumer Discretionary, Information Technology, Telecommunication Services, and Utilities had more of the market value of the index in the period of 1992 to 2002, as compared to the 2002 to 2011 period. Health care has remained the same for both sub-periods.

Figure 3 illustrates the number of stocks in 10 different sectors for the period of January1992 to December 2011. Materials, Energy, and Financials on average had the most number of stocks in the Index. On the other hand, Telecommunication and Health care had the least number of stocks in the Index for the entire period.

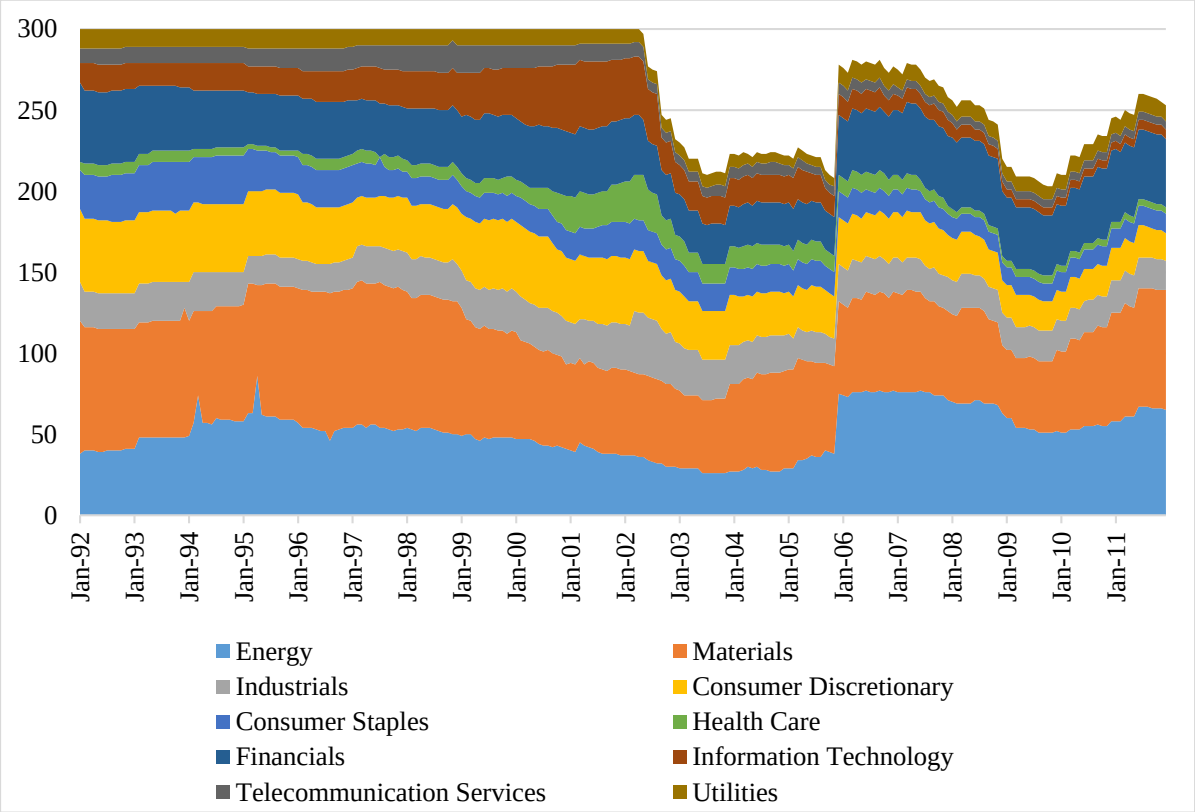

Figure 3. Number of Index's constituents in each sector.

As seen in Figure 3, the number of constituents in the index dropped from 300 to 232 by December 2002, when the conversion was in full effect. The stocks were mainly dropped from Information Technology, Health Care, Financials, and Utilities; 17, 13, 11, and 9, respectively. In December 2005, income funds became eligible securities in the Index and the number of the Index's constituents increased from 208 to 278. Income funds were mainly added to the Energy and Financials Sector, 37 and 13, respectively.

Overall, more companies from Energy and Financials have been added to the Index after 2002. Also, the companies deleted from the Index were mostly from Information Technology, Consumer Staples, Consumer Discretionary, and Telecommunication Services.

1.1.3. Frequency of Index revisions

Frequency of the Index revisions also changed in May 2002. Prior to May 2002, the composition of the Index was reviewed and adjusted annually in February unless special circumstances,--such as suspensions, delisting, bankruptcies, restructuring, etc., -- dictated otherwise. In that case, deletions were always accompanied by additions to maintain the Index number at 300.

After May 2002, revisions occurred every quarter ending in March, June, September, and December. Intra-quarterly reviews only occur on an as-needed basis. Deletions were not always accompanied by additions since there was no longer a requirement to have exactly 300 stocks in the Index.

1.1.4. Eligibility and Maintenance criteria

Prior to May 2002, to be eligible for inclusion in the Index, stocks had to meet following criteria (Shilling, 1996):

I. The company should be incorporated in Canada or be substantially Canadian owned.
II. Mostly common stocks were eligible.
III. The company should be listed on the Toronto Stock Exchange (TSE) for at least one year prior to consideration, or has been listed for at least six months on TSE

and ranks between 1 and 150 based on its Quoted Market Value (QMV) on the month-end prior to the annual stock replacement review meeting.

IV. Trading volume should be at least 100,000 shares and at least 100 transactions a year prior to consideration.

V. Trading value of the company should be at least C$1 million for the year preceding its consideration.

The stocks that met the criteria were pooled and the top 300, according to their one-year average float QMV[6], were included in the Index. During this process, if a stock on the TSE 300 fell below 325 in the average float QMV ranking, it was replaced by a stock which had taken its place within the highest 300. Similarly, if a stock not in the TSE 300 ranked 275 or higher, it replaced the one ranked lower than 300. As mentioned in section 1.1.3, the TSE 300 Index was reviewed and revised once a year, usually in February, unless unexpected corporate activities occurred, such as: suspensions; delisting; a decrease in the QMV to less than $100 million over a period that extends to 51% of the trading days for three consecutive months; mergers; acquisitions; restructuring; or bankruptcy.

In May 2002, a set of new criteria for inclusion and maintenance was announced. Stocks under consideration for addition to or deletion from the Index were now assessed by the Index Committee on the basis of the six-month data ending the month prior to the Quarterly Review.

Added securities are selected based on following criteria (S&P/TSX Canadian Indices methodology, 2011):

[6] QMV is defined as the one-year weighted average price multiplied by its float outstanding at the end of this period of the stock for preceding 12-month period.

1. *Market capitalization*	• The security must represent the minimum weight of 0.05% of the Index over the last three trading days of the month-end before the revisions. • The stocks must have a minimum value weighted average price (VWAP) of C$ 1 over the past three months and last three trading days of month-end before the revisions.
2. *Liquidity*	• Float turnover must be 0.5. Float turnover is calculated as the total number of shares traded at Canadian trading venues in the previous 12 months divided by float adjusted shares outstanding at the end of period.
3. *Domicile*	• Issuers of Index securities should be incorporated; established, in the case of income trusts; or formed, in the case of limited partnership, under Canadian federal, provincial, or territorial jurisdictions and listed on the Index

The constituents that do not meet the following "Buffer Rules" are removed from the Index.

Buffer Rules	• The security must have the minimum weights of 0.025% of the Index. • The stocks must have a minimum VWAP of C$ 1 over past three months.

- Float turnover must be 0.25.

Compared to the TSE 300 Index which uses the QMV-basis ranking, the post-2002 Index utilizes market capitalization and liquidity to determine membership. Under the new rules, all the stocks that meet the market capitalization and liquidity criteria are included in the Index. Also, stocks that do not meet the "Buffer Rules" are removed from the Index. Deletions are not necessarily followed by additions, and vice versa.

In this study, we investigate whether or not the changes after May 2002, which are presented in this chapter, impact the Index's roles. In the next chapter, we will review existing studies on the S&P 500 and TSE 300 Index.

2. Literature Review and Objectives

This chapter focuses on the most relevant literature about stock additions to and deletions from an Index. We categorize these studies into two groups: studies that examine stock price reactions to Index revisions; and studies that investigate the performance of an Index.

2.1. Stock price reactions to the Index revision

Additions to and deletions from the Index have attracted the attention of several researchers. These researchers mainly focused on finding an explanation for stock price reactions to the Index revision. Several studies have supported the following hypotheses: imperfect substitutes hypothesis (Shleifer, 1986; Beneish & Whaley, 1996; Lynch & Mendenhall, 1997; Blume & Edelen, 2001; and Wurgler & Zhuravskaya, 2002); price pressure hypothesis (Harries & Gurel, 1986); certification hypothesis (Jain, 1987); liquidity hypothesis (Hedge & McDermott, 2003); and investor awareness hypothesis (Chen, Noronha, & Singal, 2004). Reviewing the above-mentioned studies is beyond the scope of this research, since we are not considering the effects of Index revisions on the stock's prices.

2.2. Index Performance

To our knowledge, there are only three studies that investigate the Index's performance. These studies considered only the S&P 500 Index. Two of these studies compared the performance of the original S&P 500 stocks in 1957 to that of the updated Index to examine whether updating the Index hampered or enhanced the Index performance (Foster & Kaplan, 2001; Siegel & Schwartz, 2006). The other study dealt with how the S&P 500 committee balances the dual role of the S&P 500 Index (Asem & Alam, 2012).

Foster and Kaplan (2001) investigated the performance of the updated S&P 500 Index (over the 1957-1997 period), by comparing it to the performance of the original S&P 500 Index in 1957. They asserted that, if S&P 500 in 1997 was exactly the same as the list in 1957, the overall performance would be considerably less (Foster & Kaplan, 2001, p. 28). Overall, their results show that actively managing a portfolio is a better strategy than buying and holding the original S&P 500 stocks. Hence, continuously updating the component stocks of the Index improved the performance of the Index.

