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Dynamic spillover effects in futures markets: UK and US evidence

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ABSTRACT

Previous studies on spillover effects in futures markets have so far confined themselves to static analyses. In this study, we use a newly introduced spillover index to examine dynamic spillovers between spot and futures markets volatilities, volume of futures trading and open interest in the UK and the US. Based on a dataset over the period February 25, 2008 to March 14, 2013, that encompasses both the global financial crisis and the Eurozone debt crisis, we find that spot and futures volatilities in the UK (US) are net receivers (net transmitters) of shocks to volume of futures trading and open interest. The analysis also sheds light on the dynamic interdependence of spot and futures markets volatilities between the US and the UK. Specifically, the spot and futures volatility spillovers between the UK and US markets are of bidirectional nature, however, they are affected by major economic events such as the global financial and Eurozone debt crises. Several robustness checks endorse our main findings. Overall, these results have important implications for various market participants and financial sector regulators.

1. Introduction

In the aftermath of the global financial crisis, the appetite for risk in financial markets decreased, as investors sought to rebalance their portfolios towards government bonds and other vehicles of safer investments and to hedge their risky positions in spot markets by opening the offsetting positions in futures markets. Thus, the importance of futures markets has grown over time and it has stimulated a renewed research interest in the theme. There is a large body of literature that studies various aspects of futures markets. The relation between spot and futures markets is dominated by the price discovery hypothesis (Chan, 1992; Ghosh, 1993) and the volatility spillover hypothesis (Tao & Green, 2012), accompanied by the "heat wave" and the "meteor shower" hypotheses (Wu, Li, & Zhang, 2005). The relation among price volatility, volume of trading and open interest gave rise to the sequential arrival of information (SAI) hypothesis (Copeland, 1976) and to the mixture of distributions hypothesis (MDH) (Clark, 1973).

A common feature of the previous empirical studies on the above hypotheses is that they have confined themselves to the examination of static spillover effects (see, for instance, Booth, Lee, & Tse, 1996; Hamao, Masulis, & Ng, 1990; Lin, Engle, & Ito, 1994; Rittler, 2012; Tao & Green, 2012; Tse, 1999; Wu, Li, & Zhang, 2005, among others). Put differently, previous studies do not investigate the dynamic spillover effects between futures return volatility and trading volume and futures return volatility and open interest. Therefore, previous studies do not consider whether shocks in one market could be attributed to time-varying spillovers within and between US (S&P 500) and UK (FTSE 100) futures return volatility, trading volume and open interest. This is particularly important as the use of an average measure of spillovers over a fairly long and turbulent period might mask potentially interesting information on secular or cyclical movements in spillover effects. Given that many changes took place over the period 2008–2013, such as the global financial crisis and the Eurozone debt crisis, the transmission mechanism across futures markets needs reconsideration. This study provides new empirical evidence on information transmission in stock index futures markets.

In particular, this study investigates the time-varying linkages between spot, futures, trading volume and open interest in the S&P 500 and FTSE 100 markets using the Diebold and Yilmaz (2009, 2012) models. The approach proposed by Diebold and Yilmaz (2009, 2012) is (i) particularly suited for the investigation of systems of highly interdependent variables, (ii) it conveniently allows the identification of the main receivers and transmitters of shocks over time and (iii) it takes into account the existing lead–lag relationships among the aforementioned variables. The aim of this study is to test the extent to which the spillover of volatility between futures and spot market is information

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driven. Put differently, this study examines the dynamic volatility spillover mechanisms and feedback effects between US and UK cash and futures markets within a generalized VAR framework.

This research contributes to the existing literature in four ways. First, we test for dynamic interdependence between spot and futures markets volatilities, volume of futures trading and open interest in the UK and the US. To the best of our knowledge, trade volume and open interest are not considered in earlier work on volatility spillovers between international stock index futures markets (Tao & Green, 2012; Wu, Li, & Zhang, 2005). While both volume of futures trading and open interest measure futures-trading activity, they represent different types of traders. In particular, open interest is thought to represent hedging activity, whereas volume of trading is mainly driven by speculative demand for futures (Bessembinder & Seguin, 1993). Building upon Bessembinder and Seguin (1993), this research uses both trade volume and open interest to study the interdependence between spot and futures volatility measures. Second, we examine volatility spillover effects in the UK and the US using the recent econometric methods developed by Diebold and Yilmaz (2009, 2012). By means of these methods, both dynamic and static volatility spillovers can be estimated thus extending the study of Rittler (2012). Third, we enrich the state of knowledge about the futures markets developments by scrutinizing the period following the global financial crisis. Finally, we evaluate the information content of volume of trading and open interest in forecasting spot and futures return volatilities (Donaldson & Kamstra, 2005; Le and Zurbruegg, 2010). Importantly, forecasts of futures volatility can be used for the pricing of futures options.

