



Currency-Hedged S&P500 Funds: The Unsuspected Challenges

Raymond Kerzérho, MBA, CFA
RESEARCH DEPARTMENT
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Abstract

When investors opt for currency-hedged foreign-equity funds, they usually assume that this will eliminate the impact of currency fluctuations and get them a return similar to a domestic portfolio. This paper documents many of the pitfalls of currency hedging, through a study of S&P500 index funds offered on the Canadian retail marketplace. I conclude that currency hedging can be far more expensive than expected. Most of these costs can be attributed to the unforeseen but significant technical challenges involved in effectively hedging an equity portfolio. Institutional and retail investors are equally exposed to these high costs. While it is clear that perfect hedging is unattainable, I propose a procedure that may potentially reduce the cost of hedging.*

* I wish to thank *Dino Bourdos, Philip Falls, Hélène Gagné, Mario Lavallée* and *Anthony Layton* for their helpful comments.

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

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For more information about this or other publications from PWL Capital, contact:

1 Place Alexis Nihon

3400 de Maisonneuve Ouest, Bureau 1501, Montréal, Québec H3Z 3B8

Tel 514-875-7566 • 1-800-343-7566

Fax 514-875-9611

capital@pwlcapital.com



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SUMMARY

This article reviews the evidence about the tracking error for currency-hedged S&P500 funds and how this tracking error is affecting long-term returns in a major way.

Based on the evidence reviewed, it is clear to me that currency-hedged S&P500 funds will **always** suffer from a significant tracking error when benchmarked against the S&P500 in local currency. However, portfolio management should aim to minimize this tracking error.

The main factors driving the tracking error for currency-hedged S&P500 funds are management fees, transaction costs, cross-currency interest-rate differentials and the *residual-currency effect* (RCE). This paper pays special attention to the little-documented (yet very powerful) residual-currency effect.

For the 2006–2009 period, the currency-hedged S&P500 funds offered in Canada underperformed the S&P500 by a wide margin every year. Only a small portion of this gap can be explained by the management expense ratio.

When the S&P500 and the U.S. dollar (relative to the Canadian dollar) deliver returns of the same sign, the RCE introduces a positive (profitable) tracking error. When returns are of opposite signs, it introduces a negative (costly) tracking error.

In theory, periods of positive RCE and periods of negative RCE should alternate and offset each other over time.

But what happens in practice is different. I estimate that, from 2006 to 2009, the RCE costs investors 149 basis points per annum due to a negative (S&P500 vs. U.S. dollar) correlation and volatile markets. For the 1980–2005 period, the correlation was also consistently negative, costing investors an estimated (more moderate) 23 basis points per annum.

Based on the consistent negative historical correlation between S&P500 returns and U.S. dollar returns, a persistent negative RCE is a significant risk going forward.

This challenge also affects institutional funds, which generally use the same (“roll-once-a-month”) hedging technique as retail mutual funds. Furthermore, currency-hedged, actively managed U.S. equity funds suffer the same flaw as currency-hedged index funds: as soon as the market moves, they become under-hedged or over-hedged.

In this paper, I propose an alternative currency-hedging strategy to minimize this RCE (see section 8).

1. Introduction

Currency-hedged equity index funds have been around for many years. Canadians became more interested in this risk-management procedure after 2003, when a major decline in the U.S. dollar transformed a 28.7% return on the S&P500 (in local currency) into a meager 5.9% in Canadian-dollar terms. Although they did exist before, currency-hedged funds only started to gather significant assets in 2005. But until recently, very little attention was paid to the tracking error for these funds.

This article reviews the evidence about the tracking error for currency-hedged S&P500 funds and how this tracking error is affecting returns in a major way. I describe the many factors underlying the tracking error and demonstrate that these factors are so powerful that a significant tracking error is unavoidable. A large part of this paper pays special attention to a little-documented (yet very powerful) factor called the residual-currency effect.

A brief technical note is needed to clarify the context of this article. From my perspective, the purpose of hedging the currency risk on a foreign equity index fund is to achieve a return that is as close as possible to the underlying domestic index. This view may be controversial since many respected members of the financial community consider a currency-hedged version of the index to be the right benchmark. My view is that the local-currency-index return, while far more difficult to track, is the true reflection of the cost of capital of an asset class. Currency hedging is an element of “friction” that hampers investors’ chances of capturing this cost of capital. The investor’s goal should be to minimize this friction rather than endorse it by amalgamating it into the benchmark. Therefore, my paper will be completely based on the premise that the S&P500 index in local currency is the right benchmark for currency-hedged S&P500 funds (hereafter “funds”).

