

VALIDUS

To Hedge or not to
Hedge? (USDCAD)



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Canadians' (US\$) Hedging Dilemma

Canada and the United States have a unique relationship. Geographically, they share the longest international border of nearly 9000 kilometres in length, and while historically both were part of the British Empire, they chose very different paths to their independence. The geographic specificity that had isolated them from the rest of the globe, particularly before the advent of commercial air travel in the 20th century, naturally developed a trading relationship that solidified over the centuries. This culminated in a free trade agreement (NAFTA) in 1994 and its successor the USMCA (2018).

With a population roughly 1/10 of that of the US, Canada's economy evolved to be very US focused from a supply and export perspective. In 2023, trade between Canada and the US accounted for 77% of Canadian goods exports and 63% of Canadian goods imports. ^(a)

As a result, Canadians at large have a natural exposure to the US dollar, whether directly or indirectly. Canadian corporations not only import from or export to the US, but also employ, manufacture, or have important presence south of the 49th parallel. Meanwhile, Canadian pension funds are heavily invested in both public and private US markets and assets.

Fluctuations in the USDCAD exchange rate can have profound effects on Canadian businesses, pensions funds, and, by extension, the broader economy and the financial well-being of Canadians.

In this report, we will first examine the historical behaviour of the USDCAD exchange rate. Then we will explore its relationship with US equity markets as a proxy for US investments, with the goal of establishing a rule-based approach to hedging USDCAD exposure along two criteria: a) when to hedge and, b) how much to hedge.

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I. Birth of a currency

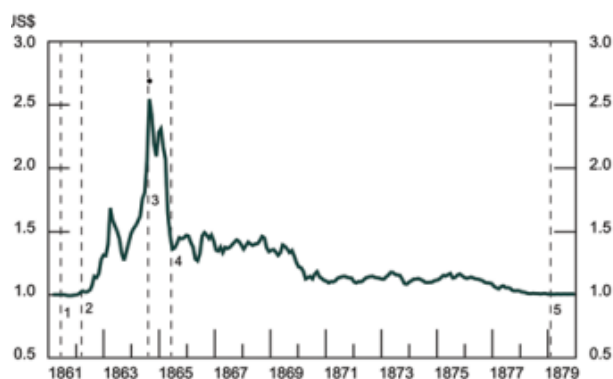
A. The pre-Bretton Woods era

The history of the Canadian Dollar is a fascinating one, shaped by its colonial history, fragmented legislations, and proximity to the US. In his seminal book published by the Bank of Canada, James Powell^(b) retraces the unique path that led to the Currency Act of 1853. The birth of a distinctive Canadian currency had to wait until 1858, when the silver and bronze coins bearing the word “Canada” were first issued.

In the years that followed, and until the creation of the Bank of Canada in 1935, monetary policy was conducted de facto by the government. The Canadian dollar (CA\$) was on the Gold Standard for nearly six decades after its creation in 1858, until the First World War (1914). It continued through intermittent cycles of being on and off the Gold Standard due to wars and economic crises (the Great Depression).

It is particularly important to note that by the 1930s, the US dollar had replaced the British Pound as the main source of pressure (or lack thereof) on Canada’s foreign exchange reserves. This shift reflected the growing economic and industrial relationship of the two countries during World War II, as well as the increasing number of Canadians now living and working in the US.

Canadian Dollar in Terms of the U.S. Dollar
Monthly averages (1861–79)

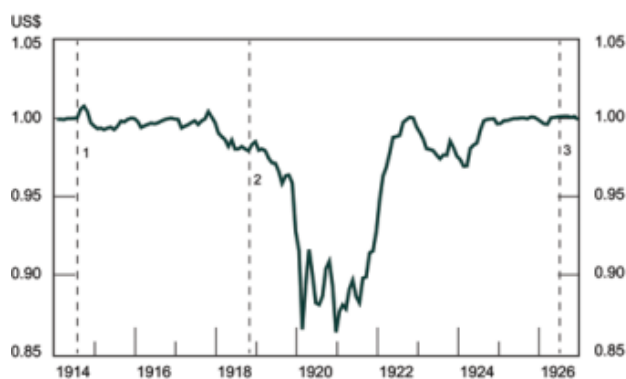


*11 July 1864: Can\$1=US\$2.78

1. April 1861: Outbreak of U.S. Civil War
2. January 1862: U.S. suspends gold convertibility.
3. June, July 1864: Closure of Gold Room, Confederate army approaches Washington.
4. April 1865: U.S. Civil War ends.
5. January 1879: U.S. returns to gold standard.

Source: Turk (1962), *Montreal Gazette*

Canadian Dollar in Terms of the U.S. Dollar
Monthly averages (1914–26)



1. August 1914: Outbreak of World War 1

2. November 1918: End of World War 1

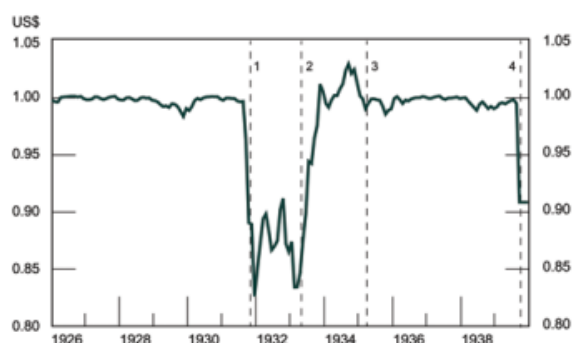
3. July 1926: Return to gold standard

Source: U.S. Board of Governors of the Federal Reserve System (1943)

It is important to observe that—except for the period of the US Civil War—the CA\$ exchange rate to US\$ remained close to par throughout its first century of existence. In fact, this was in great part by design, as each revaluation or devaluation seemed to use the par value as an anchor.

Historically, CA\$ reached its high against the US\$ during the Civil War, trading at 2.5 US\$ per CA\$, and this occurred under the Gold Standard. In the pre-Bretton Woods era, CA\$ reached its weakest point in the 1930s during the New Deal, falling to around 0.83 US\$ per CA\$.

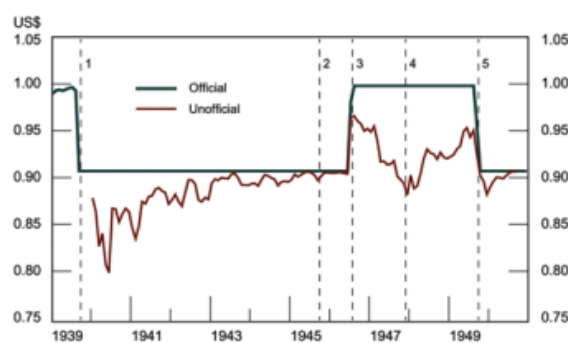
Canadian Dollar in Terms of the U.S. Dollar
Monthly averages (1926–39)



1. October 1931: Gold exports banned
2. April 1933: Redemption of Dominion notes into gold suspended
3. March 1935: Bank of Canada begins operations.
4. September 1939: War is declared, the Canadian dollar is fixed, and exchange controls are imposed.

Source: U.S. Board of Governors of the Federal Reserve System (1943)

Canadian Dollar in Terms of the U.S. Dollar
Monthly averages (1939–50)



1. September 1939: War is declared, the Canadian dollar is fixed, and exchange controls are imposed.
2. September 1945: World War II ends.
3. July 1946: Canadian dollar revalued.
4. November 1947: Exchange controls tightened.
5. September 1949: Canadian dollar devalued.

Source: U.S. Board of Governors of the Federal Reserve System (1943, 1976)

B. The Bretton Woods system and the Canadian experiment

“In July 1944, representatives from 44 countries met in Bretton Woods, New Hampshire to establish the post-war international financial architecture. Agreement was reached on creating the International Monetary Fund (IMF) which, among other things, would promote monetary co-operation and discourage competitive currency devaluations. After the IMF began operations in 1946, member countries agreed to establish “par values” for their currencies in relation to the U.S. dollar and to maintain them within narrow fluctuation bands. A par value change was permitted only to correct a fundamental disequilibrium. Louis Rasminsky, who was to become the Bank of Canada’s third Governor, played a key role in the founding of the IMF, reconciling views and mediating between the British, led by John Maynard Keynes, and the

Americans, led by Harry Dexter White. At Bretton Woods, Rasminsky chaired the key drafting committee.” (c)

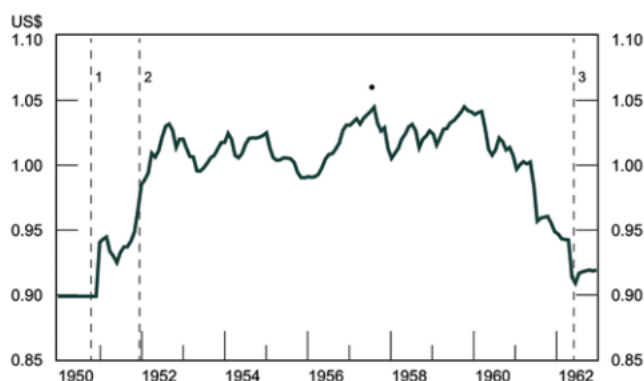
But, it was not long before Canada had to devalue its currency, in 1949. Canadian imports from US had increased in the years following the war, and the decline in US\$ reserves was not offset by an increase in exports to Europe, which were mostly financed by Canadian loans. The devaluation provided temporary relief, but the “unofficial” exchange rate market for CA\$ that had emerged in New York ultimately drove Canadian policymakers to float the CA\$ in 1950.

This was, if not the first, one of the only examples of a developed market country—signatory of Bretton Woods agreement—choosing to float its currency.

By the time it came to an end with a return to the Gold Standard in 1962, Canada’s implementation of a floating exchange rate was, by all accounts, an innovative and successful experiment in setting a flexible exchange rate regime. It was a real-life case study that inspired considerable early academic work on the merits of a flexible exchange rate system at that time.

One can consider that Canada led the world, as this episode would provide a model for the rest of the world when the Bretton Woods system of fixed exchange rates finally collapsed during the early 1970s.

Canadian Dollar in Terms of the U.S. Dollar Monthly averages (1950–62)



* 20 August 1957: Modern-day Canadian-dollar peak: US\$1.0614

1. September 1950: Canadian dollar floated

2. December 1951: Exchange controls lifted

3. May 1962: Canadian dollar fixed

Source: Bank of Canada; U.S. Federal Reserve System (1976)

C. The new world of Fiat Money

By 1970, the Gold Standard framework, which was rigid due to its fixed exchange rate structure, was proving increasingly difficult to maintain in a world of growing international trade, increasing immigration across borders, and swings in inflation that constantly affected the level of central banks' reserves. Other than devaluation and revaluation, the only tools available to governments and central banks were various forms of capital controls, with which they experimented extensively over the decades.

It was only natural that the world began to shift toward a more flexible alternative: floating exchange rates. Once again, Canada was ahead of the herd and re-adopted a flexible exchange rate in May 1970. Then in August 1971, President Nixon announced his New Economic Policy^(d). For all practical purposes, this marked the end of the Gold Standard and the era of fiat currencies (i.e. not exchangeable into gold at a fixed rate) began.

Thus started a new world where investors—at least in developed countries—could generally consider the exchange rates as any other financial asset, having a price and value that fluctuate driven in great part by supply and demand.

Five decades later, the foreign exchange market is the most liquid and heavily traded financial market in the world, with an average daily trading volume of US\$7.51 trillion (2022)^(e).

The astute investor must account for the effects of currency price changes in their investment decisions. Yet, in addition to the “value” of currencies, the relationship and interaction of currency prices are also a critical consideration in a portfolio. In this report, we will explore several of these subjects as they relate to the USDCAD exchange and Canadian investors.

II. Anatomy of USDCAD post-Bretton Wood (1971 – 2025)

A. Not so “normal”

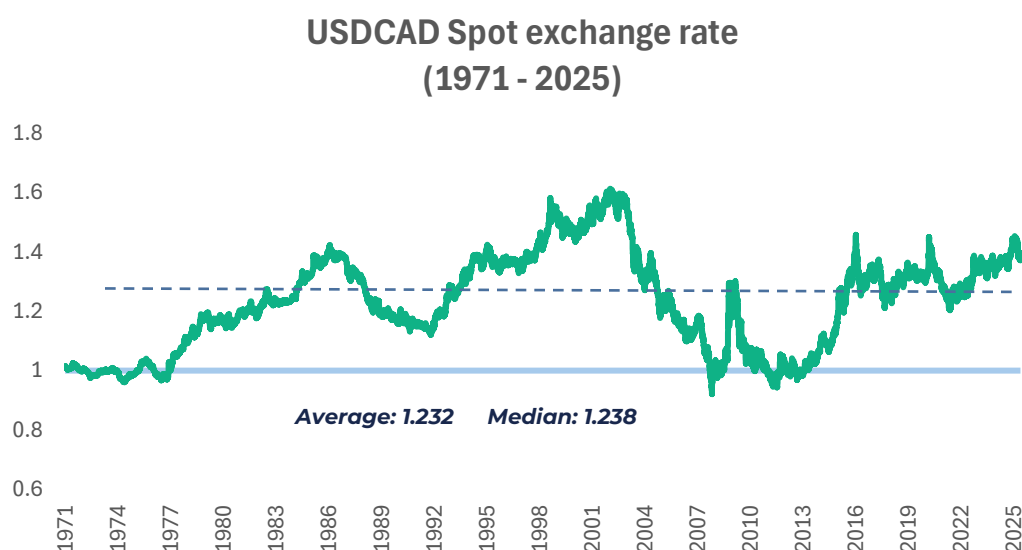
Taking a close look at the USDCAD spot price since 1971, an observer notices one distinctive element when compared to other major crosses (GBPUSD, USDDDEM and USDJPY)¹. The USDCAD price fluctuation over the five and half decades of flexible currency regime has been confined to a very tight range when compared to other major crosses.

Price range of select FX crosses as a function of minimum price (1971- 2025)			
USDJPY	GBPUSD	USDCAD	USDDDEM
472%	251%	76.6%	298%

Source: Bloomberg, Validus calculation, Jan 4th, 1971 – Jun 3rd, 2025

USDCAD range is less than 1/3rd of the British Pound fluctuations and 1/6th of that of the Japanese Yen.

Chart 1:



¹ The choice of the Deutsche Mark allows us to have a historical context and a proxy for Euro pre-2002. The DEM vs. Euro rate was fixed at 1.95583 on Jan 1st, 1999.

Qualitatively, we observe that the USDCAD exchange rate has oscillated within a range of $[0.92; 1.67]$, with an average of 1.23 which is nearly in the middle of that range. With such a range bound price series, one would not expect the distribution of returns (daily, monthly, or other periods) to be Gaussian.

