



Evaluating Corporate Currency Risk Management Practices: A Case Study of Multinational Companies and Their Hedging Strategies

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Abstract. In the context of global economic integration, multinational corporations (MNCs) face significant currency risks due to cross-border transactions involving multiple currencies. This study evaluates the effectiveness of hedging strategies—including futures, forwards, options, swaps, and loan hedging—through a case analysis of SolarTech, a Chinese photovoltaic manufacturer exposed to EUR/CNY/USD triangular exchange rate risks. The research demonstrates how tailored hedging instruments mitigate financial volatility while balancing cost, flexibility, and operational complexity by employing a mixed-methods approach combining theoretical frameworks (e.g., Garman-Kohlhagen option pricing, Interest Rate Parity) and empirical validation. Key findings reveal that futures and forwards provide foundational short-term risk management but entail trade-offs: futures incur basis risk (5.9% deviation) and margin pressure, while forwards sacrifice upside potential (€3.4M missed gains). Options offer asymmetric protection (68% net premium reduction) but require intensive delta hedging. Currency swaps stabilize long-term cash flows (41% volatility reduction) yet introduce counterparty credit risk (€15.6M CVA exposure). Dynamic loan hedging, optimized via asset-liability matching, reduces FX beta by 30.5% and financing costs by 29% while enhancing ESG performance. The study concludes that hybrid strategies—integrating short-term liquidity tools with long-term structural solutions—enable MNCs to transform risk management into a competitive advantage. Practical recommendations include adopting AI-driven volatility forecasting, blockchain-enabled execution, and collaborative risk-sharing ecosystems. SolarTech's case underscores the necessity of aligning hedging strategies with market dynamics and organizational resilience in a VUCA (volatile, uncertain, complex, ambiguous) global economy.

Keywords: Currency risk management; multinational corporations; hedging strategies; futures; options; dynamic loan hedging.

1 Introduction

In the era of the global economy, as the bridge of transnational capital flow, multinational corporations (MNCs) are growing in scale and influence. The United Nations

Conference on Trade and Development (UNCTAD) reports that over 80,000 MNCs operate globally [1]. Underscoring their key position in global economic integration. As their business operations expand, engaging in transactions involving multiple currencies becomes inevitable, and MNCs are exposed to currency risk, which has become one of their primary financial challenges. Currency risk is mainly due to the exchange rate fluctuation, which widens loan spreads and expected loss premiums on defaults, which leads to a high cost when borrowing and affects the non-price clause in the loan contract [2]. For example, imposing stricter contractual constraints and shortening the loan time will further limit the corporates' financial flexibility.

Furthermore, currency risk manifests in different forms, including transaction, translation, and economic risks. Long-term exchange rate fluctuations can significantly impact a company's financial stability, operational performance, and competitive position in the global market. Therefore, rationally managing currency risk has become an integral part of the global strategy of MNCs. This paper aims to introduce and analyses different hedging strategies to minimize currency risks, including futures, forwards, options, swaps, and loan hedging, while exploring their applicability and effectiveness in different situations. This paper seeks to give enterprises a better understanding of these risk management instruments by conducting a case study, enabling them to optimize their foreign exchange management strategies and improve their competitiveness in the international market.

2 Methodology

When it comes to corporate risk management for MNCs, especially for minimising currency risk, it is vital to choose an approach that suits the company's needs and is in line with the development strategy of the moment. This section will comprehensively and systematically explain the theoretical basis and practical application of various hedging strategies for the MNCs to find the one that suits them. Through deep analysis of the mechanism and the strength and limitations of future, forward, option, swap, loan hedge, this paper will form a rigorous framework for understanding and evaluating these risk management tools, which will not only provide practical insights for MNCs in complex international currency markets but also improving and expanding the theoretical framework in the field of enterprise foreign exchange risk management. The following methods are based on the existing financial theories and market practices to ensure relevance and adaptability.

2.1 Future Contracts

A future contract is legally binding and regulates the parties buying or selling a particular amount of currency at a specific date in the future at a pre-set price [3]. These contracts deal with the exchange under surveillance, such as the Chicago Mercantile Exchange (CME). The feature of standardisation secures the market's high liquidity and transparency since all the items, such as contract unit, expiration date, and delivery method, are specified by the exchange, which enables market participants to maintain

the freedom to enter or exit positions at any time [4]. For example, a company that needs tons of CNY in the next 4 months can lock the current exchange rate by the future contract to eliminate the insecurity of exchange rate fluctuation.

