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Abstract

This paper investigates the effect of foreign institutional investors on the stability of Chinese stock markets. Previous literature views this investor group as destabilizing feedback traders. We use the abolition of ownership restrictions on A shares as a natural experiment. There is strong evidence that foreign institutions have a stabilizing effect on Chinese stock markets and contribute to market efficiency. This finding is robust across exchanges, sample periods, size quintiles and alternative model specifications. By contrast, domestic investors appear to engage in positive feedback trading. Our results have important implications for market regulation.

JEL Classification: G14, G15, G18

Keywords: Foreign Institutional Investors, Feedback Trading, Chinese Stock Markets, Regulation, Ownership Restrictions

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1 Introduction

In rational models of stock price formation, investors base their decisions on fundamental asset values. In contrast to this view, the last two decades have seen a rapidly growing body of behavioral finance literature dealing with deviations from such rational behavior. Among other things, some stock market participants may base their investment decisions on past returns performance. Buying after prices have risen and selling in response to price declines irrespective of fundamental values is usually called positive feedback trading or momentum investing. The presence of positive feedback traders may destabilize stock markets by driving prices away from fundamentals (De Long et al., 1990b) and impeding arbitrage (De Long et al., 1990a; Brunnermeier and Nagel, 2004).

In the case of Chinese stock markets, there is widespread popular belief that the tremendous growth in recent years has attracted sentiment-driven investors. Eun and Huang (2007) for instance cite the Wall Street Journal (August 22, 2001) comparing domestic stock markets to "casinos, driven by fast money flows in and out of stocks with little regard for their underlying value." A voluminous literature suggests that domestic Chinese investors indeed engage in non-fundamental trading. Mei et al. (2005) analyze domestic investors' trading activity, building on a model where heterogeneous beliefs and short-sale constraints imply a positive relationship between a speculative stock price component and trading volume. Their empirical tests confirm that uninformed trading by domestic investors has an impact on bubbles in A-share prices. This is in line with conclusions from a recent paper by Fong (2008). He shows that A-share returns stochastically dominate B-share returns, which leads to a rejection of risk-based explanations of the A-share premium.

Furthermore, a number of studies provide evidence of herding and trend-chasing by domestic Chinese investors. Measures of return dispersion analyzed by Tan et al. (2008) indicate herding in both Shanghai and Shenzhen markets during the 1994 - 2003 period. Investors in A-share markets appear to herd in response to positive market returns, as well as high levels of trading volume and volatility. A recent contribution by Li et al. (2009) comparing volume-based herding measures for institutional and individual investors trading in the Shanghai A-share market arrives at similar conclusions. The authors also find that institutions herd more than do private investors and that institutional (individual) herding occurs primarily in small (large) stocks.

In related work studying the relationship between institutional transactions and volatility, Li and Wang (2008) argue that institutional investors have stabilized Chinese stock markets. They show that institutional investors engage in herding but not in momentum trading. However, their dataset only covers constituents of the Shanghai 180 index and does not distinguish between transactions of foreign and domestic institutions. Kling and Gao (2008) construct an index of Chinese institutional investors' sentiment. They present evidence that domestic institutional investor sentiment is driven by previous market returns, implying a positive feedback process. Finally, the study by Chen et al. (2005) looking at individual brokerage accounts finds that account holders buy stocks in response to short-term trends but care less about long-term past performance.

Summing up, there is a large body of evidence of sentiment-driven trading by Chinese domestic investors in the A-share market. Such trading activity may cause asset prices to deviate from their fundamental values, which leads to a distortion in investment and consumption decisions and a potential misallocation of capital. It also increases the probability of stock price bubbles and subsequent crashes. In this sense, sentiment traders may threaten financial stability and put economic development at risk.

At the same time, the rapid growth of the Chinese economy requires domestic firms to raise capital from abroad. Chinese regulators therefore had to open financial markets to foreign institutional investors. Moreover, foreign institutions were thought to follow rational long-term investment strategies dampening speculative activity (Walter and Howie, 2006). In the public debate about financial market liberalization, however, foreign institutional investors are often alleged to exert a potentially destabilizing influence on emerging financial markets. Such concerns are partly fueled by empirical evidence that capital flows are highly sensitive to past returns (Froot et al., 2001). In addition, a large body of literature argues that foreign institutional investors in emerging markets tend to herd and engage in positive feedback trading (Choe et al., 1999; Borensztein and Gelos, 2003; Kaminsky et al., 2004; Chen et al., 2008). These findings suggest that financial liberalization may have unintended consequences.

In this paper, we are interested in whether foreign investors indeed have a destabilizing effect on Chinese stock markets in terms of trend-chasing behavior. This issue is particularly relevant in the case of a transition economy that has gradually opened its financial markets to foreign capital while trying to maintain financial stability. The liberalization of A-share markets in Shanghai and Shenzhen provides us with a unique opportunity to shed light on the impact foreign institutional investors cast on the price formation process. Originally, A-share ownership was restricted to domestic investors, notorious for their sentiment-driven behavior. After the abolition of ownership restrictions in 2002, Qualified Foreign Institutional Investors (QFII) gained permission to enter the market. We analyze trend-chasing behavior before and after this regulatory regime shift within the Sentana and Wadhwani (1992) heterogeneous agents framework. By comparing parameter estimates across pre-liberalization and post-liberalization sample periods, we can draw conclusions about destabilizing feedback trading by both investor groups.

The remainder of the text is structured as follows. Section 2 characterizes stock markets in Shanghai and Shenzhen, focusing on regulatory peculiarities. Section 3 lays out the Sentana-Wadhwani heterogeneous agents model and describes our empirical approach. A description of the dataset can be found in Section 4. Estimation results are discussed in Section 5, while Section 6 concludes.

2 Chinese Stock Market Regulation and Investor Structure

Since their reopening on November 26, 1990 and April 11, 1991, respectively, the stock exchanges in Shanghai and Shenzhen have grown to become two of the largest stock exchanges in Southeast-Asia. At the end of 2007, total market capitalization had reached about USD 3,920 billion in Shanghai and USD 827 billion for the smaller Shenzhen Stock Exchange, rivaling the Tokyo Stock Exchange with a market capitalization of about USD 4,330 billion (World Federation of Exchanges, 2007).

Stock markets in Shanghai and Shenzhen were originally segmented into A and B shares according to ownership restrictions. Initially, domestic citizens could only buy and sell A shares, whereas foreign investors were only allowed to trade in B shares. Even though both categories were identical in terms of ownership rights, market capitalization of the latter segment remained low. As of December 2007, total market capitalization of A shares traded in Shanghai (Shenzhen) was about 170 (40) times the total value of B shares. Moreover, B shares typically traded at a considerable discount vis-à-vis A shares (Fernald and Rogers, 2002).