We have conducted various statistical tests on the data, the results of which are in Appendix A. In particular, we conclude that:

- A Q-Q plot test for normality confirms that the USDCAD **return distribution is not Gaussian**. A Similar test on the other 3 crosses, confirm their return distributions are not normal. This only confirms a well-established empirical observation of the fact that currencies and commodities price distribution in particular exhibit “fat” tails.
- However, all three additional tests² to measure which cross is the least normal, confirmed that **USDCAD has the “heaviest” tails**.
- Finally, to validate our intuition with regards to the mean reversion characteristics of the USDCAD prices, we performed statistical tests to determine the stationarity of the price returns.³ These tests indicate that USDCAD (as well as GPBUSD) **presents mean reversion properties**, which is not the case for USDJPY and EURUSD cross.

The above observations are key in our approach for devising a hedging framework in part III of this report. But it is also interesting to explore what drives this specific nature of USDCAD.

B. Why USDCAD might be different (than other crosses)?

1. **Heavy tails:** since 1971, the CA\$ has exhibited nearly 30% less volatility among the 4 selected crosses.

Realized Volatility in % per annum				
	USDJPY	GPBUSD	USDCAD	USDDEM
1971- 2025	9.98%	9.29%	6.40%	9.71%
2002-2025	9.73%	9.08%	8.40%	9.17%

² We used 3 tests to measure which currency price returns had the “heaviest” tails: t-Hill estimator, Student distribution fit, Pareto distribution fit.

³ We used two tests: Augmented Dickey Fuller test (ADF) and KPSS test.

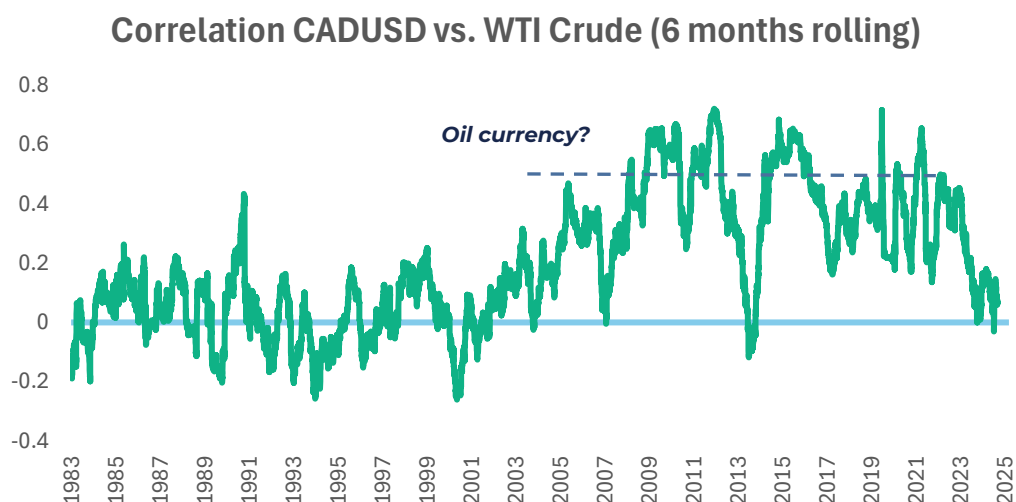
However, if we focus on the post-Asian Crisis and the Tech Bubble period (2002-2025) the CA\$ volatility has picked up noticeably by nearly 30%, and nearing the range of other crosses during the same period.

In fact, the biggest daily moves for the USDCAD were during the 2008 Global Financial Crisis (GFC) and the European Debt Crisis, whereas for all other crosses these extreme moves happened throughout 1970s to 1990s. Why? The trade balance of Canada and US was much more stable than that with the other developed markets. These imbalances drove 5 countries to conclude the Plaza Accord in 1985 and to devalue the US versus other major currencies. However, Canada did not (need to) take part in this process thanks to its stability versus the US\$.

Additionally, up to 1998, the Bank of Canada intervened in currency markets on behalf of the government to provide stability to the exchange rate. This likely dampened some of the volatility that might have resulted in its absence.

But after 1998, such interventions stopped. At the same time, Canada became increasingly dependent on oil, as oil production tripled between 2000 and 2020, and its share of US oil imports went from 12% in 2000 to over 60% in 2024. As a result, the USDCAD rate was now also affected by global oil prices, but also by this new flow of exports. For over a decade, the correlation between CA\$ and crude oil rose noticeably which provided it with commodity like behaviour—often marked by fatter tails. The fact that monetary policy was all but inexistent—with rates at near zero—further accentuated this relationship.

Chart 2:



Interestingly, this correlation seems to have subsided as the interest rates rose in 2022 following the observed bout of inflation.

- 2. Reverting to the mean:** refers to the fact the USDCAD price is bound in a range, and it has a somewhat cyclical nature over time. Rising from par in 1970s to over 1.40 in 1980s, then it dropped to below 1.20 in 1990s to rise to its historical high (post Gold Standard) of 1.61. Since then, it briefly went below par before the GFC and hovered at such levels until 2012 before taking on an ascending trend to its current level around 1.37.

There is neither a simple nor a single explanation as to what drives this mean reversion. However, we believe several factors explain greatly what lies at heart of this behaviour.

- The trade balance of Canada with the US, as well total Canadian trade balance has been an important driver of the historical CA\$ cycles versus US\$.
- In addition to the increase volume of Canada's energy export to the US affecting the trade balance, the fluctuation of oil prices, particularly post early 2000s as Canada's share of US imports grew noticeably, also affect the trade balance.
- Monetary policy & economic cycles. The geographical proximity and the great importance of the US as a trading partner of Canada creates interconnection of the two economies. With globalization, economic cycles are much more synchronized, especially Canada and the US, which can help the cyclicity—albeit with lag of their monetary policies.

C. In abnormality lies opportunity

Our brief review and analysis of the USDCAD exchange rate highlights two salient facts. First, USDCAD presents heavy tails when compared to many other developed market crosses. In other words, one can expect sudden and abrupt moves of more than “usual” amplitude at times. Second, USDCAD has a historical tendency to mean-revert both on short and long-term time scales. Its range boundness on the long-term reflects this characteristic.

To the extent that one assumes these behavioural patterns will persist and are inherent to the nature of USDCAD—a reasonable view considering our explanation of the fundamentals that drive them—they provide a valuable framework for devising both trading and hedging strategies. Having a strong hint of likely future behaviour is

a definite edge for investors and there lies opportunities for improving performance and reducing risks.

Scope of the Study

The present study focuses on the perspective of a **Canadian investor with exposure to the US currency, either directly or by virtue of their investments in US\$**. Our analysis of hedging such exposure focuses on holding periods of 5 and 10 years. These holding periods are meant to represent that of an average Canadian corporation with US\$ exposure and of an investor with longer term liabilities or exposure (pension, insurance, or private asset funds, or individual investors).

In the following sections, we will first focus on how historical observations of the USDCAD spot price behaviour since 1970s can be relevant to building a framework of decision making on hedging the currency.

Then, we will use this framework to devise a practical implementation using foreign exchange forwards for an investor who has only a direct exposure to US\$—via cash currency or a future stream of income in US\$—and evaluating its relevance and performance historically.

Finally, we will **consider the case of an investor with an indirect exposure to US\$ by virtue of holding a position in S&P500 index**. In addition to the classical correlation analysis, we will adopt a cross-sectional approach to the USDCAD vs S&P500 correlation, to conclude with guidelines and a general framework for hedging US\$ in that context.

III. Cross-Sectional Analysis of Prices

The range boundness and mean reversion of USDCAD lies at the heart of our approach. While ad hoc analyses and discussions have often relied on this angle, the novelty of the present approach is based on using a cross-sectional analysis of the performance of USDCAD spot and forwards, to build a hedging program.

A. Cross sectional analysis of USDCAD spot

For this analysis, we use the spot data starting in 1971 and calculate USDCAD returns for rolling periods of 2 years, 5 years and 10 years.

Next, we sort these returns into buckets based on the level of the USDCAD spot (or forward) at the start of that specific investment period. For example, for all dates since 1971 where the spot had a value between 1.20 and 1.25, we calculate the return of a short position in spot USDCAD over the next 2, 5 and 10 years and we further look at the summary statistics of the data—such as mean, maximum, etc. —for this bucket.

Then, we proceed to summarize the results for the mean return in a cross-sectional form (i.e. by bins based on the value of spot in table 1). (Detailed results including a wider range of statistics are included in Appendix B)

Table 1: Cross Sectional average return of a short USDCAD position (2, 5, 10 years)

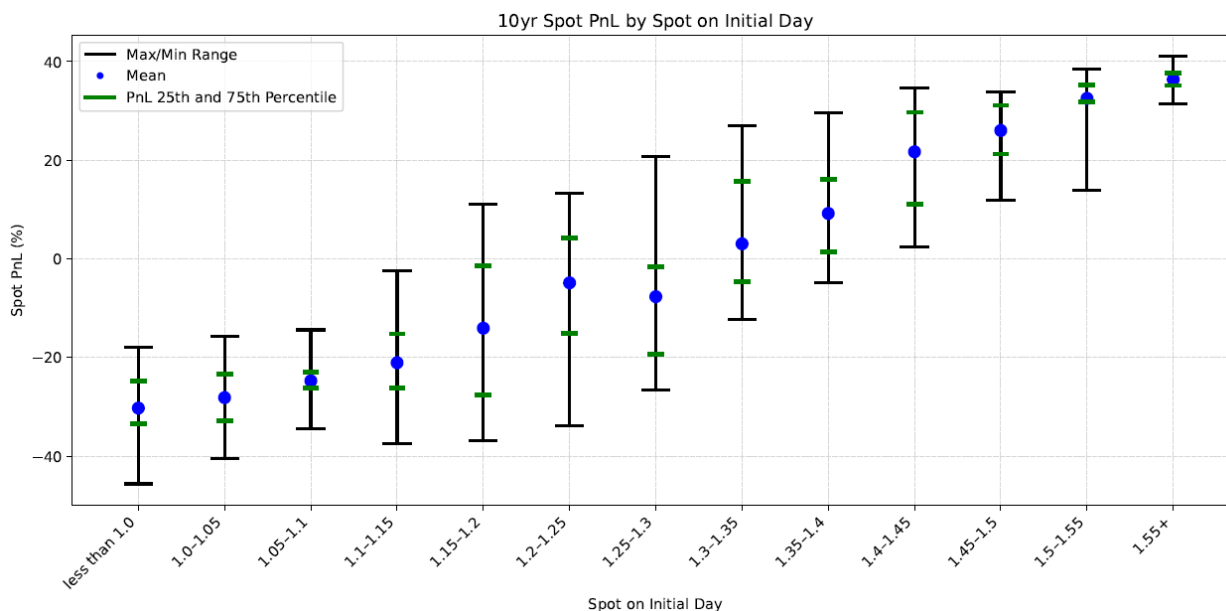
Spot Bin	2 YR	5 YR	10YR
<1.0	-5.53%	-19.84%	-30.25%
1.0–1.05	-5.85%	-15.36%	-28.13%
1.05–1.1	-7.90%	-11.54%	-24.73%
1.1–1.15	-5.34%	-6.73%	-21.06%
1.15–1.2	-1.96%	-10.08%	-14.06%
1.2–1.25	-2.42%	-2.60%	-4.86%
1.25–1.3	-3.30%	-1.44%	-7.66%
1.3–1.35	2.37%	1.97%	3.05%
1.35–1.4	1.48%	1.05%	9.22%
1.4–1.45	1.98%	1.11%	21.71%
1.45–1.5	-2.90%	13.65%	26.03%
1.5–1.55	4.39%	20.56%	32.53%
>1.55	15.32%	29.25%	36.38%

The main takeaways are:

- Shorting USDCAD at spot levels above 1.30 has resulted, on average, in positive returns over 5- and 10-year time horizons.
- Conversely, buying USDCAD below 1.30 has resulted, on average, in a positive outcome over all time horizons.
- These results validate the mean-reverting nature of the currency and provide the investor with a guideline as to when might be an opportune time to buy or sell USDCAD.
- However, this initial analysis is only based on spot prices and does not account for the “reality” of an actual trading program as we do not account for the effects of the carry in the analysis of the profit and loss.

Chart 3 represents the results for a ten-year holding period, showing the maximum, minimum as well as the 25th and 75th percentile bands for a short USDCAD position as function of the spot price at initiation.

Chart 3: Cross sectional analysis of a short USDCAD spot position held for 10 years



This further emphasizes that for a long holding period, a short USDCAD position initiated when spot is above 1.35 resulted in a positive return for more than 75% of cases. Next, we will undertake the same analysis accounting for the effects of the carry.

B. Cross sectional analysis of USDCAD forwards

For the analysis in this section, we rely data on US and Canada interest rates going **back to 1989**, to calculate the fair value of USDCAD forward contracts.

We use overnight -, two-, five- and ten-year generic interest rates. For maturities between 0 to 10 years, we rely on a linear interpolation of these rates.

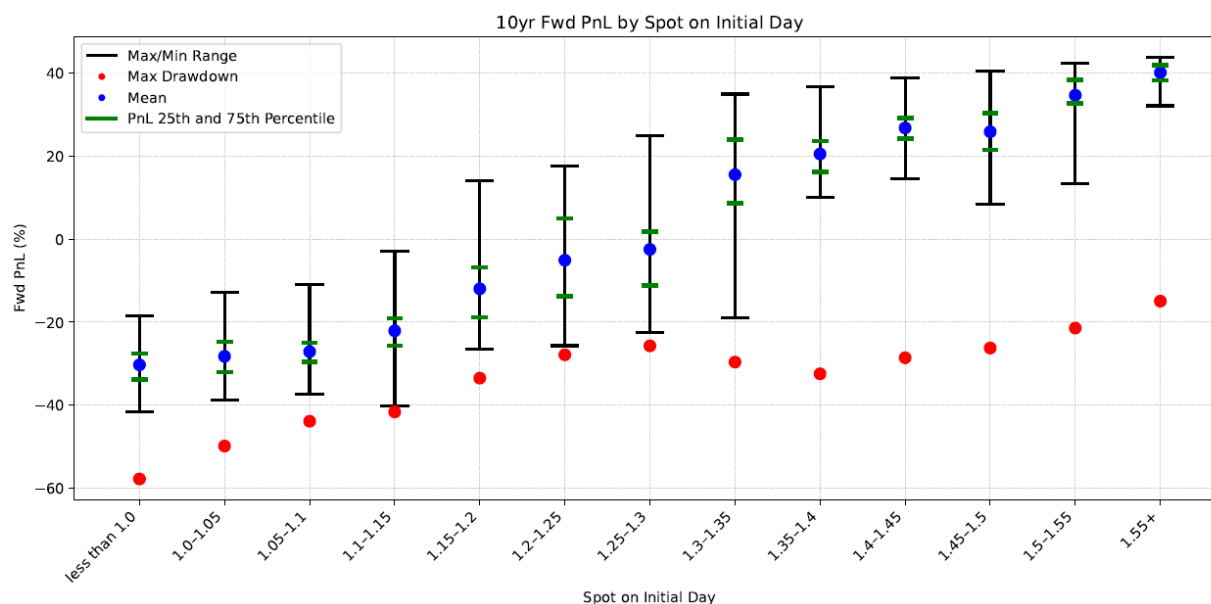
When implementing a hedging program using forwards, the investor needs to decide on what maturity to use. To hedge a given position for 5 years, the investor can, for instance, simply **short a 5-year forward on day 1, or short a shorter maturity (3 or 6 months forward) on day 1 and reinitiate a similar position as these shorter-term positions come to expiry over the next 5 years**. This is referred to as rolling a short-term hedge. In practice using 3 months forwards for a 5-year horizon, the investor will end up initiating 20 trades during that period (resp. 10 trades if using 6 months forwards).