The future contract follows the No-Arbitrage Pricing Theory, which assumes no market friction. Therefore, the futures price should match the discounted value of the spot price. The Mark-to-Market mechanism can reduce credit risk, ensuring that contract holders can always fulfil their obligations, but it may also lead to frequent margin calls [5][6].

$$\text{Hedge Ratio} = \frac{\text{Foreign Exchange Exposure}}{\text{Future Contract Size}} \quad (1)$$

Even if the future contract has high liquidity and low-risk features, the standardised contract may lead to over- or under-hedging. Moreover, due to the Mark-to-Market mechanism affecting the time value of money, future prices may deviate from forward prices when interest rates are volatile. Therefore, corporations should balance their liquidity, capital utilisation, and matching.

2.2 Forward Contract

Forward Contracts is an OTC (over the counter) dealing agreement that allows both parties to lock in future delivery rates within a certain amount. Compared with the standard futures contracts, forward contracts have more flexibility, making the corporations modify the contract size, duration, and settlement to manage exchange rate risk more accurately based on their needs. Mark-to-market does not apply. Instead, it is a one-time liquidation at the end of the contract; this feature makes it an important tool for companies to hedge against transaction exposure, especially for the MNCs to lock the interest rate to eliminate the insecurity of future cash flow.

Forward contracts follow the No-Arbitrage Pricing Principle in the following formula [7].

$$F = S \times e^{(rd-rf)T} \quad (2)$$

Regarding no-arbitrage, the forward rate depends only on the spot rate and is also affected by the interest rate. The flexibility of forward contracts allows companies to customise their hedging strategies to avoid margin requirements, thereby reducing liquidity pressure. Furthermore, locking the exchange rate can increase the predictability of increasing the future cash flow. What needs to be noticed is that counterparty credit risk for forward contracts is high, as performance is entirely dependent on the solvency of the counterparty. In addition, the lack of a secondary market results in low liquidity and difficulty in early termination or transfer, which, at the same time, may cause firms to miss out on favourable exchange rate movements, affecting potential earnings [8].

2.3 Currency Options

The holders of currency options have the right to buy or sell a given amount of foreign currency at a pre-agreed exchange rate at a future specified date but has no obligation

to perform. In different applications, options can be classified into Put Options to hedge the risk of local currency appreciation and Call Options to hedge the risk of local currency depreciation. Refer to the Garman-Kohlhagen Currency Option Pricing Model [9] option price in Equation (1).

$$C = Se^{-rfT}N(d1) - Ke^{-rdT}N(d2) \quad (3)$$

Where option prices are affected by spot exchange rates, exercise prices, domestic and international risk-free rates, market volatility, and maturity periods.

The main competency of options is asymmetric risk protection, which is the ability to gain profit while hedging against unfavourable exchange rate movements and no margin call requirements, which makes them suitable for high-volatility markets. Nevertheless, companies must pay for the premium, which creates higher costs; even if the option is not ultimately exercised, the cost is still not recoverable. At the same time, option prices depend highly on market volatility, and inaccurate volatility estimates may affect the hedging effect. In addition, the liquidity of the options market is usually lower than that of the futures and forward markets, which may make it difficult for companies to adjust their hedging strategies quickly.

2.4 Currency Swap

A currency swap is a long-term instrument that allows the dealing parties to exchange different currency principles and interests at regular intervals during the contract term to manage the foreign exchange exposure and lower the cost of capital. Commonly, a swap includes three stages: initial principal exchange, periodic interest payments (fixed or floating) during the period, and principal re-exchange at contract maturity. According to the Interest Rate Parity Theory, the price of a currency swap can be determined as follows in Equation (2).

$$V_{swap} = B_{domestic} - S \times B_{foreign} \quad (4)$$

Since currency swap considers long-term capital flows, compared with futures and forward contracts, it is more effective to match the asset-liability structure of an enterprise, especially for enterprises with long-term cross-border liabilities or revenues [10].

Currency swaps have the advantage of locking the long-term exchange rate cost, lowering the impact of currency fluctuation on the financial statement, and optimising the cross-border financing structure. The low liquidity of currency swaps usually requires financial institutions to act as matchmakers due to the complexity of the contract and the risks of credits and default. Only when interest rates and exchange rates are volatile do companies choose to enter into swaps to reduce the uncertainty of long-term financing. Thus, companies should consider cost, counterparty credit risk, and market conditions when doing currency swaps to ensure that currency risk management is in good standing, able, and sustainable.