Another key assumption of this paper is that funds’ currency-hedging positions are rolled all at once on a monthly basis (hereafter “roll-once-a-month”), which I believe suitably reflects the general practice.

2. Fund Tracking Error 2006–2009

While in theory, it may seem like an easy task to efficiently hedge the currency risk of an S&P500 fund, experience with actual funds has proven this task to be challenging. Using the PALTrak database, four currency-hedged S&P500 funds available on the Canadian retail marketplace were identified. While the history of some of these funds dates back as far as 1998, they started gathering significant assets in 2005, so I decided to focus on the 2006–2009 period.

CHART 1
S&P500 CURRENCY-HEDGED FUND RETURNS

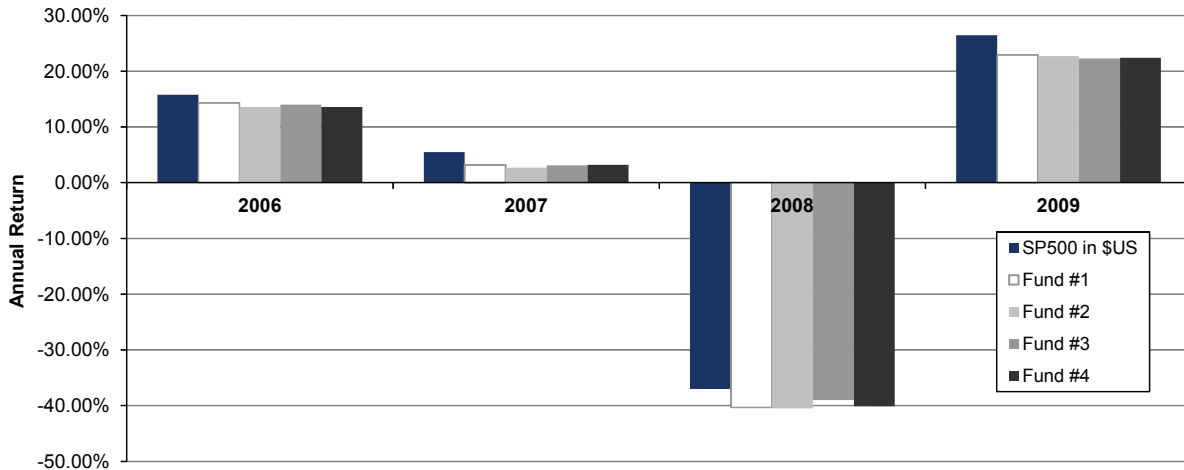
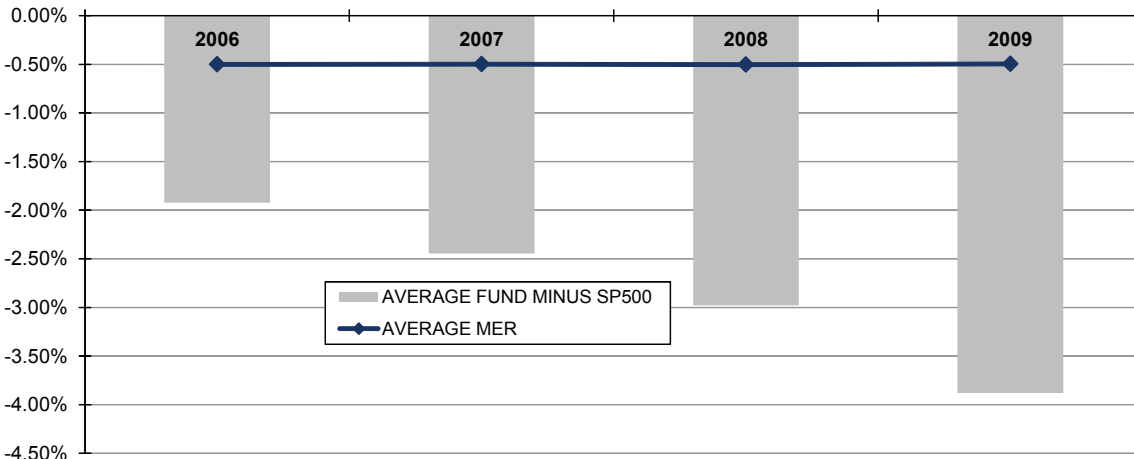


CHART 2
S&P500 CURRENCY-HEDGED FUND TRACKING ERROR



Sources: Bloomberg, Morningstar Encorr

In **Chart 1** above, the blue bars depict the return of the S&P500 in U.S. dollars, whereas the other bars depict the return of four widely-held “currency-neutral” S&P500 index funds. All funds underperformed the index every year from 2006 to 2009, in both positive- and negative-return periods.

