Carry Trade Analysis/Jasper Zhang 23/08/2025

Overview

This analysis aims to systematically capture USD/JPY carry trade opportunities through market state identification and macro risk signal management, while proactively controlling drawdown risk.

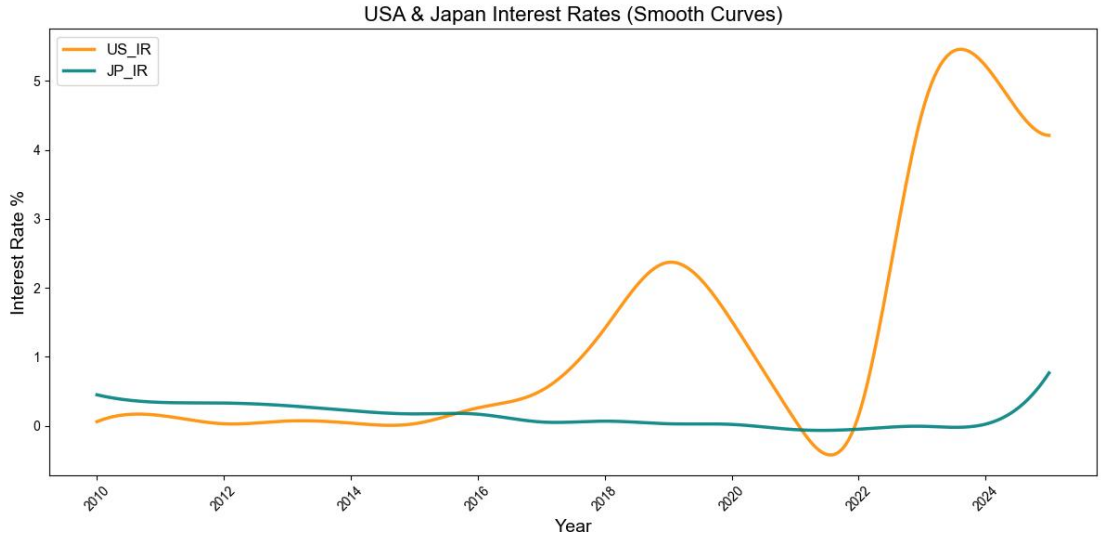

Figure 1: Historical Trend of USD/JPY Interest Rates (Jan 2010 - Jun 2025 - Monthly Data)

From the historical trend of U.S.–Japan interest rate levels, it is evident that monetary policy paths have diverged significantly over the past decade. The U.S. entered a rate-hiking cycle after 2016, with especially sharp increases beginning in 2022, while Japan maintained near-zero rates for an extended period. This structural interest rate differential had long provided the fundamental return source for USD/JPY carry trades.

However, with Japan ending its negative interest rate policy in 2024, exiting yield curve control (YCC), and scaling back government bond purchases, the rate hike on August 5, 2024, triggered a rapid yen appreciation. The resulting unwinding of global yen carry trades caused severe market turmoil, as the sudden narrowing of the interest rate differential led to panic selling.

Key Findings

（1）Carry Return is Dominated by the Exchange Rate (Δs)