1. Using long term forwards to hedge (Appendix C)

We calculate the P&L of a short position of a 5- and 10-year USDCAD forward respectively, and then do a cross-sectional analysis based on:

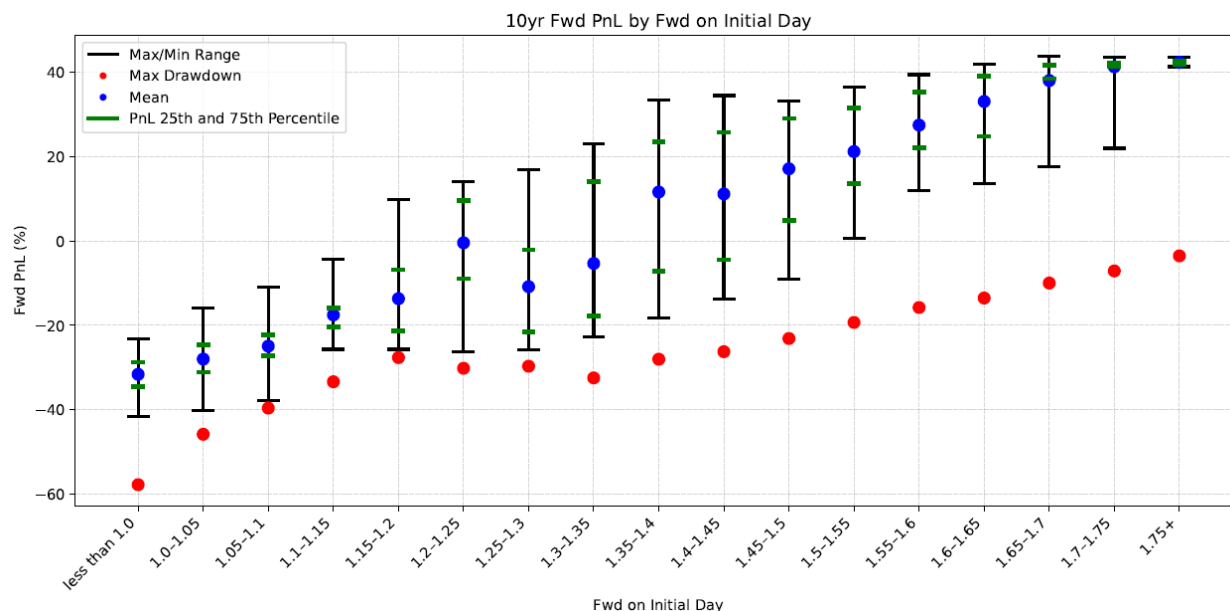
- a) Spot price at initiation of the trade.

Chart 4: Cross sectional analysis of a short 10-year USDCAD forward position held for 10 years versus spot at initiation



b) Forward price at initiation of the trade.

Chart 5: Cross sectional analysis of a short 10-year USDCAD forward position held for 10 years versus forward level at initiation



We observe a similar general pattern to the results for USDCAD spot. However, some points are worth highlighting:

- Using the spot versus the forward at initiation leads to slightly different conclusions. If an investor uses spot as an “indicator” to establish a short position in a 10-year forward, 1.30 and above will lead to average positive P&L, whereas only 1.35 level and above for the 10-year forward value at initiation will lead to a positive P&L on average.
- It is very important to note that short positions initiated at higher spot rates have increasingly higher P&L. This means that historically the P&L of a hedge has been an increasing function of the spot at initiation. This observation confirms and is in line with the mean-reverting nature of USDCAD. **Intuitively, if an investor shorts USDCAD at higher levels, the expected P&L increases as the currency reverts back to its mean.**
- **Historically for long term hedges, the carry has benefited the Canadian hedger.** The average P&L of a short 10yr forward initiated in the 1.30-1.35 range of 12% far exceeds the 3% return on a similar short spot.

- Since the main goal of this study is to **devise a practical hedging strategy**, we also measured the maximum **drawdown** along all the paths (i.e. 10-year holding periods), to identify the “worst case” scenario.
- The worst drawdown for trades initiated when 10-year forwards are 1.35 or more, is of the order 20-25%.
- The **mark-to-market** of such a long-dated trade during a great part of its life **is subject to the differential of long-term rates between the US and Canada**. The astute investor needs to incorporate a qualitative analysis of this differential along with its risk tolerance into any hedging program, which we will discuss further in part IV and the conclusion of this report. We do not account for the effects of the carry in the analysis of the profit and loss.
- In our view, using the **long term forward values as an entry “signal” is not suitable** as it is highly sensitive to the compounding effect of long-term interest rate differential.

Investors need to keep in mind that the use of a long-term forwards—while operationally convenient—can be disadvantageous when the cost of carry is elevated for the Canadian hedger (US rates higher than Canadian rates). That is why we will next look at a program that systematically “rolls” 3 or 6 months forward over a 5- or 10-year period.

2. Using short term forwards for hedging (Appendix D)

We calculate the P&L of a short position of a 3-months, 6-months forward rolled over a ten-year period and compare them to the P&L of a short 10-year USDCAD forward on a cross-sectional basis:

- The results show that **using short term forwards and rolling them** over the 10-year hedging period **can provide an additional 2 to 4% of performance per annum** if the investor initiates a hedge when USDCAD spot is above the 1.30 level.
- This additional return can be explained by the fact that, when trading a 10 year forward, the investor “locks in” the carry when initiating the hedge, whereas by choosing to short term forwards (for instance 6 months forwards), they “lock in” the carry only for 6 months at a time. The improved performance therefore suggests that the cumulative impact of carry for short term hedges is more than a long-term hedge.

Table 2: Comparing the P&L of a 3 months and 6 months forward rolled over 10 years versus a 10 year forward

Spot Bin	3MTH	6MTH	10YR
<1.0	-27.88%	-27.47%	-30.25%
1.0–1.05	-26.27%	-25.58%	-28.13%
1.05–1.1	-23.88%	-23.35%	-24.73%
1.1–1.15	-22.65%	-22.46%	-21.06%
1.15–1.2	-16.84%	-16.55%	-14.06%
1.2–1.25	-8.44%	-8.30%	-4.86%
1.25–1.3	-11.14%	-10.77%	-7.66%
1.3–1.35	7.69%	7.58%	3.05%
1.35–1.4	11.98%	11.86%	9.22%
1.4–1.45	25.87%	25.39%	21.71%
1.45–1.5	26.88%	26.16%	26.03%
1.5–1.55	36.68%	35.64%	32.53%
>1.55	42.57%	41.99%	36.38%

- In other words, historically the short-term spread (US minus Canada) of rates has changed in such manner, that it resulted in a smaller cumulative (time-weighted) spread, than the spread of long-term rates.

C. Devising a hedging framework

Based on our previous observations and analysis, we can lay the foundations of a hedging program for a Canadian investor who is looking to hedge a fixed amount of US\$ exposure.

Here are the main tenets of the suggested hedging program.

I. When to hedge?

- **Short USDCAD forward when USDCAD spot reaches 1.30.**
- **The investor can also determine a specific spot level between 1.30 and 1.60, to initiate forwards as a hedge, based on their specific constraints and preferences.**

II. How much to hedge?

- **Increasingly short USDCAD forward when USDCAD spot rises above 1.30.**
 - As USDCAD rises higher above 1.30, the probability of it continuing to rise decreases (due to its mean reverting nature).
 - As a guide, since 1971 when USDCAD was above 1.30, 89% of time it remained below 1.50.
 - Based on the historical distribution of prices, one can derive a hedge ratio presented in the table below as Alternative I.
 - Additionally, by looking at the expected return of the hedge at each level, we note for a 10-year holding shorting at 1.40 or 1.45 has very similar expected return. Given the low probability of reaching 1.45+ level in spot one can hedge the entire position at the 1.40 level, as presented under Alternative II.

Table 3: Suggested hedge ratio for a Canadian investor with US\$ exposure as a function of USDCAD spot level

Spot Bin	Alternative I	Alternative II
1.35	35%	35%
1.40	70%	70%
1.45	80%	100%
1.50	100%	100%
>1.55	100%	100%

- **An alternative to an “additive” hedging is to determine a spot level between 1.30 and 1.60 where the entire exposure positions is hedged.**

III. How to hedge?

- **If the carry of a long-dated forward is positive at the initiation of the hedge the investor should prefer using the long-dated forward that matches best their time horizon.**

- In cases where the carry of long-dated forwards is noticeably negative, the investor should prefer using short-dated forwards (3 or 6 months and roll them over the hedging period).

IV. When to unwind or adjust the hedge?

- It is important to remember that hedging is not a static proposal. In the case of USDCAD, which tends to mean revert, investors should consider reducing their currency hedge if the exchange rate falls below its historical average. This can be done either progressively or fully, based a target level. We will discuss the unwinding of hedges in further detail in the final section of this report.

D. Practical considerations

The hedging framework we defined in the previous section is meant to be both general and relatively mechanical in nature.

However, in practice the methodology can be readily improved by leveraging Validus' multi-decade expertise in foreign exchange risk management and execution. For instance:

- Rather than systematically using 3- or 6-months forwards, a decision can be made at each roll to optimize the effect of the carry. For instance, if along the life of the hedge, long-term carry changes and turns out to be beneficial, the investor can lock that level for the remainder of the life of the hedging program, in lieu of continuing to use short-dated forwards.
- An important consideration for investors—particularly for those with an exposure to US\$ with low liquidity, is the notion of mark-to-market along the life of the hedge. A closer analysis and stress-test of potential drawdown is therefore warranted and can in turn affect the decisions regarding the hedging ratio.
- Lastly, this same hedging framework can be used as the basis of a hedging program using options instead of forwards for those investors who seek to have hedges conditional on spot levels, or rather disburse a specific amount for securing a long-term hedge and forgo concerns with regards to drawdowns, etc.

In the next section, we will tackle the case of a Canadian investor with exposure to US public markets by taking the S&P500 as a proxy.

We will explore the relationship between the USDCAD exchange rate and the S&P500 through a correlation analysis, to develop a relevant hedging framework for this type of investor, which includes most major institutional and private assets Canadian investors with US\$ exposure.

IV. Cross-Sectional Analysis of Correlation

In the previous section we considered a simplified case where the investor's exposure in US\$ was constant. In essence, an investor who owns a fixed asset in US\$ whose value neither appreciates nor depreciates. While not realistic—as an investor seeks to increase their wealth—the framework we established can be extended with relative ease to assets that have a gradual increase in value or that are income generating with a known cashflow schedule. This might be the case of some private asset owners.

This extends to cases where the exchange rate and the investment asset have zero correlation. In such cases, the hedging can be static, in the sense that it does not require adjustment over the horizon of hedging.

However, hedging an exposure to public securities such as stocks, bonds, or commodities brings about further complexity. For **an ideal hedging strategy, the hedger would need to know how the price of their investment will behave in relation to USDCAD.**⁴

In this section, we will focus on the case of a Canadian investor looking to hedge their exposure to the S&P500.

Obviously, there is no certainty about the future and therefore over their hedging time horizon the investor faces 4 potential outcomes.

Table 4: P&L of an unhedged exposure to S&P500 for a Canadian investor

	USDCAD	
	Higher	Lower
S&P500 Higher	Gains on both USDCAD and S&P500	P&L depends on whether gains on S&P500 exceed losses on USDCAD
S&P500 Lower	P&L depends on whether gains on S&P500 exceed losses on USDCAD	Losses on both USDCAD and S&P500

⁴ By ideal, we mean a hedging strategy that has a high information ratio and therefore minimizes the variance for a portfolio of S&P500 and USDCAD.

The concept of hedging becomes relevant and meaningful only when there is a direct (or inverse) relationship between USDCAD and S&P500 that is relatively robust and stable over time (at least over longer time horizons).

For instance, an inverse relationship would help offset losses of S&P500, as USDCAD would rise in that scenario. The most undesirable outcome for the investor is when both USDCAD and S&P500 prices drop.

Incidentally USDCAD appreciated over 13% between September 2021 to December 2024, while the S&P500 rallied by slightly over 40%, providing the unhedged investment of a Canadian investor with “lucky” additional returns.

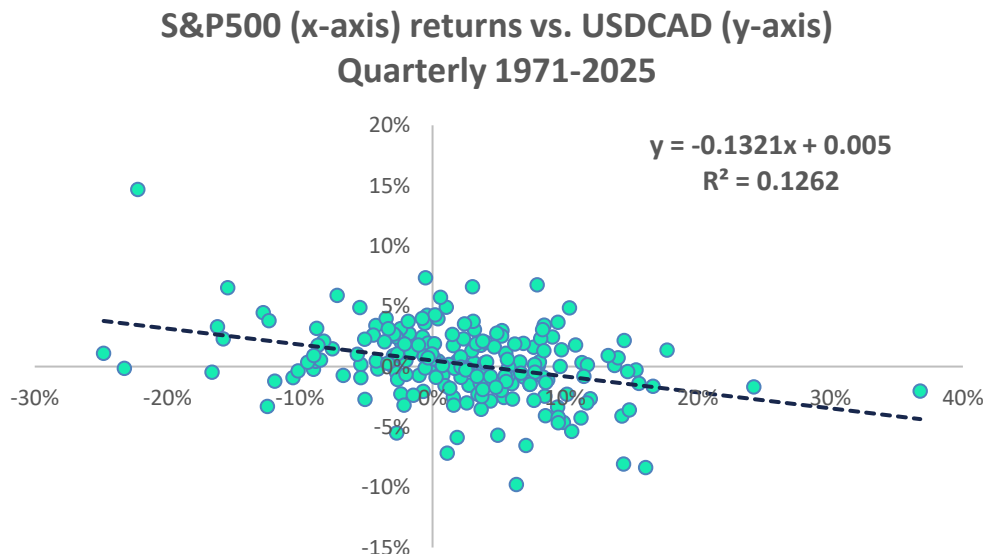
However, since early 2024, episodes of sell-off in US equities were also generally accompanied with weakening of US\$. In our view we sit at a key juncture, and it is of utmost importance for investors to focus on their US\$ exposure and eventually hedging it.