Contrary to what Foster and Kaplan (2001) found, Siegel and Schwartz (2006) showed that the original S&P 500 generated a higher return than the updated 500 companies from 1957 to 2003. Siegel and Schwartz (2006) ascribe the difference in these results to the emphasis on market value given by Foster and Kaplan. They argue that investor return is a per-share concept and includes reinvested dividends. Since market value is equal to price multiplied by aggregate number of shares, reinvested dividends are absent from the market value calculation. Siegel and Schwartz asserted that, although return based on market value is higher for the updated Index than the original Index, return per share including reinvested dividends is higher for the original 500 than for the updated stocks.

Siegel and Schwartz's results suggest that updating the original S&P 500 has hampered the Index's performance. They attribute the underperformance of the updated Index to three factors. First, high-market-value companies might become overvalued and would consequently be admitted to the Index due to pressure from investors. However, since their market price is temporarily higher than their fundamentals, their return will face a downward bias in the future. Second, price pressure occurs when Indexers are required to buy a stock the moment that a company is added to the Index. The third reason is the value bias of the original portfolio--since

the original stocks were neglected by investors, their prices were lower compared to their fundamental values.

Asem and Alam (2012) investigated how the S&P 500 committee balances the dual roles of representing the US equity market as well as acting as a performance benchmark in its add/delete decisions. Their sample data covered 1970 to 2009. Their results show that S&P 500 Index captures the US equity market well. Also, the Index's performance tracks the US equity market performance. They found that the S&P 500 Index represents the US equity market by keeping high-capitalization stocks despite the fact that these stocks underperform the updated Index by 0.24% per month. The Index committee cancels out the negative impact of large stocks on the Index's performance by substituting high-performing stocks for smaller non-performing ones. Therefore, addition/deletion events are essential in order to make the Index's performance reflective of the US equity market.

Similar to Asem and Alam (2012), we studied the dual roles of the Index, and we followed the methodology they used. However, our study is different from theirs in that we investigated the Canadian Index. To the best of our knowledge, no study has been done on the Canadian Index. The purpose of our study is to fill this gap. In particular, the objective of this study is to investigate the role of S&P/TSX Composite Index in tracking the Canadian equity market. Specifically, we researched the following three questions:

Q.1: Has the conversion of the TSE 300 Index to the S&P/TSX Composite Index enhanced the role of the Index as a performance benchmark? If so, was it due to flexibility in addition/deletion events?

Q.2: Has the conversion of the TSE 300 Index to the S&P/TSX Composite Index enhanced the role of the Index to represent the Canadian equity market? If so, was it due to flexibility in addition/deletion events?

Q.3: Has the inclusion of Income funds had any impact on the dual roles of the Index?

This study is of interest due to the differences of the Index makeup for S&P/TSX Composite Index as compared to S&P 500 Index. The differences are as follows:

1) TSE 300 Index's number of constituents was fixed prior to April 2002; then it varied. However, S&P 500 Index's number of constituents is always fixed at 500. Thus, investigating the Canadian Index gives us the opportunity to compare a fixed Index to a floating Index.
2) Income funds are ineligible securities for inclusion in the S&P 500 Index. However, since December 2005, income trusts have become eligible for inclusion in the S&P/TSX Composite Index. Consequently, the S&P/TSX Composite Index is regarded as a broad benchmark Index for the Toronto Stock Exchange.
3) There are relatively more small companies listed on the Canadian Index as compared to the S&P 500 Index and, as a result, many companies are thinly traded (Elfakhani & Lung, 2003).
4) Before May 2002, when the Toronto Stock Exchange administered its own Indices, the requirements were not as stringent as those in the S&P 500 (Masse et al., 2000).
5) The S&P/TSX Index stocks are comprised of only Toronto Stock Exchange securities; however, the S&P 500 has a sample of securities from American, New York, and NASDAQ stock exchanges (Masse et al., 2000).

The remainder of this study is organized as follows. Chapter 3 describes the research design and the methodology used in this study. Chapter 4 presents the sample data. In Chapter 5, we present the results of our analyses and discuss our findings. The last chapter summarizes our findings, discusses the limitations of our study, and provides recommendations for further studies.

3. Research Design and Methodology

In this study we investigate whether the flexibility granted to the Index's committee resulted in a better achievement of the dual roles of the Index, i.e., acting as a Canadian equity market performance benchmark and representing the Canadian equity market.

Section 3.1 provides a detailed description of how we analyze the performance benchmark role of the Index before and after May 2002. We do so by looking at the correlations and the means of the returns of the equity market and the Index. Section 3.2 presents how we investigate the market representation role of the Index by looking at the market capitalization of the Index and the equity market. Section 3.3 illustrates how we analyze the impact of income funds on the dual role of the Index.

3.1. Performance benchmark role of the Index

In order to examine whether the performance benchmark role of the Index is enhanced after the change of the Index from TSE 300 to S&P/TSX Composite Index, we divide our entire sample period into two sub-periods: January 1992 to April 2002, and May 2002 to December 2011. Then, we investigate how the Index's returns replicate the equity market's returns in both sub-periods in two ways. First, we compare and contrast the correlation of the Index's returns and the equity market's returns. Second, we test how close the Index's returns are to the equity market's returns on average.

3.1.1. Correlation of the equity market's performance and Index's performance

This sub-section describes the methodology that we use to investigate the correlation of the Index's return and the equity market's returns for both sub-periods.

We calculate the Pearson correlation coefficient of the Index's returns and the equity market's returns for each sub-period and then we compare the difference. The market's return and the Index's return are calculated by the value-weighted return of all domestic common equities in the Canadian Financial Market Research Centre (CFMRC) and all stocks in the Index, respectively. If the correlation between the equity market's returns and the Index's returns is significantly higher for a period, it shows that the Index's returns better replicate the market's returns in that period.

Next, we divide the Index into four components and compare the results. We divide all of the stocks that were in the Index into four portfolios: (i) the portfolio of continuously survived stocks, (ii) the portfolio of stocks that were added to the Index, (iii) the portfolio of stocks that were deleted from the Index, and (iv) the portfolio of discretionary deleted stocks.[7] Once we formed these portfolios, we apply the above methodology to each of the four portfolios. We compare their correlations with those of the equity market. By doing so, we can determine each portfolio's contribution to the correlation between the Index and the market.

In each of the above procedures we use the Fisher's Z transformation[8] to test the significant difference between the Pearson correlation coefficients of each portfolio's returns and the equity market's returns for two sub-periods.

[7] Please note that the portfolio of survived stocks consists of the stocks that remained intact in the Index except for a name change. The added portfolio consists of the stocks that are about to be added to the Index for the period that they are member of the Index. The deleted portfolio includes the stocks that are about to be deleted for the period that they are still member of the Index. And, the discretionary deleted stocks are the ones that are deleted based on the discretion of the Index committee.

[8] One of the implications of Z transformation is testing for equality of two population correlations. To examine the equality of two independent populations' correlations, ρ_1 and ρ_2, we first transform two sample correlations, r_1 and r_2 which are computed from two independent samples of n_1 and n_2 observations, to z-score: $z_r=\frac{1}{2}\log\frac{1+r}{1-r}$, under the null hypothesis that the population correlations are equal. The following has approximately a standard normal distribution:

The correlation shows the degree to which two variables move together. One problem with correlation is that it does not show how close the returns are. We address this issue next.

3.1.2. Average of the Index and the equity market performance

This sub-section presents the methodology that we use to examine how close the Index's returns are to the returns of the equity market.

We employ arithmetic and geometric means of the monthly value-weighted returns[9] as well as risk-adjusted returns[10] for each sub-period, and then we compare their differences. If the differences between the equity market's returns and the Index's returns are smaller for a period, it will suggest that the Index on average is closer to the market in that period.

Next, we apply the above methodology for each of the four portfolios that we constructed. We compare their returns with the Index's returns for each period. This analysis will help us to identify which portfolios are enhancing the returns of the Index. In turn, we will examine whether or not the additions/deletions are based on the returns performance of these portfolios.

In order to better understand whether or not the additions/deletions were based on their performance over time, we further examine the returns of added and deleted stocks three, two,

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$Z = \frac{Z_1 - Z_2}{\sqrt{\frac{1}{n_1 - 3} + \frac{1}{n_2 - 3}}}$

Therefore, if the above quantity is greater than 1.96 or less than -1.96, the two correlations are significantly different at 5% level of significance.

[9] The monthly value-weighted returns of each portfolio is the sum of all products of stocks returns with their market weights. A security's market weight is defined as shares outstanding times closing price in the previous month divided by the market value of all securities included in the portfolio. Returns used in this index are fully adjusted for distributions. This is the Lasperyers Price Index approach which uses the quantities traded in the base period and compares the total cost of purchasing the same quantities in the base period what would have been the total cost of purchasing the same quantities in second period: $\frac{\sum_{i=0}^{k} q_{0i} p_{1i}}{\sum_{i=1}^{k} q_{0i} p_{0i}}$ (Newbold, 1988).

[10] We use Sharpe ratio for calculation of risk-adjusted returns which is defined as: $\frac{E(R_p) - E(R_f)}{\delta_p}$, where R_p = portfolio return, R_f = risk-free rate, Canadian T-bill rate, and δ_p= standard deviation of monthly portfolio returns.

and one year(s) prior to the addition/deletion events. If the returns of the added stocks are increasing over time and the returns of deleted stocks are declining over time, we can conclude that the addition/deletion events were based on their performance.

In each of the above procedures, we also test their significant difference. We use t-test for arithmetic and geometric means, and Jobson and Korkie's (1981) test[11] for risk-adjusted returns.

3.2. Market representation role of the Index

This subsection deals with the methodology that is used to examine the equity market representation by the Index. To represent the Canadian equity market, the Index needs to capture a high percentage of the market capitalization of the equity market.

We calculate the mean of the monthly ratio of the Index's capitalization to the equity market's capitalization for the two sub-periods. Then, we test for the difference of the means of the percentages before and after May 2002. If the mean is significantly greater for one period, it suggests that the Index captured a higher percentage of the equity market's capitalization in that period.

The monthly equity market and the Index's capitalizations are calculated by the aggregation of the outstanding shares multiplied by the closing price of all Canadian common equities and all stocks in the Index, respectively.