Chart 2 demonstrates that the tracking error (grey bars) is far greater than the management-expense ratio, peaking at close to -4% in 2009.

3. Tracking Error: Explanatory Factors

The lag in fund returns is caused by the multiple frictional costs of managing a currency-hedged equity fund, including these four major costs:

- 3.1 **Management fees:** As illustrated by the average MER in Chart 2.
- 3.2 **Transaction costs:** Commissions, bid-ask spreads, and other administrative costs.
- 3.3 **Cross-currency interest-rate differentials:** In periods when the Canadian dollar interbank interest rate (also known as “CDOR”) is lower than the U.S. dollar interbank interest rate (also known as “LIBOR”), this reduces the return of the fund because the currency-forward contract used to hedge the exchange-rate risk takes this difference in interest rates into account in its price. The reverse is true when the CDOR is higher than the LIBOR: interest rates contribute to boosting the return of the fund. In short:

CDOR < LIBOR → Return(fund) < Return(S&P500)

CDOR > LIBOR → Return(fund) > Return(S&P500)

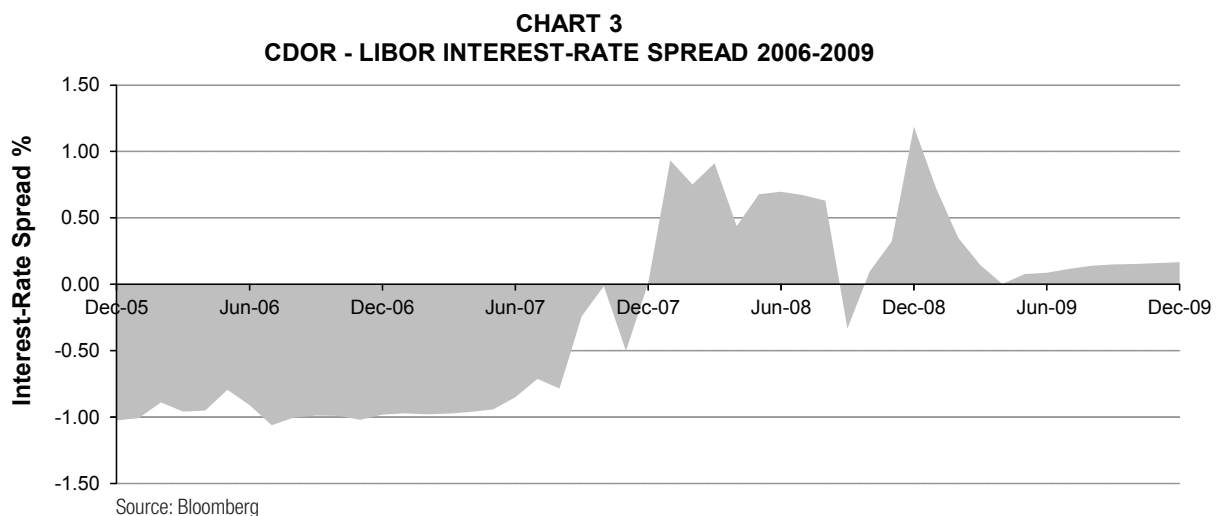


Chart 3 above depicts the history of the CDOR 1-month minus the LIBOR 1-month spread, which has been negative (detrimental to fund returns) for most of the 2006–2007 sub-period, and positive (beneficial to fund returns) in most of the 2008–2009 sub-period.

- 3.4 **The residual-currency effect (RCE):** The residual-currency effect was recently documented by Falls and Bourdos¹ (2010). Since the stock market constantly fluctuates, there is always a time lag between the movements of the market and the rebalancing of the currency hedge, no matter how frequently this rebalancing occurs. This lag will inevitably create a certain level of currency-risk exposure. Like interest-rate differentials, the residual-currency effect can be either positive or negative for fund returns. I will illustrate the workings of the residual-currency effect with concrete examples in section 4.

Definition

The **residual-currency effect** is a source of tracking error between a currency-hedged index fund and its underlying domestic index, resulting from the co-movements of the exchange rate and the stock market.

¹ Falls, P., Bourdos, D., An Imperfect Hedge, Benefit and Pensions Monitor, April 2010.