To provide further insights on why and how much to hedge, let us look first at the historical correlation of S&P500 and USDCAD and then dive into a more surgical analysis that is key to making hedging decisions in today's context.

A. Historical correlation

Chart shows the historical relationship between S&P500 and USDCAD spot quarterly returns. We focus on quarterly returns as it is relatively common for hedging programs to rebalance on shorter time horizons for instance monthly or quarterly horizons.

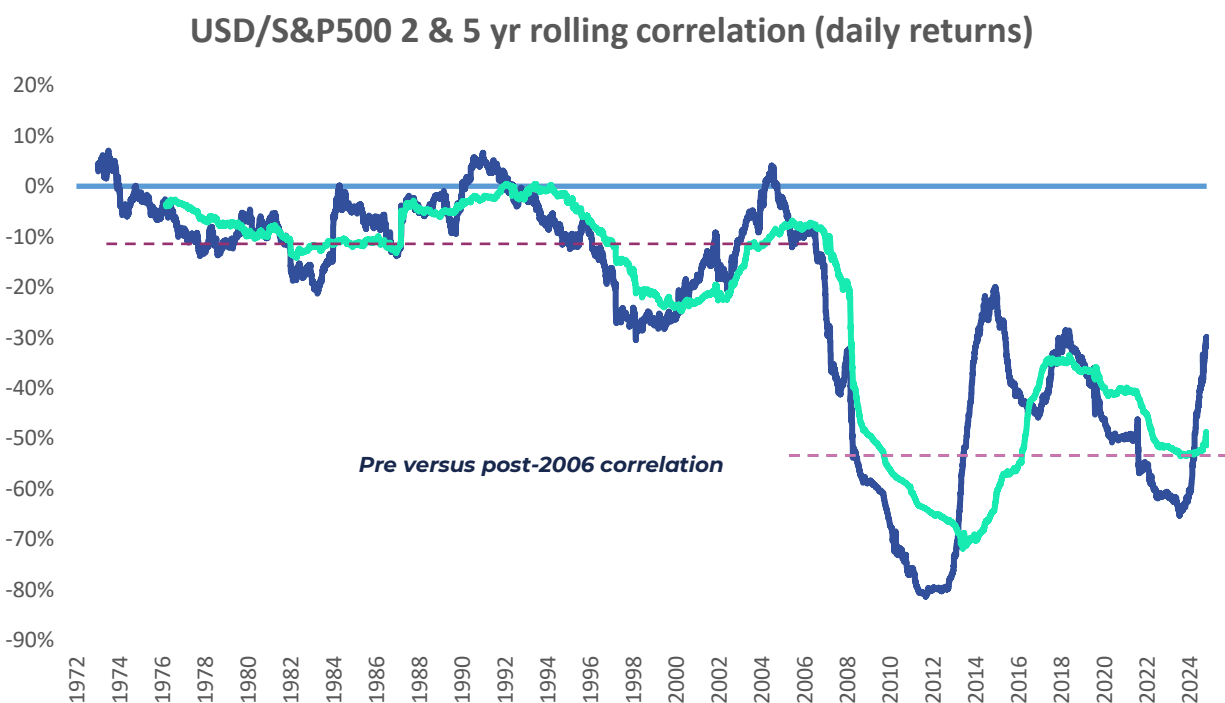
Chart 6:



This first snapshot indicates that **there is a statistically significant relationship between S&P500 and USDCAD price changes** (as we noted a p-value < 0.00001). Albeit with an R-square of 0.13, it is unrealistic to build a robust hedging scheme based on this regression. For instance, there are times where the S&P500 can have strong negative or positive returns with USDCAD exhibiting very little variation (points along the x-axis and y=0). In such cases, a USDCAD hedge will have little effect.

The above regression encompasses the 1971-2025 period which consisted of periods with likely different fundamentals. To gain more insights, we take a closer look at the rolling 2- and 5-year correlation of daily returns during that period.

Chart 7:

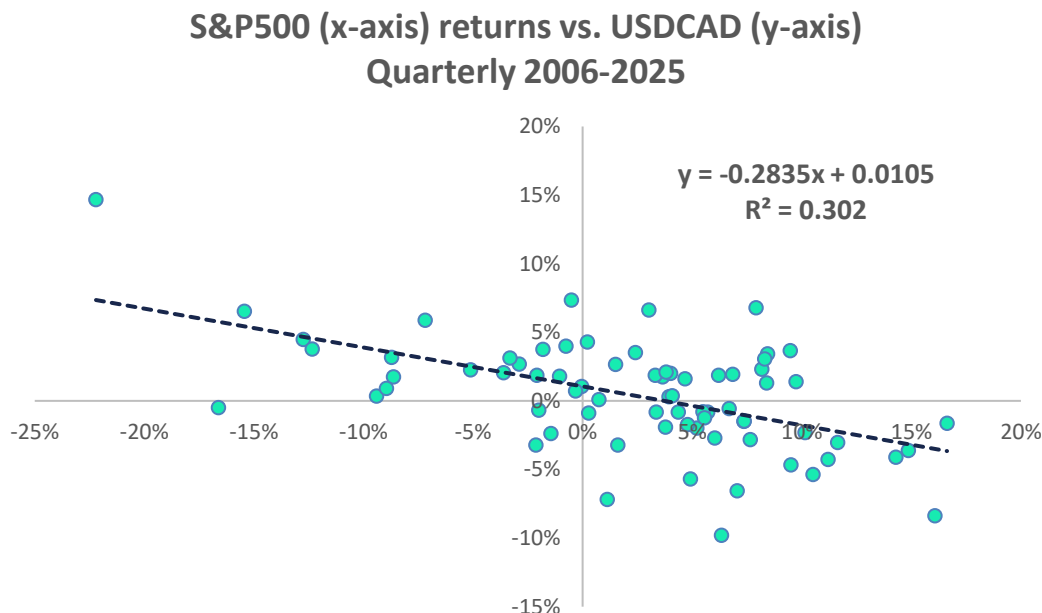


We notice two main correlation regimes pre-2006, where correlation between US equities and USDCAD was quite muted (-9% on average), and a post-2006 regime with high correlation of nearly -50%. Interestingly, the new regime seems to coincide with the advent and staggering growth of the Canadian oil industry and its increasing exports to the US.

This foundational change in the Canadian economy is not expected to change in the foreseeable future, in fact there is increasing talk of policy that would accommodate

and support it. Therefore, **we find it reasonable to focus on the post-2006 period relationship in the present study.**

Chart 8:



As expected, the relationship between US equities and USDCAD is much more robust since 2006 with an R-square that is over double that of the 1971-2025 period (0.30 vs. 0.13). Additionally, the concentration of point along the x-axis (at $y=0$) dissipated on this chart, indicating that there are less scenarios where the change in USDCAD is insensitive to variation of S&P500.

Given the mean reverting nature of USDCAD price, it is natural to ask the question: does this inverse relationship exhibit any differences for various levels of USDCAD. To answer this question, we will perform a cross-sectional analysis, this time on the correlation of S&P500 and USDCAD conditioned on levels of spot.

B. Cross-sectional analysis of correlation by spot level

Next, we will focus on the historical relationship between S&P500 and USDCAD for various levels of USDCAD in the post-2006 period. In fact, the pre-2006 can be in practice considered as a near zero correlation regime. Under that hypothesis, the investor would simply hedge statically the full notional exposure by shorting USDCAD forwards.

The hedging strategy that we build by focusing on the post-2006 period will likely be general enough to cover a variety of scenarios.

The cross-sectional analysis of correlation needs non-overlapping periods of returns of S&P500 and USDCAD. Given the limited history, we will choose to focus on monthly (221 months) and quarterly (77) return periods starting in 2006.

The findings are extremely interesting (see Appendix E). We find that:

- The negative correlation between S&P500 and USDCAD and is statistically significant across both monthly and quarterly periods for various intervals of the USDCAD spot. In particular, for values of USDCAD spot above 1.25 the R-Square exceeds 0.30.
- Further, we notice that the slope of the regression of values in sorted buckets of USDCAD above 1.25 is stable across these buckets, particularly for the monthly returns.
- Finally, for post-2006, it is quite salient to notice that the slope—which as we will see in section V represents the hedge ratio—is stable with a value of approximately $-1/3$ for monthly, quarterly, or semi-annual analysis.

Table 5: Regression of monthly returns of S&P500 vs. USDCAD spot (2006-2025)

Spot Bin	Count	R	R ²	Slope *	Intercept	T-Stat	P-Value
<1.0	21	-0.306	0.093	-0.516	0.00	-1.40	0.178
1.0–1.05	34	-0.473	0.224	-0.241	0.00	-3.04	0.005
1.05–1.1	18	-0.789	0.622	-0.697	0.01	-5.13	0.000
1.1–1.15	16	-0.273	0.074	-0.489	0.00	-1.06	0.307
1.15–1.2	10	-0.751	0.564	-0.537	-0.01	-3.22	0.012
1.2–1.25	14	-0.172	0.030	-0.088	0.02	-0.60	0.557
1.25–1.3	32	-0.582	0.339	-0.379	0.00	-3.92	0.001
1.3–1.35	47	-0.556	0.309	-0.322	0.00	-4.48	0.000
>1.35	29	-0.508	0.258	-0.246	0.00	-3.07	0.005
All data	221	-0.558	0.311	-0.406	0.00	-9.95	0.000

*** All results in the table are based on an OLS, except the slope calculated using a TLS**

The findings of this section are very important as they validate the statistical significance of the relationship between S&P500 and USDCAD prices in the ranges that matter for our strategy. Further, the stability of the regression slope across time horizons, is key in providing comfort as any hedging strategy relies greatly on it.

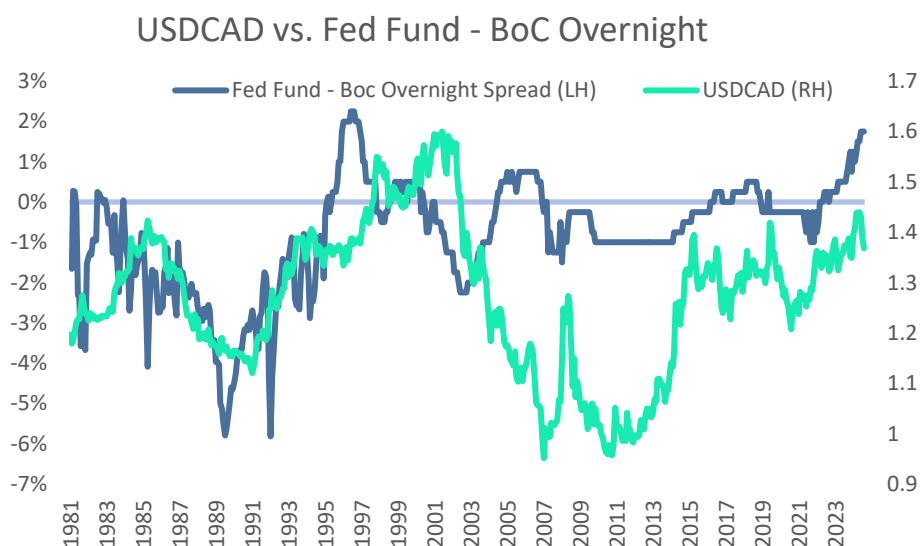
IV. Effects of Monetary Policy

So far, our study has focused on statistical properties and behaviour of USDCAD price. However, it is important to consider the role that interest rate differential might play in the performance of a systematic hedging framework on USDCAD.

The relationship between interest rates and exchange rates has been extensively studied. Generally, this body of work^(f) suggests that the difference between interest rates in each country can be a predictor of exchange rate movements in the short term. However, usually the viability of their short-term predictive power vanes for long term predictive horizons.

We find work done by the Federal Reserve^(g) particularly interesting, as it suggests that surprises and unexpected policy changes or sudden shifts in market expectation of US monetary policy—including a difference in interest rates—has a strong relationship to performance of USD pairs, including USDCAD. This observation can be very relevant in periods where monetary policy between the US and Canada diverges.

Chart 9: US/Canada overnight rate differential versus USDCAD spot (1981 – 2025)

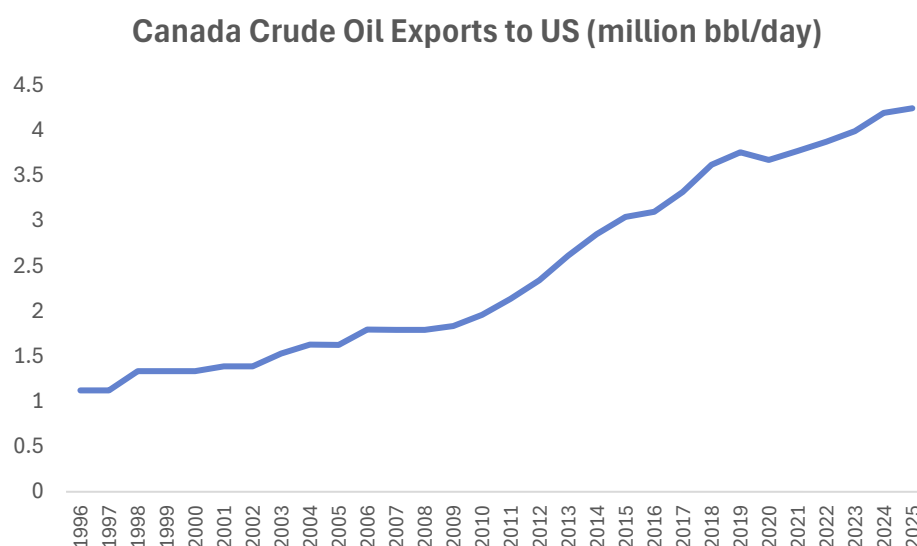


Qualitatively, we observe a co-movement between the overnight rate spread and the USDCAD spot price. Starting in mid-1980s, as the spread widened—with Canadian rates surpassing US rates in 1989—the Canadian dollar appreciated. However, this

trend reversed over the 1990s as the spread between the two overnight rates narrowed.

