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An alternative approach to evaluating the agreement between financial markets

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ABSTRACT

This research investigates that the price relationship between a stock index and its associated nearby futures markets can be explained by the cost-of-carry model using the concordance correlation (CC) coefficient in the US financial markets. The main purpose of this research is to confirm that the CC coefficient is an appropriate methodology to determine ex post arbitrage opportunities and to maximize ex ante arbitrage profits through the analysis of the price relationship derived from the cost-of-carry model. To increase the robustness of the results and to enable us to generalize our conclusions, this analysis is carried out in consideration of external uncertainty, including the marking-to-market procedure of futures contracts and the transaction cost on the stock index and its futures markets, under several assumptions related to the conditions of transactions. Examining transaction price data on the S&P 500 stock index and its futures markets shows that the CC coefficient gives a good result for ex ante arbitrage profits and is appropriate for analyzing the relationship between the observed stock index futures market price and its theoretical price derived from the cost-of-carry model.

1. Introduction

The price relationship between a stock index and its associated futures markets has been of interest to practitioners and researchers. Previous researches have investigated this relationship by dividing it

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into the price relationship between the observed stock index futures market price and its theoretical price derived from the cost-of-carry model, and the lead–lag relationship between the stock index and its associated nearby futures prices. The first topic, the price relationship based on the cost-of-carry model, has mainly been studied using the concept of relative mispricing (RM), e.g., by MacKinlay and Ramaswamy (1988), Yadav and Pope (1994), Bühler and Kempf (1995), Butterworth and Holmes (2000), and Bialkowski and Jakubowski (2008). Analyses of the second topic, the lead–lag relationship between the underlying asset market and its derivatives market, can be found in Stoll and Whaley (1990), Fleming et al. (1996), and Pizzi et al. (1998). These analyses are mainly conducted by using various methodologies, such as regression analysis, GARCH type models, the vector autoregressive (VAR) model, and the vector error correction model (VECM), in previous researches. This research focuses on the first topic related to the cost-of-carry model. In particular, this research explores the existence of mispriced futures contracts by computing the difference between the observed stock index futures market price and its theoretical price derived from the cost-of-carry model and tests whether arbitrageurs can earn arbitrage profits in real financial markets using the information of mispriced futures contracts.

Most previous researches on mispriced futures contracts have been conducted using the concept of RM. Such researches test whether arbitrageurs can determine ex post arbitrage opportunities and earn arbitrage profits by computing RM. However, RM has several limitations. The typical first limitation is that RM only offers very short-term information about the relationship between the observed stock index futures market price and its theoretical price. The arbitrage profits from arbitrage trading based on the information related to RM can be uncertain and risky if an order execution lag exists.[1,2] Therefore, if an order execution lag in arbitrage trading exists, the value of the information indicated by RM decreases, and the risk associated with the order execution lag increases. The second limitation is that the range of RM is theoretically from $-\infty$ to ∞. Due to this limitation, it is difficult for the value of RM to have an absolute meaning, and it is thus impossible to compare the degree of mispricing between financial markets or between trading periods using the magnitude of RM. Accordingly, this research suggests another methodology, which is called the concordance correlation (CC) coefficient, to make up for the limitations of RM.

This research focuses on the analysis of the price relationship derived from the cost-of-carry model using the CC coefficient. This research examines whether the results of the difference between the observed stock index futures market price and its theoretical price analyzed by the CC coefficient can provide useful information for the trading strategy of investors in real financial markets. In order to do this analysis, this research determines ex post arbitrage opportunities, and then examines whether arbitrageurs can earn ex ante arbitrage profits from transactions at the time to indicate ex post arbitrage opportunities. Also, this research conducts a comparison between ex ante arbitrage profits drawn from the CC coefficient and those drawn from absolute average relative mispricing (absolute average RM) based on the concept of RM to certify that ex ante arbitrage profits from a transaction at time to indicate ex post arbitrage opportunities determined by using the CC coefficient can really be increased relative to using absolute average RM. These analyses and comparisons were carried out in consideration of external uncertainty, such as the marking-to-market procedure or the transaction costs, under several assumptions related to conditions of transactions to increase the robustness of the results and enable us to generalize our conclusions.

The remainder of this paper is organized as follows. In Section 2, the S&P 500 stock index and its futures price data used in this paper are presented and the price relationship between the S&P 500 stock index and its futures markets based on the cost-of-carry model is described. Section 3 briefly introduces the CC coefficient as a new methodology for evaluating the degree of agreement between the observed stock index futures market price and its theoretical price. Section 4 explains the methods of determining ex post arbitrage opportunities and calculating ex ante arbitrage profits from

[1] An order execution lag mentioned by Bühler and Kempf (1995) is defined by the difference between the prices that originally indicated arbitrage opportunities and the prices at which arbitrage trading were executed.

[2] Nam et al. (2006) stated that an order execution lag can be observed in real financial markets because market friction, such as information asymmetry or various transaction costs, can delay the information reaction time at which new information is released in financial markets.