The separation of ownership according to investor groups was later abolished in two steps. First, in order to improve liquidity and market capitalization of B-share stocks, the Chinese Securities Regulatory Commission (CSRC) announced on February 19, 2001 that ownership restrictions on B shares would be lifted so that domestic investors could enter the market. This measure came into effect on February 28, 2001. Second, on November 5, 2002, the CSRC decided to liberalize the A-share market to further encourage the inflow of foreign capital. However, market entrance is restricted to QFIIs, including financial institutions and insurance companies satisfying minimum requirements regarding assets under management, paid-in capital and experience in trading (Chan and Yu (2003) for details). In what follows, our analysis focuses on the liberalization of A-share markets, which are more liquid and much larger in terms of market capitalization relative to B-share markets.

Given the short period of time since the reopening of Chinese exchanges, domestic public interest in stock markets is enormous. The large number of trading accounts in Shanghai and Shenzhen reveals widespread participation. In contrast to mature markets, institutional investors such as pension funds, mutual funds and insurance companies account for a marginal fraction of total stock investment (Kling and Gao, 2008). Correspondingly, less then 1% of A-share brokerage accounts in Shanghai and Shenzhen are owned by institutional investors (Walter and Howie, 2006). In contrast to this, the large number of private trading accounts is often interpreted as a sign of extraordinarily active stock market participation among domestic households (Li and Wang, 2008). However, Walter and Howie (2006) argue that the largest fraction of total trading volume can be attributed to privately managed (gray-market) investment funds sponsored by wealthy individuals, notorious for their speculative activity. Comparing feedback trading before and after the abolition of ownership restrictions thus allows us to draw conclusions about the impact of foreign institutional trading on a market dominated by presumably sentiment-driven domestic investors.

3 Feedback Trading and Stock Return Autocorrelation

Building on earlier work by Shiller (1984) and Cutler et al. (1991), Sentana and Wadhwani (1992) develop a simple heterogeneous agents model of feedback trading where positive (negative) feedback trading induces negative (positive) stock return autocorrelation. This effect is increasing in the variance of the asset return as the demand (and thus share in trading volume) of risk-averse smart-money traders diminishes during periods of high volatility. This approach has been widely used in the empirical literature on feedback trading. Applications to index returns include not only the US and the UK stock market (Sentana and Wadhwani, 1992), but also mature European markets (Koutmos, 1997), Japan (Watanabe, 2002), as well as emerging markets in Asia (Koutmos and Saidi, 2001) and Eastern Europe (Bohl and Siklos, 2008). Antoniou et al. (2005) use the model to analyze feedback trading in stock markets before and after the introduction of futures markets, arguing that feedback trading on spot markets is significantly lower after the inception of futures trading.

In the framework of Sentana and Wadhwani (1992), there are two types of investors. The first group are smart money traders who base their investment decision on risk and return considerations. Their demand for stocks can be modeled as

$$S_t = \frac{E_{t-1}[R_t] - \alpha}{\mu_t}, \tag{1}$$

where S_t is the fraction of stocks they hold, $E_{t-1}(R_t) - \alpha$ is the expected excess return of stocks over the risk-free rate, and μ_t measures the risk of stock holding. In what follows, we define the raw return on stocks as $R_t = P_t/P_{t-1} - 1$, where P_t is the index value at the end of period t. In a mean-variance framework, the time-varying risk measure will be an increasing function of the conditional variance of stock returns, $\mu_t = \mu(\sigma_t^2)$ with $\mu'(\sigma_t^2) > 0$. Without loss of generality, we can follow Koutmos (1997) and assume that risk is linearly related to volatility, $\mu(\sigma_t^2) = \lambda \cdot \sigma_t^2$. As Sentana and Wadhwani (1992) point out, market equilibrium in a model with investors of this type alone yields the familiar capital asset pricing model of Sharpe (1964), Lintner (1965) and Mossin (1966).

The second group of investors are feedback traders who trade stocks in response to previous returns. Their demand for stocks is given by

$$F_t = \phi R_{t-1}, \tag{2}$$

where R_{t-1} denotes the return in the previous period. This demand function captures both types of feedback trading. Positive (negative) feedback traders buy (sell) stocks when previous returns are positive, which implies $\phi > 0$ ($\phi < 0$).

In equilibrium, markets clear so that demand from both groups sums up to 1

$$S_t + F_t = 1. \tag{3}$$

Plugging in both demand functions and assuming rational expectations, $E_{t-1}[R_t] = R_t + \varepsilon_t$, yields an empirical model for returns given by

$$R_t = \alpha + \lambda\sigma_t^2 - \phi\ \lambda\sigma_t^2\ R_{t-1} + \varepsilon_t. \tag{4}$$

Notice that in the absence of feedback traders, the stock return in period t is only affected by the first two terms, the level of the risk-free rate and the riskiness of the investment. This view is consistent with the CAPM. However, if the stock market is populated by both smart money and feedback traders, the contemporaneous stock return also depends on its own lagged value. The model predicts negative or positive autocorrelation of returns, depending on the sign of the parameter ϕ, i.e. whether feedback trading is of the positive or negative kind.

Moreover, the model implies that the amount of serial return correlation crucially depends on the level of conditional stock return volatility σ_t^2. Sentana and Wadhwani (1992) argue that the influence of feedback trading on returns is stronger, the higher the conditional variance of returns. Intuitively, rational investors reduce their demand during periods of high volatility, whereas feedback traders are only concerned about past returns, ignoring such risks. Therefore, the market share of sentiment-driven investors and thus the influence of feedback trading on stock returns rises during periods of high volatility. The interaction between the demand of feedback traders and stock return volatility is reflected in the multiplicative term in Equation 4.

When testing the implications of the model, we modify Equation 4 along the lines of Sentana and Wadhwani (1992) and assume that autocorrelation depends linearly on volatility. For our baseline model, the mean equation for log returns ($r_t = \ln(R_t) = \ln(P_t) - \ln(P_{t-1})$) is given by

$$r_t = \alpha + \lambda\sigma_t^2 + (\phi_0 + \phi_1\sigma_t^2)\, r_{t-1} + \varepsilon_t \tag{5a}$$

$$= \alpha + \lambda\sigma_t^2 + \phi_0\, r_{t-1} + \phi_1\, \sigma_t^2\, r_{t-1} + \varepsilon_t \tag{5b}$$

Notice that a negative (positive) point estimate of ϕ_1 implies that the marginal effect of conditional volatility on stock return autocorrelation is negative (positive). In the Sentana-Wadhwani framework, this is consistent with the notion of positive (negative) feedback trading, corresponding to a positive (negative) parameter ϕ in the demand function of the sentiment-driven investor group. The parameter ϕ_0 captures serial correlation induced for instance by nonsynchronous trading (Lo and MacKinlay, 1990), transaction costs (Mech, 1993) or time-varying expected returns (Conrad and Kaul, 1988).

