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MODERN PORTFOLIO THEORY AND THE EFFICIENT MARKETS HYPOTHESIS: HOW WELL DID THEY SERVE CANADA'S BABY-BOOM GENERATION?

Abstract:

Modern Portfolio Theory (MPT) and the Efficient Markets Hypothesis (EMH) have had considerable influence over portfolio management strategies for the last forty years. This is also the time that the bulk of the baby boom generation entered and started to retire from the work force. Taking the example of an average Canadian family from 1977 to 2016, this paper examines how well the tenets of MPT and EMH served this generation of investors. A model investing strategy was constructed based on the principles of MPT and EMH. The results of this strategy were evaluated for the portfolio's ability to adequately provide for the subject couple's financial needs in retirement. Results of the model portfolio were compared to other popular investment alternatives. Using generally-accepted rules-of-thumb in financial planning, the model portfolio was found to have provided an adequate retirement income for the subject couple. Some of the other strategies moderately exceeded the returns of the model portfolio, while others underperformed this benchmark. Analysis of these discrepancies reinforced the significance of diversifying among and within asset classes, and of rebalancing portfolios through dynamic asset allocation.

Keywords:

Modern Portfolio Theory (MPT), Efficient Markets Hypothesis (EMH), baby-boom generation, indexing, portfolio management

JEL Classification: G11

1. Introduction

Harry Markowitz's 1952 paper on Modern Portfolio Theory (MPT) introduced guidelines for investment choice and portfolio management that departed from previously accepted practices. His advocacy of diversification among and within asset classes took some time to catch on, but by the 1970s MPT and its balancing act between risk and return had become the template for portfolio selection and management (Rubinstein, 2002). Complementing Markowitz's MPT, the Efficient Markets Hypothesis (EMH) paved the way for the concept of indexing, or achieving diversity through a broadly based market index, allowing any investor to hold an array of stocks without having to pick individual securities.

The 1970s also ushered the baby-boom generation into the work force. Hence, their investment strategies would be heavily influenced by investment advisors who were guided by Markowitz's MPT. It continued to hold court as the predominant view of how to manage investment choices for the next 40-plus years, and EMH and its indexing strategy provided a ready means for any investor to achieve instant diversity.

With the global financial crisis and ensuing recession that started in 2007, the continued relevancy of these theories was questioned. By then, the first members of the boomer generation were starting to retire. While faith in MPT and EMH might have been shaken by the economic events of the early 21st Century, they were the theoretical basis upon which the portfolios of an entire generation of investors were managed. With the vanguard of the boomer cohort entering their retirement years now, it was the opportune time to examine the efficacy of MPT.

This paper asks the question, was the average baby-boomer well-served by following an investment strategy guided by the principles of MPT and EMH? A model portfolio was constructed that encompassed the tenets of these theories. This was compared to other popular investment alternatives. Conclusions as to the efficacy of the model portfolio or other alternatives were based on their ability to provide for the retirement needs for the average Canadian who reached age 65 in 2016. It hypothesizes that the model portfolio constructed here would provide for an adequate income for the average Canadian family retiring in 2017.

2. Methodology

Canadian economist and demographer David Foote defines the Canadian baby-boom generation as those born from 1947 to 1966 (Foot & Stoffman, 1998). The generation is significant because of the large number of members in the cohort. Throughout those years, there were over 400,000 new Canadians born annually (Foot & Stoffman, 1998, p. 24). To compound the significance of the cohort's size, there was also significant immigration to Canada at the same time, notably of people who were in their prime child-bearing years.

Markowitz's portfolio theory in 1952 challenged the previous predominant investment strategy championed by Keynes and others (Boyle, Garlappi, Uppal, & Wang, 2012). For Keynes, acquired competence of certain asset classes and their specific securities

allowed the investor to discover undervalued securities of local enterprises. Diversification was not considered important, but troublesome, as all investors had limited expertise to draw from, thus limiting their investments to those securities they understood and found value in (Boyle, Garlappi, Uppal, & Wang, 2012). In contrast, Markowitz recognized the relationship between risk, return, and covariance (Markowitz, 1952). His MPT stressed the need for diversification among asset classes. This allowed the investor to hold a broad array of investments, distributed across assets such as stocks, bonds and real estate. Traditionally these asset classes had low positive or even negative covariance, meaning they would not all perform well at the same time, although the long-term returns of each class individually were positive. The volatility risk, as measured by standard deviation, was smoothed for the entire portfolio if asset allocation included investments that lacked positive covariance. This diversification theme was taken a step further, to suggest securities within each class should also be considered for their covariance within the class. For example, the equity portfolio should not consist only of automobile manufacturers, steel companies, and coal companies, all of which follow the same economic cycle.