We also study the contribution of the market capitalization of the four portfolios to the Index's capitalization in both sub-periods. To evaluate the market capitalization of the four

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[11] Jobson and Korkie use the following Z-statistic: $\frac{\delta_1\mu_2-\delta_2\mu_1}{\sqrt{\theta}}$, where $\theta = \frac{1}{T}[2\delta_1^2\delta_2^2 - 2\delta_1\delta_2\delta_{1,2} + \frac{1}{2}(\mu_1\delta_2)^2 + \frac{1}{2}(\mu_2\delta_1)^2 - \frac{\mu_1\mu_2}{\delta_1\delta_2}\delta_{1,2}^2]$, μ_1, μ_2 are the mean excess returns of the portfolios, $\boldsymbol{\delta}_1$, $\boldsymbol{\delta}_2$ are the standard deviation of two portfolios, and $\boldsymbol{\delta}_{1,2}$ is the covariance of the two portfolios' returns (Jobson & Korkie, 1981).

portfolios, the average of the ratio of the capitalization of each portfolio to the capitalization of the Index in each month is calculated. By doing so, we can determine each portfolio's contribution to the Index's capitalization. Then, we compare and contrast our results.

3.3. Robustness check for the inclusion of income funds

In order to address the third objective of this study, we repeat all of the procedures presented in section 3.1 and 3.2 without the income funds. We then compare the results with those obtained when the income funds were included to see whether or not income funds have any impact on the dual roles of the Index.

In the next chapter, we will present how the data were collected.

4. Data and Procedure

In this study, we use monthly data from the Canadian Financial Market Research Centre database (CFMRC), and TSX E-Review for the period from January 1992 to December 2011. This time frame was selected on the basis of availability of the data and also availability of sufficient data to compare the dual role of the Index before and after its change to the S&P/TSX Composite Index.

The monthly value-weighted return of the Index and Canadian equity market, monthly outstanding shares, and closing prices of stocks were extracted from the CFMRC database. The addition and deletion information and their timing were collected from the TSX E-Review. We used addition and deletion information to form our four portfolios mentioned in the methodology chapter.

Figure 4 shows the accumulated net number of additions and deletions over the sample period. The number of the Index's constituents was fixed at 300 prior to May 2002; after that date it varied. That is why we can see in Figure 4 that the number of additions and deletions were equal and the net number was zero prior to 2002. However, the number of additions and deletions are not equal after 2002.

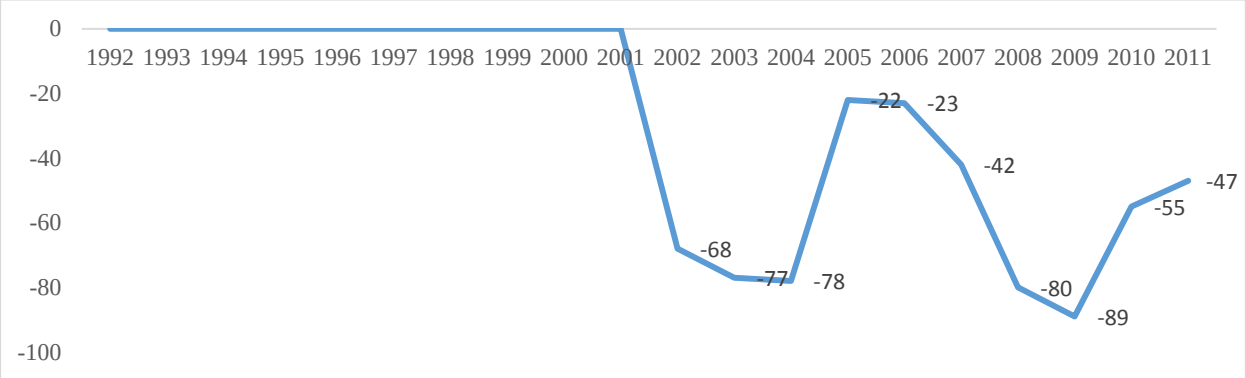

Figure 4. The accumulated net number of stocks that were added/deleted to/from the Index.

Figure 5 shows the distribution of deletion events on a yearly basis during the sample period. The deletion events are not constant over the sample period and they range from a high of 82 in 2002 to a low of 7 in 2010. The highest number of deletions occurred in a year that TSE 300 converted to S&P/TSX Composite Index. The total number of deletion events over our entire sample is 786.

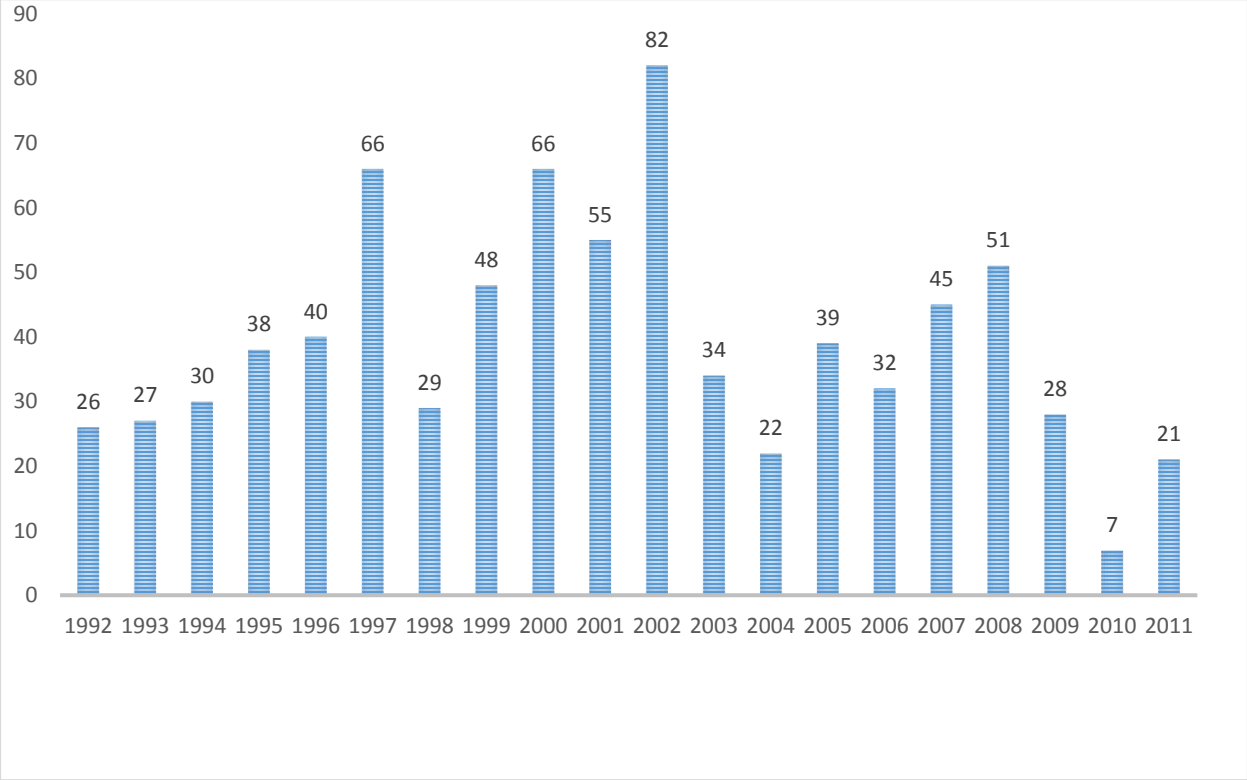

Figure 5. The number of deletions from S&P/TSX Composite by year.

Figure 6 shows the distribution of additions over the entire sample period. The numbers of additions vary from a low of 13 in 2008, to a high of 95 in 2005. The highest number of additions occurred on January 26, 2005, when Standard & Poor's announced that income trusts were qualified for inclusion in the S&P/TSX Composite Index. Effective December 2005, 73

income trusts were added to the Index. These income trusts represented 10% of the Index's capitalization in December 2005. The total number of additions over our entire sample is 739.

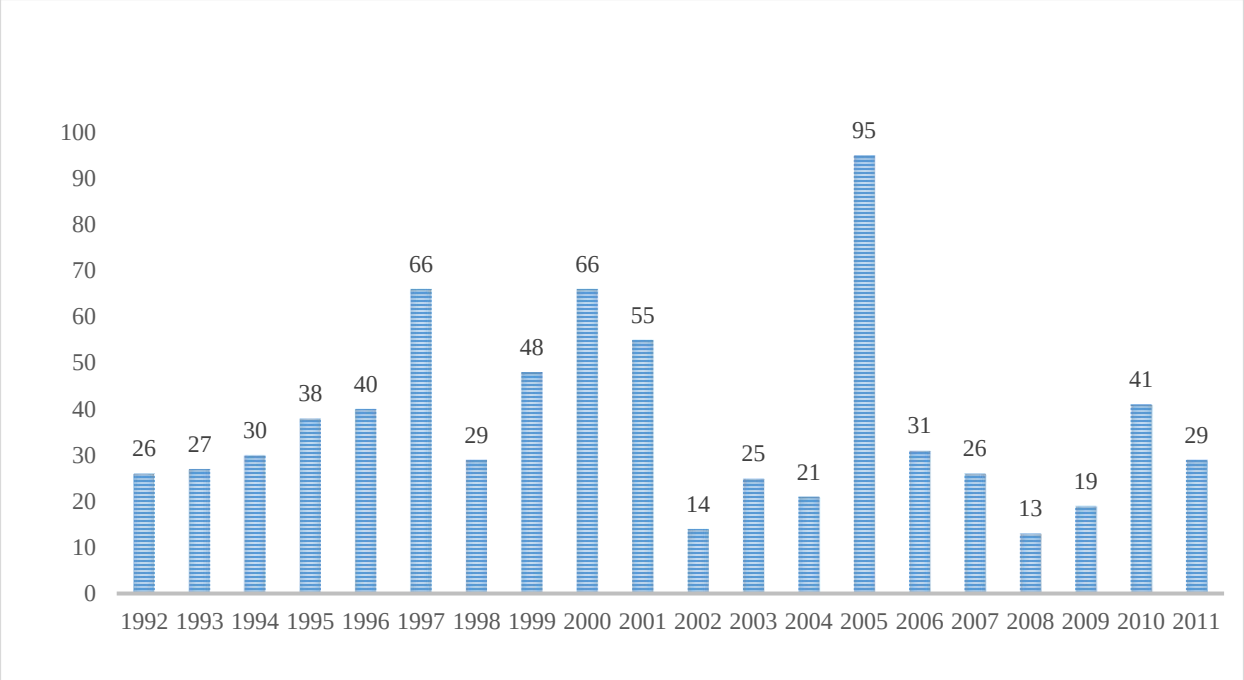

Figure 6. The number of additions from the S&P/TSX Composite by year.