Finally, we use a GARCH(1,1) approach to modeling conditional volatility of log returns

$$\sigma_t^2 = \omega + \beta_0\varepsilon_{t-1}^2 + \beta_1\sigma_{t-1}^2. \tag{6}$$

Our analysis focuses on feedback trading by domestic (mainly individual) versus foreign institutional investors, that is a shift in the parameter ϕ_1. In order to formally test the hypothesis that this change is statistically significant, we follow Antoniou et al. (2005) and estimate the following variant of Equation 5a

$$r_t = \alpha + \lambda\sigma_t^2 + [\phi_{0,1}\,(1 - D_t) + \phi_{0,2}\, D_t + \phi_{1,1}\,(1 - D_t)\,\sigma_t^2 + \phi_{1,2}\, D_t\, \sigma_t^2]\;\, r_{t-1} + \varepsilon_t, \tag{7}$$

where D_t denotes a dummy variable that takes on the value of one after the liberalization date of the A-share market. We then test the hypotheses $H_{0,1} : \phi_{0,1} = \phi_{0,2}$ and $H_{0,2} : \phi_{1,1} = \phi_{1,2}$.

In addition to the baseline model given by Equations 5b and 6, we consider two modifications. First, following Sentana and Wadhwani (1992), we investigate whether positive feedback trading is more intense during market downturns. The modified mean equation for the asymmetric model is given by

$$r_t = \alpha + \lambda\sigma_t^2 + \left(\phi_0 + \phi_1\sigma_t^2\right) r_{t-1} + \phi_2 \left|r_{t-1}\right| + \varepsilon_t \tag{8}$$

which implies that the composite coefficient on lagged returns is

$$\phi_0 + \phi_1\sigma_t^2 + \phi_2 \quad \text{if} \quad r_{t-1} \geq 0 \tag{9}$$

$$\phi_0 + \phi_1\sigma_t^2 - \phi_2 \quad \text{if} \quad r_{t-1} < 0 \tag{10}$$

A significantly positive (negative) point estimate of ϕ_2 indicates that return autocorrelation is more negative (positive) during bear (bull) markets, which in the context of our model can be interpreted as evidence of more (less) positive feedback trading. As discussed by Sentana and Wadhwani (1992), this view is consistent with margin traders being forced to liquidate their positions as well as time-varying risk aversion in response to negative changes in total wealth.

Second, we consider a modified model where serial correlation is an exponential function of conditional volatility as suggested by LeBaron (1992). The mean equation for this exponential model is

$$r_t = \alpha + \lambda\sigma_t^2 + \left[\phi_0' + \phi_1' \ \exp(-\sigma_t^2/\bar{\sigma})\right] r_{t-1} + \varepsilon_t, \tag{11}$$

where $\bar{\sigma}$ is the unconditional variance of log returns, which in empirical applications is replaced by its sample analogue. Our heterogeneous agents model predicts that, if feedback trading is of the positive kind, the parameter estimate of ϕ_1' should carry a positive sign, as opposed to the expected negative value for ϕ_1 in the baseline model. Watanabe (2002) estimates this variant of the Shiller-Sentana-Wadhwani model for Japanese stock index returns and finds a better empirical fit than for the baseline model.

4 Data

Daily observations for the value-weighted Shanghai and Shenzhen A-share indices are collected from Thomson Financial Datastream. Assuming continuous compounding, daily returns are computed as the difference in logs between closing values, $r_t = \ln(P_t) - \ln(P_{t-1})$. We choose the sample period to be symmetric around the liberalization date. It covers the period between January 2, 1997 and December 28, 2007. This also excludes observations from the early days of both stock exchanges, which suffer from poor data quality due to infrequent trading (Fong, 2008). We divide our total sample into subsamples before and after ownership liberalization. The first subsample covers the period before liberalization from January 2, 1997 to November 29, 2002. The second subperiod begins on December 2, 2002, which is the first trading day after the liberalization had come into effect. For robustness checks, we also collect data for Shanghai and Shenzhen B-share market indices. To retain the symmetry of the sample period around the liberalization date, which is February 28, 2001 in the case of B shares, we adjust the sample period to January 2, 1996 - December 29, 2006 for this exercise.

We expect the A-share market entrance of QFIIs during the post-liberalization period to affect the return dynamics of large and small stocks differently as empirical evidence suggests that institutional trend-chasing and herding mainly occurs in stocks with low market capitalization (Lakonishok et al., 1992; Li et al., 2009). Therefore, we construct size portfolios for the A-share segment of each market. We obtain daily data on close prices and market capitalization of A-share stocks listed in Shanghai and Shenzhen. Our portfolio formation procedure is as follows: On the last trading day in a given year $j-1$, we rank stocks traded for example in the Shanghai A-share segment according to their market capitalization on that particular day. Based on this ranking, we assign all stocks to quintiles for the following year j. If trading in a certain stock is discontinued during year j, the composition of the respective size portfolio is rebalanced at the beginning of year $j+1$. Finally, we calculate value and equally-weighted returns for each portfolio on a given day t.

Summary statistics for index and value-weighted portfolio returns (not shown) suggest that all time series exhibit moderate negative skewness and considerable excess kurtosis.

Comparing sample means across the five portfolios, we find that daily log returns are highest (lowest) for stocks in the low (high) market capitalization quintile.

5 Empirical Results

We estimate the empirical models outlined in Section 3 by quasi maximum likelihood assuming normally distributed errors. The parameter estimates for all structural coefficients in Equations 5b and 6 can be determined directly using constrained maximization methods implemented under RATS 6.2. Since summary statistics discussed in Section 4 suggest that all stock return time series exhibit excess kurtosis, we correct standard errors for potential non-normality as suggested by Bollerslev and Wooldridge (1992). Both Akaike and Schwarz information criteria favor the parsimonious GARCH(1,1) specification over higher order alternatives.

Table 1 summarizes our baseline estimation results for Shanghai and Shenzhen A-share indices. We start our discussion by looking at parameter estimates for the volatility equation. Both volatility clustering (β_0) and GARCH effects (β_1) are highly significant. The stationarity condition $\beta_0 + \beta_1 < 1$ is fulfilled. The intercept ω is statistically different from zero at conventional levels of significance in all cases.

[Insert Table 1 about here]

Turning to the mean equation, we find that point estimates for λ are significant in 4 out of 6 cases. This implies that the level of returns on A shares is affected by conditional volatility as a CAPM-type model would suggest. Estimates are only insignificant for the post-liberalization period. However, this finding is not uncommon in empirical tests of the Shiller-Sentana-Wadhwani model (Koutmos, 1997; Bohl and Siklos, 2008) or of GARCH-in-Mean models of stock returns in general (Nelson, 1991). For both markets and all sample periods, the intercept of the mean equation is negative and significantly different from zero in most cases. In our model, this parameter carries the interpretation of the daily risk-free interest rate. For various reasons, it appears plausible that the risk-free rate perceived by domestic investors may be exceptionally low or even negative in the case of China. Fernald and Rogers (2002) highlight the fact that the Chinese government has traditionally set interest rates on bank deposits and saving bonds close to zero or even negative in real terms, which amounts to an effective taxation of capital. They argue that such a lack of investment alternatives implies that a CAPM-type representative investor may require very low minimum returns.