The empirical findings of this study can be summarized as follows. First, spot and futures volatilities in the UK (the US) are net receivers (net transmitters) of spillovers to volume of futures trading. Second, shocks to volume of futures trading significantly contribute to the forecast error variance of open interest. Third, we find evidence of bidirectional interdependence between spot and futures volatilities in the UK and the US, which is affected by major economic events, such as the global financial crisis and the Eurozone debt crisis. Overall, there is evidence of spillovers within the volatility–volume–open interest relations. These findings are helpful to financial analysts, professional forecasters and risk managers dealing with futures markets, as well as financial sector regulators. For instance, the finding that volume of futures trading has a greater forecasting ability than open interest can be used by professional forecasters to improve the accuracy of their forecasts. Similarly, risk managers might be interested in exploring the information content of international volatility spillovers in forecasting the risk of investment in spot and futures markets. Furthermore, the finding that spot and future volatilities in the UK are net receivers of spillovers from volume of futures trading can raise concerns of the Financial Conduct Authority, a regulator of the financial services industry in the UK. Risk managers (financial analysts) can use the knowledge of futures volume in the UK and of spot and futures markets volatilities in the US to design optimal hedging strategies against undesired movements (provide a comprehensive analysis of an investment opportunity) in cash and futures markets in the UK.

The rest of this paper is organized as follows. Section 2 presents a literature review. Section 3 describes the data used, while Section 4 presents the econometric methodology employed. Section 5 reports the empirical results. Section 6 concludes the paper and discusses points for further research.

2. Literature review

The advent of futures markets opened up new opportunities for traders, investors and researchers. Specifically, researchers find that stock index futures markets incorporate market-wide information more efficiently (Bohl, Salm, & Schuppli, 2011) and more quickly (Brooks, Rew, & Ritson, 2001; Chou & Chung, 2006; Koutmos & Tucker, 1996; Pizzi, Economopoulos, & O'Neill, 1998; Stoll & Whaley, 1990; Tse, 1999) than spot markets. The issue of information transmission between spot and futures markets is of interest to financial analysts and policy makers. Numerous studies investigate how information from one market is transmitted to another; empirical investigation of this issue commonly focuses on the price discovery and volatility spillovers.[1]

Price discovery is the process by which a market (usually the futures markets) reflects new information before another related market (usually the spot market), (see, for instance, Sutcliffe, 2006). In general, futures markets play a price discovery role, implying that futures prices contain useful information about cash prices; therefore, arbitrage opportunities exist (Floros & Vougas, 2008). Several studies examine the empirical relationship between the spot and futures markets and provide evidence on the dominant role of futures in the price discovery process (Chan, 1992; Ghosh, 1993). In general, empirical studies find that futures returns lead spot returns (Floros & Vougas, 2008; Kawaller, Koch, & Koch, 1987; Ng, 1987; Stoll & Whaley, 1990).

Further, volatility spillover hypothesis exists "if volatility spillovers are combined with asymmetries, a bad news shock in either market may increase volatility and its persistence in both markets" (Tao & Green, 2012). Most articles use GARCH-family models to examine the volatility spillovers between spot and futures markets (see Booth, Lee, & Tse, 1996; Hamao, Masulis, & Ng, 1990; Lin, Engle, & Ito, 1994; Rittler, 2012; Tse, 1999). They report spillovers from the futures to the spot market. Wu et al. (2005) examine information transmissions between the S&P 500 and FTSE 100 index futures and find that the volatility of the US market is affected by the most recent volatility surprise in the UK market. They report no significant lagged spillovers in the conditional mean returns.[2] Recently, Tao and Green (2012) find significant volatility asymmetries in both the FTSE 100 cash and stock index futures prices. In contrast to the aforementioned articles, Gannon and Choi (1998) and Gannon (2005) use a system of simultaneous equations to identify contemporaneous volatility spillover effects between the Hang Seng stock index spot and futures volatilities and the overnight S&P 500 stock market index futures volatility. In particular, Gannon (2005) documents significant volatility spillover effects from the US to Hong Kong stock index futures markets. However, volatility spillover effects are not studied among two important financial variables: trading volume and open interest.

An important aspect of volatility is its relation to liquidity variables, such as trading volume and open interest (see Martinez & Tse, 2008). Trading volume has been widely used as a measure for the rate of information arrival; it is the number of transactions in a futures contract during a specified period of time (see Sutcliffe, 2006). Trading volume is viewed as a proxy for new information, consistent with the sequential information model (Copeland, 1976) and the mixture of distributions hypothesis (Clark, 1973); these theories predict a positive relationship between daily volume and volatility (see, for example, Kawaller, Koch, & Koch, 1990; Kawaller, Koch, & Peterson, 1994; Locke & Sayers, 1993; Wang & Yau, 2000 for US, and Ap Gwilym, McMillan, & Speight, 1999; Board & Sutcliffe, 1990 for UK). Trading volume measures speculative demand for futures (Lucia & Pardo, 2010). Further, open interest is an important variable and is regarded as a proxy for dispersion of beliefs (Bessembinder, Chan, & Seguin, 1996; Mougoué & Aggarwal, 2011); it is an important determinant of volume (Mougoué & Aggarwal, 2011). Open interest is the total number of futures contracts which have not been closed out (i.e. it is equal to the sum of either the outstanding long positions or the sum of the outstanding short positions); see Sutcliffe (2006). According Aguenaou, Ap Gwilym, and Rhodes (2011), open interest is an indicator of sentiment in futures markets. It is also

[1] Futures markets perform the main functions of risk transfer and price discovery (Silber, 1985). Further, volatility spillovers between spot and futures markets "play an important role in managing risk for portfolio managers and assessing market stability for policy makers" (Pati & Rajib, 2011) in returns.

[2] Their results support a "heat wave" hypothesis for returns (i.e. information affects one part of the Earth only) and a "meteor shower" hypothesis for volatility (i.e. information arrives on the Earth like a meteor shower) across markets (Wu, Li, & Zhang, 2005).

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