

# PWL

LONG LIVE YOUR MONEY



## *A Rebalancing Act*

Estimating the Value Added through Portfolio Rebalancing

### **Abstract**

We compare the return and volatility of a Canadian portfolio under a no-rebalancing scenario and ten naive rebalancing strategies, over 35 years (1980-2014) of capital market history. All rebalanced portfolios produce higher returns and lower volatilities than does the non-rebalanced one. Computing the in-sample results for the 1980-1991, 1992-2003 and 2004-2014 sub-periods arrives at the same conclusion. Finally, we test the same ten rebalancing strategies (out of sample) from the perspective of a U.S., a U.K. and a Japanese portfolio. We find that 29 of the 30 naively rebalanced portfolios outperform their non-rebalanced counterpart. We estimate that, from a Canadian perspective, rebalancing adds 0.57% to risk-adjusted returns before costs, and 0.41% net of transaction and tax costs.

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This report was written by Raymond Kerzérho, PWL Capital Inc. The ideas, opinions, and recommendations contained in this document are those of the authors and do not necessarily represent the views of PWL Capital Inc.

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## Introduction

Even when a portfolio is constructed perfectly in line with its target asset mix, this “perfection” never lasts: as soon as the market reopens, market fluctuations cause asset class weights to deviate from their target levels. Over long periods of time, asset classes can substantially drift from their target allocations. Since equity tends to outperform bonds over time, this former asset class is likely to eventually become overweighted, and as a result, portfolios will tend to get riskier. Thus, rebalancing’s primary function is to keep control of portfolio risk. But what is the effect of rebalancing on the observed return and standard deviation of portfolios? This paper aims to measure the impact of portfolio rebalancing on return and risk. Section 1 discusses methodology. Section 2 addresses our results for a Canadian portfolio. Section 3 explains our results for a U.S., a U.K. and a Japanese portfolio. Section 4 discusses the real-life costs of rebalancing. And finally, Section 5 raises some of the possible limitations of our work.

## 1. Methodology

Using data from Morningstar Encorr, we form four portfolios to test the effect of rebalancing: a Canadian, a U.S., a U.K. and a Japanese portfolio. We measure the annualized returns and standard deviation of returns, using monthly data on total index returns. For each portfolio, we select the longest data series available and we stick to the same basic asset mix of 40% domestic bonds, 20% domestic stocks and 40% foreign stocks. The four portfolios are described in Table 1 below.

TABLE 1: PORTFOLIO DESCRIPTIONS

INDEX	WEIGHT	PERIOD REVIEWED
<b>Canadian Portfolio</b>		
FTSE TMX Bond Index CAD	40%	1980-2014
S&P/TSX Composite Index CAD	20%	
Russell 3000 Index CAD	20%	
MSCI EAFE Gross Return Index CAD	20%	
<b>U.S. Portfolio</b>		
Barclays Government /Credit Bond USD	40%	1979-2014
Russell 3000 in USD	20%	
MSCI EAFE & Canada Gross Return USD	40%	
<b>U.K. Portfolio</b>		
FTSE All Stocks Bond Index GBP	40%	1976-2014
FTSE All Shares Composite GBP	20%	
MSCI World ex-UK Gross Return GBP	40%	
<b>Japanese Portfolio</b>		
Nomura Bond Performance Index JPY	40%	1970-2014
MSCI Japan Gross Return JPY	20%	
MSCI World ex-Japan Gross Return JPY	40%	

Source: PWL Capital

After establishing the four portfolios, we devise ten “naive” rebalancing strategies, which are outlined in Table 2 below. Importantly, we did not strive for return-enhancing rebalancing strategies. We only imagined ten different ways of rebalancing a portfolio and then computed the effect of these strategies on portfolio return and volatility.

