Applications of Conic Optimization and Quadratic Programming in the Investigation of Index Arbitrage in the Thai Derivatives and Equity Markets

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Abstract—This research seeks to investigate the frequency and profitability of index arbitrage opportunities involving the SET50 futures, SET50 component stocks, and the ThaiDEX SET50 ETF (ticker symbol: TDEX). In particular, the frequency and profit of arbitrage are measured in the following three arbitrage tests: (1) SET50 futures vs. ThaiDEX SET50 ETF, (2) SET50 futures vs. SET50 component stocks, and (3) ThaiDEX SET50 ETF vs. SET50 component stocks are investigated. For tests (2) and (3), the problems involve conic optimization and quadratic programming as sub-problems. This research is first to apply conic optimization and quadratic programming techniques in the context of index arbitrage and is first to investigate such index arbitrage in the Thai equity and derivatives markets. Thus, the contribution of this study is twofold. First, its results would help understand the contribution of the derivatives securities to the efficiency of the Thai markets. Second, the methodology employed in this study can be applied to other geographical markets, with minor adjustments.

Keywords—Conic optimization, Equity index arbitrage, Execution lags, Quadratic programming, SET50 index futures, ThaiDEX SET50 ETF, Transaction costs

I. INTRODUCTION

AN index arbitrage is a financial transaction involving a purchase and/or sale of certain securities linked to a stock index whereby positive profits are earned with no risk. An index arbitrage is possible when there are temporary discrepancies in the prices of the securities. This study looks at three classes of securities, namely the SET50 component stocks, the SET50 index futures contracts, and the ThaiDEX SET50 ETF, henceforth denoted as TDEX for brevity.

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This study investigates index arbitrage opportunities occurring from the three major events: (1) the SET50 futures are overpriced (underpriced) relative to the price of the TDEX. In this case, an arbitrageur can buy (sell) the TDEX and simultaneously sell (buy) the futures, with zero initial investment, and take the reverse position when the prices are corrected for a guaranteed profit. Also, (2) when the price of SET50 futures is too low compared to the price of the SET50 index, an arbitrageur can sell the SET50 component stocks and buy the futures and take the opposite position when prices are corrected. Lastly, (3) when the price of the TDEX is too low compared to the prices of the SET50 index, an arbitrageur can sell the SET50 component stocks and buy the TDEX and take the reverse position when prices are corrected. To study arbitrage in the first event, arbitrage frequency and profit are measured from the mispricing of the SET50 futures against the TDEX, hereafter referred to as Test 1. To study arbitrage in the second event, frequency and profit are measured from the mispricing of the SET50 futures against the SET50 component stocks, hereafter referred to as Test 2. Lastly, in order to study arbitrage in the third event, frequency and profit are measured from the mispricing of the TDEX against the SET50 component stocks, henceforth referred to as Test 3.

While the investigation of index arbitrage in the first test involves only the TDEX and the SET50 futures and are numerically trivial to identify, arbitrage opportunities in the second and third tests involving the SET50 component stocks are not. Numerical optimization techniques are needed in the latter case. In particular, conic optimization and convex quadratic programming are used in formulating the research questions in the second and third tests.

The use of conic optimization and quadratic programming in an index arbitrage study differentiates this research from previous works on index arbitrage. Moreover, this research is first to investigate the opportunities and profit of index arbitrage in the Thai markets.

This research paper is organized as follows. Section II reviews literatures on the applications of optimization techniques in finance and the investigation of index arbitrage. Section III introduces the three classes of financial securities involved in this study. Section IV discusses about the data and