Table 1 shows the frequency of deletions and additions over the entire sample period. From a total of 786 deleted stocks, 714 distinct stocks were deleted from the Index. From a total of 739 added stocks, 661 distinct stocks were added to the Index. The number of repeated additions is greater than repeated deletions.

Table 1

The frequency of stock addition to and deletion from the Index over the entire sample.

	Deletion Events				**Addition Events**		
Frequency of Events	1	2	3	4	1	2	3
Number of stocks	648	61	4	1	589	66	6
Total	648	122	12	4	589	132	18

Table 2 summarizes the number of added, deleted, discretionary deleted, and survived stocks before and after May 2002.

Table 2

The number of added, deleted, discretionary deleted, and survived stocks before and after May 2002.

	January 1992- April 2002	May 2002-December 2011
Number of months	124	116
Added stocks	428	311
Deleted stocks	428	358
Discretionary deleted Stocks	176	204
Survived Stocks[12]	87	95

As we can see in Table 2, the number of deletions is larger than number of additions after May 2002. Although the number of months are fewer after May 2002, we have a greater number of discretionary deleted stocks after May 2002.

Figure 7 shows the distribution of 87 survived stocks across sectors for the January 1992 to April 2002 period, when the number of stocks was fixed at 300. The stocks mainly survived from the Materials and Financials sectors.

[12] To form the survived stocks portfolio, we track the companies that remained intact (except possibly for a name change) in the Index for the specified period.

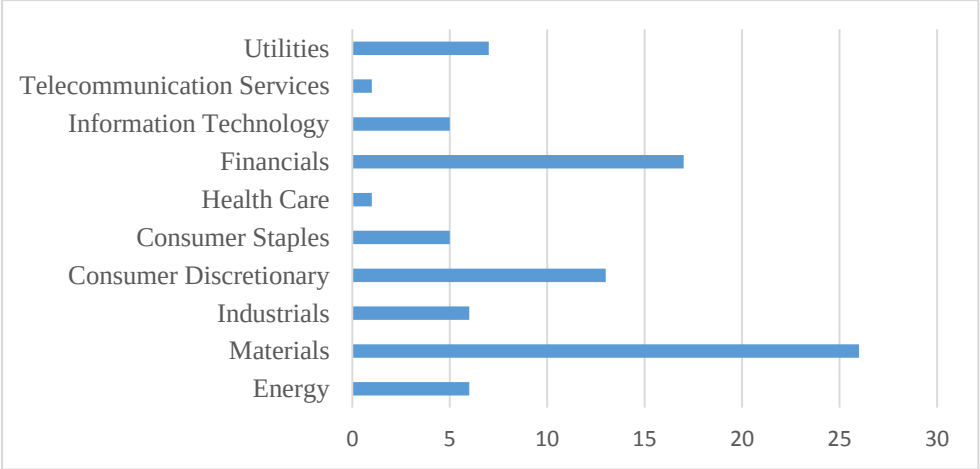

Figure 7. The number of survived stocks in each sector for the period of January 1992 to April 2002.

Figure 8 shows the distribution of 95 survived stocks across sectors for the period of May 2002 to December 2011 when the Index was floating. Financials, Energy, and Materials had the greatest number of stocks.

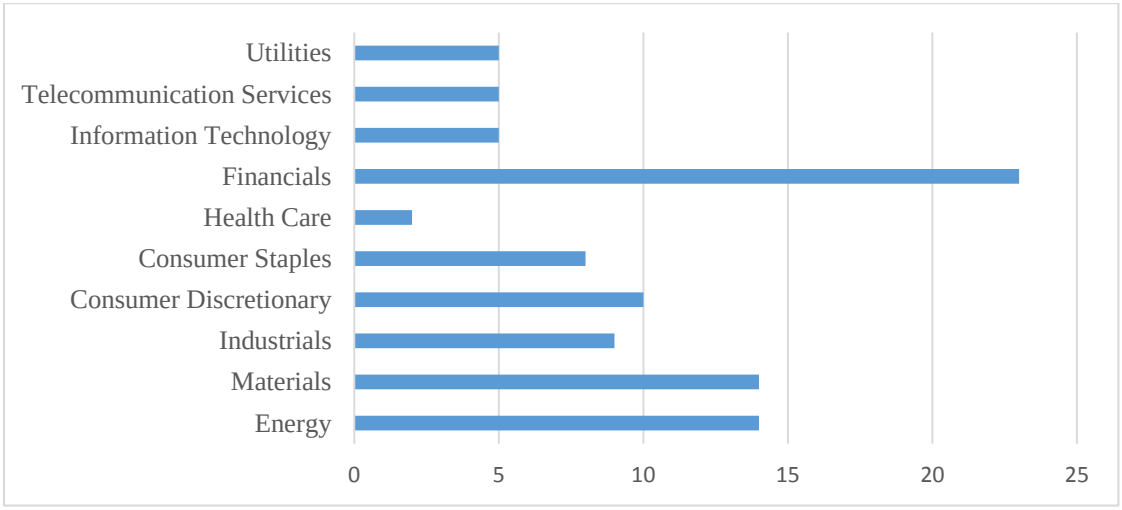

Figure 8. The number of survived stocks in each sector for the period of May 2002 to December 2011.

In the next chapter, we will present our results and analyses.

5. Results

This chapter presents the results of our study. First, in section 5.1, we examine how well the Index performs as a performance benchmark in both sub-periods by looking at the correlation and mean of the returns. Second, in section 5.2, we report our results regarding how the Index represents the equity market for both sub-periods by looking at the market capitalization of the Index and the equity market. Lastly, in section 5.3, we investigate the effects of income funds on the dual roles of the Index.

5.1. Performance benchmark role of the Index

In this section, we want to see whether the Index itself replicates the equity market performance properly for both sub-periods. For this purpose, first we look at the correlation of the Index's returns and the equity market's returns for the period of January 1992 to April 2002, and May 2002 to December 2011. We compare the correlation of the Index and market's returns for both sub-periods. If the correlation is significantly higher for a period, it shows that the Index's returns better replicate the market returns in that period. Second, we examine how close the Index's returns are to the equity market's returns for both sub-periods. If the differences are smaller, it suggests that the Index on average is closer to the market.

5.1.1. Correlation of the equity market's returns and Index's returns

In this subsection, we present the results of the Pearson correlation coefficients of the Index's returns and the equity market returns for both sub-periods. We gauge the market's returns by monthly value-weighted returns of all common equities in the CFMRC database. Similarly, we calculate the Index's returns by monthly value-weighted returns of stocks in the Index.

Figure 9 shows the monthly value-weighted returns of the equity market and the Index for the period of 1992-2011. It appears that the returns of the Index replicate the equity market returns well. However, in order to quantify this replication, we calculate the Pearson correlation coefficients of the Index's return and equity market returns.

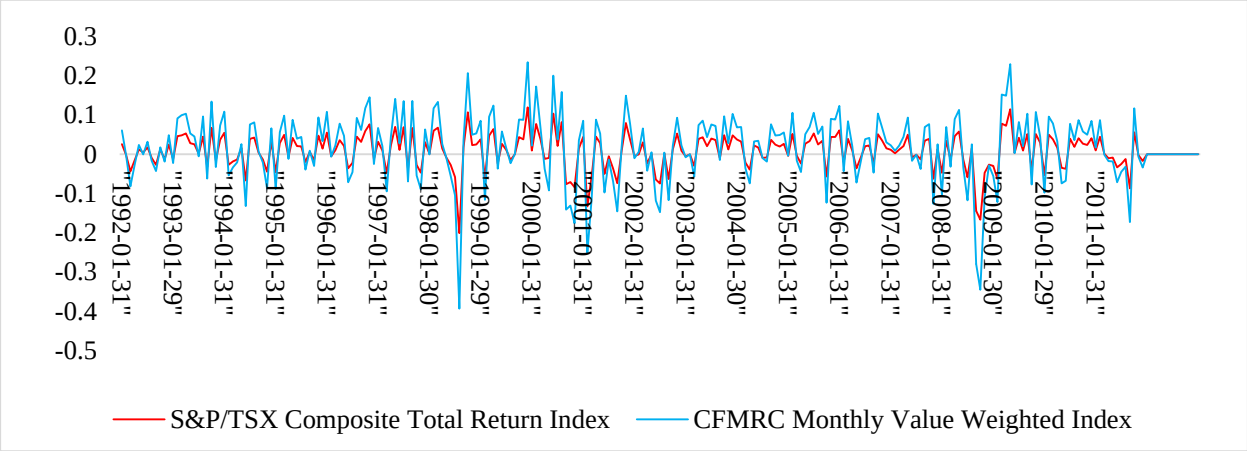

Figure 9. Report of the monthly value weighted return of all common stocks listed in the Toronto Stock Exchange and the returns of the securities in the S&P/TSX Composite Index for the period of 1992-2011.

The Pearson correlation coefficients of the Index's returns and equity market's returns for both sub-periods are presented in Table 3. The correlation is 0.983 for the period of January 1992 to April 2002 and is 0.992 for the period of May 2002 to December 2011. Both of the correlations are significantly different than zero at 1% level of significance. Table 3 also shows the results of the test for equality of the two correlations by using Fisher's Z transformation.

Table 3

Pearson correlation coefficient of the Index and equity market returns for both sub-periods.

	Correlation (r)	Z-Score	Observations	Z-statistic
(1) January 1992 – April 2002	0.983***1	2.380	124	2.89***2
(2) May 2002 – December 2011	0.992***1	2.759	116	

Note. ***1 indicates that each correlation is significantly different from zero at 1% level of significance. ***2 indicates the two correlations are significantly different at 1% level.

The results suggest that the Pearson correlation coefficient for May 2002 to December 2011 is significantly greater than that of January 1992 to April 2002 at 1% level of significance. This implies that the Index's returns better replicate (co-move) the equity market's returns for the period after May 2002 compared to the period before May 2002.