**TABLE 2: DESCRIPTION OF THE TEN “NAIVE” REBALANCING STRATEGIES**

STRATEGY NAME	DESCRIPTION
Rebal 1	Rebalance every 12 months
Rebal 2	Rebalance every 24 months
Rebal 3	Rebalance every 36 months
Rebal 4	Rebalance every 60 months
Rebal 5	Rebalance every 12 months if an asset class deviates by 1% or more
Rebal 6	Rebalance every 12 months if an asset class deviates by 3% or more
Rebal 7	Rebalance every 12 months if an asset class deviates by 5% or more
Rebal 8	Rebalance monthly if an asset class deviates by 1% or more
Rebal 9	Rebalance monthly if an asset class deviates by 3% or more
Rebal 10	Rebalance monthly if an asset class deviates by 5% or more

Source: PWL Capital

## 2. The Canadian Portfolio

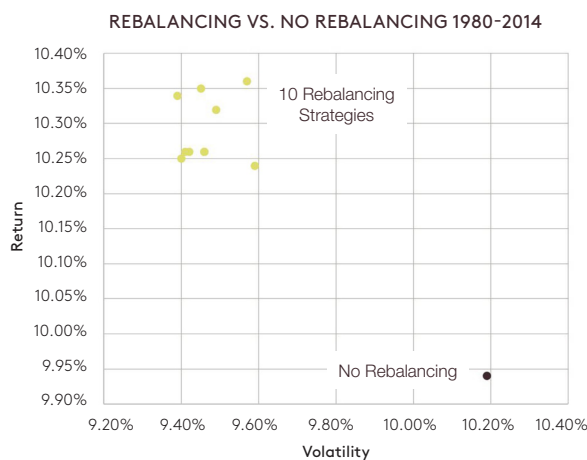
### 2.1 Complete Data Set: 1980-2014

We compute the annualized return and standard deviation (a statistical measure of volatility) of the Canadian portfolio for the 1980-2014 period (35 years), using the ten rebalancing strategies, and compare the results to those of the no-rebalancing strategy. The results are outlined in Figure 1 below.

**FIGURE 1: RETURN AND RISK OF REBALANCING STRATEGIES: 1980-2014**

REBALANCING VS. NO REBALANCING 1980-2014		
STRATEGY NAME	RETURN	VOLATILITY
Rebal 1	10.26%	9.46%
Rebal 2	10.26%	9.42%
Rebal 3	10.35%	9.45%
Rebal 4	10.36%	9.57%
Rebal 5	10.26%	9.46%
Rebal 6	10.32%	9.49%
Rebal 7	10.24%	9.59%
Rebal 8	10.25%	9.40%
Rebal 9	10.26%	9.41%
Rebal 10	10.34%	9.39%
No Rebalancing	9.94%	10.19%
<b>Rebal Minus NoRebal - Average</b>	<b>0.35%</b>	<b>-0.73%</b>

Source: Morningstar Encorr



All ten rebalanced portfolios produce higher returns and lower volatilities than does the no-rebalancing portfolio. On average, the rebalancing scenarios produce returns that are 35 basis points higher, and standard deviations that are 73 basis points lower. We estimate, using previous PWL research<sup>1</sup>, that each 1% reduction in volatility is equivalent to 30.6 basis points in additional risk-adjusted returns. In other words, since rebalancing reduces volatility, the portfolio generates more return per unit of risk. **When we account for the volatility decline in the portfolio, rebalancing adds up to 0.57% in risk-adjusted return before the costs of trading and taxes.**

## 2.2 Sub-Periods

Rebalancing adds returns and subtracts volatility in our Canadian portfolio over the 35 years under review (1980-2014). But is this result robust over shorter periods of time? We repeat our analysis for the 1980-1991, 1992-2003 and 2004-2014 sub-periods. The results are shown in Figures 2, 3 and 4 below.

