โครงการสนับสนุนทุนวิจัยด้านตลาดทุนระดับบัณฑิตศึกษา ประจำปี 2557

งานวิจัยจากการวิจัยวิทยาลัยการจัดการ มหาวิทยาลัยมหิดล
ในหัวข้อ “Arbitrage Opportunities Discovery in Thailand’s Spot and Futures Market: Pair Trading Strategy from Threshold Co-integration Model”

โดย
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Research Objectives

& Benefit for Thai Capital Market

• How does a future price relate to its underlying asset and another series from the same underlying asset.

• Is there arbitrage opportunity in Thailand Stock & Futures Market

• Is Pair-Trading Strategy profitable in Thailand Stock & Futures Market

• How can we improve the pair trading strategy

• How attractive to use the pair trading strategy in Thailand Stock & Futures Market
Executive Summary

• Study 5-minutes intraday price relationship between pairs of assets in SET and TFEX.

• 3 pairs of series of the same underlying asset (SET50, KTB, TRUE) which trade between 2/Jul/14 – 29/Aug/14 are studied.

• Found long-run relationship and short-run dynamic of the prices of pairs.

• With the existence of the transaction cost, the price relationship is estimated following the Threshold Vector Error Correction Model (TVECM)

• TVECM pair trading strategy is formulated. The performance of the TVECM pair trading strategy is superior to the traditional pair trading strategy.

• Present amount of trading volume in TFEX is too low to be attractive applying the pair trading strategy.
Pair Trading Strategy

- Market Neutral (Profitable in any market condition)
- Choose a pair of highly correlated price securities
  - When the pair diverges, open ‘Short’ position in outperforming one and ‘Long’ position in underperforming one.
  - When the pair converges, close all positions

Traditional Pair Trading uses Moving Average 2 S.D. as positioning signal
Threshold Co-integration Pair Trading Strategy

- Threshold Vector Error Correction Model (TVECM)
  - With **existence of Transaction Cost** (ex. Commission), the Adjustment Process could be Asymmetric.
  - In different regime, speed of adjustment might be different.

**Regime 1**
- Speed of adjustment: Low

**Regime 2**
- Speed of adjustment: Zero

**Regime 3**
- Speed of adjustment: High

“**No-arbitrage band**”
If the mispricing is too small to cover the transaction cost. Then, adjustment speed might be small.
Threshold Co-integration Pair Trading Strategy

Example of Threshold Co-integration Behavior

Data: S50U14 & S50Z14 (freq: 5mins)
Trading Rule

Regime 1
- Open Positions Type 1 – Short Asset 1 & Long Asset 2
- Close Positions

Regime 2
- Open Positions Type 2 – Long Asset 1 & Short Asset 2
- Close Positions

Regime 3

Trading Rule 1
Trading Rule

Regime 1

Regime 2

Regime 3

Open Positions Type 1

Close Positions Type 1 & open Positions Type 2

Positions Type 1 – Short Asset 1 & Long Asset 2
Positions Type 2 – Long Asset 1 & Short Asset 2
Performance Measurement

- Time-rolling (Out-sample Test)

1) Set Training Period = 600 periods (10 trading days) to estimate threshold values
2) Execute trading rule for next 300 periods (5 trading days)
3) Move forward 300 periods, redo steps 1) & 2) and repeat until end of data
Data

• Data selection criteria
  
  – Asset from SET and TFEX markets
  – Pair Formulate
    
    • Spot and its future
    • 2 different contract month futures from same underlying asset
  
  – Data Frequency : 5 mins
  
  – Missing data (no trade) < 10%

• Selected Data & Pairs (Trading period : 2/Jul/14 – 29/Aug/14 (2,439 Obs))
  
  – Pair 1 - Assets : S50U14 & S50Z14
  – Pair 2 - Assets : KTB & KTBU14
  – Pair 3 - Assets : TRUE & TRUEU14
## Empirical Results

(Compare training & execute period)

| Trading Rule | Pair 1  
(S50U14 & S50Z14) 200 stocks / contract | Pair 2  
(KTB & KTBU14) 1,000 stocks / contract | Pair 3  
(TRUE & TRUEU14) 1,000 stocks / contract |
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<td>Gross Profit</td>
<td>3,820</td>
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<td>**Transaction Cost</td>
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<td>Net Profit</td>
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<td><strong>2,972</strong> (👍)</td>
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<td><strong>1,896</strong> (👍)</td>
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<tr>
<td>Gross Profit</td>
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<td>1,790</td>
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<td>Net Profit</td>
<td><strong>776</strong> (👍)</td>
<td><strong>980</strong> (👍)</td>
<td><strong>294</strong> (👍)</td>
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Conclusion

• Found long-run, short-run relationships
  — S50U14 & S50Z14
  — KTB & KTBU14
  — TRUE & TRUEU14

• At 5-min frequency, found arbitrage opportunities for
  — S50U14 & S50Z14
  — KTB & KTBU14
  — TRUE & TRUEU14

• Both TVECM Pair Trading Strategy (Trading Rule 2) are superior to Traditional Pair Trading Strategy
Conclusion (cont’d)

- Attractiveness: Potential maximum profit in real-life for Prop. Trade in 2 months
  - Pair 1: S50U14 & S50Z14
    - Average trading volume = 73 contracts per period (5 mins)
    - Estimated potential maximum profit = THB 143,956
  - Pair 2: KTB & KTBU14
    - Average trading volume = 66 contracts per period (5 mins)
    - Estimated potential maximum profit = THB 42,174
  - Pair 3: TRUE & TRUEU14
    - Average trading volume = 211 contracts per period (5 mins)
    - Estimated potential maximum profit = THB 201,716
References

• Thongthip, S. (2010). Lead-lag Relationship and Mispricing in SET50 Index Cash and Futures Markets (Doctoral dissertation, Faculty of Economics, Thammasat University).