What Drives the Shanghai Stock Market? An Examination of its Linkage to Macroeconomic Fundamentals

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Abstract

Previous research has struggled to explain the valuation of A-shares in the Shanghai stock market using traditional financial indicators. We offer a different perspective by analysing the influence of key macroeconomic variables. The novelty of our econometric study is the implementation of a Markov-switching mean adjustment of stock returns that allows for detecting asymmetric relationships for periods of generally increasing and decreasing stock prices. We find evidence that whereas macroeconomic indicators do not matter during tranquil periods, investors do react to changes in domestic consumption and exchange rate policy during periods of extremely high or low excess stock returns.

JEL Classifications: G12, G15, G19, O16.
Keywords: Shanghai stock exchange (SSE); Macroeconomic fundamentals; Markov-switching (MS); bull market; bear market.
Running Header: WHAT DRIVES SHANGHAI STOCK PRICES?

1 Introduction

The Shanghai stock exchange (SSE) has experienced significant growth since its re-establishment in 1990 and has become the sixth-largest stock exchange in the world by market capitalisation. However, this growth has been extremely irregular and constrained by the market's own characteristics. The SSE A-shares are dominated by a large number of small domestic individual investors, whereas the B-shares are dominated by foreign institutional investors. The SSE A-share market is characterised by inadequate information disclosure, an incomplete corporate governance structure, inadequate regulatory capacity and the presence of intrinsic structural defects (Girardin and Liu, 2003; Gao, 2002). It has been claimed in the literature that movements in A-shares are driven by news, rumours, sentiments and speculations (Yao and Luo, 2009, Girardin and Liu, 2003; Kang, Liu and Ni, 2003, Nam *et al*., 1999). Tan *et al*. (2008) associate A-shares with herding behaviour. Based on an econometric study that analyses both A- and B-shares in the Shanghai and Shenzhen stock markets, Chiang, Yeh and Chiu (2009) argue that rational investors should not invest in A-shares. Wang, Burton and Power (2004) find evidence that A-shares overreact compared to B-shares. Contrasting the mainstream literature, Eun and Huang (2007) analyse firm-specific data up to 2004 and find that the SSE responds to some type of 'rationality'; however, this claim has not been corroborated with up-to-date data. A more updated study by Yao and Luo (2009), also examining firm-specific data, concludes that psychological factors affecting domestic investors' behaviour played a crucial role in shaping the "bubble" that affected the Shanghai stock market around 2007. In general, most of the literature has given a great deal of attention to showing the inadequacy of firm-specific fundamentals such as P/E ratios, beta factors, dividends and the like to explain the valuation of A-share firms. However, no recent work has tried to link SSE asset prices to macroeconomic fundamentals.

This paper offers a different perspective by analysing how selected macroeconomic fundamentals affect the valuation of A-shares in the SSE. Because A-shares are dominated by domestic individual investors, the evolution of macroeconomic fundamentals underpinning the Chinese economy may be relevant in explaining investors' expectations about the future, which in turn affects the valuation of A-shares. In recent times, the Chinese economy has been subject to radical changes. The Chinese monetary and exchange rate policies have allowed for a real appreciation of the renminbi. As a consequence of this policy shift and the global financial crisis, exports to major destinations such as the United States, the European Union and Japan have weakened. Moreover, China's output growth and consumers' confidence have declined as well. In addition, the recent increases in oil prices may have had a substantial impact on the valuation of SSE firms because China is a net oil importer and somewhat dependent on foreign supply of oil and other sources of energy. The main idea of this paper is to investigate whether these factors can explain the capital gains of A-shares over a relatively long period of time. With this research objective in mind, we use different econometric techniques to identify the possible links. The simplest approach that we consider is a linear time series model (known as autoregressive distributed lag (ADL) model) in which explanatory factors and lagged return values are used as explanatory factors for A-share returns. However, we believe that this approach may not be flexible enough; thus, a more specific approach is proposed. We note that our problem may be subject to asymmetric effects. For instance, the appreciation of the exchange rate could perhaps explain much of the decline in stock prices (negative returns) but the reverse may not be true; that is, a renminbi depreciation of the same magnitude may affect the valuation of A-shares at a different rate. Similarly, the downturn of the business cycle and other fundamentals may be subject to this type of asymmetry. To account for these asymmetric effects, we infer a Markov-switching regime classification that allows for distinguishing between periods of generally increasing and decreasing stock prices, which we call 'bull' and 'bear' markets, respectively. In the implementation of our econometric investigation, we follow a bottom-up strategy. First, we estimate a univariate Markov-switching model. Then, we assess whether incorporating macroeconomic fundamentals improves this baseline model with various econometric tools. In addition, we also compare alternative setups with different numbers of regimes and their linear counterparts. With the exception of Girardin and Liu's (2003) univariate model, very little attention has been paid to the rise and fall of 'bear' and 'bull' markets for returns on A-shares. After identifying our model, our investigation concludes that during periods of rapidly increasing or decreasing stock prices (excessively high or low abnormal returns), China's exchange rate and domestic consumption do matter. However, during tranquil periods in which A-shares increase or decrease at a moderate rate, macroeconomic fundamentals appear unrelated. Our macroeconomic-based model helps close the gap between the apparent discrepancies between Eun and Huang (2007)' pre-peak analysis and Yao and Luo (2009)' post-peak work.

Disentangling the behaviour of returns to A-shares in China's principal mainland stock market is becoming increasingly important as the country positions itself as a major global economic power. In many ways, China's stock market is still in the early stages of development. Building a solid stock market foundation and appropriate structures are pivotal to the consistent long-term growth of China's financial market.

The balance of this paper is organised as follows. Section II provides a preliminary analysis of SSE A-shares against a background of some macroeconomic fundamentals. While exploring the data, a detailed analysis of the SSE structure is conducted, and the role of existing literature is further discussed. In Section III, we discuss how Markov-switching models have been used in previous applications to identify ‘bear’ and ‘bull’ markets for stock returns and their links to macroeconomic variables. Due to its specificity, the econometric approach is also given some preliminary consideration, and modelling tools are introduced in Section IV. In Section V, the empirical findings are presented and analysed, which then lead to our conclusions in Section VI.