The EMH suggests that securities prices quickly adjust as investors react to information that has been disseminated to them (Fama, 1970). A strong believer in the EMH would deduce that because all information is available to all investors equally, no one has any advantage in choosing securities over anyone else. Therefore, trusting professional portfolio managers to outperform the market benchmark is folly. One is better served by investing in a broad basket of securities representative of all segments of the market, such as a market index (Buffett, 1991).

This study modelled the retirement planning of an average Canadian family in the 40-year span from 1977 to 2016, using principles associated with MPT and EMH. The beginning of this time frame marks the point at which individuals in the middle range of the baby boomer generation entered the work force and started careers.

Income data for Canadians was readily available from Statistics Canada (Statistics Canada, 2017). This study included data for non-elderly couples and couples with children, using one or the other depending on the position of the economic life cycle the subject couple were in at any given point in the timeframe studied.

In 1977 the average Canadian male married at the age of 25.2, the average female at 22.9 (Statistics Canada, October 1979). The newlywed couple in 1977 were born in 1951 and 1953 respectively, in the first half of the baby-boom generation. Our study begins in 1977, and follows an economic family unit of a couple with two children, as defined by Statistics Canada. The average age of a mother at first birth in 1977 was 24.5 years of age (Statistics Canada, 2015). Recognizing this average for our economic family, in 1977 we start to use the average after-tax income for a couple with children. This is maintained until 2003, when the data for couples without children is used. It assumes the couple have two children relatively close together, and, 26 years after the birth of the first, all children have left the economic family unit. The children were two years apart in age, and left at an average age of 25.

Data for average after-tax income is provided by Statistics Canada in 2015 constant dollars. For each year it is converted to real dollars using the inflation calculator of the Bank of Canada (Government of Canada, 2018).

All income sources were considered, including: employment income of wages, salaries and commissions, self-employment income, investment income, retirement income, and government transfers.

As the last Canadian Census was in 2016, there is data on average family incomes only up to 2015. For 2016, the year in which the male of our study turned 65, incomes were deemed to be the same as those of 2015.

When Registered Retirement Savings Plans (RRSPs) were introduced in Canada in 1957, contribution limits were based on a percentage of the current year's income. Maximum amounts were increased infrequently. There was no carry-forward provision for unused contributions. For the time-frame of this study, starting in 1977 until 1985, the limit was 20% of earned income up to a maximum of $5,500 for an individual with no pension plan (Franken, 1990). This amount increased from 1986 to 1990, to 20% up to a maximum of $7,500. From 1990 on, contribution limits have been based on 18% of the previous year's earnings, to a maximum which increased regularly. These amounts are available from Canada Revenue Agency (Canada Revenue Agency, 2016). For all years in this study, the amounts saved for investment from after-tax income for the two adults in the family falls within the contribution limits allowed for RRSPs. The family members are assumed to be rational investors, taking advantage of any tax-favored accounts at their disposal. Therefore, the investments made can be deemed to be growing tax free throughout the time period.

The adults in the family were deemed to be employed in jobs which did not provide for any pension. Their income in retirement was dependent on their own savings and investments.
The family unit is deemed to have invested 20% of their after-tax monthly income each month, at the end of the month, into their investments throughout the time period.

The equity portion of the portfolio is deemed to have been invested in the S&P/TSX Composite Index. This index serves as the main broad-based index of the Canadian equity market (S&P Dow Jones Indices LLC, 2018). It was launched in January 1977, and therefore serves the entire time frame of the study. Investments were deemed to have been made into an index mutual fund replicating the S&P/TSX Composite Index. As there was no such instrument at the time, a simulated index fund was created using the following parameters. The closing price of the index was used on the last trading day of the month as reported by the Toronto Stock Exchange (TSX) (Toronto Stock Exchange, 2018). This is consistent with the practice of having mutual funds ascertain their Net Asset Value Per Share (NAVPS) after market, on a daily basis, rather than continuously during the day. A Management Expense Ratio (MER) of 1% annually was subtracted from the fund. This is consistent with the average MER taken from an equity index fund in 2018. In keeping with mutual fund practice, the MER was subtracted quarterly, at a rate of 0.25% of the fund. Distributions were paid each month, consistent with the dividend