Since 1981, the period extending from 2003 to 2015 seems to exhibit a total detachment between interest rate differentials and USDCAD. We ascribe this to the massive rise in heavy oil exports to the US (Chart 10). During this period, heavy oil exports more than tripled, rising from 1.5 million barrels per day in 2003 to over 3 million barrels per day in 2015. This coincided with a rapid rise in oil prices, which doubled between 2004 and 2010, due to the commodity price boom driven by China's growth. The resulting surge in Canadian oil revenues likely became the main driver of USDCAD movements at that time.

Chart 10: Canada Crude Exports to US (1996-2025)



Incidentally, the stabilization of the Canadian oil export to the US, along with steady oil prices, may be a key factor for the recent re-emergence of the qualitative relation between interest rate differentials and USDCAD. This is an important consideration when building a USDCAD currency hedging framework.

To explore the predictive relationship between the overnight (ON) rate differential and the currency, we examine how changes in the spread—relative to its six-month average—relate to subsequent USDCAD price movement over a 3-month horizon⁵. (Details in Appendix F)

⁵ We regress the change in the ON US – Canada spread rate over the last 6 months versus USDCAD price change over the following 3 months for various levels of the change in the ON spread.

Table 6: Regression of change in ON spread versus its 6-months average versus subsequent 3-months change in USDCAD price for a given minimum change in ON spread

Minimum Change in ON spread (last 6m)	Slope	R-Square	P-value
0.50%	0.1916	0.089	0.153
1.00%	0.4848	0.167	2e-5
1.50%	0.4322	0.217	0.003
2.00%	0.5059	0.400	0.0005

We conclude that an ON interest rate spread of 0.50% or more in the last 6-months has a predictive value regarding the future price behaviour of USDCAD. In fact, the higher the change in ON spread the stronger its predictive value. **This observation is particularly valuable if the ON interest rates spread is wide and the investor either expects or sees a potential risk of the spread tightening.** With the current spread between Fed Funds and BoC's overnight rate at 2.25%, this is particularly relevant as we will further explain in section V.

V. The Hedging Strategy

The Hedging Framework

A sound hedging framework is built by answering the following questions. Each of them constitutes one pillar of well-thought hedging framework.

We provide answers that rely on the set findings and observations presented in this report.

a. When to hedge?

- USDCAD has a statistically significant mean reverting tendency. Based on further cross-sectional analysis, an investor with a long-term horizon should consider:

- **Shorting USDCAD at levels above 1.30.** This offers an acceptable risk-reward which becomes increasingly attractive as the level USDCAD rises.
- The hedging approach can **be either “all or none”** which consists in choosing a given level to initiate the full notional of the hedge; **or a “progressive” approach** which adds to the hedge as USDCAD rallies.

b. How to hedge?

- Our work shows that for an investor with long-term hedging horizons, using a forward contract that matches their horizon with a negative carry is not desirable, and the losses due to the negative carry mostly erode the benefits of hedging.

- In such a scenario **the investor should focus on the use of shorter maturity hedging instruments (3 to 6 months).**

- This is because, historically, for long hedging horizons, the cumulative carry of these shorter-term forwards that are “rolled”, is often less negative or could even be positive, thus making the hedging outcome viable for the investor.

c. How much to hedge?

In other words, what should the hedge ratio be: what proportion of their notional exposure to US\$ should the investor hedge. The answer to this question relies on three drivers.

- I. The first one relates to the mean reverting characteristic of USDCAD. In essence:

- The higher the USDCAD spot, the higher the hedging should be.

- **We suggest starting the hedging process for USDCAD at 1.30 and have a fully hedged position if USDCAD reaches the 1.45 to 1.50 range.**

- II. The second relates to the relationship between US equities and USDCAD. Post-Bretton Woods, this relationship has generally been negative. Further, if one excludes the pre-2006 period, **the price movement presents a strong negative relationship**. This means that from a Canadian investor's perspective, hedging the currency exposure can lead to a desirable outcome if the relationship is stable.

- The **only** scenarios where the hedger will **incur certain losses, is if the correlation becomes positive** and stays so for prolonged periods of time.
- Our analysis shows that for values of USDCAD higher than 1.25, the relationship is statistically significant and stable across various hedging time horizons. This means that the **hedge ratio h should have a value between 0 and -1**.

- III. Hedge ratio

- The slopes for a monthly and quarterly TLS regression ⁶, which in practice could correspond to a rebalancing frequency of the hedge, are **-0.16 and -0.21 respectively, since 1971**.
- If we restrict the study to the post-2006 period where the correlation is markedly more negative, interestingly the slope of the TLS regressions are **-0.41 and -0.36 respectively**.

⁶ We choose a TLS regression as we favor the view that there is no clear causal relationship between the variables (i.e., it doesn't make sense to label one variable strictly as "independent" and the other as "dependent"). TLS offers a more symmetric approach.

- All the above highlight the fact that on **aggregate, a hedging level of -1/3 would be appropriate** – for the overall historical range.
- However, given that our approach initiates a hedge only for values of USDCAD above 1.25, we refer to our cross-sectional analysis of correlation since 2006 to have a more in-depth look at the hedge ratio.
- For USDCAD bins above 1.25, the slope varies between -0.25 and -0.38.

- Therefore, for **a strategy which focuses on maximizing the information ratio alone**, we suggest **a hedge ratio of -1/3** and to monitor on an ongoing basis the regression between USDCAD and S&P500.
- However, the mean-reverting nature of USDCAD offers the opportunity **to increase the hedge ratio - incrementally - as the spot rises above 1.30**. Why? While increasing the hedge ratio might not optimize the information ratio (i.e. minimize variance) of the hedged portfolio, it will result in an **outcome which is “skewed to the right”**. In other words, the hedged portfolio will have higher volatility due to the higher probability of positive outcomes.

The core finding and main takeaway and of our body of work is that, in the case of USDCAD, investors can do away with the classic variance minimization hedging framework and adopt hedging ratios exceeding those resulting from the “traditional” approach.

d. Adjusting the hedge

The investor will need to adjust the hedge for two reasons.

The value of the investor's investment in S&P500 changes as the price of S&P500 fluctuates. The investor needs to short a USDCAD forward with a notional of:

$$N_{USDCAD} \text{ Forward} = \text{Hedge Ratio} \times \text{Value of S\&P500}$$

As the S&P500 price changes they will need to adjust this exposure. This rebalancing can be either at:

- 1) Fixed time intervals, we suggest a monthly or quarterly rebalancing.
- 2) When the change in price S&P500 since the last rebalance reaches a threshold (e.g. 2% or 5%). Or a combination of both.

Further, considering the mean-reversion characteristic of the USDCAD:

- The investor could progressively reduce the notional of the hedge as USDCAD reaches the 1.15-1.20 level.

This would be equivalent to locking in the profits of the hedging position. As USDCAD goes below 1.15-1.20, most of the observations in this report are not valid and therefore a progressive reduction of the position is recommended.

e. Risks

The main sources of risk for this strategy are:

- 1) All else equal, increased volatility of S&P500 can introduce a “tracking error”—which can be either positive or negative—because the investor will need to rebalance the notional more often to maintain a USDCAD short position equal to their S&P500 exposure.
- 2) All else equal, a fundamental and long-lasting change in the nature of the relationship of S&P500 and USDCAD, for instance one that would result in a positive correlation between US equities and currency.

Mitigation: both risks can be mitigated by increasing the frequency of rebalancing. Regarding the increased volatility of S&P500, increasing the frequency of rebalancing reduces the tracking error while adding to the number of transactions which has both a financial and operational impact. However, given the liquidity of the USDCAD cross, the trading slippage can be very muted.

- For an investor with a robust operational set-up, we recommend increasing the frequency at which they rebalance the hedge notional during periods of heightened market volatility.

VI. Current Recommendation

At the time of publishing USDCAD spot is trading at 1.371. The CA\$ has appreciated by 8% (from 1.48) since February 2025.

In our view investors with medium to long-term exposure to US assets should initiate currency hedge at present levels, if they had not started doing at levels above 1.45 already earlier in the year.

As highlighted by our in-depth analysis, the mean reverting nature of USDCAD provides a strong argument for initiating hedging positions presently.

Furthermore, from a fundamental perspective, the spread between Fed Fund and BoC overnight rate presently sits at 1.625%.

This is the widest the overnight spread has been since 1994. In our view, the spread has a vastly higher probability of tightening than widening further. If inflation were to re-emerge and prompt a rise in rates, BoC has been cutting much more aggressively than the Fed Fund and likely has more room for hikes.

On the other hand, should we witness a global slowdown and the US economy weakening over the summer as many indicators point out to, the Fed has much more room to cut as it has been so far the least aggressive developed market to ease rates.

In both cases, considering our study, the closing ON spread will result in an appreciation of the CA\$.

From an implementation perspective, we recommend the use of 3- or 6-months forwards for implementation to minimize the effect of the carry.

Furthermore, while the historical relationship between S&P500 and USDCAD suggests a stable -1/3 hedge ratio, given the mean reverting nature of the USDCAD price behaviour, investors can increase the hedge ratio without necessarily raising the downside volatility of the strategy, thus doing away with the usual variance minimization framework.

Considering recent market dynamics and the fact that USDCAD is presently above 1.37 we believe investors should consider increasing the hedge ratio beyond the level that minimizes the portfolio variance.

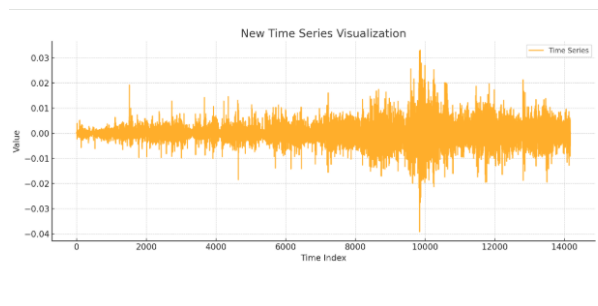
Finally, we recommend reducing the hedges if the USDCAD spot rate near the 1.20 level.

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APPENDIX A

Results of the KPSS and Augmented Dickey Fuller (ADF) test of stationarity for daily return data USDCAD (1971-2025)



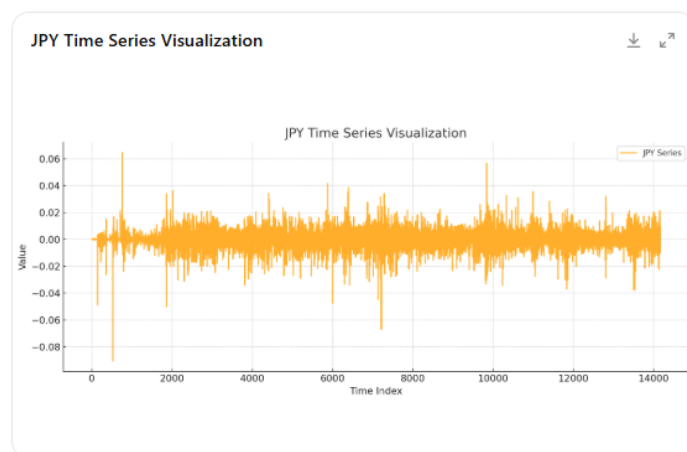
KPSS Test Results (Tests for **stationarity as the null hypothesis):**

- **KPSS Statistic:** 0.074
- **p-value:** ≥ 0.1 (upper bound of lookup table)
- **Critical Values:**
 - 10%: 0.347
 - 5%: 0.463
 - 1%: 0.739

Augmented Dickey-Fuller (ADF) Test Results for New Data:

- **Test Statistic:** -17.98
- **p-value:** $\approx 2.78e-30$
- **Critical Values:**
 - 1%: -3.43
 - 5%: -2.86
 - 10%: -2.57

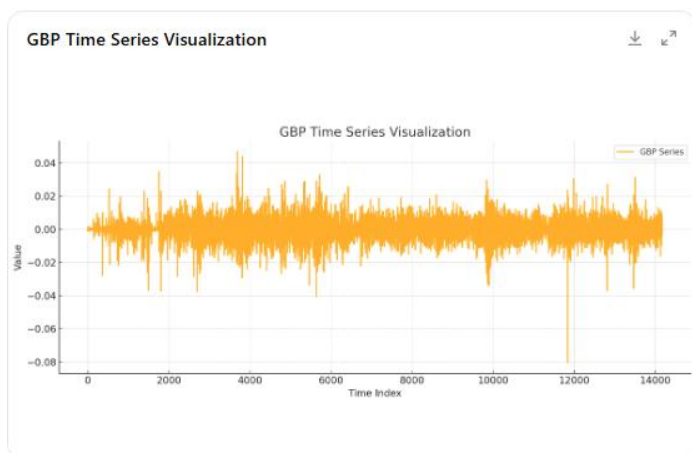
Results of the KPSS test of stationarity for daily return data USDJPY (1971-2025)



KPSS Test Results:

- **KPSS Statistic:** 0.470
- **p-value:** ≈ 0.048
- **Critical Values:**
 - 10%: 0.347
 - 5%: 0.463
 - 1%: 0.739

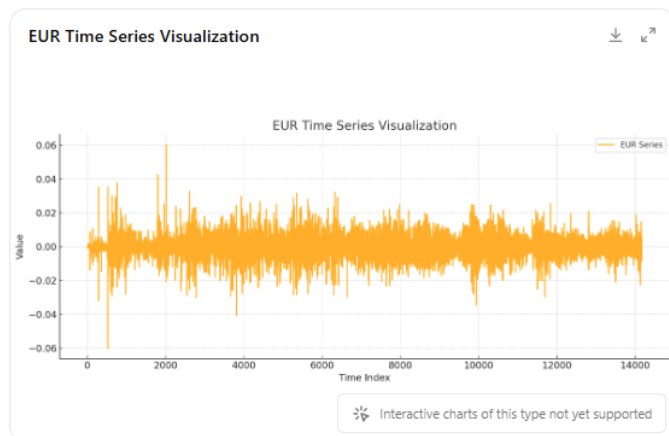
Results of the KPSS test of stationarity for daily return data GBPUSD (1971-2025)



KPSS Test Results for GBP Data:

- KPSS Statistic: 0.057
- p-value: ≥ 0.1
- Critical Values:
 - 10%: 0.347
 - 5%: 0.463
 - 1%: 0.739