2 Preliminary Data Analysis

2.2 The Shanghai Stock Market

Re-opened in 1990, the SSE has developed quickly to reach a market capitalisation of US$2.5 trillion as of December 2012. The SSE is one of the two main stock exchanges operating independently in mainland China. The design of the SSE allows for two types of shares: A and B. Due to government restrictions, the purchasing and listing of A-shares is generally restricted to Chinese participants (SSE Fact book, 2013).

Both A- and B-shares are equivalent in terms of voting power and claims on earnings and assets. A-shares are renminbi-denominated shares that can only be bought and sold by Chinese citizens. After the introduction of the Qualified Foreign Institutional Investor (QFII) in 2003, foreign investors became technically allowed to trade in A-shares with strong limitations; however, in practice the A-share market is still dominated by domestic investors. A-share holders typically include individual investors such as public shareholders and employees and institutional investors comprising the government, state-owned or partially state-owned enterprises, investment funds and insurance firms. On average, institutional investors account for 60 per cent of all shares issued. Although domestic individual private investors may have stronger incentives to maximise returns on their investments than state shareholders, private A-share investors are mainly small shareholders because individual investors are not allowed to accumulate more than 0.5 per cent of a firm's total shares. As a result, A-share investors have neither the incentive nor the capacity to directly participate in firms' decision-making. Turnover is very robust in this market, whereas management quality, disclosure, and shareholder protection tend not to be held in high regard. The strong state-ownership of companies leads to severe agency problems due to the lack of an effective incentive system for managers (Seah et al., 2005).

In contrast, B-shares are denominated in renminbi but payable in US dollars. They are available to foreign individual and institutional investors and residents of Hong Kong, Macao and Taiwan. Since 2001, B-shares can also be purchased by domestic investors holding US dollars. B-shareholders are mostly individual investors (Wong *et al*., 2004; Wong *et al*., 2006). Also in the early 2000s, B-shares became marginalised when new B-share offerings by Chinese companies were stopped. Since the B-share market became marginalised, higher volatility for A-shares has been prevalent. A merger with the much larger A-share market is widely anticipated in the future.

Because the SSE has a short history, the market is characterised by the absence of a well-established base of large institutional investors and is driven by a myriad of relatively small investors. In 2007, the SSE had approximately 40 to 50 per cent of shares owned by state-owned enterprises, and most of the remainder was owned by individual Chinese shareholders. This structure differs from other mature markets where institutions control 80 per cent or more of shares.[1] It is often claimed that the SSE is driven by the herd behaviour of investors seeking short-term capital gains. Analysts have claimed that the SSE behaves as a 'casino'

[1] http://www.sse.com.cn/sseportal/en_us/ps/about/bi.shtml, accessed: December 2011.

where playing the market is a major pastime among Chinese from all walks of life trying their luck with people waiting in line for hours to sign up for brokerage firm accounts (Girardin and Liu, 2003). A study conducted by Nam *et al*. (1999) claims that the SSE is 'a market of rumours and massive speculation.' The Shanghai stock market is known for high volatility, which sends investors into panic. Rises in the stock market are fuelled more by speculation, profit seeking, rumours and psychological factors than economic fundamentals (Yao and Luo, 2009). Many Chinese have lost significant life savings investing in stocks that the government said were good investments but that turned out to have an exaggerated export performance.

The SSE market lacks transparency. For instance, the SSE only requires very limited disclosure of specific information about constituents' fundamentals. Many of the listed firms maintain shared ownership with the Chinese government, which influences their governance and discourages shareholders from exerting their monitoring role to maximise profits. Under these constraints, A-share investors are likely to be influenced by news about policy decisions, which influence the valuation and prospects of SSE-listed firms (Wang and Xu, 2004; Girardin and Liu, 2003).

In Figure 1, we depict the evolution of the Shanghai stock exchange A-share index with data obtained from DataStream. From this index, we calculate monthly excess capital returns as the percentage change in the index minus the return of riskless investment with comparable maturity, i.e., $R_t = SSE_t/SSE_{t-1} - (i_t^*/12)$. We choose the 3-month US Treasury Bill as a proxy of the risk-free return i_t^*. Previous studies such as Pagan and Sossounov (2003) favoured "bear" and "bull" stock market analyses based on capital gains only. Given the characteristics of the SSE, the dividends distributed by the SSE are relatively small compared to the capital gains (Girardin and Liu, 2003).

In examining the data of SSE A-shares, Figure 1 reveals some important information. First, we observe a major spike occurring between November 2006 and October 2008, peaking in November 2007. After 2008, the returns of SSE A-shares became apparently more volatile. The extreme capital gains and losses during this period could be associated with changes in the exchange rate policy and the global financial crisis.