ratio of the index each month as reported by the TSX (Siblis Research, 2018). The family invested at the end of each month. Distributions of dividends were reinvested to buy more units of the fund rather than receiving them as cash at the time of each monthly deposit. Because the amount invested annually by the family was within the amount allowed for RRSP purposes, all contributions were made in an RRSP account. The couple were exempt from paying any taxes on their monthly savings or the annual mutual fund distributions deemed to have been received.

For the fixed-income portion, the family is deemed to have invested in a bond index fund fashioned after the total returns of the FTSE TMX Canadian Universe Bond Index, formerly the DEX and ScotiaMcLeod Bond Index. This index is the broadest and most widely used measure of performance of marketable government and corporate bonds outstanding in the Canadian market (FTSE Russell, 2018). Like the equity portion, the fixed-income portion was invested at the end of the month at the closing price for the bond index. The price of the index was reported on a total return basis, therefore income received during the year was deemed to have been reinvested in the fund. A MER of 0.50% annually was subtracted from the fund, consistent with the average MER taken from a fixed-income index fund in 2018. Price data from FTSE Russell was available for all years of the study except from 1977 to 1979. Returns for these three years were available, however, from the Financial Planning Standards Council (FPSC) of Canada (Financial Planning Standards Council, 2018). For these years, the annual returns were used to calculate a beginning price for the year, and that price was graduated or reduced monthly at an even rate to meet the next year's index level.

The amount marked for investment in either equity or fixed-income was based on a generally accepted rule-of-thumb in financial planning. This involves taking one's age and using that as a percentage to be invested in fixed-income, with the rest going to equity. Another way of saying this is to subtract your age from 100, and place this percentage in equity. For a 26-year old, this meant putting 74% in equity and 26% in fixed-income. Each year, as the investor aged, less was apportioned to equity and more to fixed-income.

The investor in the study was deemed to have practiced dynamic asset allocation. This involved reshuffling the portfolio annually if the portfolio becomes unbalanced as a result of one asset class having had an extraordinary year of returns. For example, at age 30, the investor should have been invested 30% in fixed income and 70% equity. If the previous year saw extraordinary gains for the stock market index, and the equity percentage of the portfolio was instead 75%, money was taken off of the equity portion and reassigned to the fixed-income portion to rebalance. This was done in December based on the portfolio weightings as new money was committed to the portfolio.

The model portfolio was based on dollar-cost-averaging into the S&P/TSX Composite Index and the FTSE TMX Universe Bond Index, reinvesting distributions, and practicing dynamic asset allocation or re-balancing annually. Initial asset allocation followed the rule-of-thumb, with 26% of the portfolio invested in equity when the male was 26 years of age. This was referred to as:

1. The Model Portfolio

Its forty-year returns were compared to a number of other investment strategies:

2. Investing in the model portfolio, but without rebalancing;
3. Investing in both the S&P/TSX Composite Index and the FTSE TMX Universe Bond Index, but with a 50% allocation to each, rebalancing annually;
4. Investing in both the S&P/TSX Composite Index and the FTSE TMX Universe Bond Index, but with a 50% allocation to each, without rebalancing annually;
5. Investing in both the S&P/TSX Composite Index and the FTSE TMX Universe Bond Index, reinvesting dividends, and practicing dynamic asset allocation or re-balancing, but assigning asset allocation in the reverse order of what it is applied in the first example. In other words, at age 25 the couple would invest 25% of their money in equites rather than fixed-income, increasing each year until at age 65 they would have 65% in equity and 35% in fixed-income.
6. Investing in just the S&P/TSX Composite Index on a dollar-cost-averaging basis, reinvesting distributions as they are received;
7. Investing in just the FTSE TMX Universe Bond Index on a dollar-cost-averaging basis;
8. Investing in Guaranteed Investment Certificates (GICs) each month through a laddered portfolio technique.

In the GIC alternative, interest was deemed to be paid annually. Interest received was added to the amount being saved and invested. Five-year terms were always purchased, with an interest rate commensurate with the five-year chartered bank administered interest rates for the month as reported by the Bank of Canada (Bank of Canada, 1965). When the five-year GIC matured, its principal and final interest payment was reinvested in a new five-year GIC along with any regular monthly savings.