In this paper, we are primarily interested in whether foreign institutions entering the A-share market after liberalization have sided with feedback traders. In fact, our results seem to suggest the opposite. For both Shanghai and Shenzhen, we obtain for the pre-liberalization period a point estimate of ϕ_1 that is negative and different from zero at the 5% level of significance, which is consistent with the predictions of the feedback trader model. This implies that a considerable fraction of domestic investors, to whom ownership of A shares was restricted, were buying (selling) stocks when prices rose (fell) regardless of fundamental values. Such evidence of positive feedback trading is consistent with previous literature. First, it is reminiscent of speculative motives of Chinese A-share investors documented by Mei et al. (2005) and Fong (2008). Second, looking at brokerage account data, Chen et al. (2005) show that domestic private investors are more concerned about short-term past performance than long-term past performance. Their results are in line with our evidence of very short-term day-to-day feedback trading by domestic individuals.

Reestimating the model for the post-liberalization sample period allows us to evaluate the effect of the market entrance of foreign institutional investors on feedback trading. Interestingly, ϕ_1 is insignificant for the later subsample. This result is consistent with the view that foreign investors may have acted as smart-money traders reducing the market dominance of trend-chasing domestic speculators. Their market entrance has thus dampened the effect of feedback trading on stock index returns and contributed to the efficiency of Chinese A-share markets.

We further investigate the trend chasing behavior of both investor groups along 5 lines. First, we test whether the change in the parameters of interest is statistically significant following the procedure of Antoniou et al. (2005). Estimation results for the modified baseline model including a post-liberalization dummy (Equations 6 and 7) are reported in Table 2. In line with the results for subsamples in Table 1, we find that the parameter estimate of ϕ_1 is negative and significant during the period when only domestic investors could trade in A shares and insignificant afterward. In addition, we can reject the hypothesis of equal coefficients at the 1% level of significance. This corroborates our conclusion that most Chinese individual investors have engaged in feedback trading during the earlier sample period whereas foreign investors seem to have sided with rational investors who base their decision on risk-return considerations.

[Insert Table 2 about here]

Second, using the date when A-share ownership restrictions where officially abolished to divide the sample may appear somewhat arbitrary. The presumed structural change in the return generating process may have occurred at a later point as institutional traders entered the market during the post-liberalization period. Therefore, we explore alternative sample splits by means of standard structural break detection methods in the spirit of earlier literature (Chiang, 1988). Specifically, we compute the cumulative sum (CUSUM) of recursive standardized residuals, which serves as a qualitative indicator of structural change in our model (Harvey, 1981). As can be seen from Figure 1, the CUSUM gradually increases after the market entrance of QFIIs. This is in line with the notion of an increasing fraction of institutional trading causing a break in the structural parameters of our model. We identify peaks in CUSUM and the liberalization date as potential switching points and employ Chow tests to formally test their significance. Table 3 reports the results along with ϕ_1 parameter estimates for the two subsamples. Two findings bear mention. For all hypothesized break points, the change in the parameters of the model is significant with the largest test statistic obtained for the liberalization date in December 2002. Moreover, point estimates of ϕ_1 are significantly negative in the earlier and insignificant in the later periods. This confirms our previous results regarding the stabilizing influence of foreign institutions.

[Insert Figure 1 and Table 3 about here]

Third, it is conceivable that the observed shift in the structural parameters of the model is not due to the influence of institutional trading but other factors affecting Chinese stock markets. Potential influences include macroeconomic conditions, learning on behalf of domestic investors and changes in regulation or policy regimes. In order to make our empirical results robust against such criticism, we compare our A-share results to additional tests on B-share returns. As explained in Section 2, B-share markets were originally restricted to foreign, mainly institutional investors but liberalized in 2001. If our previous conclusion is valid, i.e. foreign institutional investors have not engaged in feedback trading and stabilized A-share markets, there should be no evidence of feedback trading in B shares during the pre-liberalization period. By the same token, the market entrance of domestic traders may lead to significant feedback trading effects after the liberalization.

We estimate the Sentana-Wadhwani model on Shanghai and Shenzhen B-share returns for the 1996 - 2006 period, in order to maintain the symmetry of subsamples around the liberalization date. Parameter estimates are summarized in Table 4. Previous literature suggests that domestic investors have illegally traded in B-shares before the abolition of ownership restrictions (Fong, 2008; Ma and McCauley, 2002). This implies that a significant feedback trading parameter for this sample period may be due to the influence of domestic traders circumventing ownership restrictions. Estimation results for the pre-liberalization period should therefore be interpreted with caution. As a matter of fact, we obtain a pre-liberalization point estimate of ϕ_1 that is significant at the 5% level for Shenzhen, which is the smaller market in terms of market capitalization and trading volume. However, the parameter estimate is highly insignificant in the case of Shanghai. Thus, as expected, we find only weak if any evidence of feedback trading before the liberalization date. By contrast, there is strong evidence of positive feedback trading after the market entrance of domestic traders. In line with our initial hypothesis, the estimate of ϕ_1 is statistically different from zero at the 1% level of significance for both markets. Also, the coefficient is considerable larger in magnitude compared to the earlier period. Summing up, estimation results for B-share returns support our main conclusions.

[Insert Table 4 about here]

Fourth, we estimate the Sentana-Wadhwani model for value-weighted returns on individual size portfolios, ranging from 1 (low market capitalization) to 5 (high market capitalization). Tables 5 and 6 report empirical results for Shanghai and Shenzhen A-share markets. The analysis largely confirms our previous results. There is strong evidence of positive feedback trading by domestic investors during the pre-liberalization period. In the case of Shanghai (Shenzhen), the coefficient ϕ_1 is significantly negative for 5 (4) out of 5 portfolios. Interestingly, the effect appears stronger for smaller firms with the largest coefficient found for portfolio 1. Domestic investors chasing short-term trends seem to trade most actively in small cap stocks. The picture differs dramatically for the sample period after the market entrance of foreign institutional investors. With the exception of Shanghai large cap stocks, we do not find evidence of feedback trading after the market entrance of foreign investors. Even for the remaining portfolio, the relevant coefficient is only statistically different from zero at the 10% level of significance. In sum, feedback trading occurs primarily in stocks with low market capitalization and can be attributed to domestic, mostly private investors. Foreign institutions, by contrast, do not appear to engage in trend-chasing investment strategies in neither small nor large cap stocks.

[Insert Tables 5 and 6 about here]

Finally, we investigate whether feedback trading occurs primarily during market declines. We estimate the asymmetric model given by Equations 6 and 8 for the total sample period. In the case of Shanghai (Shenzhen), the point estimate for the additional parameter ϕ_2 (not shown) is positive and significant at the 5% (1%) level. As detailed in Section 3, we can infer that serial correlation in stock returns is more negative (positive) after a price decrease (increase). The influence of positive feedback trading appears even stronger during bear markets.