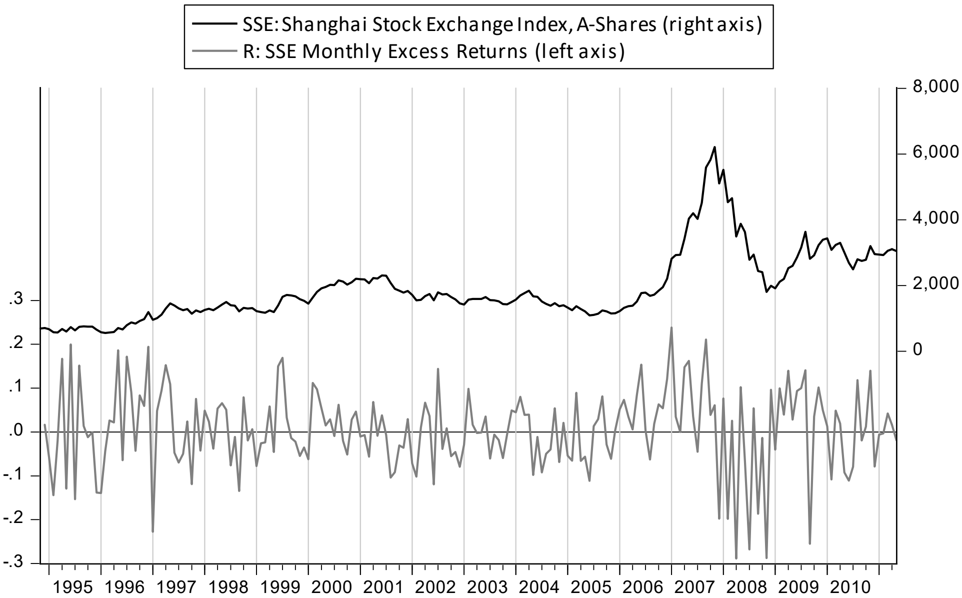
Second, between 1997 and 1999, A-shares remained relatively unaffected by the East Asian financial crisis, which affected stocks returns in Indonesia, South Korea, Malaysia, Hong Kong and the Philippines. This fact could be explained by the domestically oriented nature of the A-share market. In addition, the literature on second- and third-generation currency crises explains that contagion can be fundamentals based or self-fulfilling; however, such a crisis always presupposes a certain degree of vulnerability in macroeconomic fundamentals or currency mismatching in private firms' balance sheets.[2] Hence, an alternative explanation for this fact is that Chinese macroeconomic fundamentals and firms' balance sheets were not in a vulnerable state and that Chinese investors did not believe that their fixed exchange rate arrangement could be threatened during 1997-1999.

Third, during the period 1996-2001, the SSE index developed rapidly along with high GDP growth and optimistic prospects for the economy; however, the regulatory framework of the SSE transactions was still somehow weak. In early 2001, the Chinese authorities

[2] See Jeanne (2000), Forbes (2004) and Masson (2007) for a literature review; Forbes and Chin (2004), Forbes and Rigobon (2002), and Masson (1999a, 1999b) for literature on contagion effects; and Aghion et al. (2001) for a model on currency mismatches in private balance sheets.

implemented tougher controls on SSE transactions, with close scrutiny of origins of funds and disclosure, which led to a major crackdown of fraud and illegal operations. The SSE growth slowed down from 2001 perhaps pushed by the September 11th attacks and the impact of the avian flu affecting China's exports in 2003. Last, there was a slowdown in the SSE returns between 2001 and 2006, which could be attributable to weak economic performance caused by the global recession.

Figure 1- The Shanghai A-share stock exchange index and the implied monthly excess capital returns (source: DataStream)



2.3 Macroeconomic Fundamentals of the Chinese Economy

The concurrent growth in China's stock markets and its economy raises empirical questions regarding the connection between stock returns and macroeconomic variables. The purpose of this section is to introduce these economic fundamentals that underpin the returns of SSE A-shares. This study investigates the role of select macroeconomic factors: exchange rate, level of exports, prices of import commodities and internal consumption, each of which are treated in turn.

The first factor we consider is the role of the exchange rate policy by China's central bank. The status of the People's Bank of China (PBC) as a legal entity was confirmed in 1995. As stated in its mission, its function is to '*maintain the Renminbi exchange rate at an adaptive and equilibrium level; holding and managing the state of foreign exchange and gold reserves*.'[3] Between 1995 and 2007, the PBC committed to keeping the exchange rate at an approximately fixed value, which implied restrictions for an active monetary policy. Generally speaking, a central bank has one main policy instrument, controlling the money supply with open market operations, and more than one desirable target (such as exchange rate stability, inflation or output). With one policy instrument, only one target is achievable at a time. Although there are other softer instruments such as changing minimum requirements, imposing financial regulations and intervening in lending markets, their role for monetary policy in China is very limited. With open market operations, the PBC policy was mainly aimed at stabilising the exchange rate. In fact, the PBC's mission statement makes no reference to inflation, output or unemployment. Keeping the exchange rate at an approximately fixed level to the US dollar in the period 1995-2007 favoured export-led growth and led to an increase in the PBC's US dollar-denominated reserves to a current record level of over US$3 trillion. By 2007, the economy was showing signs of overheating and inflationary pressure. These signs, together with increasing food prices in foreign markets and pressure from policymakers in the US and Europe to allow the renminbi to appreciate led

[3] http://www.pbc.gov.cn/publish/english/952/index.html. Accessed: December 2011.

to a radical policy change. Since 2007, the PBC has allowed the appreciation of the renminbi against major currencies.

From the Shanghai stock perspective, a closer inspection of the links between the SSE returns and the appreciation of the renminbi reveals potential effects in different directions. It is difficult to assess the effect of exchange rates on trade balances (Engel, 2010). On the one hand, the appreciation of the renminbi and the resulting lower global demand for China's products has a negative impact on China's exports. Examining trade data until 2009, Ahmed (2009) finds that the renminbi appreciation caused both China's processing and non-processing exports to fall. Although it is difficult to ascertain the extent of participation of firms in the export sector, a great part of industrial production is linked to exporting. On the other hand, a renminbi appreciation increases the purchasing power of Chinese firms and households, which could lead to higher imports of intermediate inputs such as oil and natural gas, parts and components, and final goods causing a negative impact on future expected profits that underpin the value of the index of domestic firms trading in the SSE. However, while the renminbi appreciation would increase China's command over these imports, it might also signal a shift away from the export-oriented assembly operations that use imported intermediate inputs. Then, the overall effect could be a decline in imports of intermediate goods, which would have a positive impact on the value of the index of domestic firms involved in the production of import substitutes. Indeed, Garcia-Herrero and Koivu (2008) estimate that a 10 per cent renminbi appreciation would reduce China's imports of components by as much as 6 per cent.