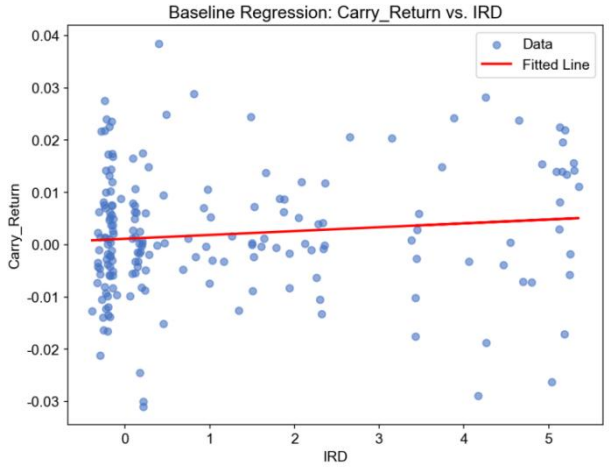

Figure 2: Scatter Plot & Fitted Line of CR vs.IRD

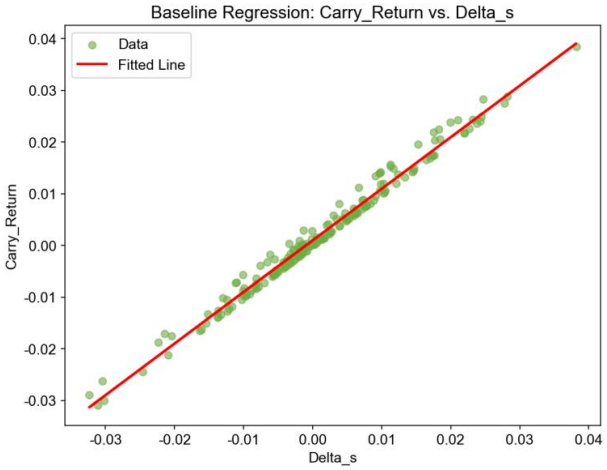

Figure 3: Scatter Plot & Fitted Line of CR vs.Δs

From the baseline regression in Figure 1, the scatter plot on the left shows a very loose distribution with almost no clear pattern, indicating that the interest rate differential has weak explanatory power for returns. In other words, a high differential does not guarantee profits in a carry trade, nor does a low differential necessarily imply losses.

By contrast, in Figure 2, the points fall almost perfectly along a straight line, suggesting that exchange rates and carry returns move almost one-to-one. Put simply, the direction of the exchange rate directly determines whether the carry trade makes or loses money.

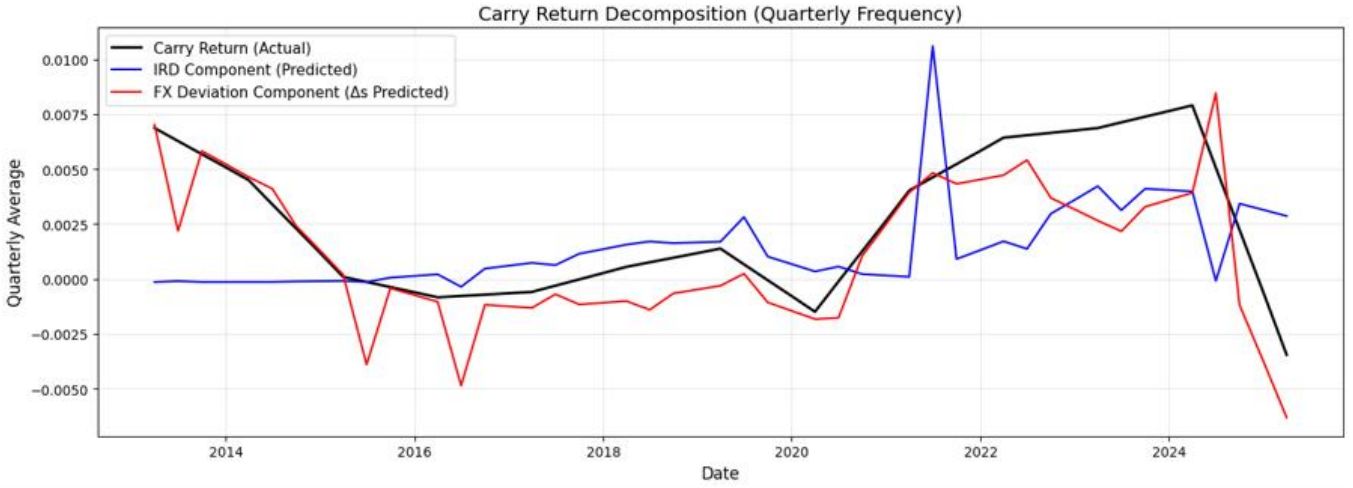

Figure 4: Regression Scatter Plot and Fitted Line of Carry Returns vs. Exchange Rate Changes

The decomposition over the past fifteen years shows that carry returns have been predominantly driven by exchange rates. From 2012 to 2015, the interest rate differential contributed almost nothing, while the exchange rate dragged down returns. Between 2016 and 2019, the differential provided some support, but in 2020 the pandemic-induced volatility directly wiped out that cushion, leading to losses. In 2021–2022, Fed rate hikes widened the differential, yet elevated exchange rate volatility still dictated outcomes. By 2023–2024, the differential had effectively lost its role altogether.