3. Results

In December of 2016, at the age of 65 and 63, the average Canadian couple who had invested for 40 years would have invested a total of $425,389.68.

After dollar-cost-averaging into the S&P/TSX Composite Index and the FTSE TMX Universe Bond Index, rebalancing to meet asset allocation targets each year, the couple had a total of $1,607,058.92 in their RRSP accounts (Portfolio 1). Of their total amount, $629,580.99 (65%) was in the S&P/TSX Composite Index fund and $976,079.60 (35%) was in the FTSE TMX Bond Index fund. A new deposit of $489.02 had just been made.

Without annual rebalancing of the portfolio through dynamic asset allocation, Portfolio 2 yielded $1,481,156.62.

If the couple had allocated 50% to both the equity and bond indexes every month, and rebalanced the portfolio annually (Portfolio 3), they would have had $1,677,369.26.

If they had allocated 50% to both the equity and bond indexes every month, but not rebalanced annually (Portfolio 4), they would have had $1,569,493.55.

If they had practiced the inverse asset allocation of the model portfolio, investing 65% in fixed-income at the beginning (Portfolio 5), they would have had $1,741,533.37.

If the couple had only invested in the S&P/TSX index over the 40 years, with distributions reinvested (Portfolio 6), they would have had RRSP accounts equaling $1,257,859.24.

Investing in only the FTSE TMX Universe Bond Index (Portfolio 7), the couple would have had a total of $1,971,470.23. This was the highest returning portfolio choice in the study, surpassing equity-only portfolios, or any portfolio where equities and bonds were combined.

The GIC portfolio (Portfolio 8) returned $1,001,745.02 at the end of the 40-year period.

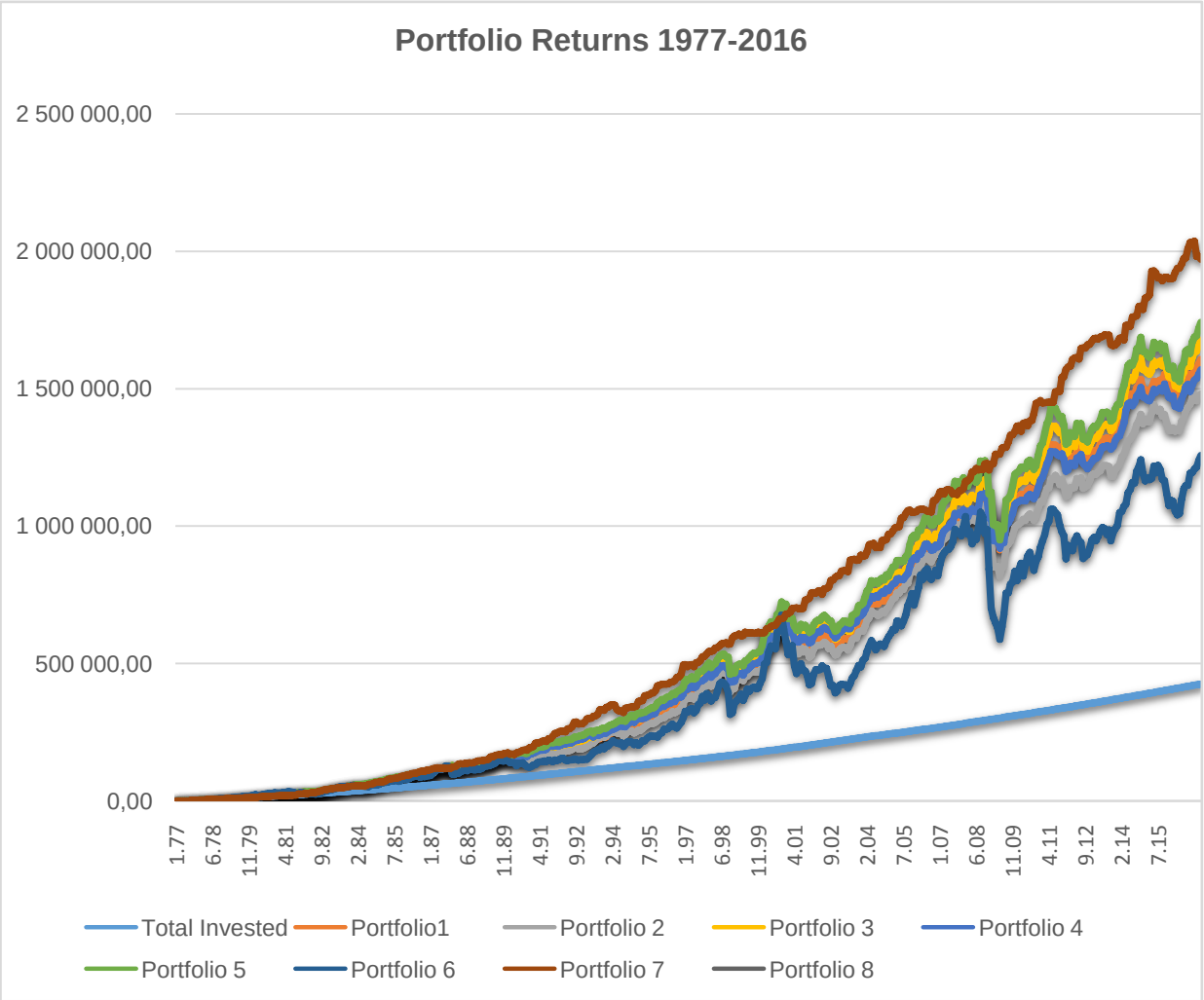
These results are summarized in Table 1.