4. The Residual-Currency Effect Illustrated

The stock market fluctuates continuously, while currency-hedged funds enter into currency-forward transactions periodically (typically on a monthly basis) for hedging purposes. Any stock-market movement occurring between these currency-hedging transactions creates an under-hedged or over-hedged position, which can then result in positive or negative tracking errors. This section demonstrates this process through four numerical examples.

Let's assume that the fund has a US\$100 million AUM at the beginning of the month. Therefore, it sells \$100 million worth of U.S. dollar forward contracts (against the \$C) to hedge the currency risk. The position at the beginning of the month is:

- Long US\$100 million S&P500 fund
- Short US\$100 million US dollar (vs. \$C) forward contracts

Case #1: The S&P500 returns +3% and the U.S. dollar returns -3%

If during the month the S&P500 returns +3%, the portfolio held by the fund then becomes:

- Long US\$103 million S&P500 fund
- Short US\$100 million US dollar (vs. \$C) forward contracts

But at this point, the value of the forward contracts remains at US\$100 million, since the hedging transaction takes place only once, at the end of each month. Therefore, [US\$103 million – US\$100 million] = US\$3 million in U.S. dollar value becomes unhedged. **The fund has become underhedged!**

If during the period the value of the U.S. dollar declines, there is US\$3 million in unhedged currency exposure that will depreciate. As a result, the return on the fund at the end of the month is:

$$\left(\frac{\text{Capital (end)}}{\text{Capital (beginning)}} \right) - 1 \rightarrow \left(\frac{103M + (-3M \times 3\%)}{100M} \right) - 1 = \left(\frac{102.91M}{100M} \right) - 1 = 2.91\%$$

Therefore, the monthly return on the fund **underperforms** the S&P500 by 9 basis points.

Case #2: The S&P500 returns -3% and the U.S. dollar returns +3%

If during the month the S&P500 returns -3%, the U.S. dollar value of the stock portfolio held by the fund then becomes:

- Long US\$97 million of S&P500 fund
- Short US\$100 million US dollar (vs. \$C) forward contracts.

Therefore, the portfolio holds US\$3 million of excess U.S. dollar hedge. **The fund has become overhedged!**

If during the period the value of the U.S. dollar appreciates, there is US\$3 million in excess currency hedge that will trigger an additional loss. As a result, the return on the fund at the end of the month is:

$$\left(\frac{\text{Capital (end)}}{\text{Capital (beginning)}} \right) - 1 \rightarrow \left(\frac{97M + (3M \times -3\%)}{100M} \right) - 1 = \left(\frac{96.91M}{100M} \right) - 1 = -3.09\%$$

Therefore, the monthly return on the fund **underperforms** the S&P500 by 9 basis points.

Case #3: The S&P500 and the U.S. dollar both return +3%

If during the month the S&P500 returns +3%, the U.S. dollar value of the stock portfolio held by the fund then becomes:

- Long US\$103 million of S&P500 fund
- Short US\$100 million U.S. dollar (vs. \$C) forward contracts.

Therefore, US\$3 million of U.S. dollar value becomes unhedged. **The fund has become underhedged!**

If during the period the value of the U.S. dollar appreciates, there is US\$3 million in unhedged currency exposure that will trigger an excess profit. As a result, the return on the fund at the end of the month is:

$$\left(\frac{\text{Capital (end)}}{\text{Capital (beginning)}} \right) - 1 \rightarrow \left(\frac{103M + (3M \times 3\%)}{100M} \right) - 1 = \left(\frac{103.09M}{100M} \right) - 1 = +3.09\%$$

Therefore, the monthly return on the fund **outperforms** the S&P500 by 9 basis points.

Case #4: The S&P500 and the US dollar both return -3%

If during the month the S&P500 returns -3%, the US dollar value of the stock portfolio held by the fund then becomes:

- Long US\$97 million of S&P500 fund
- Short US\$100 million U.S. dollar (vs. \$C) forward contracts.

Therefore, US\$3 million in U.S. dollar value of excess hedge is created. **The fund has become overhedged!**

If during the period the value of the U.S. dollar declines, there is US\$3 million in excess currency hedge that will trigger an excess profit. As a result, the return on the fund at the end of the month is:

$$\left(\frac{\text{Capital (end)}}{\text{Capital (beginning)}} \right) - 1 \rightarrow \left(\frac{97M + (3M \times 3\%)}{100M} \right) - 1 = \left(\frac{97.09M}{100M} \right) - 1 = -2.91\%$$

Therefore, the monthly return on the fund **outperforms** the S&P500 by 9 basis points.