The same picture emerges when looking at a plot that compares conditional return autocorrelation implied by the baseline model (calculated as $\rho_t^{impl} = \hat{\phi}_0 + \hat{\phi}_1 \ \sigma_t^2$) to the value of the A-share index in Figure 2. Implied serial correlation is most negative during market downturns, as for instance during the Asian Financial Crisis of 1997/1998. Sentana and Wadhwani (1992) suggest that such a relationship can be explained by models where risk-aversion declines strongly with wealth, making portfolio insurance strategies rational. Alternatively, they conjecture that margin traders, who are forced to sell their positions after prices have fallen, contribute to positive feedback trading during such periods. Although Chinese authorities have only recently officially legalized margin trading (Wall Street Journal, October 6, 2008), there is evidence that domestic investors have engaged in leveraged stock trading in the past (Girardin and Liu, 2005). This makes the margin trading interpretation of our results quite plausible.

[Insert Figure 2 about here]

To further verify the robustness of our empirical results, we conduct additional tests where the empirical approach is modified in several respects. In additional estimations of the baseline model, we explore the effect of extending the sample period to 1994 - 2007. Empirical results (not shown) confirm our main conclusions on feedback trading by foreign institutional and domestic investors. Moreover, as discussed in Section 3, serial correlation of stock returns can be modeled as an exponential function of conditional volatility. Estimation results, which are available from the authors on request, are similar across both exchanges. For the pre-liberalization period, the effect of the exponential transformation of volatility on return autocorrelation is significantly positive ($\hat{\phi}_1' > 0$) whereas the point estimate for ϕ_0' is negative and significant at the 5% level. At the same time, the corresponding parameter estimates for the post-liberalization period are not statistically different from 0 at conventional levels of significance. This result lends further support to our conclusion that QFIIs entering the Chinese A-share market after December 1, 2002 have reduced the proportion of feedback traders in this segment and thus stabilized the market.

6 Conclusions

The emerging stock markets of China are among the fastest growing in the world. A large body of literature provides evidence that sentiment-driven domestic investors play an important role in these markets. In this paper, we consider a natural experiment, namely the ownership liberalization of domestic A-share markets in December 2002. This regulatory regime shift allows us to investigate the impact of foreign institutional investors on the price formation process. Our analysis focuses on the relative propensity of domestic individual versus foreign institutional investors to follow trend-chasing trading strategies. Previous research has mainly documented destabilizing feedback trading by foreign institutions in emerging markets (Choe et al., 1999; Kaminsky et al., 2004; Chen et al., 2008). Our empirical results suggest the opposite. We find strong evidence of positive feedback trading before liberalization whereas such effects disappear thereafter. The observed parameter shift is statistically significant and robust to variations in the empirical model.

The conclusions are twofold. First, we can infer that domestic investors driving the market in the earlier period followed trend-chasing trading strategies. This empirical result lends support to anecdotal evidence comparing Chinese stock markets to casinos. More importantly, it is in line with previous empirical work suggesting speculative investment behavior of Chinese individual traders (Mei et al., 2005; Fong, 2008) as well as a strong relationship between private investors' stock purchases and short-term past performance (Chen et al., 2005). Moreover, our findings confirm previous evidence that individual investors engage in positive feedback trading (Bange, 2000). We also find that trend-chasing behavior is more dominant during market declines. This is consistent with the notion of intensified positive feedback trading by margin traders who are forced to liquidate their position after market declines. Unfortunately, because margin trading has been officially legalized only recently, we do not have data necessary to further investigate this issue.

Second, our findings have regulatory implications. Sentiment-driven investor behavior is of concern for security market regulators since positive feedback trading together with rational investors' bandwagoning can destabilize financial markets (De Long et al., 1990b). Contrary to conventional wisdom and our initial hypothesis, foreign institutional investors entering the market after November 2002 did not engage in feedback trading. By contrast, the influence of trend-chasing on A-share markets in Shanghai and Shenzhen has diminished after the market entrance of foreign investors. We can therefore conclude that market liberalization has reduced the probability of speculative bubbles in stock prices and thus contributed to a sustainable development of Chinese stock markets.

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Table 1: Estimation Results for Shanghai and Shenzhen A-Share Index Returns

Period	α	λ	ϕ_0	ϕ_1	ω	β_0	β_1
				Shanghai A-Share			
Pre	−0.132	0.069	0.042	−0.008	0.247	0.310	0.645
	(0.015)**	(0.002)***	(0.179)	(0.019)**	(0.006)***	(0.000)***	(0.000)***
Post	−0.009	0.044	−0.026	−0.001	0.070	0.082	0.891
	(0.917)	(0.206)	(0.658)	(0.966)	(0.000)***	(0.000)***	(0.000)***
Total	−0.134	0.081	0.040	−0.012	0.159	0.173	0.778
	(0.016)**	(0.001)***	(0.070)*	(0.007)***	(0.014)**	(0.000)***	(0.000)***
				Shenzhen A-Share			
Pre	−0.185	0.069	0.063	−0.008	0.304	0.254	0.674
	(0.005)***	(0.001)***	(0.036)**	(0.012)**	(0.056)*	(0.000)***	(0.000)***
Post	−0.056	0.054	−0.011	0.007	0.084	0.081	0.888
	(0.519)	(0.112)	(0.860)	(0.717)	(0.001)***	(0.000)***	(0.000)***
Total	−0.158	0.072	0.071	−0.010	0.197	0.174	0.769
	(0.005)***	(0.000)***	(0.001)***	(0.029)**	(0.060)*	(0.000)***	(0.000)***

Note: The table reports coefficient estimates and p-values (in parentheses) for the Sentana and Wadhwani (1992) GARCH(1,1) Model. The estimated mean equation is

$$r_t = \alpha + \lambda\sigma_t^2 + \phi_0\, r_{t-1} + \phi_1\sigma_t^2\, r_{t-1} + \varepsilon_t.$$

The variance equation is given by

$$\sigma_t^2 = \omega + \beta_0\varepsilon_{t-1}^2 + \beta_1\sigma_{t-1}^2$$

where r_t denotes the log return (multiplied by 100) on the Shanghai and alternatively Shenzhen A-share index. P-values are based on robust Bollerslev and Wooldridge (1992) standard errors. *,** ,*** denote statistical significance at the 10%, 5% and 1% level, respectively. The total sample period is January 2, 1997 - December 28, 2007. The 'pre' subsample ends on November 29, 2002, which is the last trading day before ownership liberalization. The 'post' subperiod begins on December 2, 2002.

