

Strategy switching in the Japanese stock market

要約

This paper discusses the expectation formation process of Japanese stock market professionals and how their expectations are related to larger fluctuations of the TOPIX price than those of economic fundamentals. By utilizing a monthly forecast survey dataset on the TOPIX distributed by QUICK Corporation, we sort forecasters into buy-side and sell-side professionals. We first demonstrate that the buy-side and sell-side professionals use both fundamental and technical trading strategies throughout their expectation formation processes and that they switch between fundamental and technical trading strategies over time. We then empirically show that strategy switching is key in understanding the persistent deviation of the TOPIX from the fundamentals.

JEL Classification: G17, G12

Keywords: Strategy switching, agent-based modeling, survey data, expectations, Japanese stock market

報告論文予稿

Since the financial market liberalization of the 1990s, we have observed remarkable increase in trading volume by institutional investors in the Japanese stock market, who have been seeking short-term profits. Certain previous empirical studies show that the short-term trading, simultaneously conducted by institutional investors, is primarily responsible for destabilizing the stock markets that often involves large deviations of the stock price from the fundamental value.¹ Practitioners try to determine the sources of the unstable stock price movements for better risk management in financial markets. The liberalization of global financial markets, which increases the number of market participants, indicates that investors' expectations are more likely to be incorporated into the asset prices than in the pre-liberalization periods. Therefore, better explanations of the expectation formation process of investors and how investors' expectations are related to asset price movements can facilitate better understanding of the sources of risk in financial markets. This paper provides empirical evidence for understanding both the determinants of expectations and the causes of stock price movements by using a monthly forecast survey dataset on the TOPIX distributed by QUICK Corporation, a Japanese financial information vendor in the Nikkei Group.

We first demonstrate that the professionals involved in the Japanese stock market utilize both fundamental and technical trading strategies in their expectation formation processes and that they switch between fundamental and technical trading strategies over time. We then empirically show that the strategy switching is key in understanding the persistent deviations of the TOPIX price from the fundamental value. Our conclusions are consistent with what several agent-based models predict and are presented as follows. Recent agent-based theoretical models successfully explain the causes of stock market instability, such as larger price fluctuations than those of the fundamental price, that are still not sufficiently explained with traditional asset-pricing models using efficient market and rational expectation hypotheses.² Many agent-based theoretical models assume that agents form their expectations by combining several investment strategies. Stock market instability is explained in an environment in which

¹ Several recent studies, such as Chen, Jegadeesh, and Wermers (2000), Nofsinger and Sias (1999), Sias (2004), and Wermers (1999) show a strong positive correlation between institutional ownership and stock returns. Shiller (1981) measures the fundamental price and demonstrates that the stock price often deviates from the fundamental price and that its variations are much greater than those of the fundamental price.

² Agent-based models also replicate volatility clustering, fat tails of return distribution, nonzero volume, autocorrelations of volume, and positive, contemporary cross-correlations between the volume and the squared returns. Hommes (2006) and LeBaron (2006) survey the literature on agent-based computational finance and explain its usefulness in generating financial market phenomena.

agents switch the level of dependence on the strategies over time. Standard agent-based models, popularly exemplified by a model created by Brock and Hommes (1998), assume that agents combine fundamental and technical trading strategies in their forecasting. Investors using the fundamental strategy expect that future prices will always hover around the fundamental or intrinsic value of the asset, which is often measured by a firm's earnings or dividends. The technical trading strategy is developed using past price information, and it suggests that expectations are positively correlated to recent price movements if agents are momentum traders and that they are contrarians when the relation is negative. The models demonstrate that when most agents select the technical strategy, the stock market tends to be unstable, which explains the phenomena of the larger deviations from the fundamental price such as bubbles and crashes. Conversely, when most agents adopt the fundamental strategy, the market will be stabilized, moving the market price back to the fundamental price and leading the market to be informationally efficient. Standard agent-based theoretical models demonstrate that investors interchangeably utilize the two strategies over time, and this "strategy switching" is a major factor in explaining unstable price movements of financial assets.³ Our paper provides empirical evidence on strategy switching in Japanese stock markets, and we further demonstrate that the strategy switching explains persistent price deviations from economic fundamentals well.