Table 1. Model portfolio returns 1977-2016 for an average Canadian family, with 20% of after-tax income invested monthly

Portfolio 1: S&P TSX Composite Index and FTSE TMX Bond Universe Index, beginning with 65/35 equity/fixed-income in year one, with annual rebalancing	**$1,607,058.92**
Portfolio 2: S&P TSX Composite Index and FTSE TMX Bond Universe Index, beginning with 65/35 equity/fixed-income in year one, without annual rebalancing	$1,481,156.62
Portfolio 3: S&P/TSX Composite Index and the FTSE TMX Universe Bond Index, but with a 50% allocation to each, with annual rebalancing	$1,677,369.26
Portfolio 4: S&P/TSX Composite Index and the FTSE TMX Universe Bond Index, but with a 50% allocation to each, without rebalancing annually	$1,569,493.55
Portfolio 5: S&P/TSX Composite Index and the FTSE TMX Universe Bond Index, reinvesting dividends, with annual rebalancing, but assigning asset allocation beginning with 35/65 equity/fixed-income in year one, with annual rebalancing	$1,741,533.37
Portfolio 6: S&P/TSX Composite Index only, on a dollar-cost-averaging basis, reinvesting distributions monthly as received	$1,257,859.24
Portfolio 7: FTSE TMX Universe Bond Index only, on a dollar-cost-averaging basis, total return	$1,971,470.23
Portfolio 8: GICS only, invested monthly in five-year terms, interest reinvested annually as received	$1,001,745.02

Figure 1 displays the returns of the various portfolios, and the total money invested, over the 40-year period.

Figure 1. Portfolio Returns 1977-2016



4. Observations

To determine if the model portfolio served our average Canadian couple suitably, we had to consider their requirements at retirement. Popular financial planning practice suggests having retirement savings to provide 70% of pre-retirement income. In 2016 the couple made $83,900. The desired annual income in retirement, following the rule-of-thumb, would be 70% of this amount or $58,730, in real dollars, throughout the life of the couple.

Four possible retirement scenarios were illustrated. A post-retirement annual return of 5% was considered for the resulting portfolio at age 65. Consideration was given to how long the couple's retirement funds would last if they took an annual income equal to 100% of their annual income received in their last year in the work force, and how long it would

last if they took 70% of this amount. A post-retirement annual return of 0% was also considered for the resulting portfolio at age 65. Again, consideration was given to the couple taking 100% of their pre-retirement annual income, or 70% of the same amount. Investment account balances for each scenario were calculated to age 100. In each of these four cases, the returns to the retired couple and the longevity of their funds are represented in Table 2.