Thus, when the spread widens, markets often fear intervention or policy correction, causing USD/JPY to move in the opposite direction; when the spread narrows, the cushion is thin to begin with, so any yen appreciation accelerates losses. The carry logic has shifted from ‘earning the spread’ to ‘betting on the exchange rate’, with risks far outweighing potential returns.

（2）Interactive Impact of Policy Variables and Carry Trade Components

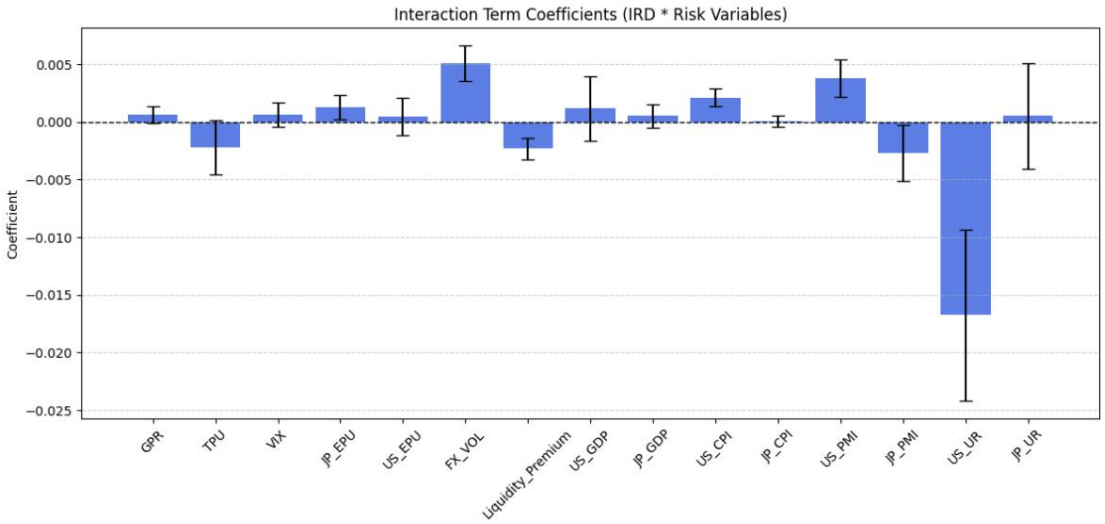

Figure 5: Interactive Coefficients of Interest Rate Differential and Policy Variables