Table 2: Tests for Changes in Model Parameters

Parameter Estimates				Hypothesis Tests	
$\phi_{0,1}$	$\phi_{0,2}$	$\phi_{1,1}$	$\phi_{1,2}$	$H_0, 1 : \phi_{0,1} = \phi_{0,2}$	$H_0, 2 : \phi_{1,1} = \phi_{1,2}$
Shanghai A-Share					
0.046	0.035	−0.012	−0.011	−31.375	46.006
(0.141)	(0.274)	(0.006)***	(0.161)	(0.000)***	(0.000)***
Shenzhen A-Share					
0.050	0.092	−0.008	−0.012	−82.870	54.370
(0.139	(0.005)***	(0.090)*	(0.118)	(0.000)***	(0.000)***

Note: The table reports coefficient estimates and p-values (in parentheses) for the Sentana and Wadhwani (1992) GARCH(1,1) Model as well as t-statistics for hypotheses regarding individual pairs of parameters. The estimated mean equation is

$$r_t = \alpha + \lambda\sigma_t^2 + \phi_{0,1}\,(1 - D_t)\, r_{t-1} + \phi_{0,2}\, D_t\, r_{t-1} + \phi_{1,1}\,(1 - D_t)\,\sigma_t^2\, r_{t-1} + \phi_{1,2}\, D_t\,\sigma_t^2\, r_{t-1} + \varepsilon_t.$$

The variance equation is given by

$$\sigma_t^2 = \omega + \beta_0\varepsilon_{t-1}^2 + \beta_1\sigma_{t-1}^2$$

where r_t denotes the log return (multiplied by 100) on the Shanghai and alternatively Shenzhen A-share index. D_t is a dummy variable that takes on the value of 1 after December 1, 2002. P-values are based on robust Bollerslev and Wooldridge (1992) standard errors. *,** ,*** denote statistical significance at the 10%, 5% and 1% level, respectively. The sample period is January 2, 1997 - December 28, 2007.

Table 3: Tests for Alternative Structural Break Dates

Date	ϕ_1 pre	ϕ_1 post	Chow
Shanghai			
December 2, 2002	−0.008	−0.001	8.981
	(0.019)**	(0.966)	(0.000)***
November 18, 2003	−0.009	−0.019	4.341
	(0.019)**	(0.232)	(0.000)***
June 3, 2005	−0.010	−0.018	3.375
	(0.020)**	(0.205)	(0.001)***
Shenzhen			
December 2, 2002	−0.008	0.007	20.394
	(0.012)**	(0.717)	(0.000)***
November 18, 2003	−0.007	−0.011	13.397
	(0.081)*	(0.504)	(0.000)***
December 5, 2005	−0.007	−0.008	13.735
	(0.044)**	(0.607)	(0.000)***

Note: The table reports results for Chow tests under the null of constant parameters as well as coefficient estimates and p-values (in parentheses) for alternative break points. P-values for ϕ_1 estimates are based on robust Bollerslev and Wooldridge (1992) standard errors. *,** ,*** denote statistical significance at the 10%, 5% and 1% level, respectively. The total sample period is January 2, 1997 - December 28, 2007. Hypthesized breakpoints: December 2, 2002 (liberalization date); November 18, 2003 (local maximum CUSUM); June 3, 2005 / December 5, 2005 (global maximum CUSUM for Shanghai/Shenzhen).

Table 4: Estimation Results for Shanghai and Shenzhen B-Share Index Returns

Period	α	λ	ϕ_0	ϕ_1	ω	β_0	β_1
				Shanghai B-Share			
Pre	−0.068	0.013	0.187	−0.002	0.391	0.227	0.736
	(0.253)	(0.149)	(0.001)***	(0.540)	(0.037)**	(0.000)***	(0.000)***
Post	−0.136	0.056	0.298	−0.020	0.757	0.247	0.574
	(0.032)**	(0.012)**	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Total	−0.137	0.028	0.115	−0.001	0.276	0.214	0.754
	(0.000)***	(0.001)***	(0.001)***	(0.791)	(0.003)***	(0.000)***	(0.000)***
				Shenzhen B-Share			
Pre	−0.043	0.006	0.296	−0.007	0.691	0.325	0.611
	(0.640)	(0.568)	(0.000)***	(0.023)**	(0.000)***	(0.000)***	(0.000)***
Post	−0.132	0.058	0.274	−0.019	0.781	0.242	0.574
	(0.099)*	(0.003)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Total	−0.055	0.019	0.184	−0.005	0.547	0.241	0.667
	(0.328)	(0.068)*	(0.000)***	(0.040)**	(0.000)***	(0.000)***	(0.000)***

Note: The table reports coefficient estimates and p-values (in parentheses) for the Sentana and Wadhwani (1992) GARCH(1,1) Model. The estimated mean equation is

$$r_t = \alpha + \lambda\sigma_t^2 + \phi_0\, r_{t-1} + \phi_1\sigma_t^2\, r_{t-1} + \varepsilon_t.$$

The variance equation is given by

$$\sigma_t^2 = \omega + \beta_0\varepsilon_{t-1}^2 + \beta_1\sigma_{t-1}^2$$

where r_t denotes the log return (multiplied by 100) on the Shanghai and alternatively Shenzhen B-share index. P-values are based on robust Bollerslev and Wooldridge (1992) standard errors. *,** ,*** denote statistical significance at the 10%, 5% and 1% level, respectively. The total sample period is January 2, 1996 - December 29, 2006. The sample is split on February 28, 2001, which marks the B-share liberalization date.

Table 5: Estimation Results for Shanghai A-Share Size Portfolio Returns

Portfolio	Period	α	λ	ϕ_0	ϕ_1	ω	β_0	β_1
1	pre	−0.085	0.064	0.133	−0.014	0.275	0.257	0.678
		(0.109)	(0.002)***	(0.000)***	(0.001)***	(0.012)**	(0.000)***	(0.000)***
	post	−0.073	0.053	0.043	0.022	0.123	0.091	0.867
		(0.414)	(0.068)*	(0.594)	(0.351)	(0.008)***	(0.001)***	(0.000)***
2	pre	−0.108	0.064	0.068	−0.010	0.268	0.244	0.695
		(0.101)	(0.003)***	(0.013)**	(0.002)***	(0.000)***	(0.000)***	(0.000)***
	post	−0.102	0.059	−0.017	0.018	0.102	0.083	0.885
		(0.321)	(0.097)*	(0.655)	(0.169)	(0.011)**	(0.000)***	(0.000)***
3	pre	−0.129	0.070	0.060	−0.009	0.284	0.239	0.689
		(0.133)	(0.029)**	(0.005)***	(0.001)***	(0.000)***	(0.000)***	(0.000)***
	post	−0.100	0.059	−0.023	0.016	0.100	0.076	0.891
		(0.283)	(0.044)**	(0.678)	(0.267)	(0.002)***	(0.000)***	(0.000)***
4	pre	−0.089	0.063	0.053	−0.009	0.229	0.280	0.677
		(0.161)	(0.009)***	(0.002)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
	post	−0.097	0.063	−0.030	0.014	0.086	0.077	0.895
		(0.059)*	(0.003)***	(0.547)	(0.331)	(0.009)***	(0.000)***	(0.000)***
5	pre	−0.154	0.074	0.034	−0.008	0.237	0.271	0.678
		(0.012)**	(0.002)***	(0.297)	(0.013)**	(0.017)**	(0.000)***	(0.000)***
	post	−0.064	0.069	−0.007	−0.009	0.070	0.087	0.888
		(0.382)	(0.051)*	(0.642)	(0.081)*	(0.000)***	(0.000)***	(0.000)***