Results of the KPSS test of stationarity for daily return data EURUSD (1971-2025)



KPSS Test Results for EUR Series:

- KPSS Statistic: 0.202
- p-value: ≥ 0.1
- Critical Values:
 - 10%: 0.347
 - 5%: 0.463
 - 1%: 0.739

APPENDIX B

Cross Sectional Analysis of rolling 2 year returns of a short USDCAD spot position as a function of spot (1971 - 2025)

Spot Bin	Max	Min	Mean	Median	Std dev	Pct25	Pct75
<1.0	2.77%	-22.58%	-5.53%	-2.83%	6.51%	-11.31%	0.02%
1.0-1.05	5.91%	-30.49%	-5.85%	-2.78%	8.52%	-9.23%	0.38%
1.05-1.1	14.10%	-32.13%	-7.90%	-8.85%	11.06%	-18.01%	2.61%
1.1-1.15	16.66%	-32.50%	-5.34%	-5.42%	10.80%	-14.50%	3.80%
1.15-1.2	21.04%	-17.36%	-1.96%	-2.73%	7.72%	-6.09%	2.25%
1.2-1.25	21.75%	-15.44%	-2.42%	-5.12%	8.89%	-9.94%	4.29%
1.25-1.3	23.67%	-15.48%	-3.30%	-5.55%	7.36%	-7.44%	-2.35%
1.3-1.35	24.12%	-16.33%	2.37%	2.11%	6.71%	-2.81%	7.67%
1.35-1.4	19.29%	-15.70%	1.48%	1.28%	7.53%	-4.50%	7.76%
1.4-1.45	16.40%	-11.28%	1.98%	-0.32%	6.83%	-2.90%	8.71%
1.45-1.5	18.34%	-11.16%	-2.90%	-4.61%	6.87%	-6.81%	-2.35%
1.5-1.55	23.50%	-5.52%	4.39%	2.45%	6.79%	-0.82%	9.82%
>1.55	24.46%	-0.95%	15.32%	16.55%	5.47%	13.94%	18.45%

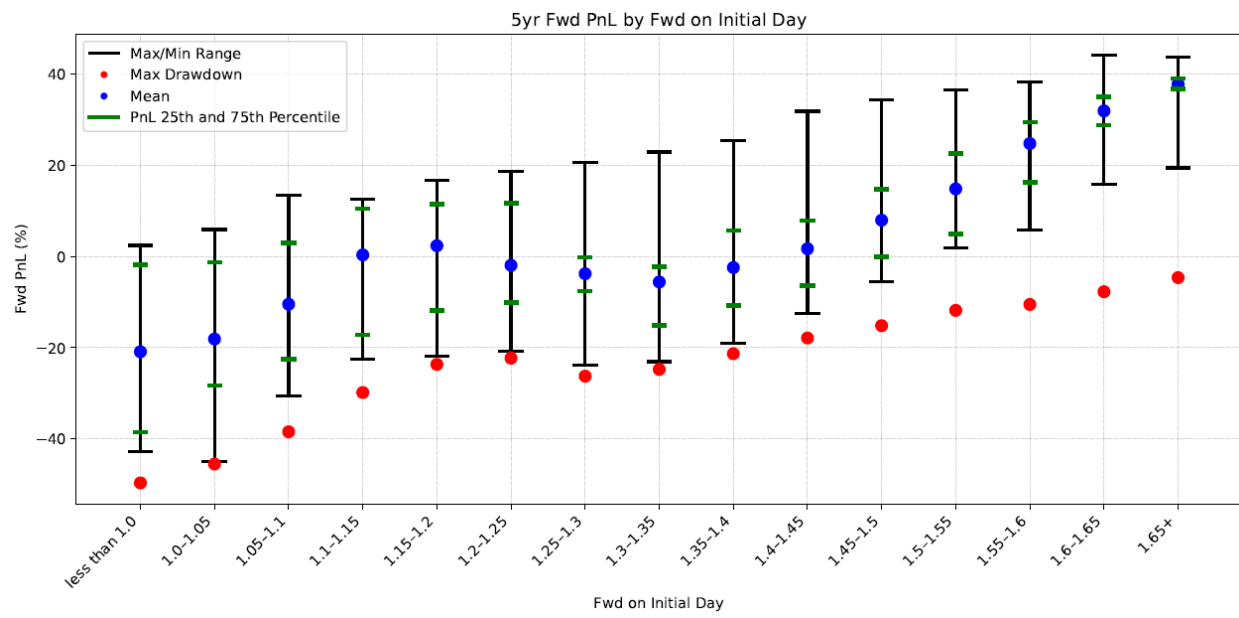
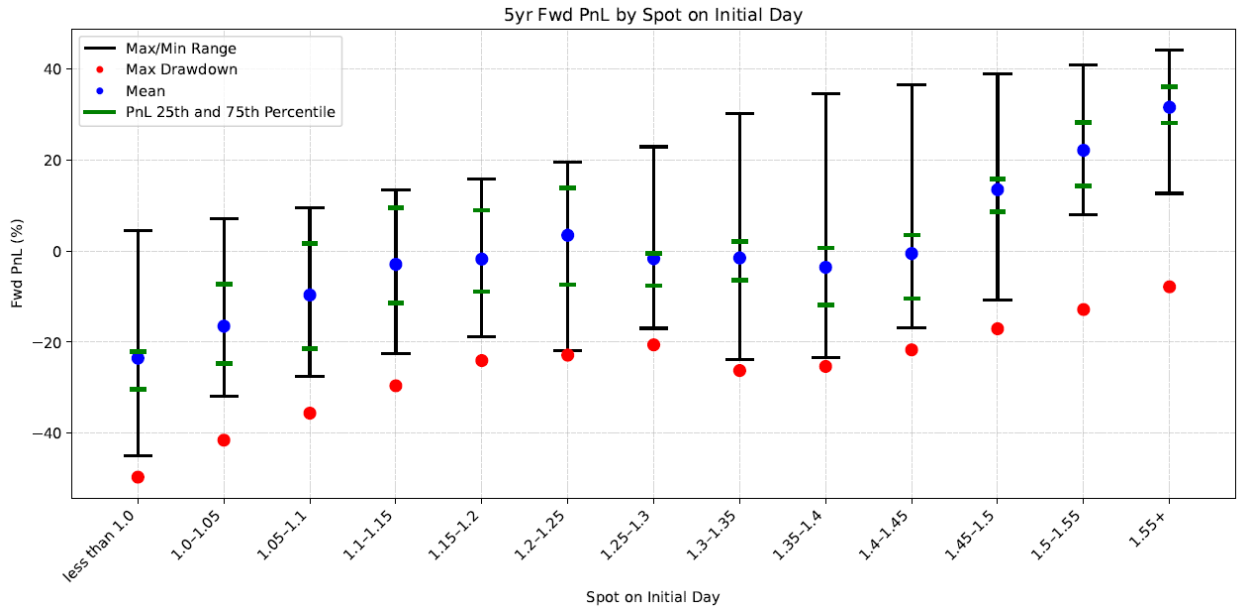
Cross Sectional Analysis of rolling 5 year returns of a short USDCAD spot position as a function of spot (1971 - 2025)

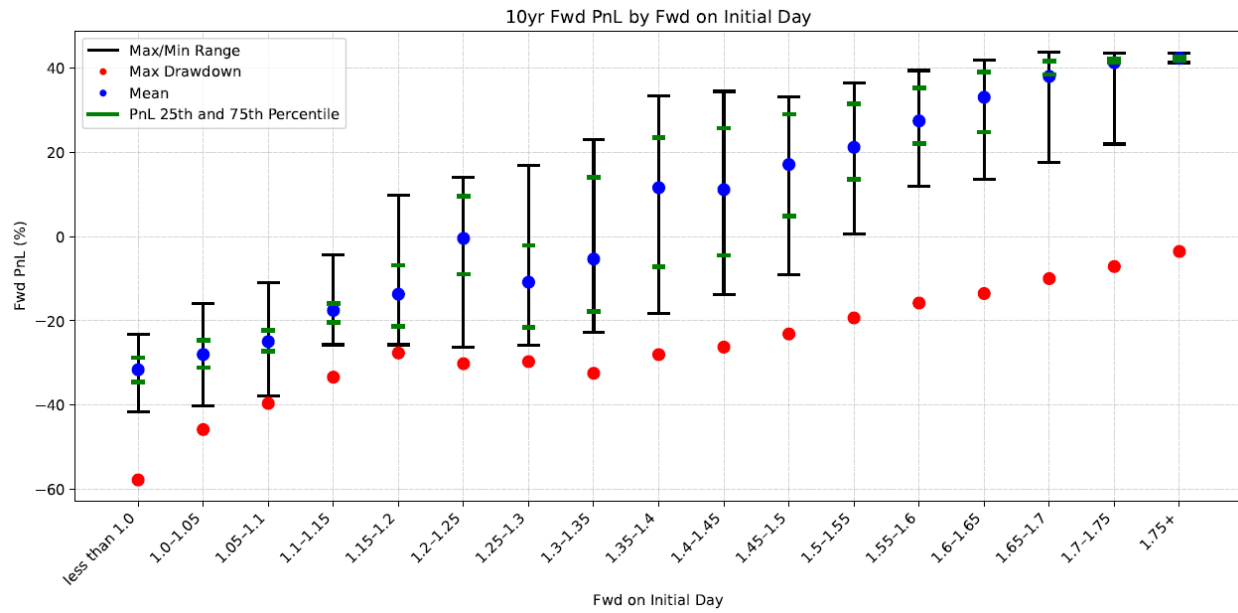
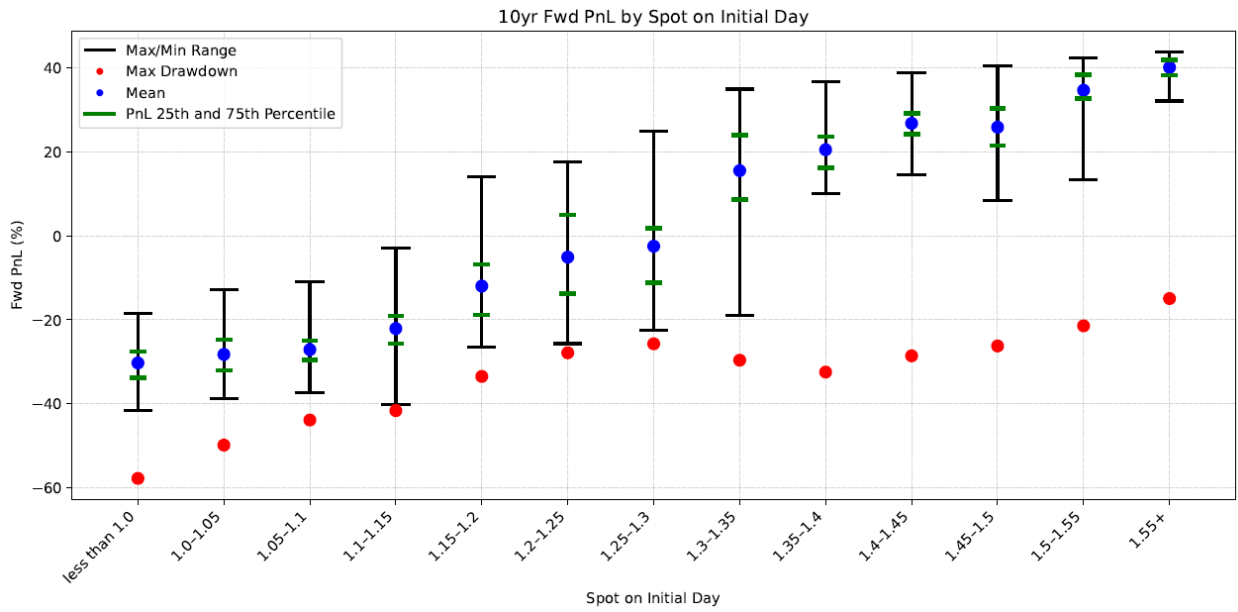
Spot Bin	Max	Min	Mean	Median	Std dev	Pct25	Pct75
<=1.0	2.59%	-48.91%	-19.84%	-19.89%	11.03%	-26.98%	-10.90%
1.0-1.05	5.42%	-35.56%	-15.36%	-15.63%	11.21%	-24.99%	-9.73%
1.05-1.1	12.99%	-26.72%	-11.54%	-15.30%	10.58%	-20.85%	-0.64%
1.1-1.15	16.00%	-23.26%	-6.73%	-10.08%	13.33%	-18.89%	10.66%
1.15-1.2	15.19%	-21.76%	-10.08%	-14.66%	10.38%	-16.82%	-8.28%
1.2-1.25	19.60%	-18.95%	-2.60%	-4.90%	9.90%	-9.59%	1.97%
1.25-1.3	20.81%	-17.69%	-1.44%	-3.20%	8.86%	-7.80%	4.55%
1.3-1.35	26.37%	-19.76%	1.97%	3.66%	9.56%	-3.55%	9.56%
1.35-1.4	29.61%	-18.18%	1.05%	-5.86%	13.68%	-10.88%	15.89%
1.4-1.45	31.92%	-14.42%	1.11%	-3.36%	12.41%	-8.70%	14.72%
1.45-1.5	34.39%	-8.59%	13.65%	14.02%	7.88%	9.45%	16.77%
1.5-1.55	38.88%	7.30%	20.56%	22.70%	7.69%	13.05%	25.92%
>1.55	41.11%	9.76%	29.25%	28.81%	4.82%	26.43%	32.29%

Cross Sectional Analysis of rolling 10 year returns of a short USDCAD spot position as a function of spot (1971 - 2025)

Spot Bin	Max	Min	Mean	Median	Std dev	Pct25	Pct75
<=1.0	-17.86%	-45.63%	-30.25%	-29.69%	6.38%	-33.39%	-24.84%
1.0-1.05	-15.70%	-40.40%	-28.13%	-28.87%	5.50%	-32.79%	-23.32%
1.05-1.1	-14.38%	-34.47%	-24.73%	-24.60%	3.00%	-26.16%	-22.91%
1.1-1.15	-2.48%	-37.48%	-21.06%	-19.81%	8.49%	-26.22%	-15.19%
1.15-1.2	11.05%	-36.90%	-14.06%	-13.08%	13.53%	-27.55%	-1.45%
1.2-1.25	13.28%	-33.87%	-4.86%	-3.15%	10.84%	-15.05%	4.18%
1.25-1.3	20.82%	-26.53%	-7.66%	-8.24%	12.36%	-19.37%	-1.57%
1.3-1.35	26.96%	-12.23%	3.05%	-2.20%	10.64%	-4.67%	15.68%
1.35-1.4	29.56%	-4.78%	9.22%	9.16%	8.49%	1.48%	16.07%
1.4-1.45	34.71%	2.44%	21.71%	25.93%	9.94%	11.06%	29.73%
1.45-1.5	33.85%	11.90%	26.03%	28.00%	6.01%	21.23%	31.14%
1.5-1.55	38.55%	13.98%	32.53%	33.96%	4.84%	31.80%	35.26%
>1.55	41.02%	31.37%	36.38%	36.15%	1.71%	35.18%	37.62%