Table 2: Annual retirement incomes for Canadian couple starting at age 66, and age at which savings are depleted

	Annual retirement income, indexed to 2% inflation, starting at age 66			
	With 5% annual investment return		**With 0% annual investment return**	
Portfolio value at age 65	**$83,900 (100% of last year income in work force, indexed to inflation)**	**$58,730 (70% of last year income in work force, indexed to inflation)**	**$83,900 (100% of last year income in work force, indexed to inflation)**	**$58,730 (70% of last year income in work force, indexed to inflation)**
Portfolio 1: S&P TSX Composite Index and FTSE TMX Bond Universe Index, reinvesting distributions, initially at 65/35 equity/fixed-income in year one, with annual rebalancing				
$1,607,058.92	Depleted at age 93	Balance $1,843,491.35 at age 100	Depleted at age 81	Depleted at age 86
Portfolio 2: S&P TSX Composite Index and FTSE TMX Bond Universe Index, beginning with 65/35 equity/fixed-income in year one, without annual rebalancing				
$1,481,156.62	Depleted at age 90	Balance $ 1,149,012.33 at age 100	Depleted at age 80	Depleted at age 85
Portfolio 3: S&P/TSX Composite Index and the FTSE TMX Universe Bond Index, but with a 50% allocation to each, with annual rebalancing				
$1,677,369.26	Depleted at age 95	Balance $2,231,324.27 at age 100	Depleted at age 81	Depleted at age 87
Portfolio 4: S&P/TSX Composite Index and the FTSE TMX Universe Bond Index, but with a 50% allocation to each, no annual rebalancing				
$1,569,493.55	Depleted at age 92	Balance $1,636,280.19 at age 100	Depleted at age 80	Depleted at age 86
Portfolio 5: S&P/TSX Composite Index and the FTSE TMX Universe Bond Index, reinvesting distributions, but initial asset allocation at 35/65 equity/fixed-income in year one, with annual rebalancing				
$1,741,533.37	Depleted at age 97	Balance $2,585,254.48 at age 100	Depleted at age 82	Depleted at age 88
Portfolio 6: S&P/TSX Composite Index only, reinvesting distributions monthly as received				
$1,257,859.24	Depleted at age 85	Depleted at age 99	Depleted at age 78	Depleted at age 82
Portfolio 7: FTSE TMX Universe Bond Index only, total return				
$1,971,470.23	Balance $844,559.59 at age 100	Balance $3,853,589.74 at age 100	Depleted at age 84	Depleted at age 90

Portfolio 8: GICS only, invested monthly in five-year terms, interest reinvested annually as received				
$1,001,745.02	Depleted at age 79	Depleted at age 89	Depleted at age 75	Depleted at age 79

If the model portfolio provided a 2% increase in income each year to accommodate inflation, by age 90 the couple would be receiving $137,646.84 annually and, at that time, could leave their estate $462,148.47. If they continued to receive inflation-indexed amounts, they would exhaust their savings at age 93.

If the couple took only the prescribed amount of 70% of their annual pre-retirement income, or $58,730 annually, indexed to inflation of 2%, they would leave their estate $1,956,125.50 at age 90, or $1,843,491.35 at age 100.

In either of these scenarios, the couple that followed the model portfolio strategy had enough savings to provide for a comfortable retirement.

There is one caution for the couple if they take 100% of their annual pre-retirement income. This alternative brings with it the possibility of outliving their savings if they live beyond 93 years of age, even if their investments continued to grow at a rate of 5% annually. If the account had a return of 0% annually, it would be depleted by age 81.

The retirement incomes and their longevity from the other model portfolios are shown in Table 2. Most of these also provided for a reasonable retirement on their own. This is particularly the case if the couple took an income equal to 70% of annual pre-retirement income, and the portfolio continues to grow at a rate of 5% annually. The exception was the GIC portfolio. To meet the minimum annual income of $58,730, the GIC portfolio would need to be topped up by Canada Pension Plan (CPP) and Old Age Security (OAS) payments. The couple would normally be entitled to these benefits. If they elected to start receiving them at age 65, they could expect to receive up to approximately $20,000 annually in CPP benefits, and an additional $14,000 in OAS benefits in 2016 dollars, indexed to inflation (Government of Canada, 2016). The addition of government pensions also makes the GIC alternative a feasible retirement savings strategy. Government pensions also extend longevity of a number of the other portfolios if they reduce their income taken from their investment savings relative to the amount they receive in CPP and OAS benefits.

