Multi-Asset Arbitrage Strategy Framework in Excel Stocks, Commodities and Currencies

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1 Project Overview

This project consists of the development of a multi-asset arbitrage detection framework implemented in Excel. The model covers three asset classes:

- Equities (Stock index or single stock futures)
- Commodities
- Foreign Exchange (FX forwards)

For each asset class, the model:

- Computes the theoretical forward or futures price
- Measures mispricing relative to the observed market price
- Determines whether an arbitrage opportunity exists
- Automatically generates the appropriate trading strategy
- Computes the associated profit and loss (PnL)

All arbitrage decisions are determined dynamically from the sign of the mispricing variable.

2 General Arbitrage Logic

For each asset class, mispricing is defined as:

$$\text{Mispricing} = F_{\text{market}} - F_{\text{theoretical}}$$

The trading strategy is entirely driven by the sign of this value:

- If mispricing > 0: the contract is overpriced
- If mispricing < 0: the contract is underpriced
- If mispricing $= 0$: no arbitrage opportunity

The PnL corresponds to the theoretical risk-free gain obtained by implementing the strategy until maturity.

3 Equity Arbitrage (Cash-and-Carry Framework)

Theoretical Pricing

For equities paying a continuous dividend yield:

$$F_0 = S_0 e^{(r-q)T}$$

where:

- S_0 is the spot price
- r is the risk-free rate
- q is the dividend yield
- T is time to maturity

Arbitrage Strategies

If mispricing > 0 (Future Overpriced):

- Buy the Spot (or ETF)
- Sell the Future
- Hold until maturity
- Deliver spot / settle the future

If mispricing < 0 (Future Underpriced):

- Short the Spot (or ETF)
- Buy the Future
- Hold until maturity

If mispricing $= 0$:

- No arbitrage possible

4 Commodity Arbitrage (Cost-of-Carry Model)

Theoretical Pricing

For commodities:

$$F_0 = S_0 e^{(r+u-y)T}$$

where:

- u represents storage, insurance, financing and transport costs

- y represents convenience yield

In the model:

- Cost of carry is computed dynamically
- Convenience yield is derived via an Excel formula

Arbitrage Strategies

If mispricing > 0 (Future Overpriced):

- Buy the physical commodity
- Pay storage + insurance + financing + transport
- Sell the Future
- Deliver at maturity

If mispricing < 0 (Future Underpriced):

- Short the physical commodity
- Buy the Future

If mispricing $= 0$:

- No arbitrage possible

5 Foreign Exchange Arbitrage (Covered Interest Arbitrage)

Theoretical Pricing

Under Covered Interest Parity (CIP):

$$F_0 = S_0 e^{(r_d - r_f)T}$$

where:

- r_d is the domestic interest rate
- r_f is the foreign interest rate

Arbitrage Strategies

If mispricing > 0 (Forward Overpriced):

- Borrow foreign currency
- Convert to domestic currency (spot)
- Invest domestically
- Sell the forward to lock future conversion

If mispricing < 0 (Forward Underpriced):

- Borrow domestic currency
- Convert to foreign currency
- Invest abroad
- Buy the forward

If mispricing $= 0$:

- No arbitrage possible

6 Model Structure

Each asset class has its own dedicated input structure:

- Maturity in years is calculated via Excel formulas
- For commodities, cost of carry and convenience yield are dynamically computed
- Strategy generation is handled via conditional logic based on the mispricing cell

The arbitrage strategy is therefore fully automated and consistent with no-arbitrage pricing theory.

7 Potential Extensions

The framework can be extended by:

- Integrating live market data feeds (Bloomberg, Refinitiv, APIs)
- Including transaction costs and funding spreads
- Adding capital allocation constraints
- Implementing margin and liquidity considerations
- Building a real-time arbitrage monitoring dashboard
- Automating asset selection through VBA UserForms

8 Conclusion

This project implements a unified arbitrage detection engine across equities, commodities, and FX markets. It combines theoretical pricing models with automated strategy generation and direct PnL estimation.

The framework demonstrates practical application of:

- Cash-and-Carry and Reverse Cash-and-Carry
- Cost-of-Carry pricing
- Covered Interest Arbitrage

It provides a structured approach to identifying and quantifying cross-asset arbitrage opportunities.