FIGURE 2: RETURN AND RISK OF REBALANCING STRATEGIES: 1980-1991

REBALANCING VS. NO REBALANCING 1980-1991		
STRATEGY NAME	RETURN	VOLATILITY
Rebal 1	14.47%	11.80%
Rebal 2	14.46%	11.82%
Rebal 3	14.56%	11.91%
Rebal 4	14.53%	12.10%
Rebal 5	14.47%	11.80%
Rebal 6	14.46%	11.81%
Rebal 7	14.45%	11.83%
Rebal 8	14.52%	11.58%
Rebal 9	14.43%	11.62%
Rebal 10	14.46%	11.62%
No Rebalancing	14.15%	12.58%
<b>Rebal Minus NoRebal - Average</b>	<b>0.33%</b>	<b>-0.79%</b>

Source: Morningstar Encorr

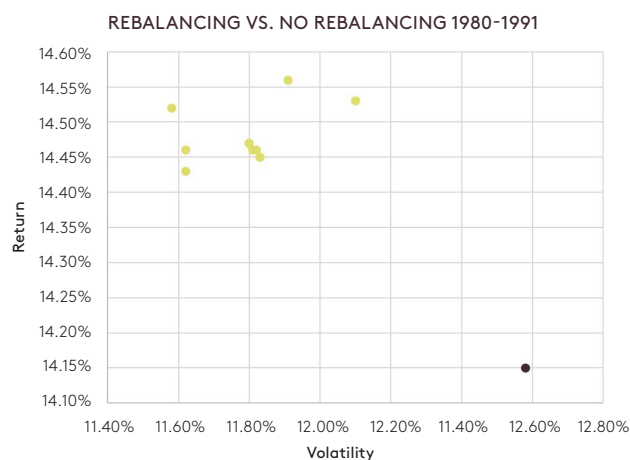
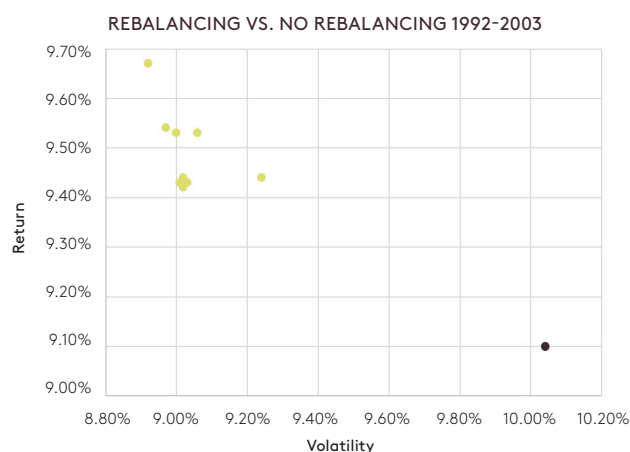


FIGURE 3: RETURN AND RISK OF REBALANCING STRATEGIES: 1992-2003

REBALANCING VS. NO REBALANCING 1992-2003		
STRATEGY NAME	RETURN	VOLATILITY
Rebal 1	9.43%	9.03%
Rebal 2	9.43%	9.01%
Rebal 3	9.54%	8.97%
Rebal 4	9.67%	8.92%
Rebal 5	9.43%	9.03%
Rebal 6	9.53%	9.06%
Rebal 7	9.44%	9.24%
Rebal 8	9.42%	9.02%
Rebal 9	9.44%	9.02%
Rebal 10	9.53%	9.00%
No Rebalancing	9.10%	10.04%
<b>Rebal Minus NoRebal - Average</b>	<b>0.39%</b>	<b>-1.01%</b>