The bottom line

When the S&P500 generates a significantly positive monthly return, the fund's currency risk will become underhedged. On the other hand, when the S&P500 generates a significantly negative monthly return, the fund's currency risk will become overhedged. If such moves are combined with significant intra-month volatility in the Canadian dollar – U.S. dollar exchange rate, they will produce the following results:

Table 1: Fund Performance Relative to the S&P500

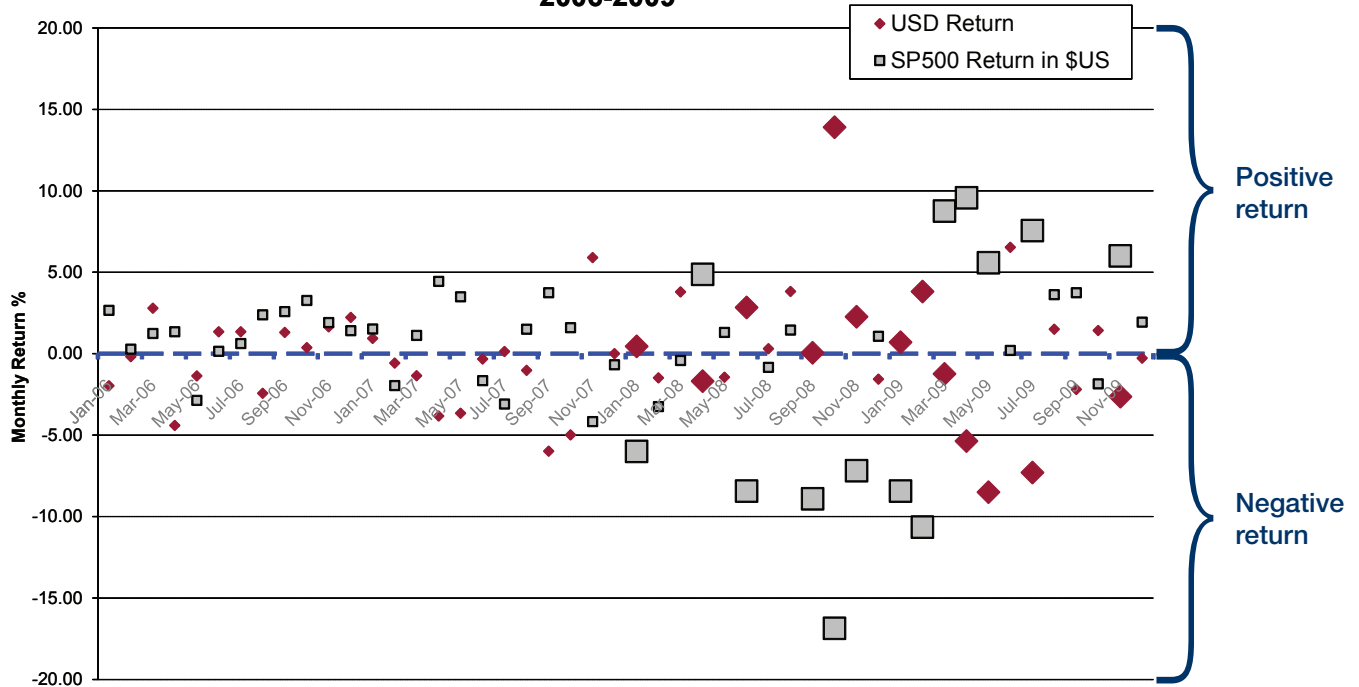
		S&P500 Index	
		Positive Return	Negative Return
U.S. \$ (vs. the CDN \$)	Positive Return	The fund outperforms the S&P500	The fund underperforms the S&P500
	Negative Return	The fund underperforms the S&P500	The fund outperforms the S&P500

Source: PWL Capital

5. The Residual-Currency Effect: Data Analysis for 2006–2009

In theory, monthly returns of the same sign and of opposite signs should occur randomly, one offsetting the other over time. **But historical analysis shows that, for the 2006–2009 period, opposite-sign months (underperformance events) outweighed same-sign months (outperformance events) by a wide margin: the correlation between S&P500 and U.S. dollar returns is -0.77.** Furthermore, as depicted by Chart 4 below, large (negative or positive) S&P500 returns were accompanied by U.S. dollar returns of the opposite sign most of the time.