We explore them by sorting forecasters into buy-side and sell-side professionals.⁴ Buy-side professionals are those who work for investment institutions, such as mutual funds, pension funds, and insurance firms, which purchase securities on their own account. Sell-side professionals work for companies that sell investment services to asset management firms, or buy-side professionals, and provide research including their recommendations to their clients.⁵ We empirically identify the strategy switching of buy-side and sell-side professionals, and we demonstrate that their strategy switching explains persistent price deviations from economic fundamentals. Previous studies on expectation formations focus on measuring the characteristics of the central tendency of the forecasts.⁶ However, the distribution of the forecasts may not be symmetrical, and the distribution may vary over time. Thus, if we use the measure of the central tendency of the forecast series, we cannot characterize the expectation formation of professionals forecasting differently from the average, and will not be able to identify the types of professionals who are actually destabilizing the market.

Most significantly, this paper contains the following five contributions. First, this paper validates the strategy switching and demonstrates the significant relation between the strategy switching and stock market instability, which is an important contribution of several agent-based models to the literature. Some laboratory experiments with human subjects support this important observation in theoretical agent-based stock markets.⁷ In addition, some survey studies in financial markets provide evidence of strategy switching among the market professionals.⁸ Although we have seen theoretical and laboratory work, direct evidence is still required to empirically support strategy switching and its contribution in generating the empirical features of stock markets.

³ Kirman (1991), and Lux and Marchesi (1999) also explain the strategic interactions and volatility. In addition, Chiarella, Iori, and Perelló (2009) and Farmer and Joshi (2002) show that trend-following strategies amplify noise and cause stylized phenomena in financial markets such as excess and clustered volatility.

⁴ Pfajfar and Santoro (2010) sort forecasters' expectations in each period in ascending order with respect to value, and they construct time series of percentiles from the empirical distribution. They adopt the approach of investigating the effect of strategy switching on inflation expectations.

⁵ For more information on the different activities in which buy-side and sell-side professionals engage, see Groyberg, Healy, and Chapman (2008) and Busse, Green, and Jegadeesh (forthcoming).

⁶ For example, see Branch (2004), Brown and Cliff (2004), Lux (2009), and Verma, Baklaci, and Soydemir (2008).

⁷ See, for example, Hommes, Sonnemans, Tunstra, and van de Velden (2008) and Heemeijer, Hommes, Sonnemans, and Tuinstra (2009).

⁸ In the literature on foreign exchange markets, Frankel and Froot (1990) empirically show strategy switching, while Boswijk, Hommes, and Manzan (2007) investigate it in the US stock market. In the literature on inflation expectations, Branch (2004) and Pfajfar and Santoro (2010) provide empirical evidence that agents switch prediction regimes using a survey on inflation expectations.

Second, we empirically identify the types of professionals who actually switch the strategies and destabilize the market. Previous research on agent-based models concludes such investors' behavior to be key in explaining several empirical features in stock markets. Nonetheless, those papers identify neither the type of financial institutions to which those agents specifically belong nor their respective business categories.

Third, we empirically analyze the strategy switching by both buy-side and sell-side professionals. Several papers, such as Clement (1999) and Hong and Kubik (2003), investigate the behavior of sell-side investors from a cross-sectional viewpoint, but they exclusively focus on the sell-side professionals. Accordingly to Groysberg, Healy, and Chapman (2008), this is due to a lack of data on buy-side professionals. Within the relatively limited amount of research conducted on buy-side professionals, Cowen, Groysberg, and Healy (2006) and Groysberg, Healy, and Chapman (2008) examine the forecasts made by both buy-side and sell-side professionals but do not characterize the strategy switching by buy-side and sell-side professionals. In addition, by analyzing the expectation formations by types, we can characterize the forecast behavior of professionals expecting different from the cross-sectional average of the forecasts.