Next, we want to see where the higher correlation comes from. For this purpose, we decompose the Index itself into four components: the continuously survived stocks, added stocks, deleted stocks, and discretionary deleted stocks.[13] We calculate the correlations of the monthly value-weighted returns of each portfolio and the Canadian equity market in the two sub-periods: January 1992 to April 2002, and May 2002 to December 2002. The results are presented in Tables 4 and 5.

Table 4

Correlation of the portfolios and the Canadian equity market before and after May 2002.

Pearson correlation coefficient	Before May 2002		After May 2002		Z-statistic
Column	(1)	(2)	(3)	(4)	(5)
	r_i	*p*-value	r_i	*p*-value	
The Market and the Added Portfolio (1)	0.878	0.0000	0.842	0.00	-1.06
The Market and the Deleted Portfolio (2)	0.791	0.0000	0.911	0.00	3.49***
The Market and the Discretionary Deleted Portfolio (3)	0.720	0.0000	0.861	0.00	2.78***
The Market and the Survived Portfolio (4)	0.794	0.0000	0.943	0.00	5.22***

Note. *** indicates that the correlations in columns (1) and (3) are significantly different at 1 % level based on Fisher's Z transformation (compares before and after May 2002).

[13] The survived stocks are the ones that never went out of the Index during the period. Then, we calculated the monthly value-weighted returns of them. For deleted stocks, we looked at the stocks that are going to be deleted for the period they were still members of the Index. Thus, the data go back to how long they survived until their deletion. We also did the same thing for discretionary deleted stocks. Added stocks are the ones that are going to be added in the Index and the added portfolio is composed of the stocks that were added to the Index for the period they survived in the Index.

Table 5

The results of equality test for correlations between added stocks and the other three portfolios in each sub-period.

	Before May 2002	After May 2002
Column	1	2
Portfolios	Z-statistic	
(1),(2)	2.26**	-2.28**
(1),(3)	3.48***	-0.518
(1),(4)	2.21**	-3.504***

Note. *** and ** indicate that the correlations are significantly different at 1 % and 5% level based on Fisher's Z transformation, respectively.

As we can see in column 1 of Table 5, before May 2002 the correlation of the added stocks (0.878) is statistically higher than any other three portfolios (0.791, 0.720 and 0.794). On the other hand, as it is reported in column 2, the correlation of the added stocks (0.842) is statistically lower than any other three portfolios, except the discretionary deleted portfolio after May 2002 (0.911 and 0.943). When we compare the correlations of each portfolio across two panels (column 1 and 3) of the Table 4, we see that all of the portfolios had a higher correlation with the market after May 2002, except for the added portfolio.

Further, it is noted that the correlation of deleted stocks became significantly higher than the added stocks after May 2002. The question arises of why the stocks that are being added to the Index had a lower correlation with the market and the ones that are being deleted had a stronger correlation. One explanation could be that the returns of the deleted stocks are calculated for the period that they were still members of the Index. Since the above analysis does not give us a clear answer, we turn to investigating the difference of the mean of the Index's returns and the equity market's returns.

5.1.2. Average of the Index and the equity market performance:

After finding that the correlation of the Index and the equity market returns improved after the introduction of the new Index, we turn our attention to investigate whether the Index return is close to the market return on average. To do so, we calculate the arithmetic and geometric means, as well as the risk-adjusted returns of the equity market and the Index for each sub-period.

Table 6 shows the results of the average returns for the equity market and Index for both sub-periods. Panel A presents the geometric mean returns of the equity market and the Index. Panel B, and C present the results for arithmetic mean returns, and risk-adjusted returns for the equity market and the Index, respectively.

As we can see in Panel A of Table 6, before May 2002, the difference between the geometric mean returns of the equity market and the Index is 0.052%. However, the difference is not statistically significant. On the other hand, after May 2002, the difference between the geometric mean returns of the equity market and the Index is 0.0071%. This difference is also not statistically significant. The difference of geometric mean returns appears to be smaller after May 2002. However, the differences are not statistically significant. Panel B and C suggest similar results to Panel A (0.0476% vs. 0.0075% for arithmetic means and 0.0127 vs. 0.0016 for risk-adjusted returns).

We also calculate the ratio of the mean of the Index to the equity market which is presented in all three Panels of Table 6. We can see that the Index's returns captured 99% of the equity market's returns after May 2002 (98.8%, 98.90%, and 98.62% for geometric, arithmetic, and risk-adjusted means, respectively), while before May 2002, the Index's returns captured at

Table 6

The monthly returns of the equity market, and the Index before and after May 2002

	Before May 2002	After May 2002
	Panel A1: Geometric Mean Return	
Equity Market	0.8458%	0.5934%
Index	0.7938%	0.5863%
t-statistic	0.0889	0.0127
The difference between equity market and the Index	0.052%	0.0071%
Ratio (Index/equity market)	93.85%	98.80%
	Panel B: Arithmetic Mean Return	
Equity Market	0.9577%	0.6854%
Index	0.9101%	0.6779%
t-statistic	0.0814	0.0134
The difference between equity market and the Index	0.0476%	0.0075%
Ratio (Index/equity market)	95%	98.90%
	Panel C: Risk-Adjusted Arithmetic Return	
Equity Market	0.1201	0.1166
Index	0.1074	0.1150
z-statistic	0.6808	0.0182
The difference between equity market and the Index	0.0127	0.0016
Ratio (Index/equity market)	89.42%	98.62%

Note. t-test is used for testing the difference of the geometric and arithmetic means of the Index and equity market. Whereas, Jobson and Korkie (z-statistic) test is used for the difference of risk-adjusted returns of the Index and equity market.

most 95% (93.85%, 95%, and 89.42% for geometric, arithmetic, and risk-adjusted means, respectively) of the equity market returns. This suggests that the Index's returns are capturing a higher percentage of the equity market's returns for the period after May 2002. This states that even though the closeness of the returns of the Index and equity market for the periods before and after May 2002 are not significantly different, the percentage of the market returns that is captured by the Index is higher for the period after May 2002.

Next, we decompose the Index itself into 4 portfolios (added, deleted, discretionary deleted, and survived portfolios) to see which portfolios are contributing more to the Index's returns.

Table 7 shows the average value-weighted returns of the equity market, Index, survived, added, deleted, and discretionary deleted stocks. Panel A of Table 7 presents the results for the period of January 1992 to April 2002, and Panel B reports the results for the period of May 2002 to December 2011. Column 1 of table 7 shows the geometric mean of the portfolios. Columns 2, 3, and 4 present the results of arithmetic mean, standard deviation, and risk-adjusted of returns of respective portfolios.

First, we look at column 4 of Table 7 which represents the risk-adjusted returns for both sub-periods for each portfolio. Panel A shows that the added, survived, and discretionary deleted portfolios have less risk-adjusted returns compared to the Index. Whereas, the deleted portfolio has almost the same risk-adjusted return as the Index. Moreover, the deleted portfolio has the highest risk-adjusted return among the other three portfolios.

Panel B shows that the added and survived portfolios have higher risk-adjusted returns compared to the Index for the period after May 2002, while the deleted and discretionary deleted stocks[14] have less risk-adjusted returns compared to the Index after May 2002. It should be noted that the discretionary deleted stocks have negative risk-adjusted returns for the period after May 2002. Similar results are found in columns 1 and 2 of Panels A and B.

Comparing the column 4 of Panels A and B, we notice that the added stocks are contributing more to the Index after May 2002 as compared to before May 2002, whereas, the contribution of the deleted stocks decreases after May 2002. Therefore, it can be suggested that the new flexible system is targeted toward eliminating the lower performing stocks and bringing

[14] It should be noted that the financial crisis of 2008 happened in our second sub-period. Hence, in order to determine whether or not this crisis had any impact on our results, we excluded the stocks that were deleted in the period of 2008-2009 from the deleted and discretionary deleted portfolios. The risk-adjusted returns for these modified deleted and discretionary deleted portfolios are 0.0255 and -0.2152, respectively. These results show that deleted and discretionary deleted stocks still have less risk-adjusted returns compared to the Index for the period after May 2002. Thus, considering the financial crisis of 2008 does not negate our findings.

in the higher performing ones. In order to investigate this further, we report the three-, two-, and one-year returns of the added and deleted portfolios prior to their additions/deletions.

Table 7.

The returns of the Index, survived, deleted, and added stocks for both sub-periods.

Portfolio	Geometric Mean Return	Arithmetic Mean Return	Standard Deviation	Risk-Adjusted Return
		Panel A: Pre May 2002		
Column	(1)	(2)	(3)	(4)
Equity Market (1)	0.85%	0.96%	0.0455	0.1201[6]
Index (2)	0.80%	0.91%	0.0465	0.1074[6]
Survived Stock Portfolio (3)	0.70%	0.87%	0.0565	0.0806[6]
Added Stock Portfolio (4)	0.66%	0.81%	0.0545	0.0737
Deleted Stock Portfolio (5)	0.80%	0.92%	0.0490	0.1039
Discretionary Deleted Stocks(6)	0.47%	0.55%	0.0396	0.0344
		Panel B: Post May 2002		
Equity Market(1)	0.59%[6]	0.68%[6]	0.0425	0.1166[6]
Index (2)	0.59%[6]	0.68%[6]	0.0424	0.1150[6]
Survived Stock Portfolio (3)	0.58%[6]	0.66%[6]	0.0399	0.1185[6]
Added Stock Portfolio (4)	0.82%[6]	1.00%[6]	0.0589	0.1373[6]
Deleted Stock Portfolio (5)	0.52%[6]	0.74%[6]	0.0649	0.0840[6]
Discretionary Deleted Stocks(6)	-2.25%	-1.97%	0.0716	-0.3011

Note. [6] indicates that the mean is different than the mean of the discretionary deleted portfolio at 5% level of significance.

5.1.3. Three-, two-, and one-year returns of added/deleted stocks prior to addition/deletion events

In this subsection, we investigate the three-, two-, and one-year returns of added/deleted stocks prior to addition/deletion events in both sub-periods. Tables 8 and 9 present the returns of the four portfolios three, two, and one year(s) prior to addition/deletion events for both sub-periods. Panels A of Tables 8 and 9 report the geometric mean returns. Panels B present the arithmetic mean returns. Lastly, Panels C show the risk-adjusted returns. Columns 1 to 3 of Tables 7 and 8 report the three-, two-, and one-year returns of the portfolios before addition/deletion events.