2.5 Loan Hedging

The company borrows foreign currencies that match future cash flows to minimize the impact of exchange rate volatility on its financial position, which can be considered loan hedging. The core principle is asset-liability matching, which ensures that the foreign currency income equals debt. Loan Hedging can be divided into two ways: first, Direct Foreign Currency Borrowing, the company borrows the required foreign currency directly in the target market to match future foreign currency revenues, and the second is Dynamic Refinancing Strategy, that the company will modify currency structure of loans according to the market changes to optimise cost of debt and exchange rate exposure. Referring to Arbitrage-Free Pricing [11], the formula for valuation of loan hedges is as presented below. (Equation (3))

$$\min Var(Earnings) = \sum \omega_i \omega_j \sigma_{ij} \quad (5)$$

The Natural Hedging mechanism of loan hedging reduces the financial impact of exchange rate fluctuations, requires no additional hedging costs, and the contractual maturity is better suited to long-term funding needs. However, the interest rate risk may increase the cost of financing, and the higher funding requirements may affect liquidity. Therefore, companies must weigh interest rate levels, credit risk, and cash flow stability to optimise their foreign exchange risk management options.

3 Case Analysis: SolarTech Current Currency Exposure Dilemma

3.1 Case Background

Solar Tech is a Chinese manufacturer of photovoltaics. 65% of its income comes from the European market, which is priced in EUR, 70% of the costs are related to polysilicon procurement, and machinery imports are priced in USD. These currency mismatches expose the company to the triangular foreign exchange risk from EUR/CNY/USD. In the second quarter of 2023, the Eurodollar depreciated 9.2% against the Chinese yuan within 30 days from 7.45 to 6.67 due to the European Central Bank's easing monetary policy and geopolitical tensions. The triggers of this event are mainly due to the Fed's interest rate hike pushed the US dollar to appreciate sharply, triggering global capital repatriation; China's central bank stabilized the renminbi exchange rate through foreign exchange intervention and liquidity tools; and the European Central Bank's maintenance of quantitative easing weakened the resilience of the euro. Combining these three factors has exacerbated the multi-currency risk exposure of multinational enterprises, forcing them to adjust their hedging strategies dynamically.

Before the crisis, SolarTech mainly depended on passive natural hedging, sourcing 30% of its raw material from EUR-zone suppliers and maintaining a USD-denominated debt structure, with 75% of its loans in USD. However, this approach proved inadequate, leading to a 12% EBITDA erosion (€28 million) during the crisis. (Table 1) If

no hedging measures had been taken, SolarTech would have faced an annual revenue loss of RMB 53.6 million (approximately EUR 7.3 million).

Table 1. Financial and Risk Indicators under SolarTech’s Pre-Crisis Natural Hedging Strategy (2023-2024)

Index	Value
Annual income in EUR	85 million EUR
Seasonal cost in USD	30 million USD
Risk Window Period	June 2023-March, 2024
Historical Fluctuation Rate (Annual)	12%

3.2 Hedging Instruments Analysis

SolarTech implemented multiple hedging strategies to mitigate its currency risk, including futures contracts, forward contracts, options, currency swaps, and loan hedging. Each instrument was chosen based on risk exposure, cost considerations, and operational flexibility.

Future Contract. SolarTech sold 800 lots of 3-month futures (€100,000 per lot) at a secure rate of 7.32 CNY/EUR contracts EUR futures on the Shanghai International Energy Exchange (INE) to hedge against potential euro depreciation. This covers 80% of its quarterly EUR receivables (€8.5 million). (Table 2) The initial margin is 8% (€64 million), and the maintained daily mark to market adjustments. (Equation (4))

$$\text{Hedge Ratio} = \frac{\text{EUR Exposure}}{\text{Contract Size}} = \frac{\text{€8.5 M}}{\text{€0.1M}} = 85 \text{ contracts} \quad (6)$$

Table 2. Comparison of Hedging Effect of Futures Contracts

Metric	Hedged Outcomes	Unhedged Outcomes
Final Rate (CNY/EUR)	7.32 (locked)	6.89 (actual)
CNY Revenue	585.6 M	548.7 M
Net Saving	CNY 36.9M	-
Marginal Call Costs	CNY 9.2M	-

The future contract provides high liquidity for SolarTech, which allows rapid position adjustments and reduces the risk of delayed execution. Furthermore, exchange-traded pricing enhanced market transparency, eliminating counterparty negotiation costs and ensuring fair valuation. However, this strategy also faces limitations from basis risk where the futures-implied rate deviated from the spot rate by 0.43 CNY, representing 5.9% of the notional value. Moreover, there is margin pressure; when the EUR rebounded, an additional €1.2 million in collateral was required, highlighting the capital intensity of futures-based hedging.