Fourth, we validate the strategy switching in the Japanese stock market at a monthly frequency. Boswijk, Hommes, and Manzan (2007) find strategy-switching behavior at a yearly frequency. But it still remains unknown at what frequency stock investors actually change their strategies.

Fifth, we demonstrate that the professionals in the Japanese stock market have systematic prediction biases and anchoring in some observable priors, contradicting the prediction of the efficient market hypothesis. Our results indicate that professional forecasters combine technical and fundamental strategies, meaning that they refer to past price information in predicting future prices. The efficient market hypothesis suggests that a market is informationally efficient when the market price, or current price, already reflects all known information at any point in time. The beliefs of all investors regarding future prices are fully incorporated into the current price. Thus, the market price is an unbiased estimate of the true asset value in the sense that past price information cannot be further used to predict future prices. While Shiller (1999) argues that past price information helps to explain current prices in stock markets, several studies that examine this hypothesis by using survey data for professional forecasters have indicated systematic prediction biases. Our empirical results are consistent with the findings of laboratory studies conducted by Kahneman and Tversky (1973). Thus, our results help to improve the robustness of the findings of these studies by using survey data for Japanese stock markets.

Boswijk, Hommes, and Manzan (2007) provide evidence of strategy switching in stock markets. They estimate Brock and Hommes's (1998) type of agent-based model in which agents switch their strategies between fundamental and trend-following regimes based on recent past performance. They use the yearly S&P 500 and the corresponding earning data from 1871–2003 and show that trend-following behavior explains the persistence of the deviation of stock prices from their fundamental value, which is estimated based on the Gordon growth model using earnings data, while the fundamental strategy tends to revert the prices back to their historical mean.

Our paper differs from that of Boswijk, Hommes, and Manzan (2007) as follows. First, we characterize expectation formations of the buy-side and sell-side professionals. Thus, we demonstrate the mechanisms of the strategy switching by different types of professionals. Second, Boswijk, Hommes, and Manzan (2007) assume an agent-based model in estimating strategy switching such that the market is in equilibrium, on average. As we see in the following section, we follow the approach of Boswijk, Hommes, and Manzan (2007) to derive a fundamental price and construct a fundamental strategy. However, our estimation equation is not an equilibrium pricing equation; rather, it uses forecast survey data for stock market professionals to investigate strategy switching. Thus, compared to Boswijk, Hommes, and Manzan (2007), we impose fewer assumptions in validating strategy switching.

Empirical model

We estimate the following model for each type i to validate the strategy switching.

$$\ln\left(\frac{{}_tF_{t+1}^i}{P_t}\right) = \alpha_0^i + \sum_{n=1}^N \alpha_n^i \ln\left(\frac{{}_{t-n}F_{t+1-n}^i}{P_t}\right) + (1 - n_{Tc,t}^i) \beta_F^i \ln\left(\frac{P_t^*}{P_t}\right) + n_{Tc,t}^i \beta_{Tc}^i \ln C_t^i + \varepsilon_t^i \quad (1)$$

The left-hand side is the forecasted variable. We denote that ${}_tF_{t+1}^i$ is the average one-month-ahead forecast made by type i at t where i = buy-side professionals or sell-side professionals. We define P_t as a monthly stock price and the stock price preceding the prediction date. The first and second terms in the right-hand side are a constant term and the lagged observations with order N , respectively. We add autoregressive components because the forecasts are likely to have persistently upward biases. We focus on the one-month-ahead forecast to avoid the overlapping forecast problem, in spite of the fact that the QUICK dataset contains one-month-, three-month-, and six-month-ahead forecasts. The third term on the right-hand side represents the fundamental strategy, while the fourth term on the right-hand side represents the technical strategy. $\ln\left(\frac{P_t^*}{P_t}\right)$ is a fundamental indicator measuring the deviation of the

preceding price from the fundamental or intrinsic value P_t^* , while $\ln C_t^i$ is a technical indicator measuring the recent price trend, both of which are defined in more detail in the paper.