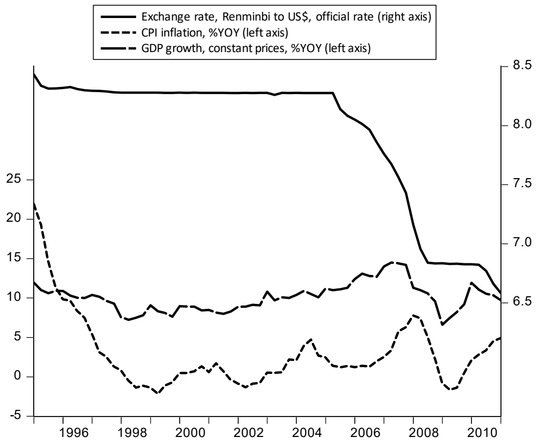
Because of these trade effects in opposite directions, it would be misleading to incorporate the value of the real exchange rate alone to account for the effects of trade on SSE capital returns; thus, we add additional explanatory variables. First, we incorporate the log of combined exports to major markets; namely, the US, Europe and Japan. We consider that the major concerns about China's exports in the long run are related to these three major destinations. Second, we include an energy price represented by the WTI (World Texas Intermediate) oil price.[4]

In relation to the domestic market, we consider a monthly indicator of domestic consumer confidence in China's economy in our model because trends in domestic consumption may influence SSE firms' sales in the domestic market. When consumer confidence deteriorates, we would expect a decrease in expected sales and profits of SSE firms with a subsequent increase in SSE A-share returns. In the absence of monthly data for consumption, we use the Consumption Confidence Index (CCI) provided by the National Bureau of Statistics of China.[5] Whereas the index does not explain the large spike between the 2007 and 2009 SSE index, it could potentially provide some explanatory power in combination with other variables. The dataset of relevant variables is summarised in Figure 2.

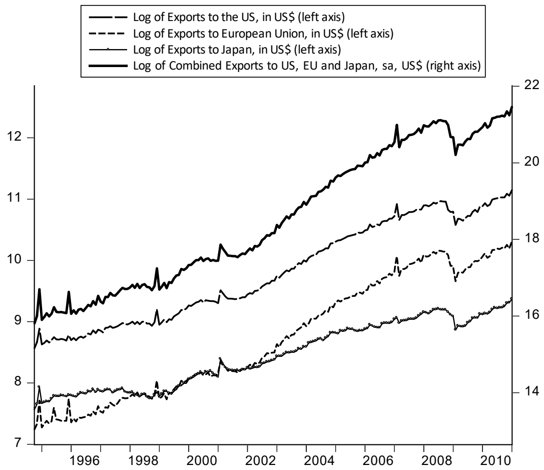
Figure 2- Factors affecting SSE returns

[4] Because the SSE A-share market involves transactions mainly between domestic residents investing in firms that operate domestically, we use the value of exports and energy prices *denominated in domestic currency*. In addition, it is worth noting that there is no international price for natural gas, which is typically set through bilateral contracts between transacting countries; however, natural gas prices are generally correlated with the oil price. Thus, we use the WTI oil price as proxy of both the international oil price and the international gas price.

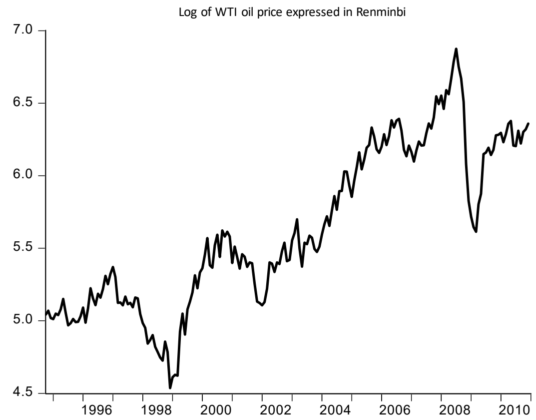
[5] The Consumer Confidence Index (CCI) is a barometer of Chinese consumers' changing outlook toward the macroeconomy, pricing and living conditions. The CCI is composed of two sub-indices; namely, the current index and the expectations index. The CCI covers four key sectors (real estate, durables, automobiles and stock investment) and is sampled from consumers of different age, income level and geographical location. The CCI is based on a monthly survey of 1,500 Chinese households via stratified random sampling in 50 representative cities across the eastern, middle and western parts of China using the well-established methodology based out of the University of Michigan.

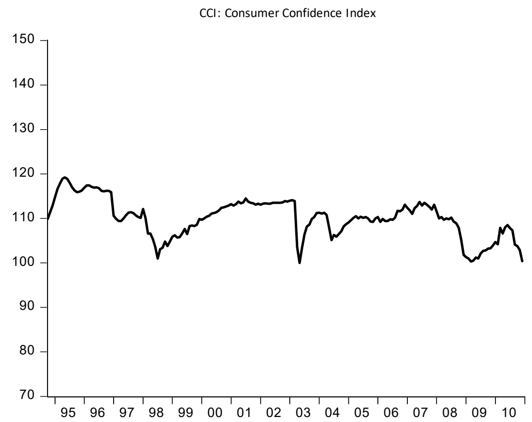


Exchange rate, Renminbi to US$, official rate (right axis)
CPI inflation, %YOY (left axis)
GDP growth, constant prices, %YOY (left axis)
25
20
15
10
5
0
-5
8.5
8.0
7.5
7.0
6.5
1996
1998
2000
2002
2004
2006
2008
2010



Log of Exports to the US, in US$ (left axis)
Log of Exports to European Union, in US$ (left axis)
Log of Exports to Japan, in US$ (left axis)
Log of Combined Exports to US, EU and Japan, sa, US$ (right axis)
12
11
10
9
8
7
22
20
18
16
14
1996
1998
2000
2002
2004
2006
2008
2010





Top-left: managed exchange rate and potential monetary policy targets of the People's Bank of China. Top-right: log of exports to major blocs and log of combined exports in renminbi. Bottom-left: log of WTI oil price in renminbi. Bottom-right: consumer confidence index. Source: DataStream.

3 Bear and Bull Markets and Markov-Switching Models in the Literature

The terminology 'bull' and 'bear' markets have had different definitions in the literature. Chauvet and Potter (2000, p. 90) used the following definition: 'In stock market terminology, bull (bear) market corresponds to periods of generally increasing (decreasing) market prices.' W. P. Hamilton in his editorials in the *Wall Street Journal* popularised the terms as follows:

‘*…Dow theory which saw the stock market as composed of three distinct movements and distinguished between the daily fluctuation... a briefer movement typified by the reaction in a bull market or the sharp recovery in a bear market which has been oversold... and the main movement which decides the trend over a period of many months’* (Hamilton, 1919, pp. 181-182).