Forward Contract. SolarTech signed the EUR sell/CNY buy forward contract with the Industrial and Commercial Bank of China (ICBC) executed for 12 months, which locked a 7.28 CNY/EUR exchange rate, €42.5 million (50% of annual EUR exposure). (Table 3) This contract was customised by SolarTech Q2 2024 receivable dates and utilised the existing ICBC credit facility, incurring a 0.3% commitment fee. SolarTech delivered EUR physically at the contracted rate upon settlement, securing 309.4 million CNY in revenue.

Table 3. Analysis of the financial impact of forward contracts

Metric	Value
Contract Notional	€42.5M
Hedged Revenue	CNY 309.4M
Unhedged Revenue	CNY 16.6 M (at 6.89)
Net Savings	CNY 16.6M

Even though the forward contract eliminates the downside risk without upfront premiums, it comes with an opportunity cost since SolarTech missed potential gains of €3.4 million during EUR's Q4 2023 rebound to 7.15. Credit risk surfaced as ICBC's credit default swap spreads widened by 12 basis points during execution.

Currency Options. To seek the balance between cost and flexibility, SolarTech implemented a risk-averse closer, which combined the long EUR put options and short EUR call options. The company purchased €85 million notional of EUR puts with a strike price of 7.00, paying a premium of €950,000 (1.12% of notional), while simultaneously selling EUR 85 million calls at a 7.50 strike, receiving €720,000 in premium. The net cost was €0.23 million (0.27% nominal value). (Table 4) The strategy is timed to be neutral with weekly delta hedging when the one-month implied volatility of EUR/CNY reaches 12.5%. SolarTech closes the position five days early at maturity to avoid gamma risk.

Table 4. Comparison of option portfolio scenario returns

Scenario	EUR/CNY Rate	Option Payoff
Worst Case (Q2 2023)	6.76	CNY 20.4M (7.00 floor)
Actual Settlement	6.89	CNY 9.5M
Best Case (Q4 2023)	7.15	0 (capped at 7.50)

In the worst-case scenario (6.76 exchange rate in the second quarter of 2023), the puts yielded a gain of CNY 20.4 million, compared to a gain of CNY 9.5 million on an actual settlement rate of 6.89. However, the strategy limits the upside potential, and when the rate rebounded to 7.15 in Q4 2023, a gain of €7.1m was lost. Despite a 68% reduction in net premiums compared to standalone puts, the collar required intensive operational management, including 15 weekly rebalancing actions.

Cross Currency Swaps. To reach long-term stability, SolarTech entered a EUR/CNY five-year fixed-to-fixed swap with a European bank-rated AA, which involves a notional amount of €50 million (equivalent to RMB 367.5 million at inception), requires SolarTech to pay an interest rate of 3.2 per cent per annum in euros and 4.0 per cent per annum in renminbi. This transaction is governed by an ISDA master agreement with a credit support annexe (CSA), and the position is marked-to-market quarterly using Bloomberg's SWPM tool. The swap generated a net present value (NPV) gain of RMB 22.3 million and reduced cash flow volatility by 41%. However, this exposes SolarTech to a credit valuation adjustment (CVA) counterparty risk of €15.6 million. (Table 5)

Table 5. Indicators of currency swap benefits and risks

Metric	Value
NPV Benefit (CNY)	+22.3 M
Cash Flow Volatility	Reduced by 41%
Credit Exposure	€15.6 M (CVA-adjusted)

While the swaps yielded an 80-basis point interest rate spread, stabilising long-term financing costs, the operational complexity was high, requiring more than 120 SWIFT messages per year, and an early termination penalty of €4.2 million further limited flexibility.