Note: The table reports coefficient estimates and p-values (in parentheses) for the Sentana and Wadhwani (1992) GARCH(1,1) Model, which is given by

$$
\begin{aligned}
r_{i,t} &= \alpha + \lambda \sigma_t^2 + \phi_0 \, r_{i,t-1} + \phi_1 \sigma_t^2 \, r_{i,t-1} + \varepsilon_t \\
\sigma_t^2 &= \omega + \beta_0 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2
\end{aligned}
$$

where r_t denotes the value-weighted log return (multiplied by 100) on portfolio i. Stocks are sorted into 5 portfolios according to market capitalization at the last trading day of the previous year, ranking from 1 (low market cap) to 5 (high market cap). P-values are based on robust Bollerslev and Wooldridge (1992) standard errors. *,** ,*** denote statistical significance at the 10%, 5% and 1% level, respectively. The total sample period is January 2, 1997 - December 28, 2007. The 'pre' subsample ends on November 29, 2002, which is the last trading day before ownership liberalization. The 'post' subperiod begins on December 2, 2002.

Table 6: Estimation Results for Shenzhen A-Share Size Portfolio Returns

Portfolio	Period	α	λ	ϕ_0	ϕ_1	ω	β_0	β_1
1	pre	−0.053	0.048	0.141	−0.011	0.338	0.303	0.634
		(0.392)	(0.004)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
	post	−0.111	0.073	0.080	0.022	0.184	0.097	0.835
		(0.371)	(0.130)	(0.577)	(0.630)	(0.124)	(0.010)***	(0.000)***
2	pre	−0.105	0.053	0.095	−0.008	0.369	0.295	0.635
		(0.000)***	(0.000)***	(0.016)**	(0.088)*	(0.000)***	(0.000)***	(0.000)***
	post	−0.109	0.055	0.023	0.011	0.152	0.089	0.866
		(0.358)	(0.152)	(0.576)	(0.364)	(0.043)**	(0.000)***	(0.000)***
3	pre	−0.194	0.075	0.036	−0.005	0.365	0.253	0.658
		(0.000)***	(0.000)***	(0.020)**	(0.284)	(0.000)***	(0.000)***	(0.000)***
	post	−0.046	0.035	−0.050	0.022	0.081	0.061	0.915
		(0.716)	(0.384)	(0.420)	(0.163)	(0.004)***	(0.000)***	(0.000)***
4	pre	−0.165	0.060	0.039	−0.006	0.276	0.252	0.690
		(0.023)**	(0.004)***	(0.152)	(0.063)*	(0.049)**	(0.000)***	(0.000)***
	post	−0.079	0.056	−0.039	0.017	0.081	0.077	0.897
		(0.343)	(0.054)*	(0.517)	(0.307)	(0.000)***	(0.000)***	(0.000)
5	pre	−0.165	0.058	0.082	−0.009	0.197	0.234	0.731
		(0.000)***	(0.000)***	(0.020)**	(0.047)**	(0.117)	(0.001)***	(0.000)***
	post	−0.032	0.056	0.012	−0.001	0.068	0.085	0.891
		(0.653)	(0.052)*	(0.860)	(0.935)	(0.000)***	(0.000)***	(0.000)

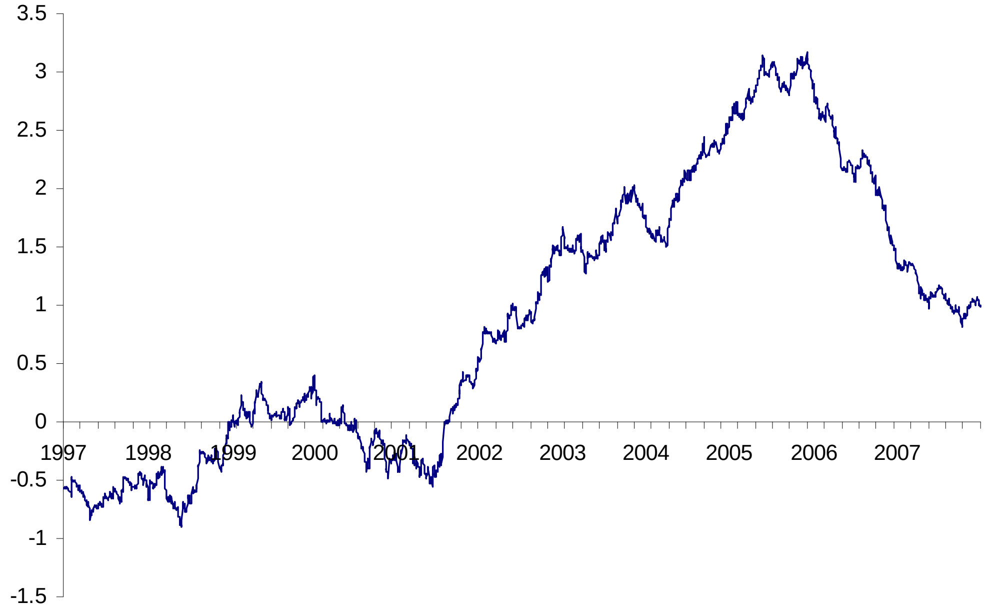
Note: The table reports coefficient estimates and p-values (in parentheses) for the Sentana and Wadhwani (1992) GARCH(1,1) Model, which is given by

$$r_{i,t} = \alpha + \lambda\sigma_t^2 + \phi_0\, r_{i,t-1} + \phi_1\sigma_t^2\, r_{i,t-1} + \varepsilon_t$$
$$\sigma_t^2 = \omega + \beta_0\varepsilon_{t-1}^2 + \beta_1\sigma_{t-1}^2$$