Source: Morningstar Encorr

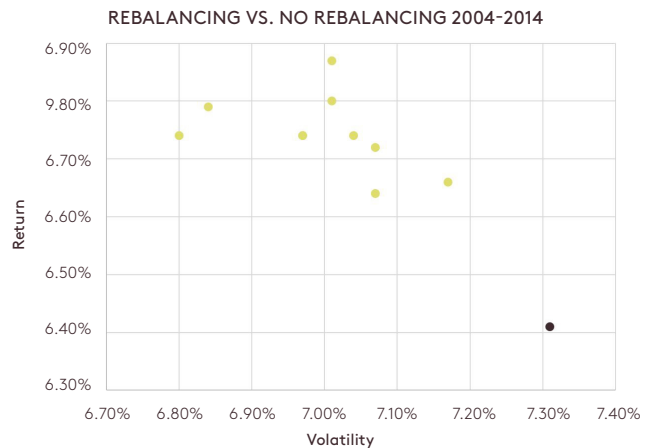


<sup>1</sup> Kerzérho, R., Bortolotti, D., "Great Expectations: How to estimate future stock and bond returns when creating a financial plan", PWL CAPITAL, 2016

**FIGURE 4: RETURN AND RISK OF REBALANCING STRATEGIES: 2004-2014**

REBALANCING VS. NO REBALANCING 2004-2014		
STRATEGY NAME	RETURN	VOLATILITY
Rebal 1	6.74%	6.97%
Rebal 2	6.74%	6.80%
Rebal 3	6.79%	6.84%
Rebal 4	6.72%	7.07%
Rebal 5	6.74%	6.97%
Rebal 6	6.80%	7.01%
Rebal 7	6.66%	7.17%
Rebal 8	6.64%	7.07%
Rebal 9	6.74%	7.04%
Rebal 10	6.87%	7.01%
No Rebalancing	6.41%	7.31%
<b>Rebal Minus NoRebal - Average</b>	<b>0.33%</b>	<b>-0.31%</b>

Source: Morningstar Encorr



In the three sub-periods, the rebalanced strategies produce, on average, excess returns of 0.33%, 0.39% and 0.33%, respectively, with reductions in standard deviation ranging between 0.31% and 1.01%. All 30 rebalancing scenarios produce returns above their corresponding no-rebalancing scenario. Our only reservation is that, in the 2003-2014 period, the return and risk of the rebalanced scenarios are more scattered; this may indicate that rebalancing is less effective in that period. But overall, we believe the sub-period sample strongly supports the risk-adjusted enhancement observed for the whole 1980-2014 period.

### 3. Non-Canadian Portfolios

To further validate our results, we compute the same rebalancing scenarios for a U.S., a U.K. and a Japanese portfolio. These three countries are selected for the following reasons:

- They currently have the three largest national stock markets.
- Their returns data is available dating back to at least 1980.
- They have maintained the same currency across the whole period. Countries using the euro (since 1999), such as Germany and France, are excluded for this reason.

The results for the international portfolios are shown in Figures 5, 6 and 7 below.

**FIGURE 5: RETURN AND RISK OF REBALANCING STRATEGIES U.S. PORTFOLIO: 1979-2014**

REBALANCING VS. NO REBALANCING 2004-2014		
STRATEGY NAME	RETURN	VOLATILITY
Rebal 1	10.01%	10.82%
Rebal 2	10.20%	10.94%
Rebal 3	10.22%	11.11%
Rebal 4	10.04%	11.23%
Rebal 5	10.01%	10.82%
Rebal 6	10.09%	10.85%
Rebal 7	10.13%	10.86%
Rebal 8	9.85%	10.89%
Rebal 9	9.88%	10.91%
Rebal 10	9.95%	10.90%
No Rebalancing	9.78%	12.70%
<b>Rebal Minus NoRebal - Average</b>	<b>0.26%</b>	<b>-1.77%</b>