Based on these observations, we define a bull (bear) market as a period of generally increasing (decreasing) stock prices that deviates from a long-term trend. The crucial aspect here is establishing the ‘long-term trend’ in our sample. To this end, we consider a mixture of both autoregressive terms and fundamental variables.

The use of Markov-switching econometric techniques for the analysis of stock returns became popular after the contributions of Hamilton (1989) and Hamilton and Gang (1996). In the applied finance literature, it is common to identify bull and bear regimes in stock markets with the use of Markov-switching models (Gordon and St. Amour, 2000, Maheu and McCurdy, 2000, Pagan and Sossounov, 2003, Edwards, Gomez Biscarri and Perez de Gracia, 2003, and Lunde and Timmermann, 2004). Generally speaking, these models study stock market returns using an autoregression with a regime-dependent mean or constant and regime-dependent heteroskedasticity. When returns are below (above) the long-term trend, the regime is identified as a bull (bear) market. This econometric approach can be traced back to Schaller and van Norden (1997), although these authors consider a simple hidden Markov chain rather than an autoregressive specification.

The main disadvantage of using univariate models is that the trend may not capture the effects of exogenous fundamental variables. These observation-motivated models with exogenous variables, such as the models of Chen (2009) and Chang (2009), introduce macroeconomic variables before identifying bull-and-bear switching stock market regimes. Other examples include Guidolin and Timmermann (2005) who identify bull and bear regimes in monthly data for portfolio allocations of stocks and bonds and Liow and Zhu (2007) who apply a bear-and-bull market model to asset allocation in real estate security markets. A theoretical justification for linking Markovian regime shifts with trading strategies is given by Gordon and St. Amour (2000) and Guidolin and Timmermann (2005). Gordon and St. Amour (2000) suggest that bull and bear markets can be associated with a utility function allowing agents' sentiments to switch from one state to another in a manner reminiscent of Keynes' 'animal spirits'.

In our case, it is particularly important to examine the link between SSE A-share bull and bear markets and monetary policy. Changes in policy targets since 2007 and its implications for China's exports and domestic consumption may have a considerable influence on China's stock markets. These possible links for China have not been explored in the literature. However, there has been extensive research linking US stock market behaviour to monetary policy. Bernanke and Kuttner (2003) find that unanticipated monetary surprises appear to have a significant effect on equity prices through changes in the equity premium. Conover, Jensen, and Johnson (1999) show that foreign stock returns generally react both to local and US monetary policy announcements. Thorbecke (1997) and Patelis (1997) demonstrate that shifts in monetary policy can help explain US stock returns. Further evidence of the strong historical link between US monetary policy and stock returns is found in Ehrmann, Michael and Fratzscher (2004), Rigobon and Sack (2003), Garcia and Schaller (2002) and Patelis (1997). In the context of identifying bull and bear markets, Chauvet and Potter (2000) use a Markov-switching stock return factor model that incorporates a 3-month T-Bill.

An interesting study that is similar to this paper is given by Chen (2007) who uses monthly data to analyse the effects of US monetary policy on the S&P 500 index. The author concludes that contractionary monetary policy has 'asymmetric' effects on stock returns because it is associated with a bear-market regime. Regarding SSE A-shares, the only study aimed at identifying bull and bear regimes is Girardin and Liu's (2003) study, which analyses returns that are adjusted by a Markov-switching mean in a univariate model with switching variance. The authors, however, do not consider any exogenous explanatory factors, and their data set is limited to the year 2002. With our model, we aim at improving on these results by incorporating the effects of changes in the exchange rate policy and other explanatory factors with data up to December 2010.

4 Model Structure

Our methodology follows a bottom-up approach. First, we fit Shanghai's stock excess returns with an autoregressive model allowing for a Markov-switching mean and variance. Second, we incorporate exogenous fundamental variables to assess whether they improve the baseline model. We consider different model variants with and without bull and bear markets and with and without fundamentals. The identification of a model and the dynamic statistical properties of bull and bear markets should provide insights into the dynamic property of this stock market.

As a baseline, we use an MSMH-AR (Markov-switching mean-adjusted heteroskedastic autoregression) approach to model the SSE A-share excess capital returns. The proposed model consists of a mean-adjusted autoregression in which the mean and the variance are allowed to switch among states. More formally, our MSMH(M)-AR(k) is written as follows:

$$[R_t - \mu(s_t)] = \phi_1[R_{t-1} - \mu(s_{t-1})] + \phi_2[R_{t-2} - \mu(s_{t-2})] + \cdots + \phi_k[R_{t-k} - \mu(s_{t-k})] + u_t,$$
$$u_t \sim N[0, \sigma(s_t)]. \tag{1}$$

where $s_t = j$ indicates which of the $[j, \ldots, M]$ regimes prevail in the system at time *t*. It is assumed that the transition among states is governed by a first-order, homogeneous Markov chain. Under this assumption, the probability of jumping from a state *i* to a state j is expressed as $p_{ij} = \Pr[s_t = j | s_{t-1} = i]$. These probabilities are collected in the following transition matrix:

$$P = \begin{pmatrix} p_{11} & p_{21} & \cdots & p_{M1} \\ p_{12} & p_{22} & \cdots & p_{M1} \\ \vdots & \vdots & \ddots & \vdots \\ p_{1M} & p_{1M} & \cdots & p_{MM} \end{pmatrix}, \ \sum_{i=1}^{M} p_{ij} = 1.$$

The values of the elements in this transition matrix are unknown and unobservable but can be inferred in a statistically efficient way in the estimation procedure. Unlike in other studies such as Pagan and Sossounov (2000), no minimum duration constraints for the regimes are imposed.