**CHART 4
MONTHLY RETURNS ON THE S&P500 AND THE US DOLLAR
2006-2009**



Sources: Bloomberg, Morningstar Encorr

NB: Larger dots represent months with S&P500 returns close to or above 5% (absolute value)

As demonstrated in Section 3, I am able to produce estimates of the residual-currency effect for currency-hedged S&P500 funds. For 2006–2009, I obtained a cumulative residual-currency effect of -5.97%, or 1.49% per annum, based on the following formula:

$$\begin{aligned} \text{Estimated RCE}_{2006-2009} &= \sum \text{Return (S\&P500)}_i \times \text{Return (Canadian dollar/US dollar)}_i \\ &= 5.97\% \end{aligned}$$

In substance, the residual-currency effect seems to explain more than half of the negative tracking error (597 bps/1099 bps – see Table 2) of the four currency-hedged funds for the 2006–2009 period – an astonishing finding!

Table 2: Fund Tracking Error 2006-2009

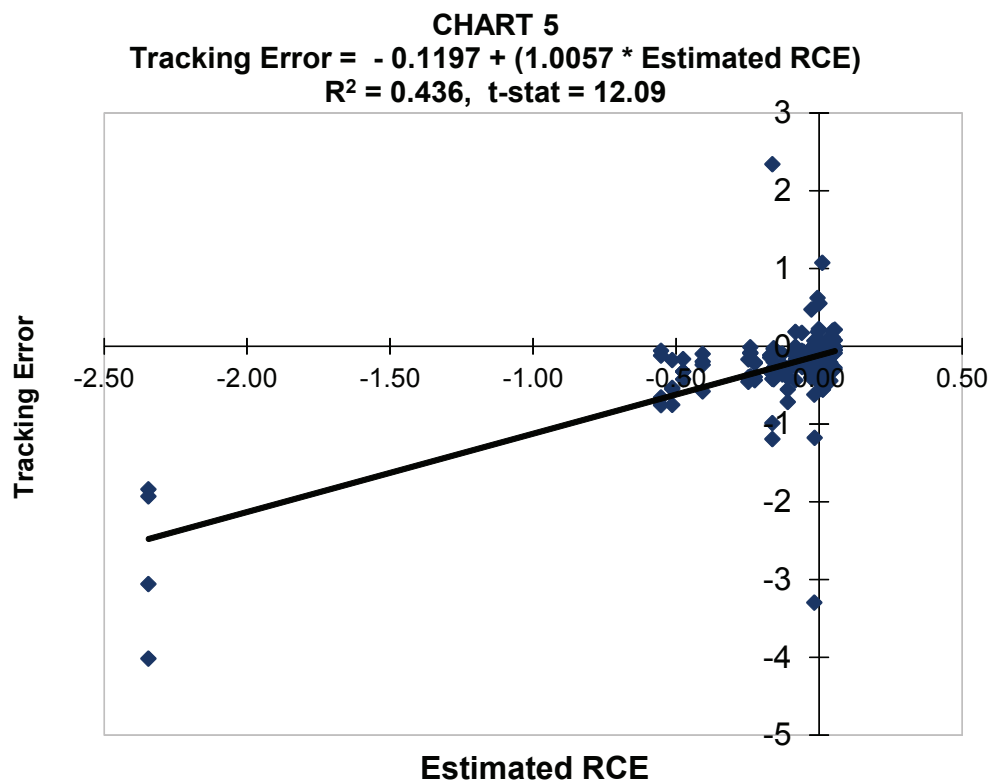
Fund	Cumulative Tracking Error
Fund #1	-10.79%
Fund #2	-12.15%
Fund #3	-9.64%
Fund #4	-11.37%
Average	-10.99%

Source: Bloomberg, Morningstar Encorr

It must be understood that these estimates are not precise for several reasons. In real life, other than by coincidence, the fund's foreign-currency-forward contracts are never actually rolled over at the month's closing price. Indeed, they are not even always rolled over on the last trading day of the month, as the timing of the currency-forward transaction may differ from one manager to another. Furthermore, intra-month cash flows in and out of the fund tend to influence the degree of over- or under-hedging. Another limitation is that monthly closings may occasionally not be an accurate reflection of the market's intra-month volatility. For example, the S&P500 could appreciate by 8% early into a given month, and then lose all of its gains later on, to close the month basically with zero return. Therefore, looking solely at the monthly return creates the false impression that there was little volatility during the month. But despite these limitations, I believe that my results provide a correct appreciation of the residual-currency effect on the tracking error of the funds.