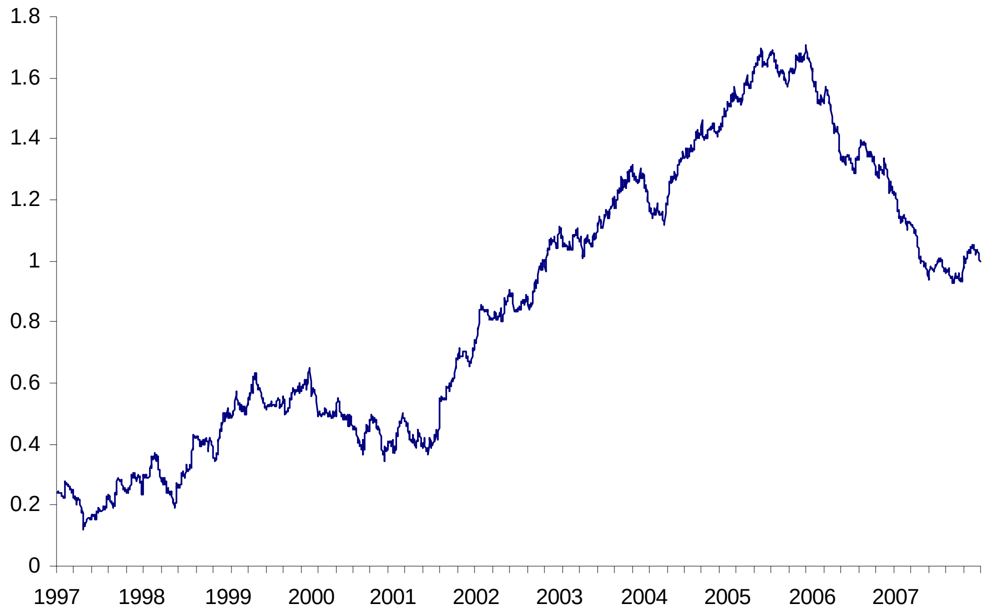
where r_t denotes the value-weighted log return (multiplied by 100) on portfolio i. Stocks are sorted into 5 portfolios according to market capitalization at the last trading day of the previous year, ranking from 1 (low market cap) to 5 (high market cap). P-values are based on robust Bollerslev and Wooldridge (1992) standard errors. *,** ,*** denote statistical significance at the 10%, 5% and 1% level, respectively. The total sample period is January 2, 1997 - December 28, 2007. The 'pre' subsample ends on November 29, 2002, which is the last trading day before ownership liberalization. The 'post' subperiod begins on December 2, 2002.

Figure 1: Cumulative Sum of Recursive Residuals

Shanghai A-Share Market



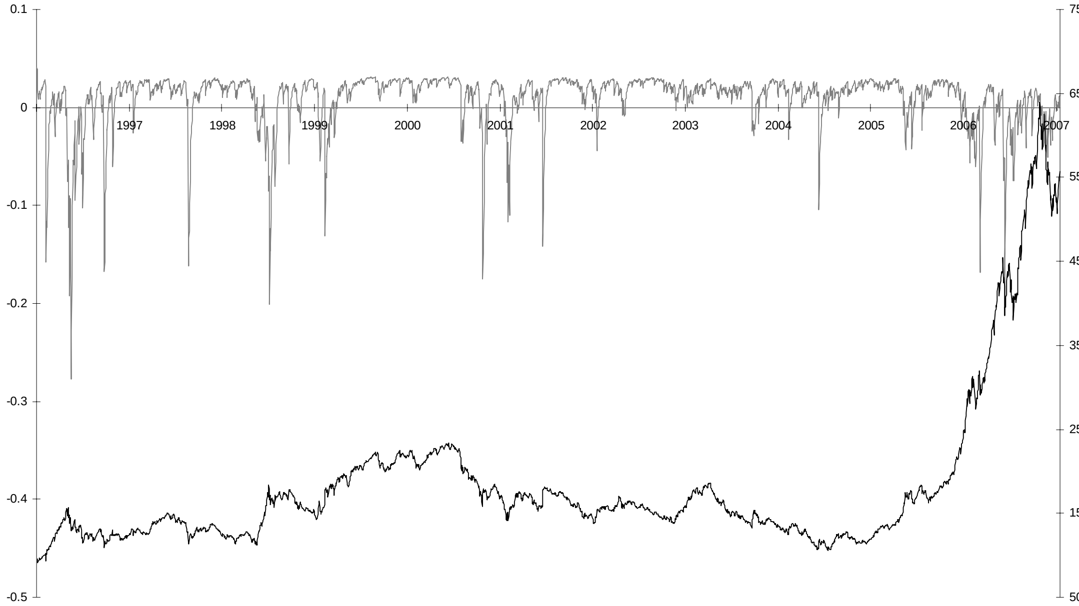
Shenzhen A-Share Market



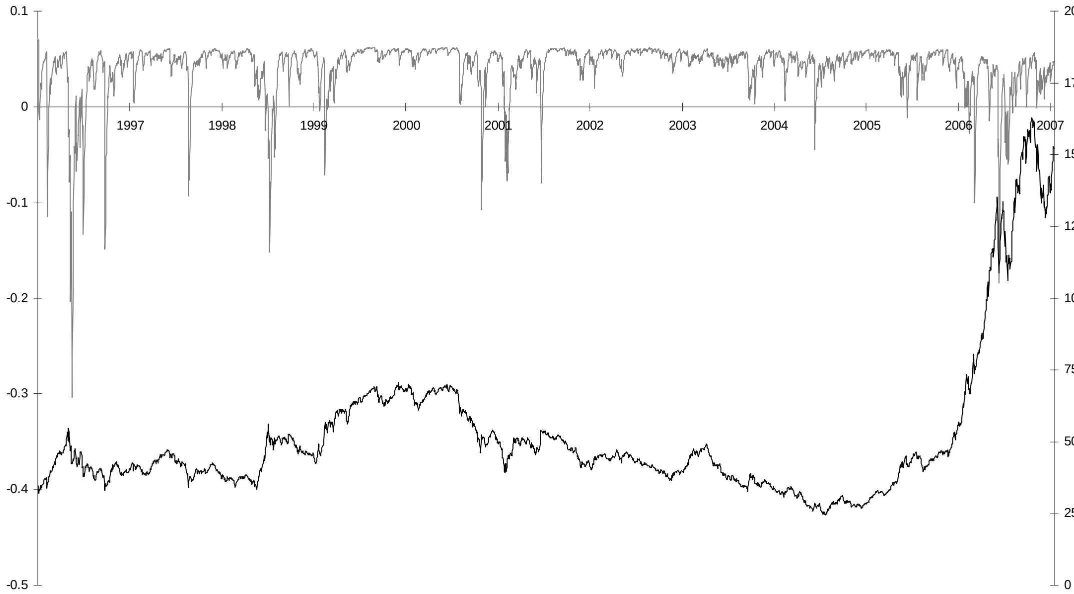
Note: The figure graphs the cumulative sum of standardized residuals from the recursive estimation of the Sentana and Wadhwani (1992) GARCH(1,1) model, starting from an initial January 3, 1994 - January 2, 1997 sample period.

Figure 2: A-Share Indices and Implied Conditional Return Autocorrelation

Shanghai A-Share Market



Shenzhen A-Share Market



Note: The figure graphs the value of the Shanghai and Shenzhen A-Share Index (black) as well as return autocorrelation implied by our heterogeneous agents model (gray), computed as $\rho_t^{impl} = \hat{\phi}_0 + \hat{\phi}_1 \, \sigma_t^2$.