In the next step, we proceed to analyse the possible influence of fundamental variables with the models defined by Eq. (2), (3), (4) and (5). Models (2) and (3) are linear (i.e., exclude the possibility of bull/bear markets), and models (4) and (5) are their Markov-switching counterparts. Model (2) includes autoregressive parameters whereas Model (3) does not. Model (2) is also known as an ADL (autoregressive distributed lag model), and model (4) is a MS-ADL. The vector of explanatory variables X accounts for both contemporary effects X_t and lagged effects $X_{t-1}, \ldots, X_{t-\hbar}$. In the Markov-switching specifications, model (4) allows for smooth adjustment after shifts in the mean $\mu(s_t)$ through its autoregressive terms whereas the adjustment in model (5) is abrupt.

$$[R_t - \mu_R] = \sum_{l=t-1}^{k} \phi_l [R_{t-l} - \mu_R] + \sum_{q=t}^{h} \beta_q (X_q - \mu_X) + u_t, \;\; u_t \sim N[0, \sigma]. \quad (2)$$

$$[R_t - \mu_R] = \sum_{q=t}^{h} \beta_q (X_q - \mu_X) + u_t, \;\; u_t \sim N[0, \sigma]. \quad (3)$$

$$[R_t - \mu_R(s_t)] = \sum_{l=t-1}^{k} \phi_l [R_{t-l} - \mu_R(s_{t-l})] + \sum_{q=t}^{h} \beta_q (X_q - \mu_X) + u_t, \;\; u_t \sim N[0, \sigma(s_t)]. \quad (4)$$

$$[R_t - \mu_R(s_t)] = \sum_{q=t}^{h} \beta_q (X_q - \mu_X) + u_t, \;\; u_t \sim N[0, \sigma(s_t)]. \quad (5)$$

The vector X_t includes the following monthly variables[6]:

ΔRER_t: Changes in real exchange rate.

ΔEXP_t: Change in the natural log of combined exports to the US, the European Union and Japan in renminbi.

ΔOP_t: Change in log of the WTI oil price.

ΔCCI_t: Year-over-year change in the Consumption Confidence Index.

ΔD_t: Seasonal and intervention dummies for ΔEXP_t. Intervention dummies correct for large spikes in ΔEXP_t occurring around Christmas-time for the years 1995, 1997, 2006 and 2008 (see Fig. 2).

The raw data have been sourced from DataStream. Subject to data availability restrictions, we use monthly data for the period January 1995 to December 2010.

[6] In our preliminary work and estimations, we also considered the possibility of incorporating monthly data for China's investment, lending rate and industrial production. We found that gross fixed investment bears no relationship with the evolution of the SSE index or excess returns; a closer examination of the data revealed why this result happened. As was explained earlier, the SSE index reflects transactions between residents and domestic firms whereas total national investment is fuelled by foreign direct investment inflows of firms from abroad that set their operations in China. In addition, domestic investment channels are strongly influenced by government decisions or intervention in certain sectors. Aggregately, the lending rate does not appear to relate smoothly to investment decisions; again this result is due to fact that the Chinese government plays an important role in allocating capital through government-owned investment banks and the fact that foreign firms rarely borrow from Chinese institutions in mainland China. Finally, we considered industrial production as a proxy of income and consumers' purchasing power. A closer look revealed a very high correlation between exports and industrial production (not adding additional information in econometric terms); thus, we decided to use exports and a consumption confidence index instead.

The estimation of all parameters in the Markov-switching models (1), (4) and (5) is conducted by log-likelihood maximisation with an *Expectation Maximisation* (EM) algorithm. A full description of this estimation procedure is given in Kim and Nelson (1999, Ch. 5) and Krolzig (1997); the slightly different procedure is described in Hamilton (1994, Ch. 22)[7]. Here, we only outline a brief description of this procedure. It is useful to denote the autoregressive parameters of model (4) with the vector $\theta = [\{\phi\}_{k\times 1}\ \{\mu\}_{Mk\times 1}\ \{\sigma\}_{M\times 1}]'$ and define a vector $\xi_{t,M}$ as an indicator of the state prevailing in the system at time *t* (this indicator takes on the value 1 for the prevailing state and 0 elsewhere). Now, noting that the density function of (4) is composed by a joint probability, the log-likelihood function can be written as follows:

$$L(\theta, P, \xi | R_T) = \int p(R_T | \xi, \theta) \times \Pr(\xi | P, \xi_0)\, d\xi. \qquad (6)$$

Due to the conditional definitions and the non-linearities that emerge from the first order conditions, the estimation of the parameters requires an iterative EM algorithm (Kim and Nelson, 1999; Krolzig, 1997). Initially, starting values (θ_0, P_0, ξ_0) are proposed. In the *expectation* step, filtered $\xi_{t|t}$ and smoothed $\xi_{t|T}$ regime classifications are inferred from a state-space representation. Notably, the Kalman filter cannot be used because the transition innovations $v_{t+1} = \xi_{t+1} - E(\xi_{t+1}|\xi_t)$ are non-normal. Instead, the Kim filter and smoother is used (see Kim and Nelson, 1999, Ch. 5). The *maximisation* step is threefold. First, the transition matrix *P* is reconstructed from the hidden Markov process implied by $\xi_{t|T}$ and the initial conditions. Second, the initial state ξ_0 is recomputed. Third, conditional on *P* and ξ_0, the parameters θ are estimated. Then, the new estimates (θ_1, P_1, ξ_1) are proposed as initial

[7] The main difference is that Kim and Nelson (1999) and Krolzig (1997) use smoothing techniques that are easier to compute than Hamilton (1989, 1994).

values and EM steps are repeated. This process is iterated until convergence. The estimators obtained with this method are asymptotically efficient (see Krolzig, 1997).

5 Empirical Findings

This section follows a bottom-up approach. In the first subsection, we perform a dynamic analysis of bull-and-bear markets with a univariate model (1). In the second sub-section, we investigate the effects macroeconomic variables (exchange rate, exports, oil prices and a domestic consumption confidence index) with models (2)-(5) and various econometric tools allowing for model comparison and identification. In the last subsection, we present the best findings that we can obtain with the methodology described in Eq. (1) through (5).