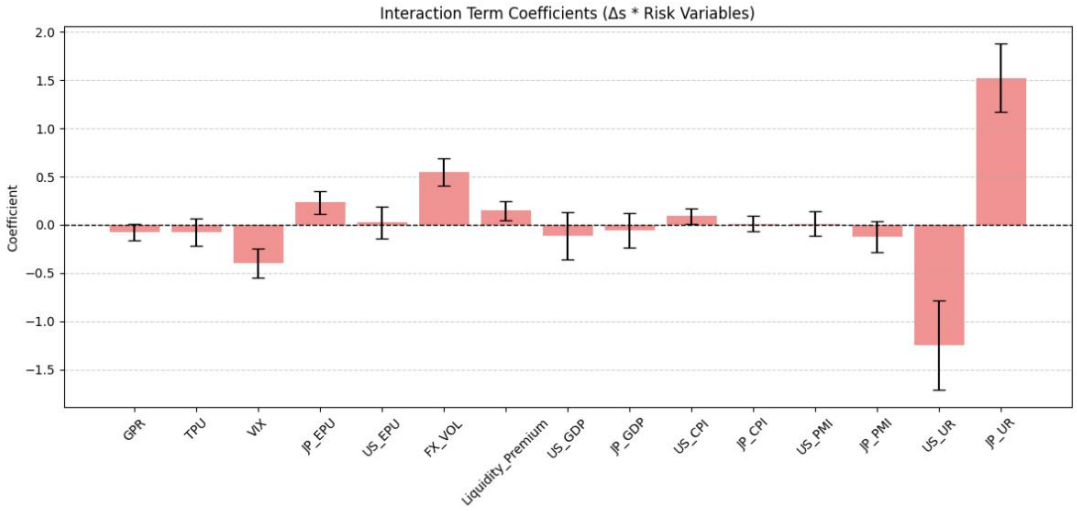

Figure 6: Interactive Coefficients of Exchange Rate Change and Policy Variables

Figure 5 shows the interaction effects between the interest rate differential and various macro variables. Most variables have near-zero impact, but U.S. unemployment and FX volatility stand out. The U.S. unemployment rate has a significant negative effect, meaning that carry returns can only barely survive on the differential when U.S. employment is strong and unemployment is low. Once unemployment rises, markets immediately price in faster and deeper Fed rate cuts, causing the dollar interest rate differential to collapse. In such cases, the differential not only fails to generate returns but may even accelerate losses. FX volatility, on the other hand, shows a positive relationship: when market volatility rises, investors demand a higher differential to compensate for added risk, implying a widening spread. In practice, however, the improvement in the U.S.–Japan spread lags far behind the pace of rising volatility, so higher volatility amplifies risk without the spread filling the gap, leaving carry positions more vulnerable to losses.

Figure 6 illustrates the interaction effects on the exchange rate component (Δs). Here, U.S. unemployment also shows a negative relationship: when the labor market weakens, markets anticipate Fed rate cuts, the dollar weakens, USD/JPY falls, and carry trades lose money. In contrast, Japanese unemployment has a

positive relationship: when Japan's labor market deteriorates, markets doubt whether the BOJ can continue raising rates, which pressures the yen to depreciate. USD/JPY then rises, which temporarily benefits carry trades. The two effects thus move in opposite directions.

Figure 7: USD/JPY Exchange Rate Trend (Jan 2025 - Jun 2025)

The market moves in the first half of the year (Figure 7) perfectly validate these relationships. At the start of the year, weaker U.S. employment data led markets to reprice rate cuts, compressing the U.S.–Japan interest rate differential from elevated levels, while USD/JPY quickly retreated from around 155 to near 150, putting persistent pressure on carry trades. Entering the spring, with wages and inflation staying elevated, expectations of BOJ tightening intensified, JGB yields rose, and funding costs climbed further. USD/JPY briefly broke below 145, marking the largest loss of this carry cycle. During May–June, the differential saw a modest recovery and the exchange rate stabilized temporarily around 144.

The key finding is that U.S. unemployment, Japanese unemployment, and FX volatility are the true determinants of carry positions. They trigger exchange rate swings or differential collapses through different channels, and in high-risk environments their impact becomes exponentially magnified.

（3）Market Regime Switch between Interest Rate Differential and Exchange Rate

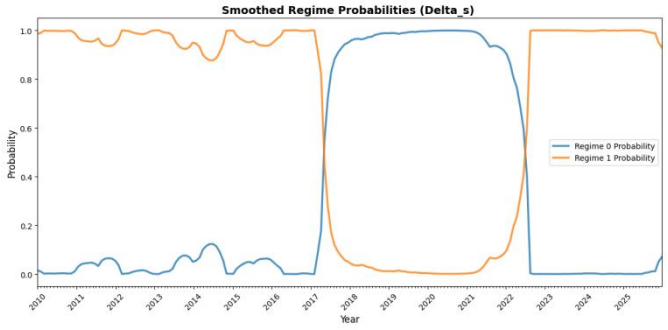

Figure 8: Exchange Rate Volatility Regime Switching Pattern

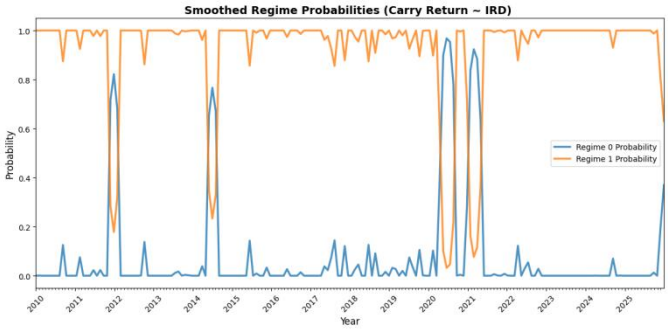

Figure 9: Carry Return Regime Switching Pattern on IRD

Figure 8 shows the market environment for the exchange rate. When the blue line is on top, volatility is low; when the orange line is on top, volatility is high. From 2017 to 2021, the exchange rate was mostly in a low-volatility regime, allowing carry strategies to rely on the interest rate differential for steady gains.