Sharpe ratios were calculated for each of the portfolios which held equities, bonds, or both, using the following:

Sharpe Ratio = $\{[E(R_p-R_{rf})] / \sigma(R_p-R_{rf})\} \times \sqrt{N}$

Where:

R_p = the monthly return of the portfolio

R_{rf} = the risk-free rate of return, in this case the monthly return of the 3-month Canadian Treasury Bill (Statistics Canada, 2019) (Government of Canada, 2019)

R_p-R_{rf} = the return differential between the portfolio and the risk-free rate

$E(R_p-R_{rf})$ = the average of the monthly differential returns

$\sigma(R_p-R_{rf})$ = the standard deviation of the differential returns

N = 12, the number of months in the year, to annualize the Sharpe ratio results gleaned from monthly data

Sharpe ratios are displayed in Table 3.

Table 3. Sharpe Ratios for Portfolios

Portfolio 1: S&P TSX Composite Index and FTSE TMX Bond Universe Index, beginning with 65/35 equity/fixed-income in year one, with annual rebalancing	29.64
Portfolio 2: S&P TSX Composite Index and FTSE TMX Bond Universe Index, beginning with 65/35 equity/fixed-income in year one, without annual rebalancing	22.77
Portfolio 3: S&P/TSX Composite Index and the FTSE TMX Universe Bond Index, but with a 50% allocation to each, with annual rebalancing	32.22
Portfolio 4: S&P/TSX Composite Index and the FTSE TMX Universe Bond Index, but with a 50% allocation to each, without rebalancing annually	31.27
Portfolio 5: S&P/TSX Composite Index and the FTSE TMX Universe Bond Index, reinvesting dividends, with annual rebalancing, but assigning asset allocation beginning with 35/65 equity/fixed-income in year one, with annual rebalancing	33.94
Portfolio 6: S&P/TSX Composite Index only, on a dollar-cost-averaging basis, reinvesting distributions monthly as received	14.86
Portfolio 7: FTSE TMX Universe Bond Index only, on a dollar-cost-averaging basis, total return	38.46

The Sharpe ratio is used with ex-post returns to measure the excess return earned given the excess risk (standard deviation) undertaken to earn it. Where portfolios have equivalent returns, the one with the higher standard deviation will have a lower Sharpe ratio. Higher Sharpe ratios therefore demonstrate a higher performance given the relative amount of risk taken in the portfolio. Portfolios 1, 3, 4, and 5 all employ a similar investment strategy, combining equity and fixed-income indexing. They are distinguished from each other by differences in their rebalancing and initial distribution of those assets. Their ratios of 29.64, 32,22, 31.27 33.94 respectively are close for a 40-year time frame. These four portfolios are composed solely of the same one equity and one bond index throughout their 40-year period and no efforts were made in any of the portfolios to change their strategy during the time period. Thus, it is not surprising that their relative performance would be similar. The underperforming Portfolio 6, composed of the equity index only, givens a much lower ratio of 14.86. The superior-performing Portfolio 7, composed of the bond index only, gives a much higher ratio of 38.46. During the 40-year period, the Canadian bond market outperformed the Canadian equity market as measured by their relative indexes. Historically, this is an anomaly (Ibbotson & Chen, 2009). In particular, the 21st Century has been a difficult time for equities, and this period constitutes the last 16 years of the 40-year study. The higher Sharpe ratio for Portfolio 7 reflects its acceptance of higher risk through less diversification, being composed of only bonds. It is not a reflection of manager out-performance, as the bond portfolio was passively managed. Moreover, it is a reflection of the portfolio's time period chance conclusion with back-to-back corrections in the stock market. If anything, the Sharpe ratios of the various portfolios demonstrate the expediency of diversifying among asset

classes as well as within. A lesson that can be learned for any investor, no matter which portfolio they might have pursued, is the advantage given by regularly investing 20% of after-tax income on a dollar-cost averaging basis.

It is notable that the FTSE TMX Universe Bond Index portfolio outperformed all others, including the equity-only or the model portfolio. In the 40-year period studied, the Canadian stock market as evidenced by the S&P/TSX Composite underwent two 50% corrections, beginning in 2000 and 2007 respectively. The “lost decade” followed the historical bull market for stocks in the 1990s. While the 40-year period does suggest bonds outperform stocks, longer-term analysis still says otherwise. While the couple in this study from 1977 to 2016 would have done better had they invested only in the bond index, the anomalies of the stock market in the new millennium could not have been known to them. In any time period measured, either bonds or stocks will likely outperform the other by some degree. While stocks might historically have been the favorite in the long term to outperform, the 40-year period studied here provides proof that diversification among asset classes is necessary, and returns in any one-time period can be surprising.