Table 8

The mean monthly percentage returns of survived, added, deleted, and voluntarily deleted stocks from Jan 1992 to Apr 2002.

Years Before Events	3 Years	2 Years	1 Year
	Panel A: Geometric Mean Returns		
Column	1	2	3
Survived (1)	0.93%	0.87%	0.73%
Additions (2)	3.53%	4.62%	6.16%
Deletions (3)	0.31%	0.12%	0.14%
Discretionary Deletions (4)	0.57%	0.36%	0.31%
	Panel B: Arithmetic Mean Returns		
Survived (1)	1.06%[2]	1.02%[2]	0.88%[2]
Additions (2)	4.99%[3,4]	6.23%[3,4]	7.38%[3,4]
Deletions (3)	0.91%	0.76%	0.84%
Discretionary Deletions (4)	0.95%	0.76%	0.63%
	Panel C: Risk-Adjusted Returns		
Survived (1)	0.1364	0.1469	0.1406
Additions (2)	0.2603	0.3415	0.4813
Deletions (3)	0.0375	0.0371	0.0649
Discretionary Deletions (3)	-0.1023	-0.1500	-0.2668

Note. [2, 3, 4] indicate that the mean is different from the mean in portfolio 2, 3, 4 at the 5% level. We use t-tests for difference in means

Pre-May 2002

Panel C of Table 8 presents the results of risk-adjusted returns for the period before May 2002. The risk-adjusted returns of the added stocks are 0.2603, 0.3415, and 0.4813 for three, two, and one year(s) prior to the addition events, respectively. This implies that that the risk-adjusted returns of the added stocks are increasing as we get closer to the addition events. On the other hand, the risk-adjusted returns of the discretionary deleted stocks are -0.1023, -0.1500, and -0.2668 for three, two, and one year(s) prior to the deletion events, respectively. Hence, it can be suggested that the risk-adjusted returns of the discretionary deleted stocks are decreasing as we get closer to the deletion events. Since the returns of added stocks are increasing and the returns of discretionary deleted stocks are declining overtime, we can argue that the additions and deletions are based on performance. Similar results are found in Panels A and B.

Next, we report the returns of all four portfolios three, two, and one year(s) prior to addition/deletion events for the period after May 2002.

Table 9

The mean monthly percentage returns of survived, added, deleted, and voluntarily deleted stocks from May 2002 to Dec 2011.

Years Before Events	3 Years	2 Years	1 Year
	Panel A: Geometric Mean Returns		
Column	1	2	3
Survived (1)	0.67%	0.68%	0.70%
Additions (2)	1.75%	3.01%	4.41%
Deletions (3)	0.79%	0.81%	0.62%
Discretionary Deletions (4)	-0.02	-2.81%	-4.81%
	Panel B: Arithmetic Mean Returns		
Survived (1)	0.75%[2,3,4]	0.76%[2,3,4]	0.77%[2,4]
Additions (2)	2.58%[3,4]	3.77%[3,4]	5.09%[3,4]
Deletions (3)	1.61%[4]	1.47%[4]	1.35%[4]
Discretionary Deletions (4)	-0.01	-2.05%	-3.94%
	Panel C : Risk-Adjusted Returns		
Survived (1)	0.1888	0.22	0.27
Additions (2)	0.2082	0.3287	0.5139
Deletions (3)	0.1185	0.1342	0.1375
Discretionary Deletions (4)	-0.1293	-0.2114	-0.3669

Note. Since the longest window of our event analysis is three years, our sample covers April 1999 to Dec 2011. [2, 3, 4] indicate that the mean is different from the mean in portfolio 2, 3, 4 at the 5% level. We use t-tests for difference in means.

Post-May 2002

Panel C of Table 9 presents the results of risk-adjusted returns for the period after May 2002. The risk-adjusted returns of the added stocks are 0.2082, 0.3287, and 0.5139 for three, two, and one year(s) prior to the addition events, respectively. This implies that that the risk-adjusted returns of the added stocks are increasing as we get closer to the addition events. On the other hand, the risk-adjusted returns of the discretionary deleted stocks are -0.1293, -0.2114, and -0.3669 for three, two, and one year(s) prior to the deletion events, respectively. Hence, it can be suggested that the risk-adjusted returns of the discretionary deleted stocks are decreasing as we get closer to the deletion events. Since the returns of added stocks are increasing and the returns

of deleted stocks are declining over time, we can argue that the additions and deletions are based on performance. Similar results are found in Panels A and B.

Tables 8 and 9 show that in both sub-periods, the added stocks exhibit strong performance prior to addition events, and the deleted ones display poor performance prior their deletions. However the risk-adjusted returns of added stocks are increasing more for the period after May 2002, with 247% increase over three years, compared to the period before May 2002, with 185% increase over three years. Also, the risk-adjusted returns of discretionary deleted stocks are declining more during the period after May 2002, with 284% decrease over three years, as compared to the period before May 2002, with 261% decrease over three years. These results support our previous suggestion that added stocks are contributing more to the Index's returns after May 2002, whereas the deleted stocks are contributing less to the Index's returns.

To sum up, we looked at the correlation of the Index and the equity market's returns. The results suggest that the Index's returns correlate with the market's returns better after the introduction of the new Index. We also investigated how close the Index's returns were to the returns of the equity market on average. Our results suggested that after May 2002 the Index's returns captured a higher percentage of the equity market's returns.

Furthermore, we decomposed the Index into four different portfolios. We investigated the contribution of each portfolio to the Index's returns. We found that after May 2002, the added stocks were contributing more to the Index's returns compared to the period before May 2002, while the deleted stocks were contributing less. This implies that with the new flexible system the Index committee was able to bring in higher performing stocks and remove the lower performing ones. This argument was further supported by investigating the three, two, and one year returns of the added and deleted stocks prior to their additions/deletions.

Now that we have studied the first role of the Index, the performance benchmark role, in the next section we will discuss the second role of the Index, the market representation role.

5.2. Market representation role of the Index

This section presents our results regarding how the Index represents the equity market by looking at the market capitalization of the Index and the equity market.

To represent the Canadian equity market, the Index needs to capture a high percentage of the Canadian equity market capitalization. Figure 10 presents the percentage of the market capitalization that is captured by the Index's capitalization for the period of January 1992 to December 2011. This percentage changes from 58% in 1992 to 83% in 2011. The S&P/TSX Composite Index captures an average of 74.7% of the equity market for the period of 1992-2011.

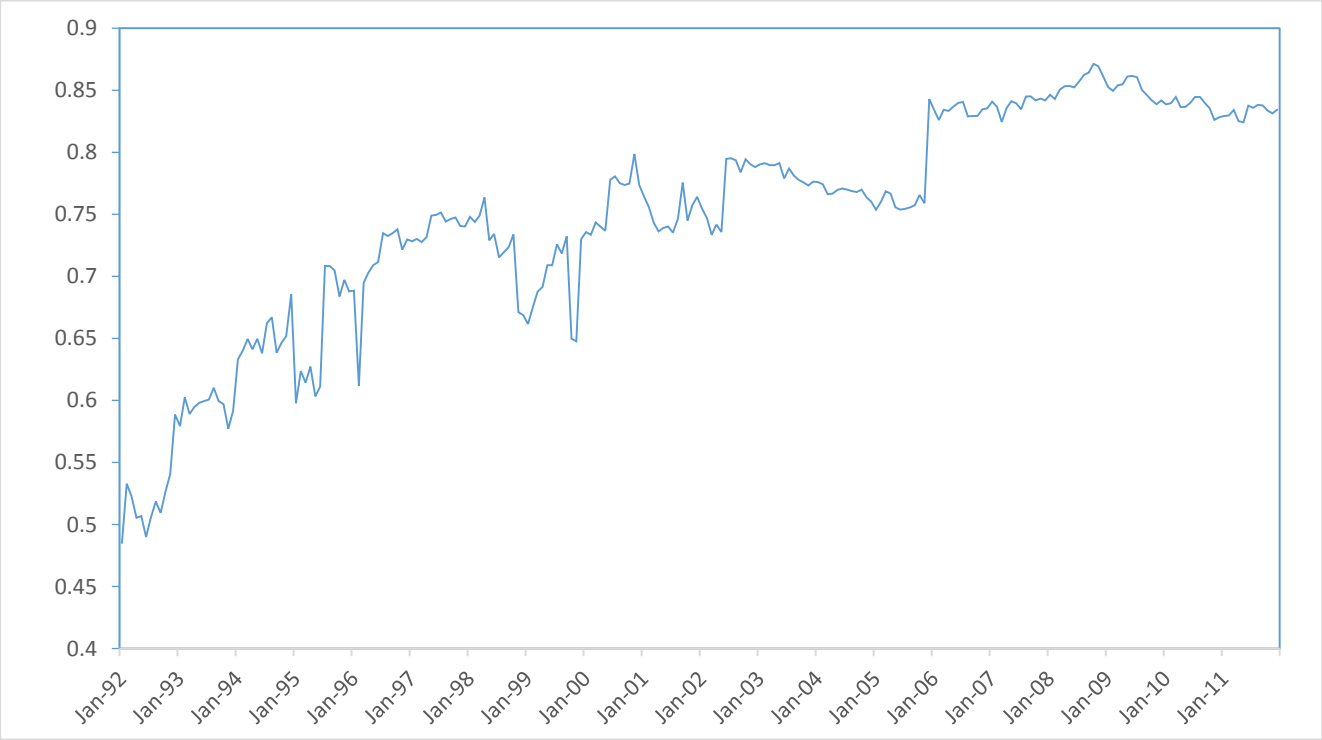

Figure 10. The dynamics of the percentage of Canadian equity market (TSE) capitalization that is captured by the S&P/TSX composite Index stocks for the period of 1992-2011.

The average of monthly percentages for both sub-periods are shown in Table 10.

Table 10

The mean of the monthly percentage of the equity market capitalization that is captured by the Index's capitalization for both sub-periods.

Period	Average of monthly percentages	t-statistic
January 1992 to April 2002	68.22%	17.545^{***}
May 2002 to December 2011	81.64%	

Note. *** indicates that the means are significantly different at 1% level of significance.