But since 2022, the market has clearly shifted into a high-volatility regime, which has persisted into the first half of 2025. At the start of the year, overlapping Fed rate-cut expectations and BOJ rate-hike expectations drove USD/JPY down from 157 to 143 with extreme turbulence. This indicates that the current market environment itself is fundamentally unfavorable to carry trades, with the interest rate differential offering virtually no protection under such conditions.

Figure 9 shows regime switching in the relationship between the differential and returns. When the blue line is on top, the differential is effective—returns increase when the spread widens. When the orange line is on top, the differential has broken down—changes in the spread do not help returns. The data reveal that for most of the time, markets have been in the 'spread ineffective' regime, rarely entering the 'spread effective' zone. May of this year is a real-world example: although the spread briefly recovered, USD/JPY only stabilized slightly around 144, with carry returns still overwhelmingly driven by exchange rates rather than the differential.

From historical experience, 2017–2019 was the classic golden period: the Fed was steadily hiking, Japan maintained near-zero rates, and volatility in the exchange rate trended lower, enabling stable carry profits. But conditions in 2022–2024 were different: while aggressive Fed hikes pushed the spread to a historic high of 5%, geopolitical conflicts and policy divergence kept FX volatility elevated, eroding the protective power of the differential.

Looking ahead to 2025, if Japanese inflation holds in line with expectations, further BOJ tightening is likely, while markets also expect the Fed to keep cutting rates in the second half of the year. Alongside the risk of yen interventions and U.S. trade pressures, the market is likely to remain in a high-volatility regime. In this environment, carry trades are essentially equivalent to naked FX exposure. This suggests that the tailwind period for carry is already over, and going forward, strategies must be run with embedded risk control rather than waiting for the market to self-correct.

Strategy Implications and Trading Design

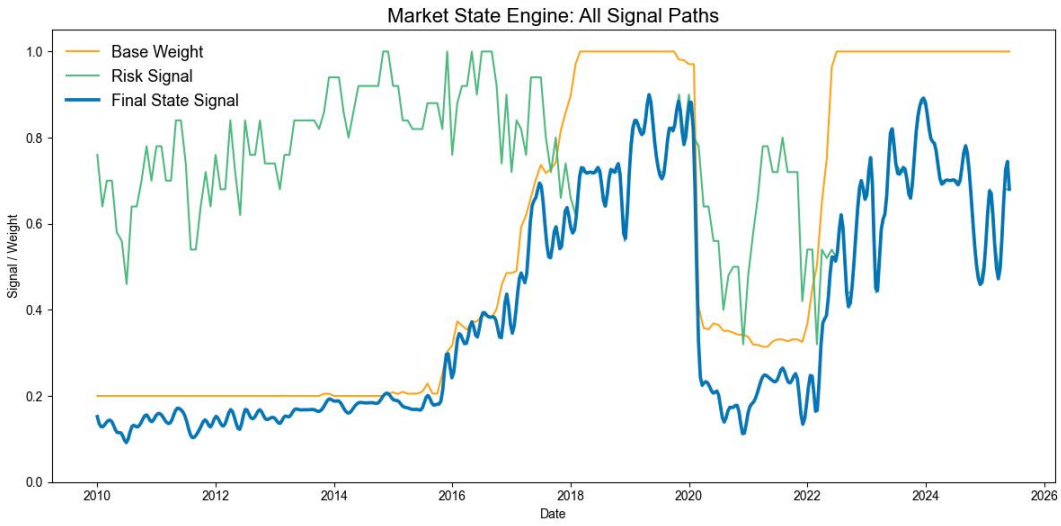

Figure 10: Carry Trade Position Signals

Figure 10 illustrates the three signal paths of the strategy. The Base Weight represents the differential baseline, which adjusts positions according to the percentile of the U.S.–Japan interest rate spread: when the spread is at the low end, exposure is capped at 0.2; as the spread rises, exposure increases linearly,

reaching near full allocation when the spread is at the high end. However, this measure only considers the spread and ignores risk.