5.1 Univariate Analysis

In this baseline model represented in Eq. (1), several choices have to be made. The first choice is about the number of regimes. Traditional literature suggests using two regimes for identifying bull and bear regimes (Section III). Girardin and Liu (2003) and Nielsen and Olesen (2001) have proposed incorporating a third 'speculative bull' regime. We consider that if more than two regimes have to be considered, an even number would be the best choice. An odd number of regimes could bias the regime classification during periods of rapid changes or high volatility. For instance, if some periods are associated with a higher mean and volatility, we believe that it is better to incorporate "highly speculative" bull and bear market regimes in addition to the "normal" bull and bear regimes. It is worth remarking that we use the term "highly speculative" to simply differentiate regimes with higher mean returns and higher volatility. We do not say, by any means, that these regimes should be associated with market manipulation or herding behaviour or that these regimes could not be explained by firm-specific fundamentals. This issue was addressed in some of the papers we reviewed in Section I. We return to this issue in Section VI.

From the pure statistical efficiency viewpoint, we cannot justify a large number of regimes given the number of observations. Thus, we consider the possibility of using no, 2 or 4 regimes. We select the number of regimes and the number of autoregressive lags according to Akaike's information criterion (AIC) and likelihood-ratio (LR) tests. We find that the best model contains 4 regimes and 3 lags. We avoid eliminating intermediate lags because it may affect the regime classification and lead to periodicity effects in the Markov process, which are difficult to interpret. In Table 1, we report a summary of the estimation output for model (1) and its comparison with a linear mean-adjusted autoregression.

Table 1- Summary of MSMH(4)-AR(3) estimation output and comparison with linear model

MSMH(4)-AR(3) Model

Estimation Report

Properties	
Sample period	01:1995 12:2010
Frequency	Monthly
Number of autoregressive lags	3
Number of Markov-switching regimes	4
Number of parameters	23
Number of parameters in linear model	5

Estimation Output vs. Linear Model	MSMHAR	Linear
Log-Likelihood	204.930	184.552
AIC	-1.9252	-1.900
Linearity Test		
LR Statistic (χ^2_{18})	40.7578	
Test p-value	0.0016	

Markovian Dynamics	Number of Obs.	Ergodic Prob.	Av. Duration
Regime 1: Highly Speculative Bear Market	24.1	0.087	3.80
Regime 2: Moderate Bear Market	83.1	0.510	4.77
Regime 3: Moderate Bull Market	44.6	0.263	2.29
Regime 4: Highly Speculative Bull Market	37.2	0.140	6.05

Parameter Estimates

Parameter	Estimate	Std. Error	t-Ratio
$\mu(1)$	-0.0853	0.0277	-3.0768
$\mu(2)$	-0.0297	0.0115	-2.5804
$\mu(3)$	0.0612	0.0177	3.4698
$\mu(4)$	0.0766	0.0178	4.3113
ϕ_1	-0.2783	0.0964	-2.8862
ϕ_2	-0.1751	0.0855	-2.0484
ϕ_3	-0.2741	0.0730	-3.7567
$\sigma(1)$	0.115410		
$\sigma(2)$	0.048051		
$\sigma(3)$	0.050490		
$\sigma(4)$	0.076768		

Transition Probability Matrix

$$\begin{pmatrix} 0.73690 & 2.233(10)^{-6} & 9.883(10)^{-6} & 0.1652 \\ 1.004(10)^{-9} & 0.7902 & 0.4070 & 3.500(10)^{-8} \\ 0.09091 & 0.2097 & 0.5627 & 2.978(10)^{-7} \\ 0.1722 & 4.187(10)^{-6} & 0.03031 & 0.8348 \end{pmatrix}$$

A priori, our expectations about the values of the means and volatilities in *M*=4 MSMH-AR model are as follows. Defining the regimes:

Regime 1: Highly speculative 'bear' market

Regime 2: 'bear' market

Regime 3: 'bull' market

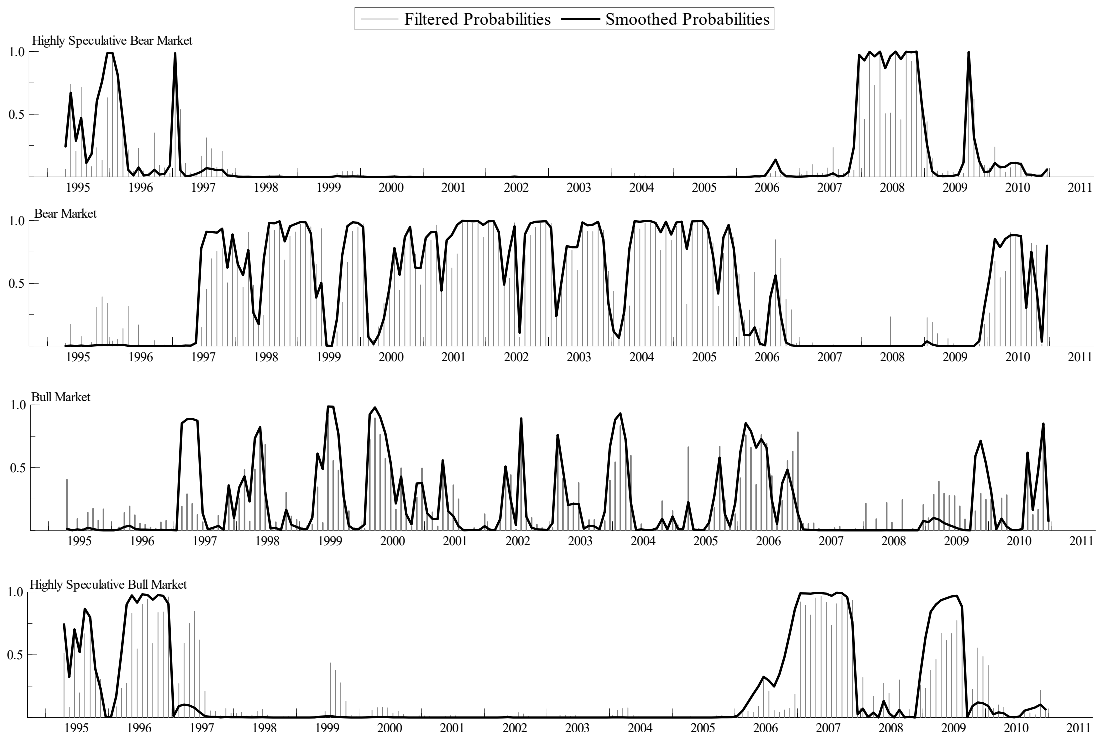
Regime 4: Highly speculative 'bull' market.