The results in Table 10 show that the mean monthly percentage for the period after May 2002 (81.64%) is significantly higher than that of the period before May 2002 (68.22%). It suggests that the Index captures higher capitalization of the equity market in the period after May 2002 compared to the period before May 2002. It is interesting that following May 2002, there are a fewer number of stocks in the Index, yet it exhibits higher capitalization representation.

Next, we look at the contribution of the four portfolios to the Index's capitalization for both sub-periods. Tables 11 and 12 show the percentage of the Index's and market's capitalization that is captured by the four portfolios for both sub-periods, respectively.

Table 11

The percentage of the Index's capitalization that is captured by survived, added, deleted, and discretionary deleted stocks before and after May 2002.

	Before May 2002	After May 2002
Survived Stocks	57.00%	75.62%
Added Stocks	17.11%	12.77%
Deleted Stocks	25.71%	13.22%
Discretionary Deleted Stocks	5.25%	3.25%

Table 12

The percentage of the market's capitalization that is captured by survived, added, deleted, and discretionary deleted stocks before and after May 2002.

	Before May 2002	After May 2002
Survived Stocks	38.89%	61.74%
Added Stocks	11.67%	10.43%
Deleted Stocks	17.54%	10.79%
Discretionary Deleted Stocks	3.58%	2.65%

As can be seen in the Table 11, before May 2002 the survived stocks (57%) had just more than half of the Index's capitalization. However, after May 2002, the ratio of survived stocks' capitalization to the Index's capitalization increased to 75.62%. Added and deleted stocks after May 2002 on average had a smaller contribution to the Index's capitalization compared to the period before May 2002. The results suggest that the better equity market representation is mainly due to the higher capitalization of the survived stocks after the introduction of the new Index. Table 12 suggests similar results with respect to capturing the capitalization of the equity market.

It should be noted that although the deleted stocks capture a higher percentage of the Index's capitalization compared to the added stocks, it does not necessarily mean that added stocks have less of a contribution to the Index's capitalization. The higher percentage of the deleted stocks may be a consequence of the fact that there are 47 stocks more in the deleted portfolio compared to the added portfolio (Table 2, p. 24).

The monthly capitalization of survived stocks against the Index's capitalization are graphically illustrated in Figure 11 and 12 for the periods before and after May 2002, respectively.

Figure 11 depicts the monthly ratio of the Index's capitalization that is captured by eighty-seven survived stocks over the period of January 1992 to April 2002.

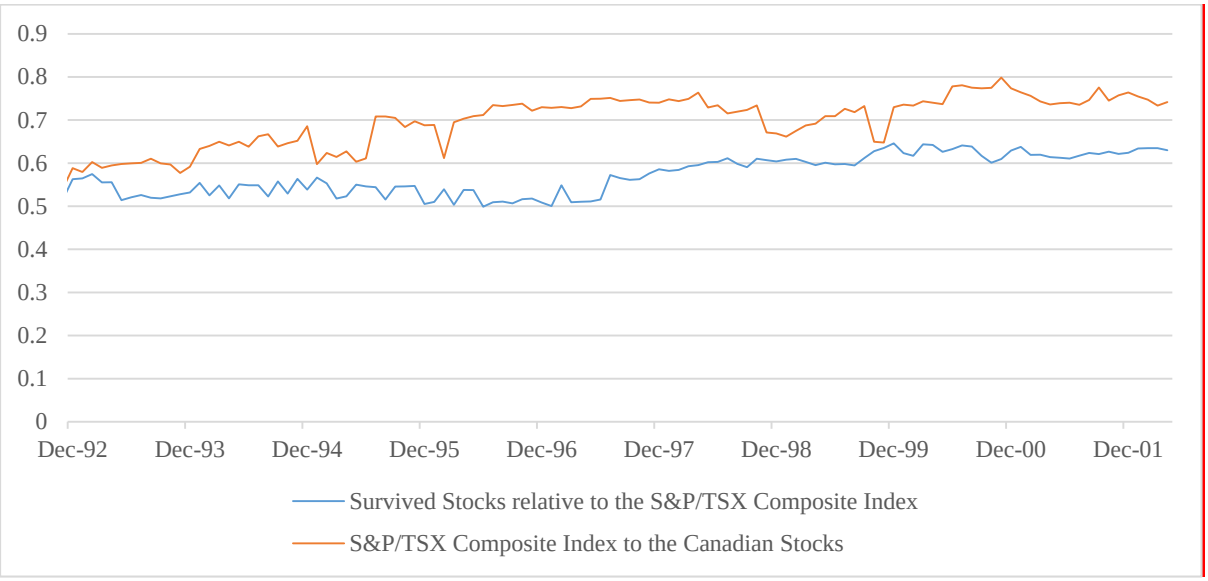

Figure 11. The dynamics of the percentage of the Canadian equity market capitalization that is captured by the S&P/TSX Composite Index and the percentage of the capitalization of the S&P/TSX Composite stocks that is captured by 87 survived stocks for the period of Jan 1992 to Apr 2002.

Figure 12 shows the monthly ratio of 95 survived stocks' capitalization to the Index's capitalization over the period of May 2002 to December 2011

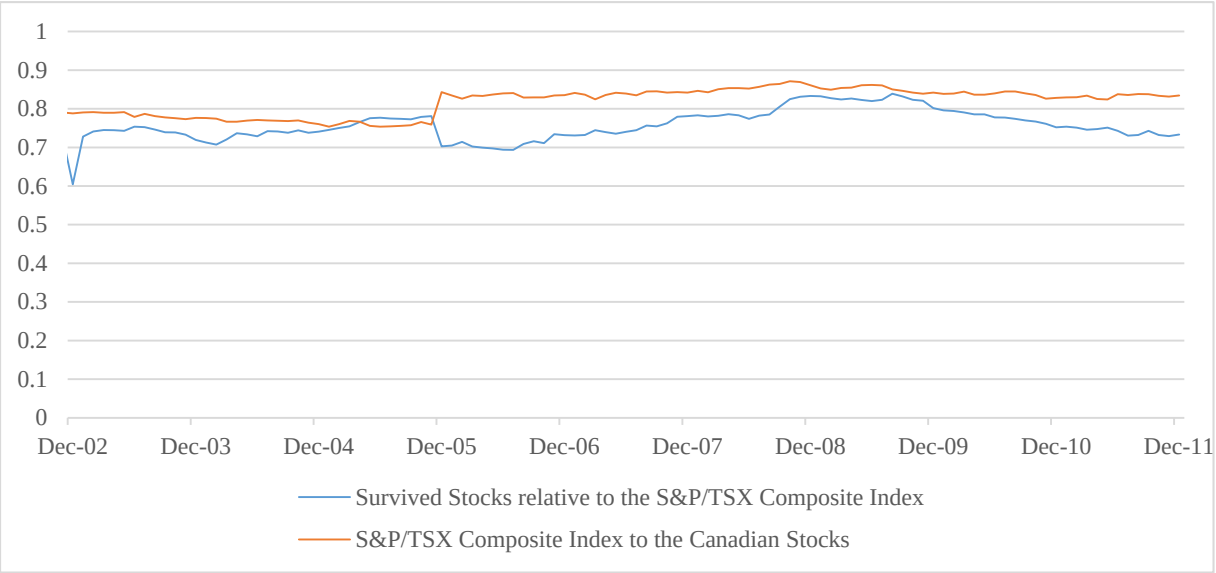

Figure 12. The dynamics of the percentage of the Canadian equity market capitalization that is captured by the S&P/TSX Composite Index and the percentage of the capitalization of the S&P/TSX Composite stocks that is captured by 95 survived stocks for the period of May 2002 to Dec 2011.

Overall, our results suggest that the Index, over the period of May 2002 to December 2011, with an average of 81.64%, was a better representation of the Canadian equity market compared to the period of January 1992 to April 2002 with an average of 68.22%. This improvement was mainly due to higher capitalization of the survived stocks after May 2002.

5.3. Robustness check for the inclusion of income funds

In this section, we investigate whether or not the inclusion of the income funds has had any impact on the dual roles of the Index.

In order to study the impact of the inclusion of the income funds on the performance benchmark role of the Index, we exclude the income funds from the Index. First, we examine the correlation of the Index's returns with market returns. Similar to the case where income funds were included in the Index (Table 3), the Pearson correlation coefficient for the period after May 2002 is significantly greater than that of the period before May 2002 (Table B1). We also investigate the correlations of the four new portfolios with the market (Table B2). The results suggest that all portfolios except the added one have a higher correlation with the market for the period after May 2002, which is also similar to the previous case (Table 4).

We also investigate the closeness of the Index's returns to the equity market returns. We find that, similar to the case where the income funds are included, the differences between the Index and equity market for the period before May 2002 and after May 2002 are not statistically significant (Table B3). However, when we compare the results with Table 6 where the income funds where included, we find that excluding the income funds from the Index decreases the ratios for the period after May 2002 to almost the same ratios as the period before May 2002.

Table B4 reports the average value-weighted returns of the equity market, the Index, and four portfolios. In Table B4, column 4 of panel B suggests that the added portfolios have higher risk-adjusted returns compared to the Index after May 2002, while the deleted and discretionary deleted stocks have less risk-adjusted returns compared to the Index after May

2002. These results are consistent with our previous results when the income funds were members of the Index and our four portfolios.

Moreover, in order to study the effects of the inclusion of income funds on the equity market representation role of the Index, we examine the percentage of the market capitalization that is captured by the Index's capitalization (Table B5) and the contribution of the four portfolios to the Index's capitalization (Table B6) when the income funds are excluded from the Index.

We found that the Index without income funds still represents the equity market better for the period after May 2002, with 77.72%, compared to the period before May 2002, with 68.22% (Table B5). However, including the income funds increases the equity market representation from 77.72% to 81.64% for the period after May 2002 (Table 10). It is also evident from Figure 10, where there is a permanent jump at December 2005 when income funds became eligible securities in the Index. Furthermore, including the income funds has increased the contribution of added stocks' capitalization to the Index's from 8.21% (Table B6) to 12.77% (Table 11).

Overall, our results show that even though the inclusion of income funds has some impact on the dual roles of the Index, it does not negate our findings and our results are robust with respect to the inclusion of income funds.

