1995年度日本オペレーションズ・リサーチ学会
秋季研究発表会

Granger Causality/Block Exogeneity Test between Stock Returns and Volume[1]

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To research relationship between returns and the state variables is one of the main area of empirical finance. In this paper, we investigate the relationship between returns and trading volume in Tokyo Stock Exchange. There has been many empirical analysis regarding this theme. See Karpoff (1987) for a survey. But most of previous research examine the temporal relationship, hence we pay attention to the dynamic relation between returns and trading volume in this research. Granger (1969) proposed a idea and testing methodology of statistical causality, we test for the Granger causality between daily returns and trading volume.

There are several and serious econometric issues in testing for Granger causality. The first is the effect of nonstationarity on the estimated parameters of VAR model. Traditional causality tests assume the variables to be weakly stationary. But as Sims, Stock, and Watson (1990) and Toda and Phillips (1993) point out, the usual Wald statistic for Granger noncausality based on levels VAR's not only has a nonstandard asymptotic distribution but depends on nuisance parameters in general if the process is $I(1)$. It is well known that trading volume is highly persistent, hence traditional causality tests based on stationary VAR model may fail in detecting causal relationship correctly.

The second is the power of the test in linear setting against the nonlinear causal relations. Baek and Brock (1992a,b) show the example that can fail to be detected in linear VAR model. If the true relaion between returns and trading volume is nonlinear, we can not infer the true relationship from the data.

In this paper, we test for linear and nonlinear Granger causality between returns and trading volume. In linear setting, we use the test method recently proposed by Toda and Yamamoto (1995). After determining a lag length k, we estimate a $(k + d_{\max})$th-order levels VAR system via ordinary least squares, where $d_{\max}$ is the possibly maximal order of integration, and test linear restrictions on the coefficients by a battery of Wald Statistics. Next, in nonlinear setting, we use the test statistic introduced by Baek and Brock (1992a) and developed by Hiemstra and Jones (1994). This statistic is based on the correlation integral (Grassberger and Procaccia (1983)), which is a measure of nonlinear spatial correlation, and a multivariate extension of the BDS statistic (Brock, Dechert, and Scheinkman (1987).

The detail empirical result will be presented in the conference.

[1]The full paper is available on request.

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