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The overnight effect on the Taiwan stock market

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ABSTRACT

This study examines statistical regularities among three components of stocks and indices: daytime (trading hour) return, overnight (off-hour session) return, and total (close-to-close) return. Owing to the fact that the Taiwan Stock Exchange (TWSE) has the longest non-trading periods among major markets, the TWSE is selected to explore the correlation among the three components and compare it with major markets such as the New York Stock Exchange (NYSE) and the National Association of Securities Dealers Automated Quotation (NASDAQ). Analysis results indicate a negative cross correlation between the sign of daytime return and the sign of overnight return; possibly explaining why most stocks feature a negative cross correlation between daytime return and overnight return [F. Wang, S.-J. Shieh, S. Havlin, H.E. Stanley, Statistical analysis of the overnight and daytime return, Phys. Rev. E 79 (2009) 056109]. Additionally, the cross correlation between the magnitude of returns is analyzed. According to those results, a larger magnitude of overnight return implies a higher probability that the sign of the following daytime return is the opposite of the sign of overnight return. Namely, the predictability of daytime return might be improved when a stock undergoes a large magnitude of overnight return. Furthermore, the cross correlations of 29 indices of worldwide markets are discussed.

1. Introduction

Price dynamics of financial markets has received extensive interest among economists [1–8] and physicists [9–32]. Of relevant concern is the collective motion of financial markets. The typical variable for quantifying the price dynamics is the return [1,10,33,11]. Analyzing the return time series may allow investors to estimate risks and optimize portfolios. Statistical properties of the returns of daily data [16,21,27,28,31] or high-frequency intraday quotes [13,15,17,20,29] have been extensively studied. For instance, based on detrended cross-correlation analysis [32], Podobnik et al. [27] found a power-law cross-correlation between the absolute values of both price changes and volume changes. An approximate inverse cubic law in trading volume changes was also observed.

Financial market studies focus mainly on characterizing the features of stocks and then predicting the behavior of financial markets. Related studies normally analyze a price time series which does not include non-trading time. However, during non-trading periods, current events and information still affect the markets. Thus, the overnight effect on the financial markets must be considered to increase forecasting accuracy.

Most studies on overnight return were published in economic journals. Guner and Onder examined the price of daily stock data and returns during trading and non-trading hours for securities on the Istanbul Stock Exchange [2]. Tsutsui examined daily data of the Nikkei Average, indicating that trading and non-trading hours differ in rates of changes [5]. Barclay and Hendershott compared trading mechanisms with non-trading ones on NASDAQ [6]. This issue has seldom been addressed based on econophysical analysis. Wang et al. studied the statistical distribution and correlations among total return (close-to-close), overnight return (close-to-open), and daytime return (open-to-close) of 2215 stocks in New York Stock Exchange

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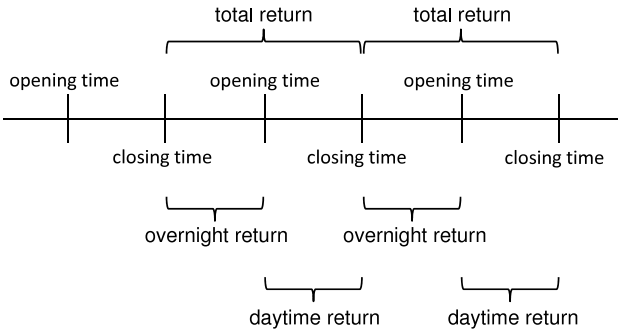

Fig. 1. Illustration of the definition of the three types of returns.

(NYSE) from 1988 to 2007 [28]. In addition to a strong cross correlation between daytime returns and total returns that study found that daytime returns and overnight returns tended to be anti-correlated. Above studies generally focused on how price returns during trading hours and overnight price returns during non-trading periods differ. This study attempts to determine how non-trading periods affect the subsequent trading hours.

Although, most econophysical studies in the recent decade have focused only on main markets or large capitalization markets, many financial markets have adopted electronic trading systems to increase efficiency and disclose trading information. Thus hot money not only flows in local markets, but also inflows emerging or small capitalization ones, which leads to the important question "What is the overnight effect on price returns in different markets?". This study analyzes the datasets of stocks in NYSE and NASDAQ (i.e. large capitalization markets), and the Taiwan stock exchange (TWSE) (i.e. a small capitalization market). Established on February 9, 1962, TWSE had a market capitalization value of US$837710.9 million in April 2011 (i.e. the world's 22nd-largest domestic market capitalization globally), according to the World Federation of Exchanges (WFE) database. TWSE thus has a typically smaller market capitalization than that of NYSE (US$14721845.3 million) and NASDAQ (US$4195339.3 million). Moreover, the trading period of TWSE lasts from 9:00 to 13:30. The non-trading period is longer than that of major markets, implying that more events and news might occur during non-trading periods.

2. Data analysis

This study collected the daily opening price and closing price of stocks from three distinct markets: (a) 755 stocks in TWSE, a major stock market in Asia with shorter trading hours globally; (b) 2478 stocks in NYSE, recording trades for all securities in the United States stock markets; and (c) 2590 stocks in NASDAQ, the largest electronic screen-based equity securities trading market in the United States. This study did not analyze the quotes before August 2, 1993, largely owning to the fact that the electronic trading system of TWSE was upgraded to a fully automated securities trading (FAST) system in 1993. Thus, the study period here lasted from January 1, 1994 to April 30, 2011. The length of stocks ranges from 327 to 4513 trading days, which exclude the latest listed companies after 2010. Additionally, many companies had splits in our concerning period, possibly causing considerable returns. Thus these returns are selected based on the historical splits.

For each stock, two typical variables are defined in this study to quantify the stock price dynamics, i.e. return R and volatility V, which are the logarithmic change in price and the absolute value of the logarithmic change, respectively. The overnight effect on daily and intraday change is studied by focusing on three types of returns: (a) total return, i.e. logarithmic change in successive closing prices,

$$R_T(t) \equiv \ln(p^{\text{close}}(t)/p^{\text{close}}(t-1)); \tag{1}$$

(b) daytime return, i.e. logarithmic change over the trading hours,

$$R_D(t) \equiv \ln(p^{\text{close}}(t)/p^{\text{open}}(t)); \tag{2}$$

and (c) overnight return, i.e. logarithmic change over non-trading periods,

$$R_N(t) \equiv \ln(p^{\text{open}}(t)/p^{\text{close}}(t-1)). \tag{3}$$

Here, $p^{\text{open}}(t)$ and $p^{\text{close}}(t)$ individually refer to the opening price and closing price on trading day t. Fig. 1 illustrates the chronological sequence of the opening and closing times on a daily time frame. $R_D(t)$ followed $R_N(t)$, and $R_D(t)$ and $R_N(t)$ are in the same day, in other words, $R_T(t) = R_N(t) + R_D(t)$. The corresponding volatilities to the three types of returns are total return V_T, daytime return V_D, and overnight return V_N, which are defined as the same in Ref. [28],

$$V_T(t) \equiv |R_T(t)|, \tag{4}$$

$$V_D(t) \equiv |R_D(t)|, \tag{5}$$

$$\text{and} \quad V_N(t) \equiv |R_N(t)|. \tag{6}$$