β_F^i and β_{Tc}^i are coefficients of the fundamental and technical trading strategies, respectively, for type i . When β_F^i is positive, forecasts based on the fundamental strategy are made around the fundamental value. For example, if professionals use the fundamental strategy and the most recent price is below the fundamental price, they expect that the future price will move back toward the fundamental price, so they predict upward price movement, and vice versa. When β_{Tc}^i is positive, investors extrapolate the future path of the stock price in accordance with the past trend. They are contrarians when β_{Tc}^i is negative, predicting a turning point in the price trend. We assume that professionals utilize both fundamental and technical trading strategies to reflect investors' realistic behavior, as found in some studies on surveys of financial market participants, such as Lui and Mole (1998) and Menkoff and Taylor (2007).

$(1 - n_{Tc,t}^i)$ and $n_{Tc,t}^i$ are the fractions of professionals in type i , who utilizes the fundamental and technical trading strategies in forecasting, respectively, ranging from 0 to 1. In the paper, we formulate $n_{Tc,t}^i$ by assuming that professionals evaluate past performance every month and they switch between fundamental and technical trading strategies over time, hoping to obtain better performances in the future. The strategy switching suggests that this variable $n_{Tc,t}^i$ changes over time. We define the details in the paper regarding (1) the fundamental price P_t^* ; (2) technical indicator $\ln C_t^i$; (3) the fractions of the fundamental and technical trading strategies $(1 - n_{Tc,t}^i)$ and $n_{Tc,t}^i$; and (4) order N in the autoregressive components, in order.

Summary of the results

We first estimate our empirical model, i.e., equation (1), by nonlinear least squares (NLLS) after determining appropriate lag lengths for N , selected independently by AIC and BIC for buy-side and sell-side professionals. We find that parameter estimates of the fundamental and trend-following are both significantly positive for buy-side and sell-side professionals. We plot the fitted value of $n_{Tc,t}^i$ (i.e., fraction of professionals in type i utilizing the technical trading strategy). We validate the strategy switching, because the fitted value of $n_{Tc,t}^i$ varies by time.

Standard agent-based models, such as that of Brock and Hommes (1998), predict that the trend-following strategy can be a key factor generating unstable phases in the economy, while the fundamental strategy contributes to stabilizing price fluctuations. As more agents adopt trend-following strategies, the price moves away from the fundamental price and the price deviations persist. During the period of persistent price movements, the trend-following strategies produce better forecast performances, which results in more investors choosing the trend-following strategies. Thus, the trend-following strategies reinforce the deviations. When the price deviates much from the fundamental price, agents tend to predict the price reverting to the fundamental price. As more agents choose the fundamental strategy, the price goes back to the fundamental price. This implies that there is a positive correlation between the fraction of professionals *in the market* utilizing the trend-following strategy and the price deviation from the fundamental price. We investigate the dynamic relation between the fraction and the price deviation from the fundamental price. Consistent with earlier research on agent-based theories, we find a significant influence of the fraction on the price deviation from the fundamental value.

To summarize, our paper demonstrates that the buy-side and sell-side professionals in the Japanese stock market utilize both fundamental and trend-following strategies in their forecasting and that they switch strategies over time. We also show that strategy switching by buy-side and sell-side professionals has a significant impact on the TOPIX price deviations from the fundamental value. Our findings help to validate strategy switching as well as its influences on the persistent deviations of the price from the fundamentals, which are important results in standard agent-based models, such as that of Brock and Hommes (1998).

Our paper tries to relate the stock price forecast series to the stock price dynamics. Therefore, our results suggest that the stock price forecast series can possibly be utilized to identify the shape of the return distribution. Since practitioners calculate the probability of large and small price movements from the tail of the return distribution, the thickness of the tail is important information for better risk management. Therefore, we can utilize the forecast series to provide a better idea on understanding the sources of risk in stock markets. One possible extension of our work involves relating the forecasts to the probability of the large stock price movements, and it is the subject of our future work.

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