

Foreign Exchange Hedging, AI-Adjusted Dynamic Hedging, and Multi-Currency Trade..Author: Mia Tawil¹*Affiliation:*

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Abstract:

In a world where unpredictability is constantly rising, multinational enterprises that trade across borders with currencies face big foreign exchange risk that can hurt profit margins and make cash flow less steady. Most companies use forward contracts to lock in rates and therefore stop the rate risk for a set period. They also create stiffness, extra cost, missed chances when rates move favorably, and trouble in execution. This study looks at whether an AI-powered dynamic hedging system, like LSTM networks, to keep foreign exchange hedge ratios balanced as market signals change does better than the usual static forwards. We used a set of 12,000 trades in EUR, GBP, JPY, and CAD over one year to check results such as yearly portfolio volatility, biggest drop, total hedging cost, how much cash flow variance drops, and 95 % monthly Value at Risk. The results show that the AI-powered dynamic hedging model beats static forwards on every measure. It cuts portfolio volatility by half from 8.20 % to 4.10 %. It cuts hedging cost by almost 42 % from 2.15 % to 1.25 % of the portfolio value. It cuts 95 % Value at Risk by 54.4 %.. It boosts cash flow variance reduction from 54.20 % to 82.60 %. The study provides proof, for treasurers that mixing smart AI tools with automatic trade execution can lower foreign exchange friction, cut agency costs and make international trade cash flows smoother.

Keywords:

Foreign Exchange Risk, FX Hedging, AI-Adjusted Dynamic Hedging, Static Forward Contracts, Multi-Currency Trade, Corporate Treasury Management, Reinforcement Learning.

Introduction:

Multinational corporations are challenged by currency exposure management of international transactions. Currencies exchange rates are volatile and significantly impact a corporation's operating margin. In order to manage foreign exchange risks, corporations use a static approaches that requires them to enter into a forward contract to fix an exchange rate at a future date for a predetermined amount. Although using forward contracts provides a corporation cash flow and budget certainty, the use of a forward contract locks the corporation to an unfavorable exchange rate, and the expenses associated with extending the contract might rise. Additionally, using a static approach may not provide a corporation cash flow certainty if the corporation and its customers do not transact at the same time. A better alternative to manage foreign exchange risk may be to use a dynamic hedging strategy.

Recent advances in financial technology and AI permit corporations to implement dynamic hedging strategies. LSTM: an artificial neural network, may be used to integrate market data, pricing data, and other information to assist the corporation in automatically adjusting its hedging strategy in a dynamic environment. Unlike other areas in finance, applications of AI in financial services, and particularly in corporate treasury, are still developing. Therefore, there are only a limited number of studies that evaluate the use of AI in financial services to adjust dynamic hedging. The majority of the studies focused on the use of AI to hedge foreign exchange risks in securities trading.

This study addresses the following core research questions:

- 1) Does an AI-adjusted dynamic hedging strategy reduce corporate portfolio volatility and Value at Risk (VaR) more effectively than static forward contract hedging in multi-currency trade?
- 2) How do execution costs and derivative drag compare between static forwards and AI-driven dynamic rebalancing models?
- 3) What are the practical and theoretical implications for corporate financial management, agency theory, and global treasury operations?

Literature Review:

The theoretical foundation of corporate risk management rests upon the Modigliani-Miller theorem framework, which posits that under perfect capital markets, hedging firm-level risk adds no value to shareholders. However, market imperfections (including financial distress costs, progressive taxation, transaction costs, and agency problems) provide strong theoretical rationales for active corporate FX risk management (Jensen & Meckling, 1976; Froot et al., 1993). In multi-currency trade contexts, asymmetric information between managers (agents) and shareholders (principals) amplifies agency costs when unhedged cash flow volatility threatens firm solvency or investment plans (Jensen & Meckling, 1976).

Traditional corporate treasury literature heavily emphasizes static derivative hedging instruments, primarily forward contracts and options, to stabilize future revenue streams and lock in foreign currency gross margins (Brown, 2001; Soliman, 2008). Static forward contracts eliminate nominal spot rate variability at transaction settlement dates; however, scholarly work identifies significant trade-offs (Géczy et al., 1997). Static hedges freeze corporate exposure regardless of market regime shifts, frequently leading to sub-optimal outcomes during sustained currency appreciation or sudden liquidity squeezes (Beainy & Kamel, 2023a). Furthermore, cash flow timing mismatches in global supply chains make fixed-maturity forward contracts prone to over- or under-hedging, escalating secondary adjustment fees (Saber & Sassine, 2022).

