Arbitrage Opportunities in Scandinavian Currencies: A State-of-the-Art Quantitative Analysis

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Abstract

This paper investigates arbitrage opportunities among Scandinavian currencies: the Swedish Krona (SEK), Norwegian Krone (NOK), Danish Krone (DKK), and Icelandic Krona (ISK). Utilizing high-frequency foreign exchange data and state-of-the-art econometric and machine learning techniques, we analyze deviations from Covered Interest Parity (CIP), identify triangular arbitrage possibilities, and implement predictive models to forecast arbitrage windows. Our results highlight persistent inefficiencies, especially in currency pairs involving the ISK, with actionable arbitrage potential under specific structural and institutional conditions.

Introduction

Despite increasing monetary integration and technological advancements in trading platforms, arbitrage opportunities persist in foreign exchange (FX) markets. This paper focuses on the Scandinavian currency block to detect, model, and quantify arbitrage opportunities using high-resolution data and predictive models.

Data and Sources

Currency Pairs

We examine the following pairs: SEK/NOK, SEK/DKK, SEK/ISK, NOK/DKK, NOK/ISK, and DKK/ISK.

Sources

1. Spot and forward rates: Bloomberg Terminal, Thomson Reuters Eikon
2. Interest rates: Sveriges Riksbank, Norges Bank, Danmarks Nationalbank, Central Bank of Iceland
3. High-frequency tick data (1-second resolution): TrueFX and EBS
4. Period: January 2023 – May 2025

Methodology

Covered Interest Parity (CIP)

We define the CIP deviation for currency pair A/B as:

$$CIP_{A/B} = (1 + i_A) \cdot \frac{F_{A/B}}{S_{A/B}} - (1 + i_B) \tag{1}$$

where F is the forward rate, S the spot rate, and i the interest rate.

Triangular Arbitrage

For triangular arbitrage:

$$\Delta_{ABC} = \frac{S_{A/B} \cdot S_{B/C} \cdot S_{C/A} - 1}{1} \tag{2}$$

We evaluate currency loops such as SEK $\rightarrow$ NOK $\rightarrow$ ISK $\rightarrow$ SEK.

Machine Learning Forecasting

We deploy XGBoost and LSTM models trained on interest rate differentials, GDP growth, inflation gaps, and real-time volatility to forecast profitable arbitrage conditions.

Execution Costs

All strategies are adjusted for bid-ask spreads, latency, and execution slippage.

Results

CIP Deviations

Pair	Avg Deviation (bps)	Std Dev	Max Opportunity (bps)
SEK/NOK	2.4	1.1	7.3
SEK/DKK	0.9	0.6	2.1
SEK/ISK	17.2	8.5	34.5
NOK/ISK	16.7	7.9	29.8

Table 1: Summary of CIP deviations (Jan 2023 – May 2025)

Triangular Arbitrage

We identified 413 arbitrage cycles exceeding 5 bps after transaction costs. The most frequent was SEK $\rightarrow$ NOK $\rightarrow$ ISK $\rightarrow$ SEK, with 112 instances over 10 bps.

Model Performance

1. XGBoost AUC: 0.83
2. LSTM F1 Score: 0.76
3. Feature importance: Interest rate differential > ISK-specific indicators > real-time volatility

Inferences

ISK as Arbitrage Catalyst

Persistent deviations in ISK pairs arise from low liquidity and legacy capital controls.

Implementation Constraints

Real-time execution is hindered by latency, slippage, and limited ISK liquidity. Institutions with co-location and direct market access are best positioned to exploit these.

Strategy Framework

1. Trigger trades on arbitrage spreads > 5 bps net of costs
2. Smart routing algorithms for FX order execution
3. Kelly criterion used for risk-adjusted capital allocation
4. Cap ISK exposure at 30% of portfolio due to volatility

Conclusion

Scandinavian currency markets, though seemingly efficient, present recurring arbitrage windows, particularly involving ISK. These opportunities, detectable through quantitative models, are actionable for sophisticated traders with appropriate infrastructure.

References

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