Source: Morningstar Encorr

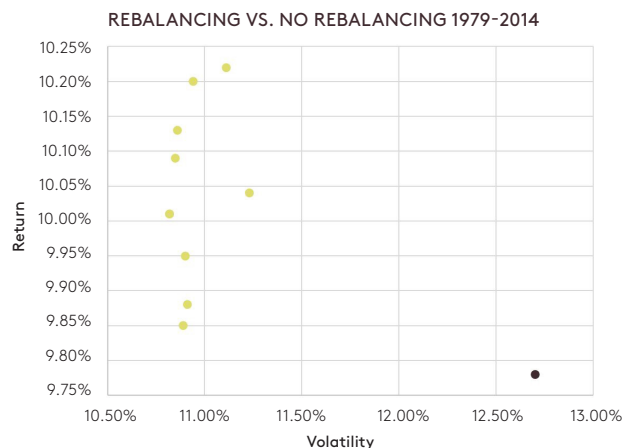


FIGURE 6: RETURN AND RISK OF REBALANCING STRATEGIES U.K. PORTFOLIO: 1976-2014

REBALANCING VS. NO REBALANCING 1976-2014		
STRATEGY NAME	RETURN	VOLATILITY
Rebal 1	10.45%	10.64%
Rebal 2	10.25%	10.54%
Rebal 3	10.32%	10.72%
Rebal 4	10.10%	10.65%
Rebal 5	10.45%	10.65%
Rebal 6	10.47%	10.68%
Rebal 7	10.40%	10.71%
Rebal 8	10.38%	10.69%
Rebal 9	10.42%	10.72%
Rebal 10	10.41%	10.76%
No Rebalancing	10.12%	11.49%
<b>Rebal Minus NoRebal - Average</b>	<b>0.24%</b>	<b>-0.81%</b>

Source: Morningstar Encorr

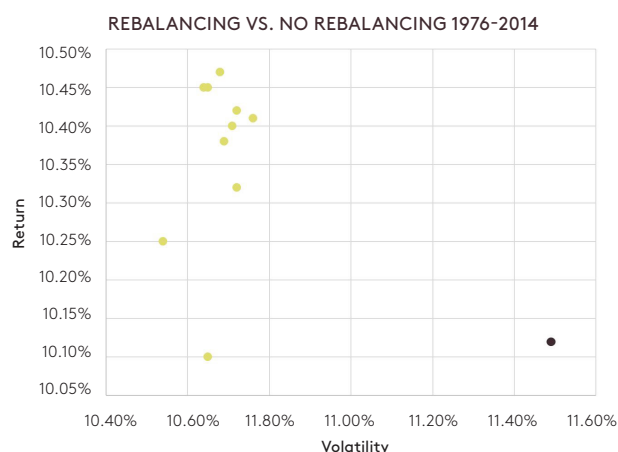
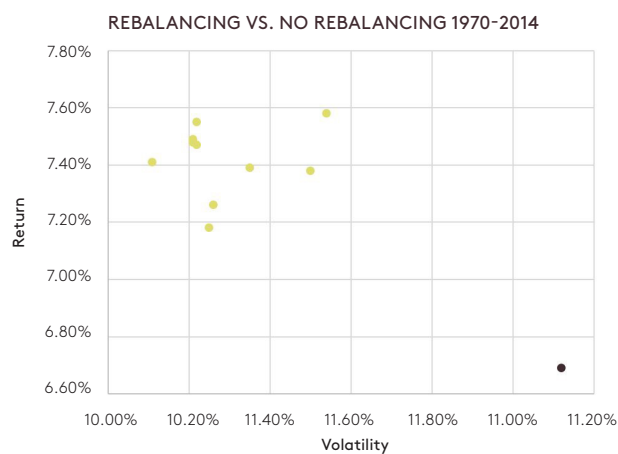


FIGURE 7: RETURN AND RISK OF REBALANCING STRATEGIES JAPANESE PORTFOLIO: 1970-2014

REBALANCING VS. NO REBALANCING 1970-2014		
STRATEGY NAME	RETURN	VOLATILITY
Rebal 1	7.48%	10.21%
Rebal 2	7.41%	10.11%
Rebal 3	7.58%	10.54%
Rebal 4	7.38%	10.50%
Rebal 5	7.49%	10.21%
Rebal 6	7.55%	10.22%
Rebal 7	7.47%	10.22%
Rebal 8	7.18%	10.25%
Rebal 9	7.26%	10.26%
Rebal 10	7.39%	10.35%
No Rebalancing	6.69%	11.12%
<b>Rebal Minus NoRebal - Average</b>	<b>0.73%</b>	<b>-0.83%</b>