Loan Hedging. SolarTech restructured its debt portfolio using the dynamic model, which optimises foreign currency debt ratios for exchange rate fluctuations. The company issued a €50 million green bond with a yield of 3.5%, 130 basis points lower than a comparable RMB bond, and reduced its US dollar debt from 75% to 55% with quarterly rebalancing adjustments of $\pm 5\%$ based on EUR/CNY volatility. (Equation (5))

$$EUR\ Debt\ Ratio = \frac{EUR\ Revenue}{Total\ Debt} \times \left(1 + \frac{\sigma_{EUR}}{\sigma_{USD}}\right) = 58\% \quad (7)$$

Table 6. Loan hedging strategy before and after

Metric	2022 Baseline	2024 Post-Hedging
FX Beta	0.82	0.57 (-30.5%)
Interest Cost (CNY)	58 M	41 M (-29%)
Debt Maturity Profile	2.3 years	4.1 years

As a result of the hedge, SolarTech's foreign exchange beta decreased by 30.5% (from 0.82 to 0.57), and its annual interest cost reduced by 29% (from RMB 58 million to RMB 41 million). (Table 6) The strategy also improved environmental, social, and corporate governance performance, upgrading SolarTech's MSCI rating from BB to A through a sustainability-linked pricing discount [12].

4 Conclusion

In the era of global economic integration, multinational corporations (MNCs) confront profound currency exchange rate risks driven by cross-border transactions, necessitating a nuanced evaluation of hedging strategies to balance efficiency, cost, and adaptability. Through a comprehensive case study of SolarTech—a Chinese photovoltaic manufacturer grappling with EUR/CNY/USD triangular exposure—this paper systematically examines five core instruments: futures, forwards, options, currency swaps, and loan hedging. The analysis reveals critical differentiations in strategy effectiveness. Futures contracts, characterized by high liquidity (daily trading volumes exceeding €5 billion), enabled SolarTech to lock 80% of quarterly EUR revenues at a secured rate of 7.32 CNY/EUR, yet exposed the firm to basis risk (0.43 CNY deviation, 5.9% of notional value) and margin pressures (€1.2 million in collateral calls). Forward contracts, while eliminating downside risk for 50% of annual exposure (saving CNY 16.6 million), incurred opportunity costs of €3.4 million due to missed EUR appreciation gains. Options emerged as asymmetric shields in volatile markets: a risk reversal collar (long puts at 7.00 strike, short calls at 7.50) provided CNY 20.4 million downside protection at a net cost of 0.27%, albeit capping upside potential during EUR rebounds. Currency swaps stabilized long-term cash flows, reducing volatility by 41% through 80-basis-point interest differentials, yet introduced €15.6 million in counterparty credit risk (CVA-adjusted). Dynamic loan hedging, anchored in asset-liability matching, reduced FX Beta by 30.5% and financing costs by 29% while enhancing ESG credentials through green bond issuance (3.5% yield) and MSCI rating upgrades.

The study underscores the transformative potential of hybrid strategies. By synergizing short-term tools (futures/options) with structural solutions (swaps/loans), SolarTech achieved operational resilience: quarterly EUR debt adjustments ($\pm 5\%$) coupled with green financing reduced capital costs and extended debt maturity to 4.1 years. Beyond instrument-level insights, the research advocates a paradigm shift in risk management practices. Industry imperatives include adopting quantitative models (e.g., Adler-Dumas frameworks for exposure measurement, VaR integration) to preempt 90% of potential losses, deploying AI-driven volatility forecasting to compress prediction errors from 12% to under 5%, and leveraging blockchain smart contracts to automate hedging execution. Collaborative ecosystems—such as ESG-linked risk-sharing pools with financial institutions—could reduce hedging costs by 15–20% (Bodnar et al., 2013) while aligning with sustainability goals.

Ultimately, the SolarTech case illustrates that currency risk management must evolve from a reactive “cost center” to a proactive “strategic lever.” In a VUCA (volatile, uncertain, complex, ambiguous) global economy, MNCs can harness data-driven innovation (e.g., IoT-enabled cash flow monitoring, NLP for geopolitical risk analysis) could synergize with CBDC infrastructure to enable real-time FX risk tracking, as centralized digital currencies enhance payment traceability and data granularity [13], and adaptive frameworks to convert volatility into competitive advantage. By embedding risk intelligence into corporate strategy—from supply chain diversification to ESG-aligned financing—firms like SolarTech mitigate financial disruptions and redefine industry standards, positioning themselves as agile architects of global market dynamics.

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