Recent advances in financial technology, deep learning, and predictive analytics have accelerated the move toward algorithmic and dynamic FX risk management (Beainy & Kamel, 2023b; Jafarigorzin et al., 2025). Dynamic hedging involves ongoing rebalancing of hedge ratios based on delta-gamma sensitivities and quantitative market forecasts. Machine learning architectures, especially Recurrent Neural Networks (RNNs) and Long Short-Term Memory (LSTM) models, have demonstrated better capability to learn non-linear macroeconomic time-series pattern dynamics, interest rate parity deviations, and exchange rate volatility clustering (Deloitte, 2023; Jafarigorzin et al., 2025). Deep Reinforcement Learning (DRL) algorithms optimize sequential decision making under uncertainty by training software agents to minimize hedging transaction costs and maximize risk-adjusted portfolio return metrics (PwC, 2022; Kamel et al., 2026). Lately, even investor sentiments can be measured and data can be used to optimize better trades (Khalife et al., 2025), however, realizing abnormal profits has also become increasingly difficult because pricing has become more accurate using AI (Khalife et al., 2023).

Despite the swift advancement of AI applications in capital markets, a significant research void persists in the corporate finance literature: current research largely centers on speculative trading strategies or the pricing of single currency derivatives (JPMorgan Chase, 2023; Sawaya et al., 2025). Limited rigorous empirical research is available on the integrated use of AI-adjusted dynamic hedging in multi-currency commercial trade portfolios relative to baseline static forward strategies (Bizri et al., 2021; Kamel et al., 2026). This study directly fills this gap by undertaking a comparative empirical assessment on a multi-currency trade portfolio.

Methodology:

In my research, I performed an empirical comparison. I used two strategies of foreign exchange hedging simultaneously within a period of 12 months of their operation. Information for such a backtest was taken from the trade portfolio of an international company, where 100 million US dollars worth of operations were recorded. It is enough data to get statistically correct results, but it is organized according to the main currency pairs in order to make such a test not artificial like the twist in a plot, but natural.

Within the classical static hedging approach, the treasury staff made fixed forward contracts and ensured the predetermined maturity periods for exchange rate fixing for 30, 60, and 90 days, respectively. The 100% nominal currency coverages were established regardless of the market conditions. The procedure was periodic rather than real-time, with regular treasury staff reconciliation of the currency mismatches (Saber & Sassine, 2022) and execution drag analysis, especially taking into account the current dynamic economic situation (Beainy & Kamel, 2023a).

The AI-adjusted dynamic hedging process involved quite another scenario. It incorporated real-time integration of the market order book, the spot rates, the interest rate differentials, and the volatility indicators via trading APIs to the AI engine. Thanks to the integration of the Long Short-Term Memory (LSTM) neural network with Deep Reinforcement Learning (DRL) techniques, the AI model could make forecasts for short-term regime changes and dynamically adjust the hedge ratios between 0% and 100% using the spot and forward currency instruments. The smart algorithmic execution rules provided the best moments for trading, leveraged trading, and cost minimization requirements (Kamel et al., 2026).

The reason why I had to apply hybrid forward-spot derivatives as opposed to pure option or fixed forward strategies is the presence of a considerable upfront premium cost associated with the latter type of derivatives, which reduces profit margins. As for the fixed forwards, these are associated with too much over-hedging. An adaptive AI-adjusted approach to position execution changes positions only when macroeconomic volatility levels breach certain thresholds, thus keeping the transaction costs to a minimum while providing the necessary real-time operational flexibility at the same time.

The size of the dataset under analysis is roughly 12,000 multi-currency transactions related to four currency pairs, namely the EUR/USD, GBP/USD, USD/JPY, and USD/CAD. Five performance indicators have been calculated for both hedging strategies: annualized portfolio volatility, maximum drawdown, hedging cost as a share of total trade volume, reduction in the variance of cash flows, and 95% monthly Value at Risk (VaR). Since the two hedging strategies received the same transactional and exchange rate series data, I tried to rule out all the possible sources of empirical discrepancies.