Source: Morningstar Encorr



Of the 30 rebalancing scenarios under review, 29 produced a higher return and lower volatility than did their corresponding no-rebalancing scenarios. The only exception is the U.K portfolio rebalanced every five years (Rebal 4), which underperforms the return of the no-rebalancing scenario, but only by 2 basis points. On average, rebalancing adds 0.26%, 0.24% and 0.73% to the return of the U.S., the U.K. and the Japanese portfolios, while reducing volatility by 1.77%, 0.81% and 0.83% respectively.

#### 4. Rebalancing the Canadian Portfolio: What Does It Cost?

The cost of rebalancing is highly variable from one portfolio to another. These costs basically sum up to:

- Trading commissions; and
- Capital gain taxes are triggered earlier than under the no-rebalancing case. Rebalancing involves the sale of securities at a profit and the purchase of new securities at current market prices. This process triggers capital gain taxes, but also increases the overall adjusted cost base of the securities in the portfolio. As a result, rebalancing also leads to tax savings in later years. **The net tax cost is the difference between the taxes paid upon rebalancing minus the net present value of the future tax savings resulting from the increased adjusted cost base.**

The cost of rebalancing is greatly influenced by its frequency. For example, rebalancing every year is more expensive than rebalancing every second year, and so on. Table 3 below outlines the average number of months that elapse between rebalancing for each strategy. The higher the number, the lower the frequency.

**TABLE 3: CANADIAN PORTFOLIO REBALANCING FREQUENCIES 1980-2014**

STRATEGY NAME	DESCRIPTION	FREQUENCY OF REBALANCING (MONTHS)
Rebal 1	Rebalance every 12 months	12
Rebal 2	Rebalance every 24 months	24
Rebal 3	Rebalance every 36 months	36
Rebal 4	Rebalance every 60 months	60
Rebal 5	Rebalance every 12 months if 1% deviation	12
Rebal 6	Rebalance every 12 months if 3% deviation	21
Rebal 7	Rebalance every 12 months if 5% deviation	38
Rebal 8	Rebalance every month if 1% deviation	2
Rebal 9	Rebalance every month if 3% deviation	11
Rebal 10	Rebalance every month if 5% deviation	21

Source: PWL Capital

As can be seen above, the *Rebal 7* strategy generates the second-lowest frequency of rebalancing (every 38 months on average); yet, it ensures that asset classes don't drift from their target weight by more than 5% for long.

## 4.1 Cost of Rebalancing a Taxable Portfolio

In order to estimate the cost of rebalancing, we need to make some assumptions:

- All interest and dividend receipts are automatically reinvested in the same asset class.
- There are no contributions to or withdrawals from the portfolio.
- Trading commission costs are minimal. If a portfolio is properly structured, these commissions, once scaled by the total value of the portfolio and the number of years elapsing between rebalancing operations, may amount to 0.02%. The estimated cost of commissions is detailed for several asset levels in Table 4 below, assuming that each rebalancing operation costs \$300 regardless of the asset level.
- Rebalancing occurs every 38 months or 3.17 years, as per *Rebal 7*.
- Transactions triggering taxable capital gains involve 15% of the portfolio market value each time.
- Taxable securities sold in rebalancing are worth double their cost (100% profit).
- All capital gain taxes would have been paid twenty (20) years later if no rebalancing had taken place.
- The 20-year interest rate is 3.1%, based on the yield to maturity of the FTSE TMX Canadian Long Term Bond Index at the time of writing.