6. The Residual-Currency Effect Illustrated

As demonstrated in Section 4, the residual-currency effect partly explains the negative tracking error for S&P500 funds during the 2006–2009 period. This conclusion is also supported by statistical analysis. Chart 6 below depicts the regression analysis of the relation between the tracking error and the estimated RCE during the 2006–2009 period, for the four funds under review.

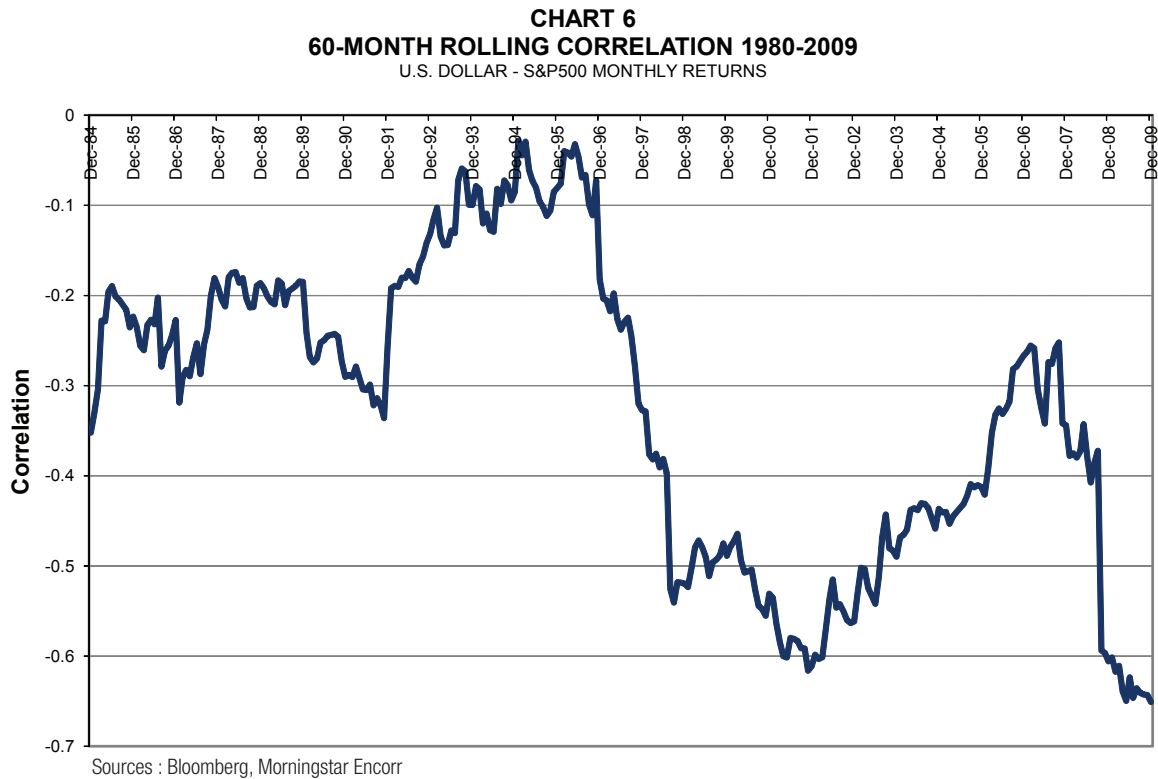


Sources: Morningstar Encorr, Bloomberg, PWL Capital

Three highlights of this analysis are noteworthy. First, the relation's R-square is 0.43; meaning that 43% of the fund's tracking error is explained by the estimated RCE. This is high for a single-factor regression. Second, the "beta" of the relation is 1.0057, which suggests an almost 1-to-1 relationship between the two variables. Finally, the t-statistic of the beta is 12.09, once again suggesting a strong statistical relationship.

7. The Residual-Currency Effect: Data Analysis for 1980–2009

While I am unsure of the fundamental reasons for the observed negative correlation between the returns of the S&P500 and the U.S. dollar (relative to the \$C) during the 2006–2009 period, this phenomenon is consistent with data spanning a longer period. During the 1980–2009 period, the correlation was -0.38 . In addition, Chart 6 demonstrates that the 60-month rolling correlation has *never* moved into positive territory. I find it difficult to believe that this history of negative correlation can be the result of coincidence, given that the underlying data spans 30 years.



Based on this evidence, I believe that a negative correlation is likely to persist rather than revert towards zero, and that this therefore imposes a large inefficiency cost on the unitholders of S&P500 currency-neutral funds.