While the normal rule-of-thumb suggests investing in 65/35 equity/fixed-income early and adjusting annually, the portfolio which did the opposite of 35/65 equity/fixed-income performed marginally better. This can be accounted for by the lackluster performance of stocks since 2000.

In all cases where there was rebalancing annually, the results were higher than when rebalancing was not done. There are not significant differences between 50/50 portfolios held throughout, or 65/35 portfolios to start or 35/65 portfolios to start. Whichever breakdown in asset allocation is used, the key to enhancing returns seemed to be rebalancing.

For the subject couple, stock markets recovered from their lows by the time the male reached age 65. For an investor at the very vanguard of the boomer generation, who might have reached age 65 and retired a few years earlier than the subject couple, in the depths of the Great Recession, their equity portion would have been significantly less. However, by practicing dynamic asset allocation at that time and rebalancing, they would eventually recoup those losses and make gains, if they took retirement income from the bond side only. This would necessitate a firm belief in the fact that for stock markets in Western industrialized nations, the long-term trend is up, despite disappointing returns in the short or medium term.

In summary:

1. The MPT portfolio served the average couple in the study by providing an adequate retirement income.
2. Variations in asset allocation on occasion outperformed the model portfolio, as did the portfolio investing only in the bond index. These differences can largely be accredited to the lackluster performance of stocks in the 21st Century. This demonstrates the uncertainty as to which markets will outperform in the short and medium term, emphasizing the case for diversity.

3. There was no great difference in returns between portfolios that started with either a 65/35 or 35/65 asset mix, or that maintained a 50/50 asset mix.
4. Dynamic asset allocation, or rebalancing, enhanced returns in all cases.

5. Conclusions

Data reflected average earnings for a Canadian couple for the 40-year time period, with no consideration for the variables of occupation, career changes, changing family status, or geographic location within Canada. While this study has attempted to remain observant of a much-generalized average Canadian family, it is understood that one individual is likely to undergo many personal and professional changes in the course of 40 years of adulthood.

This paper hypothesized that an investment strategy following principles of MPT and EMH and followed by an average Canadian couple retiring in 2017 would have provided them with an adequate income in retirement. The focus here was on a baby-boom family which would recently have reached retirement age. While adherence to the model portfolio in their time frame provided them with an adequate income in retirement, and was therefore successful, this is not necessarily the case for the rest of the baby-boom generation. The methodology can be duplicated on earlier retirees to determine if the portfolio strategy has served all boomers to date, and how it is serving those who have some years yet to retire. More general conclusions might be reached about the efficacy of MPT and EMH strategies with such further analysis which is beyond the scope of this paper.

Investors and investment professionals have been applying MPT and EMH principles of investing strategy for roughly 40 years. While the strategies of diversification within and among asset classes seemed to be sound advice, forecasting based on expected market returns was fraught with difficulty. Investors and their advisors alike have had to take something of a leap of faith that the theories were sound. With the passing of time, this study is able to look back on this one case study and verify that, in this instance, the investing strategy did indeed meet the goals of the subject investor by providing an adequate retirement income. Markets will always be characterized by uncertainty, particularly in the short term. However, any investor needs to have some parameters to operate within in order to try and succeed in the long term. While the instruments that were used in this study were synthesized due to the absence of suitable index funds in the beginning years of the time frame discussed, such instruments are now plentiful. Investing in index funds on a disciplined, dollar-cost-averaging basis with regular re-balancing is now easily done. The results found here should provide investors and their advisors looking at the long-term horizon to continue to view such an investment strategy favorably.

Markowitz and his followers advocated asset allocation across a number of asset classes. This study saw the subject couple diversify across stocks and bonds, and diversify widely within those two classes by investing in the relative indexes. No consideration was given for real estate. Further study could examine the outcome for the same couple who also invested another 20% (or other percentage) in home ownership, using average home prices and mortgage rates over the same period. The couple could

then consider down-sizing from the home they had bought to provide for their family-rearing years to something smaller, investing any gains accrued.
This study can be easily replicated in other industrialized economies where there are mature stock and bond markets.

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