The Risk Signal works in the opposite way, adjusting positions purely based on policy and risk variables. For example, a rise in U.S. unemployment weakens the dollar; higher spring wage settlements strengthen BOJ rate-hike expectations; and FX volatility at the upper percentile magnifies tail risks. Under such conditions, even if the spread is wide, positions will be quickly reduced.

The Final State Signal combines the two: it starts with the spread-based position path and then applies the risk signal as a discount on the upper bound. (For instance, when the U.S.–Japan spread is high, the model theoretically allows near-full exposure; but if U.S. unemployment weakens or FX volatility spikes, the risk signal immediately scales the position back.) In other words, final positions never exceed what the spread permits, but whenever risks are triggered, exposure contracts right away.

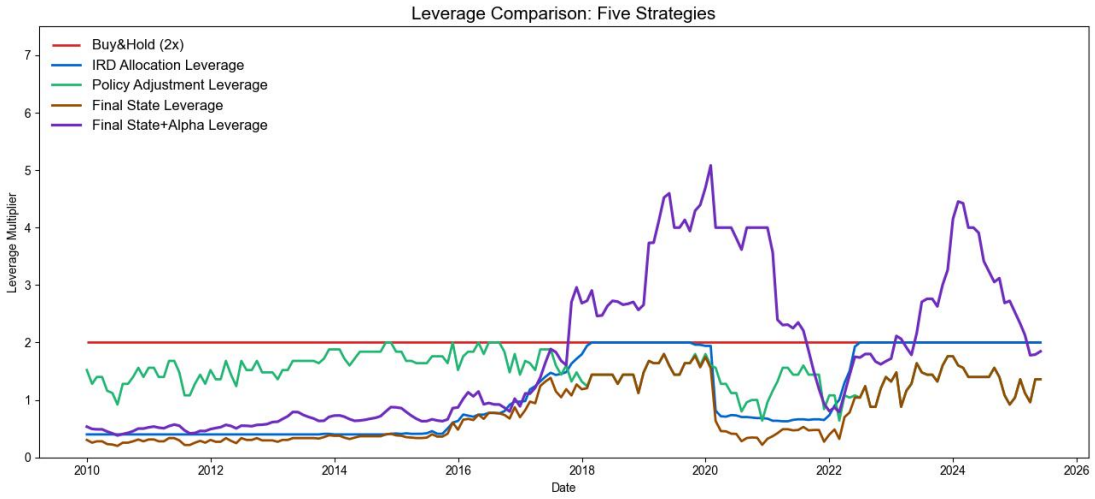

Figure 11: Leverage Paths of Carry Trade Under Different Strategies

Figure 11 compares the leverage paths of five strategies. The red line represents a fixed 2x leveraged Buy & Hold, which stays at 2x regardless of market conditions. The blue line (IRD Allocation) is based on the Base Weight signal—adjusting only by the interest rate differential: leverage rises gradually when the spread is wide and falls when the spread is narrow, but it cannot contract during risk events. The green line (Policy Adjustment) is based on the Risk Signal—it cuts exposure quickly in crises, but in favorable periods it fails to scale up. The brown line (Final State) is based on the Final State Signal—it maintains leverage during favorable conditions but automatically reduces it close to zero in risk regimes.

The purple line (Final State + Alpha) builds on the brown line with an added amplifier. When both the spread and risk signals point to favorable conditions and price momentum is also upward, leverage expands to 4–6x to magnify gains. But once a risk signal is triggered or drawdowns hit the preset threshold, leverage quickly tightens to 1–2x with no delay. This approach clearly downshifts to avoid large drawdowns, while in favorable markets it dares to scale up, keeping returns at the front of the pack.