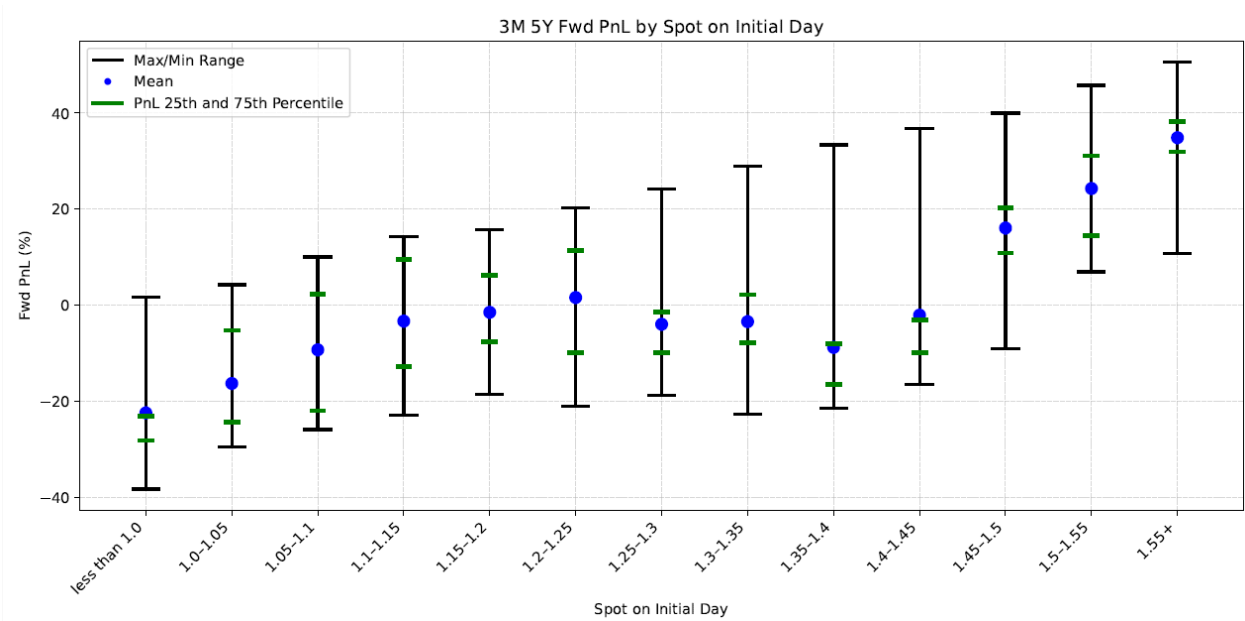
APPENDIX C



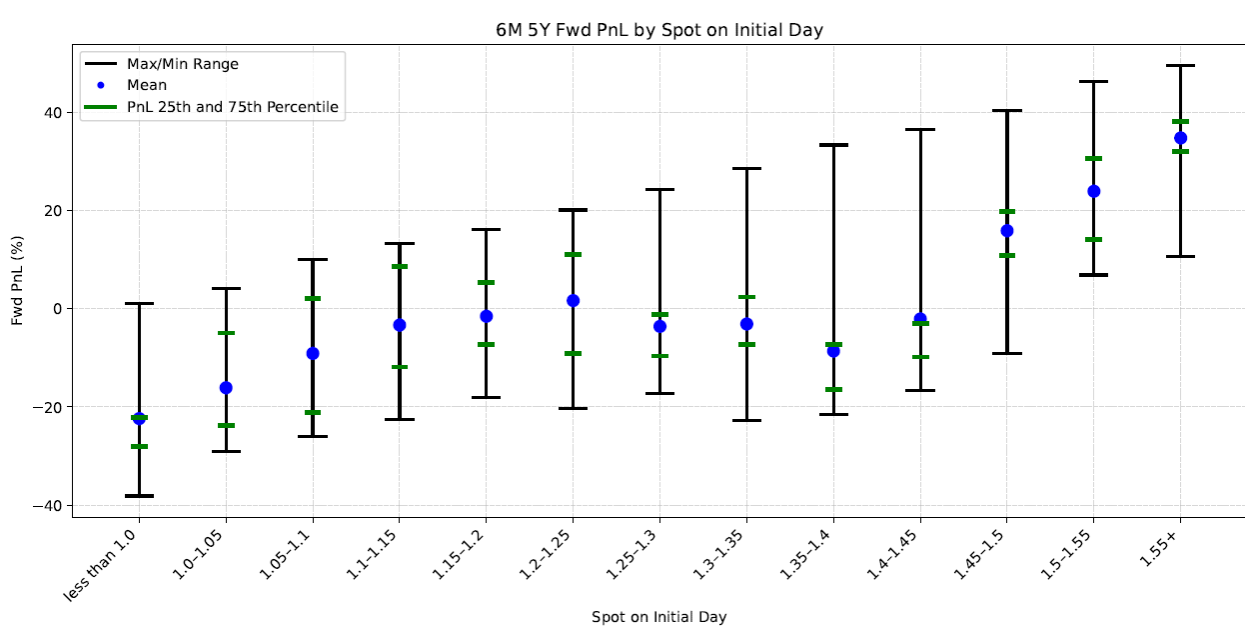


APPENDIX D

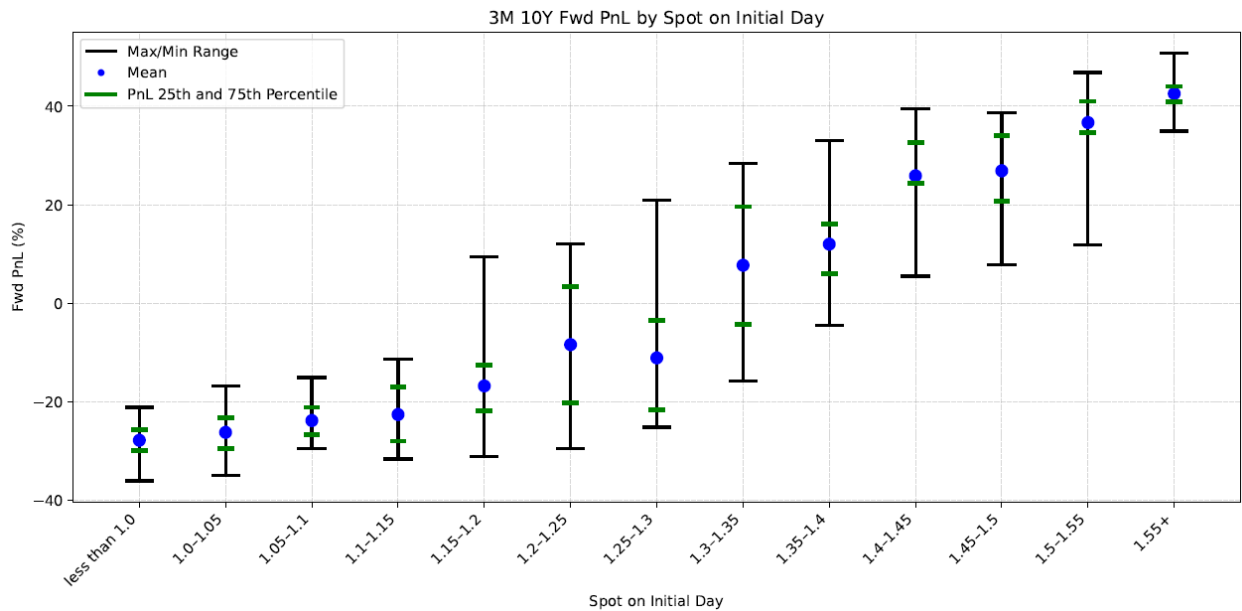
Statistics of a 5 year hedging strategy using 3 months forwards



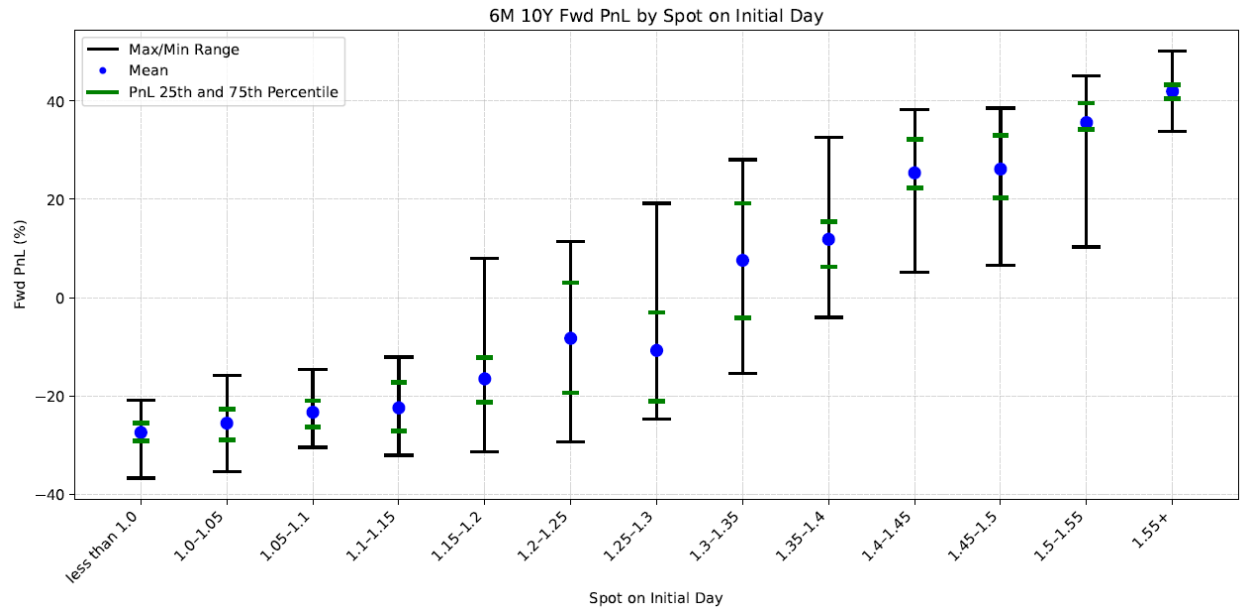
Statistics of a 5 year hedging strategy using 6 months forwards



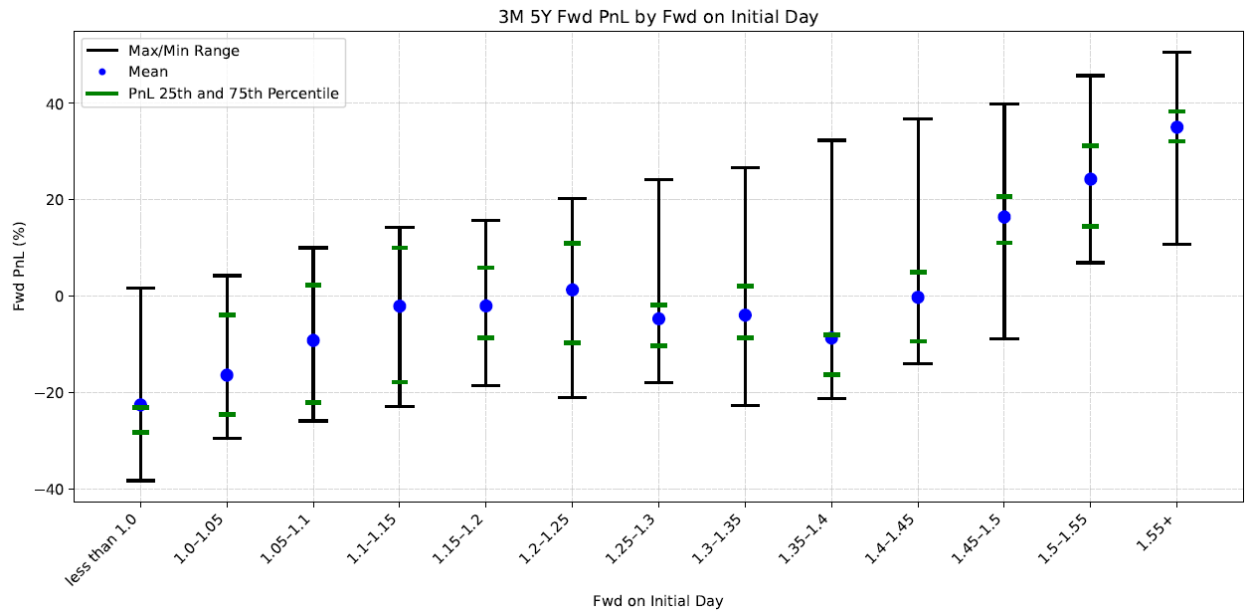
Statistics of a 10 year hedging strategy using 3 months forwards



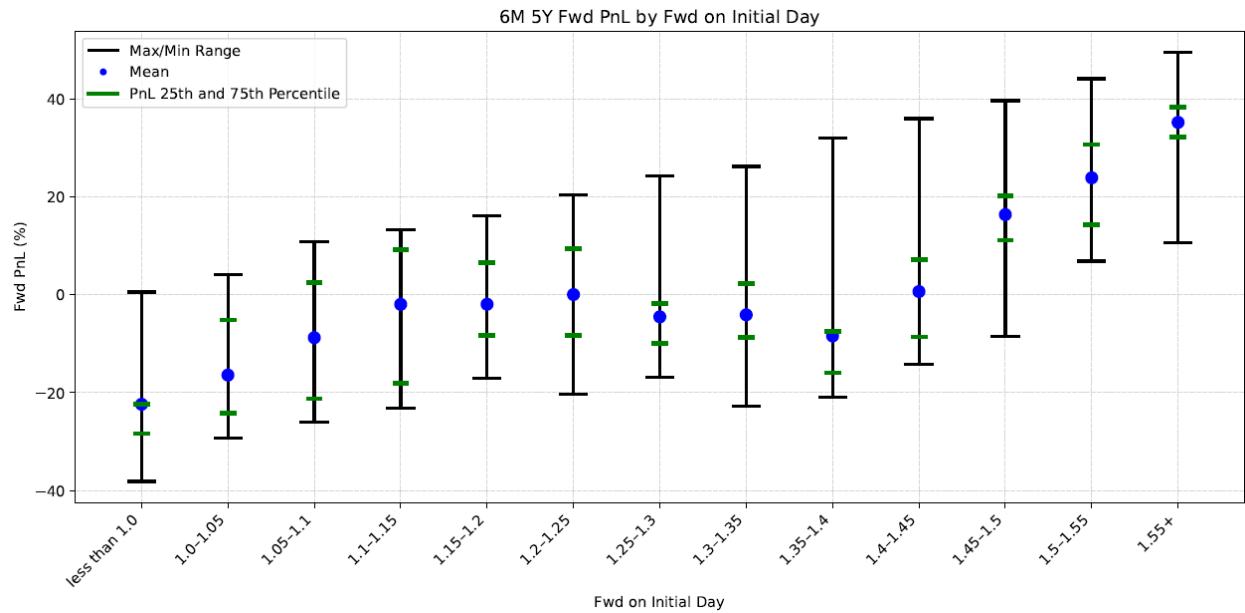
Statistics of a 10 years hedging strategy using 6 months forwards



