1. INTRODUCTION

- Financial institutions are required to absorb risks associated with foreign exchange (FX) transactions.
- Risks arise mainly due to exchange rate volatility and unpredictability of client flow.

2. FOREIGN EXCHANGE RISK MODEL

2.1. Broker’s Trading Model

2.2. Targets in risk management

- Risk: Exposure of positions to exchange rate volatility.
- Transaction costs: incurred by interbank trade

2.3. Stochastic Cost-Risk Modeling

- FX broker is modeled as linear system:
  \[ x_{t+1} = x_t + f_t + h_t \]
  \( x_t \): broker’s positions
  \( f_t \): client flow
  \( h_t \): hedging action

- Some brokers impose constraints on hedging size:
  \[ |h_t| \leq h_{max} \]

- Optimization goal is reducing cost and risk:
  \[ \min_{h_t} \mathbb{E} \left[ \sum_i (h_i \delta)^2 \right] + (1 - \lambda) \text{var} \left[ \sum_i x_i r_i \right] \]
  \( \delta \): half-spread
  \( r_i \): exchange rate returns
  \( \lambda \): risk preference

3. STOCHASTIC MODEL PREDICTIVE CONTROL

- At each time step, client flow and exchange rate are simulated using Monte Carlo methods.
- Optimal hedging actions are computed using a stochastic optimizer.
- Models are updated from market conditions.

4. RESULTS

Based on client data from Westpac bank

5. CONCLUSION

- First reported application of SMPC in FX Hedging
- Results are always better than naïve strategy.
- Hedging improves with better predictions.
- Applicable to other markets:
  - Electricity Market
  - Cloud Computing Spot Market