To sum up, our results show that the performance benchmark function of the Index has been enhanced for the period after May 2002 as compared to the period before May 2002. This enhancement is mainly due to the addition of higher performing stocks and deletion of poorly performing stocks. Our findings are consistent with those of Asem and Alam (2012). They also

found that the S&P 500 Index is able to track the U.S. equity market by the addition of strong-performing stocks and deletion of poorly performing stocks. We also found that the Index is a better representation of the market for the period after May 2002 largely as a result of higher capitalization of the survived stocks.

This study may have implications for traders, portfolio managers, and policy makers. Since the Index tracks the equity market by adding high-performing stocks and deleting poorly performing ones, trader and portfolio managers may be able to predict which stocks are going to be added to or deleted from the Index and act accordingly. Moreover, as we found that the floating Index is a better replicate and representative of the Canadian equity market, policy makers may consider adopting a floating Index for other markets.

The next chapter presents the summary of our study, limitations that we faced, and recommendations for future studies.

6. Summary and Conclusion

Major Indices such as S&P 500 and TSE 300 fulfill dual roles of acting as a performance benchmark and representing the equity market. In May 2002, major changes in the makeup of TSE 300 occurred, and TSE 300 was renamed S&P/TSX Composite Index. The major impact of these changes was that the number of stocks in the Index varied according to new inclusion criteria. Revisions occurred on a quarterly basis instead of the previous annual basis. In addition, industrial sectors were categorized based on the new classification procedure (GICS). Thus, the number of sectors dropped from 14 to 10. Consequently, the question of whether such changes to the composition of TSE 300 affected the dual role of the Index, or not, was posed.

More precisely, in this study we intended to address three main questions: first, whether the conversion of TSE 300 to S&P/TSX Composite Index in May 2002 enhanced the role of the Index as a performance benchmark; second, whether the introduction of the new Index improved the role of the Index to represent the equity market; and lastly, whether or not income funds had any impact on the Index's roles. This study utilizes data for the period from January 1992 to December 2011.

To address the first question, we compared how the Index's returns replicated the returns of the equity market in two sub-periods: January 1992 to April 2002, and May 2002 to December 2011. We did so by looking at correlations and the means of the returns of the Index and the equity market. The results suggest that the Index's returns replicated the market's returns better in terms of both correlation and mean of the returns after the conversion of TSE 300 to S&P/TSX Composite Index. Hence, the Index serves as a better performance benchmark for the equity market after May 2002. The reason for this improvement after May 2002 is that the committee's addition/deletion decisions were based on the stocks' performance.

We studied the percentage of the equity market capitalization that was captured by the Index's capitalization in both sub-periods. Results show that the Index on average was a better representation of the Canadian equity market over the period of May 2002 to December 2011, compared to the period of January 1992 to April 2002. We also investigated the ratio of the four portfolios' capitalization to the Index's capitalization for both sub-periods. We found that the higher percentage of the market capitalization captured by the Index in the period after May 2002 is mainly due to the higher capitalization of survived stocks. Furthermore, we found that the addition/deletion decisions did not have an immediate impact in terms of a better representation of the equity market.

In order to address the third question, we excluded the income funds from the Index and repeated all of our analyses. We found that our results were robust with respect to the inclusion of income funds in December 2005.

Overall, our findings show that the addition/deletion decisions made by the Index's committee enhanced the performance benchmark role of the Index, whereas they did not have a direct immediate impact on the representation role of the Index.

The implications of this study for traders, fund managers, and policy makers are as follows. High-performing stocks which meet the Index inclusion criteria are likely to be added to the Index. Also, the stocks which perform poorly overtime are likely to be deleted from the Index. Hence, monitoring the performance of the stocks can help traders and fund managers to predict which stock may be added to or deleted from the Index. Furthermore, in general the S&P/TSX Composite Index is a better performance benchmark and representation of the equity market compared to the TSE 300 Index. Moreover, since the conversion of TSE 300 Index to a

floating Index has enhanced the its ability to replicate and represent the Canadian equity market, the policy makers may consider adopting a floating Index for other equity markets.

This study had a few limitations, especially with regard to the dataset, as data on TSE 300 is not easily accessible.

In this study, we did not consider the performance of the deleted stocks after they were deleted from the Index because the data were not easily available. This study could be extended by considering the deleted stocks after the deletion event.

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Appendices

Appendix A

Table A1

Relative weight of each sector to the Index.

	Jan-92	Apr-02	Averages for the Period Pre May 2002	May-02	Dec-11	Averages for the Period Post May 2002
Energy	6.52%	13.46%	10.85%	13.41%	27.07%	23.99%
Materials	21.58%	14.77%	21.07%	15.77%	21.12%	17.58%
Industrials	8.73%	8.86%	7.84%	9.20%	5.76%	6.00%
Consumer Discretionary	8.84%	8.14%	8.38%	8.04%	4.02%	5.44%
Consumer Staples	10.52%	4.25%	6.25%	4.37%	2.81%	3.27%
Health Care	0.82%	2.95%	1.45%	2.73%	1.38%	1.24%
Financials	22.81%	32.29%	21.31%	32.14%	29.37%	30.83%
Information Technology	4.64%	6.76%	10.27%	5.69%	1.27%	4.44%
Telecommunication Services	11.34%	4.40%	8.43%	4.45%	5.22%	5.02%
Utilities	4.23%	4.16%	4.18%	4.22%	1.97%	2.17%

Table A2

Number of Index's Constituents in each sector

	Jan-92	Apr-02	Averages for the Period Pre May 2002	May-02	Dec-11	Averages for the Period Post May 2002
Energy	38	36	50	36	65	53
Materials	82	51	72	51	74	56
Industrials	24	38	23	38	18	22
Consumer Discretionary	45	38	40	38	17	25
Consumer Staples	24	19	22	19	12	14
Health Care	5	28	9	28	4	9
Financials	49	37	37	34	42	35
Information Technology	12	36	24	36	6	11
Telecommunication Services	9	9	12	9	5	6
Utilities	12	8	11	8	10	9

Appendix B

Table B1

Pearson correlation coefficient of the Index and equity market returns for both sub-periods.

	Correlation (r)	Z-Score	Observations	Z-statistic
(1) January 1992 – April 2002	0.983	2.380	124	3.411***
(2) May 2002 – December 2011	0.993	2.831	116	

Table B2

Pearson correlation coefficient	Before May 2002		After May 2002		Z-statistic
Column	(1)	(2)	(3)	(4)	(5)
	r	*p*-value	r	*p*-value	
The Market and the Added Portfolio (1)	0.878[2,3,4]	0.0000	0.8277[2,3,4]	0.00	-1.41
The Market and the Deleted Portfolio (2)	0.791	0.0000	0.8802	0.00	2.28**
The Market and the Discretionary Deleted Portfolio (3)	0.720	0.0000	0.8632[4]	0.00	2.97**
The Market and the Survived Portfolio (4)	0.794	0.0000	0.943	0.00	5.22**

Correlation of the portfolios and the Canadian equity market before and after May 2002.

Note. ** indicates that the correlations are significantly different at 5 % level based on Fisher's Z transformation (compares before and after May 2002). [2,3,4] Indicates that correlation is different from the correlation in portfolio 2,3,4 at the 5% level (compares portfolios within each sub-periods)

Table B3

The monthly returns of the equity market, and the Index before and after May 2002.

	Before May 2002	After May 2002
	Panel A: Geometric Mean Return	
Equity Market	0.8458%	0.5934%
Index	0.7938%	0.55%
t-statistic	0.0889	0.08846
The difference between equity market and the Index	0.052%	.0434%
Ratio (Index/equity market)	93.85%	93.22%
	Panel B: Arithmetic Mean Return	
Equity Market	0.9577%	0.6854%
Index	0.9101%	0.65%
t-statistic	0.0814	.0801
The difference between equity market and the Index	0.0476%	0.0354%
Ratio (Index/equity market)	95%	95%
	Panel C: Risk-Adjusted Arithmetic Return	
Equity Market	0.1201	0.1166
Index	0.1074	0.1048
z-statistic	0.6808	.5235
The difference between equity market and the Index	0.0127	0.0118
Ratio (Index/equity market)	89.42%	90%

Table B4

The returns of the Index, survived, deleted, and added stocks for both sub-periods.

Portfolio	Geometric Mean Return	Arithmetic Mean Return	Standard Deviation	Risk-Adjusted Return
		Panel A: Pre May 2002		
Column	(1)	(2)	(3)	(4)
Equity Market (1)	0.85%	0.96%	0.0455	0.1201[6]
Index (2)	0.80%	0.91%	0.0465	0.1074[6]
Survived Stock Portfolio (3)	0.70%	0.87%	0.0565	0.0806[6]
Added Stock Portfolio (4)	0.66%	0.81%	0.0545	0.0737
Deleted Stock Portfolio (5)	0.80%	0.92%	0.0490	0.1039
Discretionary Deleted Stocks(6)	0.47%	0.55%	0.0396	0.0344
		Panel B: Post May 2002		
Equity Market(1)	0.59%[6]	0.68%[6]	0.0425	0.1166[6]
Index (2)	0.55%[6]	0.65%[6]	0.0425	0.1048[6]
Survived Stock Portfolio (3)	0.58%[6]	0.66%[6]	0.0399	0.1185[6]
Added Stock Portfolio (4)	0.80%[6]	1.05%[6]	0.0686	0.1249[6]
Deleted Stock Portfolio (5)	0.28%[6]	0.56%[6]	0.0726	0.0509[6]
Discretionary Deleted Stocks(6)	-2.25%[6]	-1.97%	0.0718	-0.3005[6]

Table B5

The mean of the monthly percentage of the equity market capitalization that is captured by the Index's capitalization for both sub-periods.

Period	Average of monthly percentages	t-statistic
January 1992 to April 2002	68.22%	13.311^{***}
May 2002 to December 2011	77.72%	

Table B6

The percentage of the Index's Capitalization that is captured by survived, added, deleted, and discretionary deleted before and after May 2002.

	Before May 2002	After May 2002
Survived stocks	57.00%	79.50%
Added Stocks	17.11%	8.22%
Deleted Stocks	25.71%	12.39%
Discretionary Deleted stocks	5.25%	3.26%