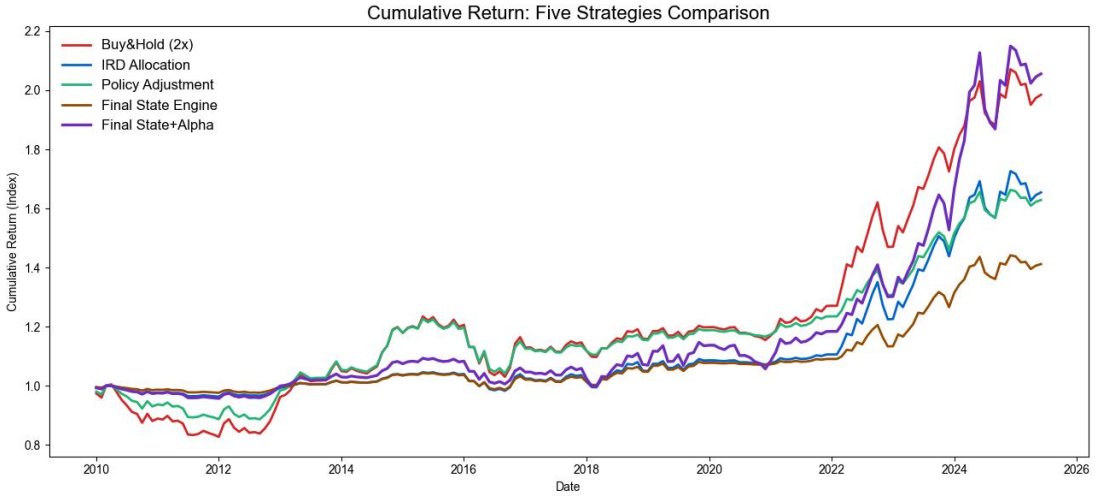

Figure 12: Cumulative Performance of Strategies

Performance Comparison: Five Strategies

Metric	Buy&Hold (2x)	IRD Allocation	Policy Adjust.	Final State	Final State+Alpha
Annual Return	4.87%	3.46%	3.39%	2.33%	5.08%
Annual Volatility	8.23%	5.61%	6.11%	3.85%	7.89%
Sharpe Ratio	0.59	0.62	0.55	0.60	0.64
Max Drawdown	17.65%	9.32%	15.10%	6.01%	12.14%

Table 1: Performance Metric Comparison

The performance metrics further confirm this point: the Buy & Hold strategy delivered a cumulative return of 4.87%, but with volatility as high as 8.23%, a maximum drawdown of 17.6%, and a Sharpe ratio of only 0.59. In contrast, the *Final State + Alpha* strategy, which applies risk-controlled rebalancing by combining the differential and policy variables, achieved an annualized return of 5.1% with a Sharpe ratio of 0.64—higher than fixed leverage. Its maximum drawdown was also reduced from 17.6% to 12.1%, significantly improving risk tolerance.

Investment Recommendation

In the current environment, most arbitrage capital is funded in yen. When expectations for the U.S.–Japan interest rate differential shift or BOJ/FOMC policies diverge, the shock first manifests in USD/JPY before quickly spreading to other high-yield pairs such as AUD/JPY and MXN/JPY. This transmission mechanism makes USD/JPY the 'switch' for the entire carry basket. Therefore, we recommend maintaining diversified positions within the basket but using USD/JPY risk signals as the primary adjustment trigger: once the signal deteriorates, the entire basket's risk exposure should be scaled down, not just USD/JPY itself.

Particular attention should be paid to intervention and policy turning-point risks. Ministry of Finance verbal warnings or outright intervention can drive USD/JPY down by two to three points within a short span, a pace of adjustment that position management alone cannot withstand. We recommend maintaining short-dated JPY call options as a low-cost hedge against sudden FX shocks. In addition, if the U.S. enters a deeper-than-expected rate-cutting cycle, the differential will collapse rapidly and the carry logic as a whole will break down. The corresponding hedge is to add U.S. Treasury longs, which generate offsetting gains as rates decline.

From a positioning standpoint, USD/JPY remains the most crowded carry trade. If the market turns, unwinds will amplify volatility and drag down other currencies. To prevent the portfolio from being overly exposed to a single pair, we suggest capping USD/JPY's weight at below 30% of the carry basket. Meanwhile, if volatility indicators (VIX, FX VOL) rise significantly, this often signals deteriorating risk appetite and the potential for a collective carry unwind. At that point, emerging-market carry exposure should be reduced, while increasing long positions in safe-haven currencies such as CHF and USD to preserve portfolio stability.