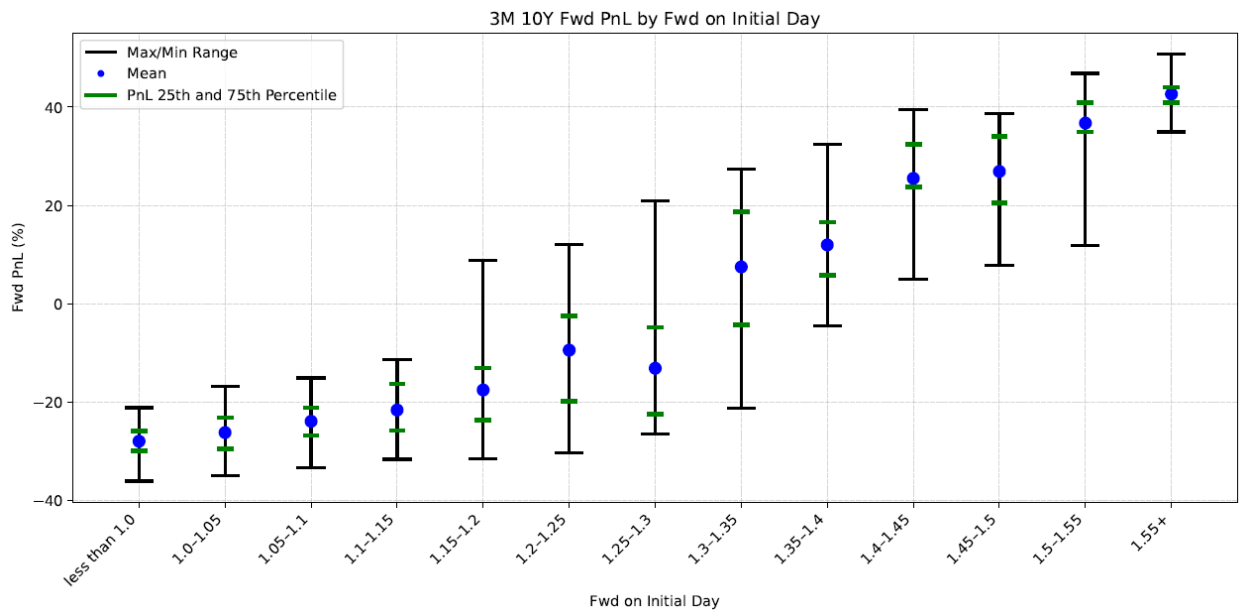
Statistics of a 5 years hedging strategy using 3 months forwards



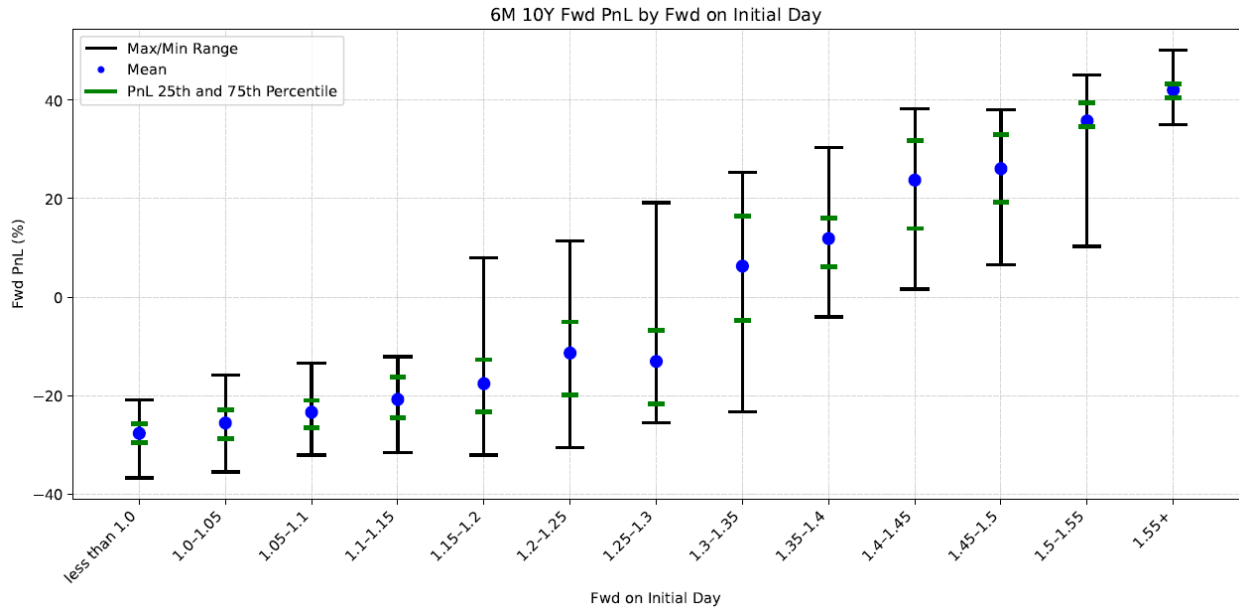
Statistics of a 5 years hedging strategy using 6 months forwards



Statistics of a 10 year hedging strategy using 3 months forwards



Statistics of a 10 year hedging strategy using 6 months forwards



APPENDIX E

Cross Sectional Analysis of Correlation of S&P500 and USDCAD Spot (monthly returns – 2006 to 2025)

Spot Bin	Count	R	R ²	Slope	Intercept	T-Stat	P-Value
0.90–1.0	21	-0.3056	0.0934	-0.5161	0.0048	-1.399	0.1779
1.0–1.05	34	-0.4728	0.2235	-0.2405	0.0015	-3.035	0.0047
1.05–1.1	18	-0.7886	0.6219	-0.6971	0.0078	-5.1298	0.0001
1.1–1.15	16	-0.2727	0.0744	-0.4889	0.0038	-1.0606	0.3068
1.15–1.2	10	-0.7508	0.5637	-0.5365	-0.0056	-3.2152	0.0123
1.2–1.25	14	-0.1717	0.0295	-0.088	0.0181	-0.6038	0.5572
1.25–1.3	32	-0.5821	0.3388	-0.3791	0.0022	-3.9207	0.0005
1.3–1.35	47	-0.5556	0.3087	-0.3215	0.004	-4.4829	0.0001
1.35–1.45	29	-0.5082	0.2583	-0.2456	-0.0018	-3.066	0.0049
All data	221	-0.5579	0.3113	-0.4064	0.0043	-9.9485	0

Cross Sectional Analysis of Correlation of S&P500 and USDCAD Spot (quarterly returns – 2006 to 2025)

Note: given the low number of observations, we do not draw any conclusion of this cross sectional analysis for and focus on the monthly returns.

Spot Bin	Count	R	R ²	Slope	Intercept	T-Stat	P-Value
0.95–1.0	7	-0.6833	0.4669	-0.3632	0.0087	-2.0924	0.0906
1.0–1.05	12	-0.4864	0.2365	-0.2504	0.0065	-1.7602	0.1089
1.05–1.1	7	-0.9411	0.8857	-0.5126	0.0176	-6.2234	0.0016
1.1–1.15	3	0.2045	0.0418	13.0432	-0.6562	0.2089	0.8689
1.15–1.2	7	-0.594	0.3528	-0.5467	-0.0027	-1.6511	0.1596
1.2–1.25	4	-0.4468	0.1996	-0.5384	0.0048	-0.7063	0.5532
1.25–1.3	11	-0.5627	0.3166	-0.1689	0.0072	-2.0421	0.0715
1.3–1.35	17	-0.7522	0.5658	-0.4214	0.0227	-4.4213	0.0005
1.35–1.45	9	-0.1788	0.032	-0.1221	-0.011	-0.4807	0.6454
All data	77	-0.5815	0.3381	-0.356	0.0109	-6.1898	0

Cross Sectional Analysis of Correlation of S&P500 and USDCAD Spot (monthly returns – 1971 to 2025)

Spot Bin	Count	R	R ²	Slope	Intercept	T-Stat	P-Value
0.90–1.0	57	-0.2471	0.0611	-0.0683	0.0029	-1.8915	0.0638
1.0–1.05	61	-0.5058	0.2558	-0.2198	0.0031	-4.5035	0
1.05–1.10	25	-0.7996	0.6393	-0.602	0.0013	-6.3847	0
1.10–1.15	36	-0.0538	0.0029	-0.022	0.0012	-0.3144	0.7552
1.15–1.20	84	-0.2629	0.0691	-0.1151	0.0017	-2.4674	0.0157
1.20–1.25	59	-0.4856	0.2358	-0.2164	0.0036	-4.1941	0.0001
1.25–1.30	52	-0.4559	0.2079	-0.2481	0.002	-3.6223	0.0007
1.30–1.35	85	-0.5258	0.2764	-0.1832	0.0031	-5.6313	0
1.35–1.40	81	-0.2692	0.0724	-0.1166	-0.0004	-2.484	0.0151
1.40–1.45	40	-0.3621	0.1312	-0.1409	0.0024	-2.395	0.0217
1.50–1.65	36	-0.0275	0.0008	-0.0061	-0.0025	-0.1601	0.8737
All data	616	-0.387	0.1498	-0.1576	0.0019	-10.4	0

Cross Sectional Analysis of Correlation of S&P500 and USDCAD Spot (quarterly returns – 1971 to 2025)

Spot Bin	Count	R	R ²	Slope	Intercept	T-Stat	P-Value
0.90–1.0	18	-0.3574	0.1277	-0.1711	0.0072	-1.5307	0.1454
1.0–1.05	27	-0.5804	0.3369	-0.4126	0.0122	-3.564	0.0015
1.05–1.10	4	-0.9466	0.896	-0.5643	0.0193	-4.1503	0.0534
1.10–1.15	13	-0.0499	0.0025	-0.0977	0.0118	-0.1657	0.8714
1.15–1.20	29	-0.4092	0.1674	-0.1408	0.0034	-2.33	0.0275
1.20–1.25	25	-0.3893	0.1516	-0.1568	0.0043	-2.0269	0.0544
1.25–1.30	16	-0.4584	0.2101	-0.3274	0.012	-1.9298	0.0741
1.30–1.35	29	-0.3896	0.1518	-0.1542	0.0105	-2.1984	0.0367
1.35–1.40	28	-0.2958	0.0875	-0.1813	0.0044	-1.5789	0.1265
1.40–1.45	14	-0.4076	0.1661	-0.1624	-0.0058	-1.5461	0.148
1.50–1.65	12	-0.4308	0.1856	-0.0931	-0.0065	-1.5098	0.162
All data	215	-0.4221	0.1781	-0.2055	0.0066	-6.7944	0

APPENDIX F

Regression of change in overnight spread over the last 6 months when it exceeds the last months average by 0.5% versus the change in USDCAD price over the next 3 months

SUMMARY OUTPUT

Regression Statistics

Multiple R	0.094077
R Square	0.008851
Adjusted R Square	0.004541
Standard Error	0.0177
Observations	232

ANOVA

	df	SS	MS	F	Significance F
Regression	1	0.000643	0.000643	2.053801	0.153185
Residual	230	0.072054	0.000313		
Total	231	0.072698			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	-0.00133	0.001176	-1.13098	0.25924	-0.00365	0.000987	-0.00365	0.000987078
X Variable	0.045253	0.031577	1.433109	0.153185	-0.01696	0.107471	-0.01696	0.107470748

Regression of change in overnight spread over the last 6 months when it exceeds the last months average by 0.5% versus the change in USDCAD price over the next 3 months

SUMMARY OUTPUT

Regression Statistics

Multiple R	0.409232
R Square	0.167471
Adjusted R Square	0.158888
Standard Error	0.021224
Observations	99

ANOVA

	df	SS	MS	F	Significance F
Regression	1	0.008789	0.008789	19.5124	2.6E-05
Residual	97	0.043694	0.00045		
Total	98	0.052483			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	-0.0032	0.002209	-1.4469	0.151149	-0.00758	0.001188	-0.00758	0.001188
X Variable	0.337748	0.07646	4.417284	2.6E-05	0.185995	0.489501	0.185995	0.489501

Regression of change in overnight spread over the last 6 months when it exceeds the last months average by 1.5% versus the change in USDCAD price over the next 3 months

SUMMARY OUTPUT

Regression Statistics

Multiple R 0.466416
 R Square 0.217544
 Adjusted R Square 0.195809
 Standard Error 0.025785
 Observations 38

ANOVA

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	0.006655	0.006655	10.00899	0.003161
Residual	36	0.023936	0.000665		
Total	37	0.03059			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	-0.00948	0.004226	-2.24248	0.031182	-0.01805	-0.00091	-0.01805	-0.00091
X Variable	0.503368	0.159107	3.163699	0.003161	0.180683	0.826053	0.180683	0.826053

Regression of change in overnight spread over the last 6 months when it exceeds the last months average by 2.0% versus the change in USDCAD price over the next 3 months

SUMMARY OUTPUT

Regression Statistics

Multiple R 0.6324
 R Square 0.39993
 Adjusted R Square 0.374927
 Standard Error 0.026315
 Observations 26

ANOVA

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	0.011076	0.011076	15.99536	0.000528
Residual	24	0.016619	0.000692		
Total	25	0.027696			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	-0.01	0.005319	-1.87927	0.072405	-0.02097	0.000982	-0.02097	0.000982
X Variable	0.790581	0.197674	3.99942	0.000528	0.382602	1.19856	0.382602	1.19856

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