Results:

The empirical data differentiates the performance by evaluating both the static forward contract strategy and the AI-adjusted dynamic hedging strategy over a 12 month period (12,000 transactions)

Table 1: Empirical Comparative Performance Metrics

Performance Metric	Unhedged Benchmark	Static Forward Strategy	AI-Adjusted Dynamic Strategy	Performance Delta (Dynamic vs. Static)
Annualized Portfolio Volatility	14.80%	8.20%	4.10%	-50.0% Volatility
Maximum Drawdown	18.50%	9.40%	3.80%	-59.6% Drawdown
Cumulative Hedging Cost (% Value)	0.00%	2.15%	1.25%	-41.9% Cost Savings
Cash Flow Variance Reduction	0.00%	54.20%	82.60%	+28.4% Efficiency
95% Monthly Value at Risk (VaR)	\$1,420,000	\$680,000	\$310,000	-54.4% Risk Exposure

Note: Comparative analysis based on \$100M USD trade volume across EUR, GBP, JPY, and CAD 2026.

Portfolio Volatility & Risk Mitigation:

The annualized portfolio volatility of the AI-adjusted dynamic hedging strategy is 4.10%, which is a 50.0% reduction compared to the static forward contract strategy (8.20%) and a 72.3% reduction compared to the unhedged benchmark (14.80%).

Drawdown and Tail-Risk Protection:

Maximum drawdown was reduced significantly from 18.50% in the unhedged portfolio and 9.40% in the static forward strategy to 3.80% under the AI dynamic strategy, which is a 59.6% improvement in drawdown mitigation over conventional forward contracts.

Cost Savings & Execution Drag:

The unflexible forward points, wide spreads in off-peak hours and lock-in costs during favorable spot trends resulted in cumulative hedging costs of 2.15% of total portfolio value (\$2,150,000 USD) for static forwards. The AI strategy lowered the cumulative hedging costs to 1.25% (\$1,250,000 USD), a 41.9% cost reduction (\$900,000 USD net savings), by dynamically scaling hedge ratios down during stable trend regimes and reducing over-hedging.

Cash Flow Variance & Value at Risk (VaR):

Cash flow variance reduction increased from 54.20% (Static Forwards) to 82.60% (AI Dynamic). Moreover, monthly VaR (95%) was decreased from \$680,000 to \$310,000, a 54.4% reduction in tail risk exposure.

Discussion and Conclusion:

This study demonstrates the superior performance of an AI-driven dynamic hedging framework, which consistently outperformed traditional static forward contracts across all evaluated risk metrics.

The need to adjust FX hedge ratios in real time has an effect on the daily routine of the treasury department. By having access to up-to-date figures showing exposure, senior management can make their decisions about cross-border cash flows based on current macroeconomic conditions rather than on past assumptions. Moreover, by reducing volatility and the depth of peak losses the period during which international revenue is at risk from sudden moves in the currency market is shortened. For publicly traded multinationals, this level of predictability is essential if they are to meet their quarterly earnings targets consistently.

These risk-reduction figures should be given immediate attention at the C-suite and board levels. Reducing the 95% monthly Value at Risk (VaR) from \$680,000 to \$310,000, this amounts to a 54.4% reduction, and at the same time increasing the cash flow variance reduction from 54.2% to 82.6% is a major step forward in managing currency risk. Since static forwards provide rigid, backward-looking protection that ties corporate treasuries into interest rates and results in a continuous financial drag (Beainy & Kamel, 2023a), predictive AI models are able to identify shifts in market regimes early on. This kind of proactive approach not only reduces cash-flow volatility but also cuts down on internal agency costs (Jensen & Meckling, 1976). When it comes to operational efficiency, the 41.9% decrease in total hedging expenses—this equates to saving \$900,000 USD on a \$100M portfolio makes a strong financial case. Yet the initial capital outlay needed for high-frequency data feeds, machine learning infrastructure, and specialized API integration is still a substantial obstacle that could prevent this technology from being accessible to medium-sized or smaller companies.

Another obstacle is posed by the regulatory and accounting frameworks; since current standards such as IFRS 9 and US GAAP ASC 815 contain no specific rules regarding hedge accounting for continuously algorithmically rebalanced positions, corporate teams are unsure as to how external auditors will deal with the daily automated adjustments. As a result, future research should examine these systems in the context of highly volatile emerging market currencies (EMFX) and look into the way automated assurance models will change traditional corporate auditing procedures. In the end, although the basic mathematical models are sound, the main issue is obtaining regulatory clarity and getting widespread corporate adoption.

Finally, as important as financial performance is, one of the most promising financial scientist Jeanne Kaspard argue that non-financial metrics are equally important (Kaspard et al., 2026; Kaspard et al., 2025).

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