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The dynamic relations among return volatility, trading imbalance, and trading volume in futures markets

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Abstract

Trading imbalances reflect the quality of market information and may contain more information than the number of trades or trading volume. In order to better understand how trading imbalances play a role different from traditional variables (i.e., number of trades and trading volume) in explaining volatility, we use intraday data to examine the dynamic relations among return volatility, trading imbalances, and traditional variables for E-mini S&P 500 futures and Japanese Yen futures contracts, respectively. The Granger-causality tests indicate strong feedback effects between volatility and trading variables, confirming the information-based and hedging-based trading. We also compare the results of the traditional volumes and trading imbalances through variance decomposition and impulse responses analysis. It is shown that the sequential arrival of private information through trading imbalance is more important in explaining return volatility than the traditional variables, which are a proxy for the public information.

Keywords: Trading imbalance; Information-based trading; Hedging-based trading; Granger-causality test; Impulse response analysis

1. Introduction

New information releases usually prompt heavy trading and volatility shocks. Many studies, including Clark [2], Tauchen and Pitts [13], Jones et al. [9], Andersen [1], Xu et al. [15], and Ludvigson and Ng [10], have examined the volatility–volume relation that is related to the information-based hypothesis. Since trade occurs at the time of public information releases, the number of trades or the trading volume used in the literature in the analysis of volume–volatility relation can be viewed as a proxy for the public information.

In an asymmetric information environment, informed traders conduct trades that are closely related to private information. If more informed traders are confident of the information they possess, their orders will cluster on one side of trading and will cause a greater trading imbalance, thereby inducing a drastic change in asset prices. Trade imbalances reflect the quality of information, which is private, and hence affects the pricing dynamics. That

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is, trading imbalance, which can be used as a proxy for private information incorporating net of buy and seller orders, may be different from the number of trades or the trading volume, a proxy for the public information on asset pricing.

The analysis of the relations between trading imbalance and volatility is limited in the literature, with the exception of Chan and Fong [3] and Wu and Xu [14].[3] In this paper, we use a vector autoregressive (VAR) model to conduct Granger causality tests on the relations between asset volatility and different trading variables for the E-mini S&P 500 futures and Japanese Yen futures markets. Particularly, we examine whether futures trading is driven by information-based or by hedging-based trading. We also use the variance decomposition and impulse response functions to shed light on the speed of information adjustment in futures markets. The paper is of interest for several reasons.

First, unlike previous studies which often examine volatility–volume relation through trading volume or the number of trades (Sarwar [11], Fung and Patterson [6,7], Jones et al. [9], and Darrat et al. [4]), we include another important factor, trading imbalance, to examine how trading imbalance plays a role in volatility behavior together with volume. This analysis helps us understand better the volume–volatility relation.

Second, we analyze the futures market instead of the spot market because traders (especially informed traders) may be more attracted to the futures markets than the spot markets because of their low transaction costs and fast price discovery. In particular, the minute-by-minute data of the futures markets may capture releases of more private information through the trading imbalance variables than the daily spot data, and thereby allows us an examination of the speed of adjustment for shocks in the futures markets.

Third, most studies examining volatility–volume relations are based on information-based trading, presuming the unidirectional link from trades to return volatility. Different from the spot market, futures market not only provides speculative (information) function for investors, it also has a hedging function. That is, greater volatility in the futures market (reflecting the greater price uncertainty of the cash market) triggers an increased use of futures contracts or more futures trading. This result would support the hypothesis of the hedging-based trading hypothesis because traders use the futures market to hedge the spot market volatility.

On the other hand, if traders base information to trade in the futures markets and the volatility increases as a result of the trading activity, this relation supports the hypothesis of information-based trading. Granger-causality tests on the volatility-trade relations would enable us to understand better the hedging-based and information-based hypotheses in the futures markets.

The paper is organized as follows. In the next section, we describe the data and methodologies. Details of our proposed trading imbalance metrics and the empirical VAR models (including Granger-causality test, variance decomposition and impulse response analysis) are explained. Empirical results are presented and discussed in Section 3. Section 4 summarizes and concludes the paper.

2. Data and methodology

2.1. Data

We use the intraday Up/Down Tick Data in E-mini S&P 500 index futures and Japanese Yen Foreign Exchange (FX) futures, which are traded on the Chicago Mercantile Exchange (CME). Both futures contracts are actively traded index futures and foreign exchange futures contracts traded at the CME. Focusing on these contracts allows us to minimize possible bias caused by infrequent trading.

At the CME, futures are traded by open outcry on the floor of the exchange in the futures pits, and also electronically on the GLOBEX trading system. The E-mini S&P 500 futures and JY FX futures are traded on GLOBEX (Chicago Mercantile Exchange's platform) and for almost 24 h a day. Since the tick number (or volume) for E-mini and JY futures before the opening and after the closing of the floor-traded futures markets is relatively small, our empirical analysis focuses on the regular trading time only.[4]

[3] Chan and Fong [3] found that order imbalance explains a substantial portion of daily price movement. Wu and Xu [14] showed that trading imbalances have strong explanatory power on modeling return volatility.

[4] The regular trading time of the S&P 500 index runs from 8:30 to 15:15; JY FX open-outcry trading is from 7:20 until 14:00.