Due to this negative correlation, the estimated RCE is -0.40% per annum for the 1980–2009 period, based on the following calculation:

$$\text{Estimated Loss}_{1980-2009} = \frac{\sum \text{Return (S\&P500)}_i \times \text{Return (Canadian dollar/US dollar)}_i}{30 \text{ years}}$$

Nonetheless, it should be noted that the estimated RCE is far smaller for the 1980–2005 sub-period than for the 2006–2009 sub-period, as described below:

Table 3: Estimated Residual-Currency Effect

1980-2005:	-0.23%
2006-2009:	-1.49%
1980-2009:	-0.40%

Sources: Bloomberg, Morningstar Encorr, PWL Capital

8. Conclusion

The residual-currency effect was a major cause of the negative tracking error for Canadian-dollar-hedged S&P500 funds in the 2006–2009 period. I estimate that, due to a large negative correlation between the returns on the U.S. dollar and the S&P500 in a period of extremely high volatility, the RCE has subtracted 149 basis points per annum from investors' returns.

The correlation was also consistently negative in the 1980–2005 period, leading to a less-damaging 23 basis points in estimated return reduction.

In theory, the RCE can lead either to a positive or negative tracking error, depending on the correlation between the returns on the S&P500 and the U.S. dollar relative to the Canadian dollar. Over the long haul, periods of positive and negative RCE should offset each other. But in practice, we can't ignore the fact that this correlation has been consistently negative over the past 30 years, which has produced a negative impact on fund returns.

Furthermore, this challenge also affects institutional funds, which generally use the same hedging techniques as retail mutual funds. Currency-hedged, actively managed U.S. equity funds suffer from the same major flaw as index funds: the fund becomes over-hedged or under-hedged as soon as the stock market fluctuates.

While it is clear that perfect hedging is unattainable, I think there is an opportunity to consider alternatives to the "roll-once-a-month" technique, in order to minimize the cost of the residual-currency effect. One such alternative is a laddered strategy, which would roll on daily basis 1/21 of the 1-month-forward currency contracts (let's assume there are 21 business days in each month), instead of rolling the whole position once a month. This strategy would allow the fund manager to adjust the size of the currency hedge to the total value of the fund on a daily basis, with no other trading cost than having to make 21 smaller transactions per month instead of only one.



About the author

Raymond Kerzérho, MBA, CFA

Raymond is the Director of Research and Chairman of the Investment Committee at PWL Capital. He has spent a large part of his career managing bond and derivative product portfolios for pension funds, mutual funds and for a major bank. He holds degrees from HEC Montreal (BBA) and Laval University (MBA) and has earned the Chartered Financial Analyst (CFA) designation. Raymond's mission is to maximize clients' risk-adjusted return by applying his in-depth knowledge of the capital markets.

Over the years Raymond has authored numerous articles, white papers and economic commentaries. He is sought-out by members of the media as a trusted and knowledgeable source on capital markets.

T 514 875.7566 ext. 263

1 800 875.7566 ext. 263

raymondk@pwlcapital.com

www.pwlcapital.com

About PWL Capital Inc.

With offices in Montreal, Ottawa, Rivière-du-Loup, Toronto and Waterloo and a combined staff of more than 40 financial professionals, PWL Capital Inc. offers integrated wealth management solutions for a successful investment experience.

For more information, please visit **www.pwlcapital.com**.



Montreal

3400 de Maisonneuve O.
Suite 1501
Montreal, Quebec
H3Z 3B8

Tel 514-875-7566
1 800-343-7566

Fax 514-875-9611

capital@pwlcapital.com

Ottawa

265 Carling Avenue
Suite 100
Ottawa, Ontario
K1S 2E1

Tel 613-237-5544
1 800-230-5544

Fax 613-237-5949

ottawa@pwlcapital.com

Toronto

3 Church Street
Suite 601
Toronto, Ontario
M5E 1M2

Tel 416-203-0067
1 866-242-0203

Fax 416-203-0544

toronto@pwlcapital.com

Waterloo

20 Erb St. West
Suite 506
Waterloo, Ontario
N2L 1T2

Tel 519-880-0888
1 877-517-0888

Fax 519.880.9997

waterloo@pwlcapital.com

Rivière-du-Loup

494 rue Lafontaine
PO Box 397
Rivière-du-Loup, Quebec
G5R 3Y9

Tel 418-862-5643
1 800-774-7418

Fax 418-862-3585

rdl@pwlcapital.com