**TABLE 4: THE COMMISSION COST OF REBALANCING**

Total cost:	\$ 300.00
Frequency:	3.17 years
ASSETS	COMMISSION COST
\$ 100,000.00	0.09%
\$ 250,000.00	0.04%
\$ 500,000.00	0.02%
\$ 750,000.00	0.01%
\$ 1,000,000.00	0.01%

Source: PWL Capital

We estimate the cost of rebalancing a Canadian taxable portfolio to be 0.29%, using the following formula:

$$\begin{aligned}
 \text{Average Annual Cost}_{\text{Taxable}} &= C + \text{TAX} - \text{RECOV} \\
 &= 0.02\% + 0.59\% - 0.32\% \\
 &= 0.29\%
 \end{aligned}
 \tag{1}$$

Where:

C = Trading commissions

TAX = Taxes paid on realized capital gains triggered by the rebalancing

RECOV = Present value of the taxes saved in the future due to the higher adjusted cost base.

Mathematically, we define:

$$\text{TAX} = \frac{W * \text{CG} * T * \text{INCL}}{\text{FREQ}}
 \tag{2}$$

$$0.59\% = \frac{15\% * 50\% * 50\% * 50\%}{3.17}$$

Where:

W = Average weight rebalanced

CG = Average capital gain, as a % of the settlement value

T = Marginal tax rate

INCL = Capital gains inclusion rate

FREQ = Frequency of rebalancing, in years

$$\text{RECOV} = \frac{\text{TAX}}{(1 + \text{INT})^N}
 \tag{3}$$

$$0.32\% = \frac{0.59\%}{(1 + 3.1\%)^{20}}$$

INT = Yield to maturity of the FTSE TMX Canadian Long Term Bond Index

N = Deferral period (in years) of the tax savings due to the higher adjusted cost base

## 4.2 General Cost of Rebalancing a Portfolio

Based on the preceding assumptions, the cost of rebalancing a non-taxable portfolio (such as an RRSP, a RRIF or a TFSA) would only amount to the trading commission costs:

$$\begin{aligned} \text{Average Annual Cost}_{\text{Non-Taxable}} &= C \\ &= 0.02\% \end{aligned} \tag{4}$$

We estimate the general cost of rebalancing as simply the average between a taxable and a non-taxable portfolio:

$$\begin{aligned} \text{Average Annual Cost}_{\text{General}} &= \frac{\text{Average Annual Cost}_{\text{Taxable}} + \text{Average Annual Cost}_{\text{Non-Taxable}}}{2} \\ &= \frac{0.29\% + 0.02\%}{2} \\ &= 0.16\% \end{aligned} \tag{5}$$

## 5. Limitations

We acknowledge that our estimates of the benefits of rebalancing are subject to several criticisms. Here are just a few, all of which we consider legitimate:

- Real-life portfolios usually generate cash interest and dividend payments, contributions and withdrawals, all of which often facilitate portfolio rebalancing at no marginal cost. As a result, costly rebalancing will take place less often than every 38 months.
- The *Rebalance every 12 months if 5% deviation* rule may be considered inadequate, as it can theoretically let the overall weight in equities drift by 15% (5% each for Canadian, U.S. and International equity). Rebalancing should take place much more often than every 38 months.
- The transaction cost assumption is too low.
- The *average weight rebalanced (W)* estimate is too low or too high.
- The *average capital gain (CG)* as a % of the settlement value is too low or too high.

## Conclusion

We calculated the return and volatility of a Canadian broad-asset-class portfolio, comparing the results for ten naive rebalancing strategies with those for a no-rebalancing portfolio. We conclude that rebalancing adds an average 0.57% to risk-adjusted returns before costs. This result is confirmed with both in-sample (sub-periods on the Canadian portfolio) and out-of-sample (U.S., U.K. and Japanese portfolios) data analyses. We estimate the general cost of rebalancing to be 0.14% per annum. This cost can vary widely depending on the portfolio size, structure and tax status; therefore, our estimate is meant as a rough gauge and should be interpreted with caution. Nonetheless, we estimate the net benefits of rebalancing at  $[0.57\% - 0.16\%] = 0.41\%$ .



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