These definitions lead us to expect the following:

$\mu(1) < \mu(2) < \mu(3) < \mu(4); \mu(1), \mu(2) < 0; \mu(3), \mu(4) > 0; \sigma(1) > \sigma(2); \sigma(4) > \sigma(3).$

These expectations can be verified with results in Table 1.

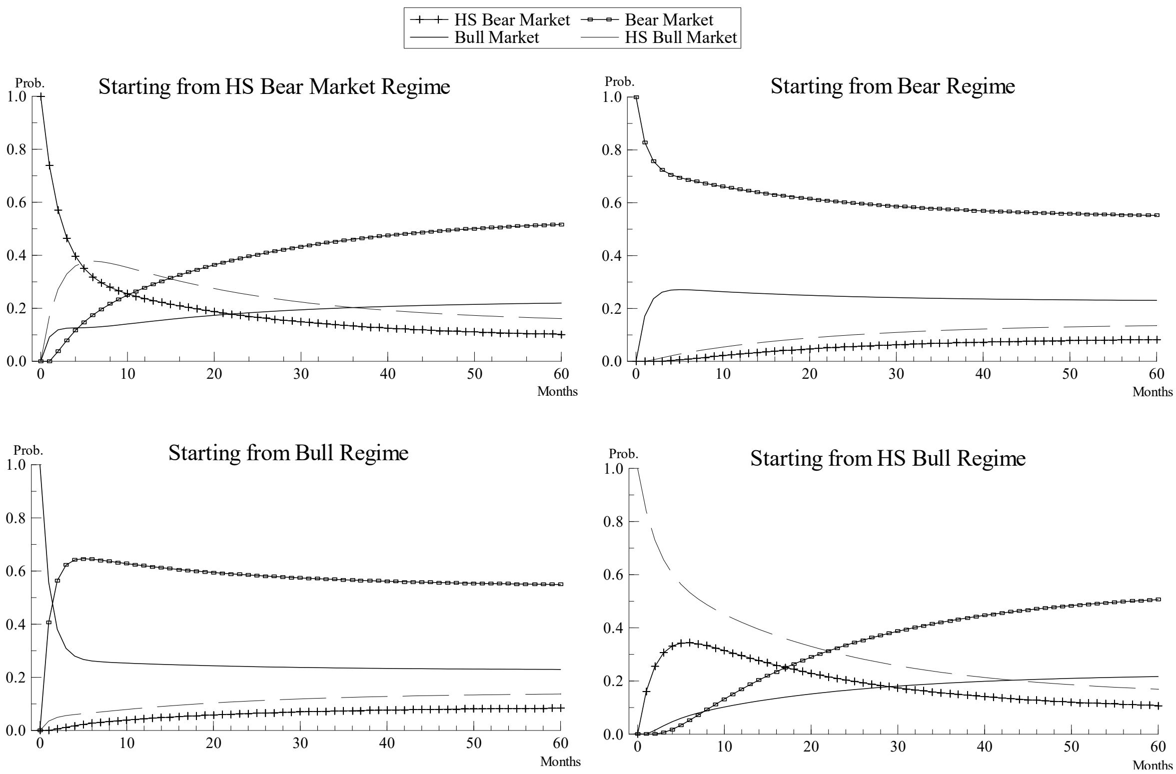
Figure 3- Regime Classification: filtered and smoothed probabilities of each regime



The most interesting information comes from the regime classification. In Fig. 3, we show the evolution of filtered (using up-to-date information) and smoothed (using whole-sample information) probabilities of being in each regime. The most persistent regime is regime 2 (moderate bear market). Inspecting the Markov-switching means in Table 1 reveals that regime 3 (moderate bull market) has a greater impact than regime 2, although it occurs less often. Considering these two regimes only suggests a cyclical behaviour in which Shanghai capital returns increase quickly and then smoothly decrease over time until the next increase takes place. Further inspection of the transition probability matrix in Table 1 reveals no evidence of absorbing states (i.e., states not allowing for switching); however, various Markovian probabilities are close to zero. For instance, regime 2 is not likely to switch to any state other than regime 3. From regime 3, it is more likely to switch to a highly speculative regime first (such as regime 4), and only from that new regime the system will likely move to the highly speculative bear market (regime 1). The one-period probability of remaining in regime 2 (bear market) is$p_{22} = 0.79$ which is not substantially higher than the probabilities for regimes 1 and 4. However, the probabilities of returning to regime 2 from other regimes are high, which suggests that overall the system exhibits a mean-reverting property associated with regime 2. As a consequence, regime 2 does not have a very high average duration (estimated at 4.77 months, which is lower than the duration of regime 4) but still accounts for the largest number of observations (approximately 83 months, according to Table 1).
Regimes 1 and 4 (highly speculative bear and bull markets) represent more extreme reactions and occur less often. Fig. 3 suggests that states 3 and 4 are present mostly around the time of the global financial crisis and recession, during 1995-7 when the SSE was still relatively new and following the development of the South East Asian financial crisis after the devaluation of the Thai Baht.

The information about persistence, mean-reversion and switching is summarised in the long-term probabilities of the Markovian process. The Markov process converges to unconditional ergodic probabilities $\bar{P} = Lim_{h\to\infty} P^{h}$, which become stationary. We have plotted these probabilities in Fig. 4, which shows that convergence occurs after approximately 50 periods. Fig. 3 also contains important information about the short-term dynamic adjustment. The unconditional probability of being in regime 2 converges to 0.51 (Table 1) making it the most recurrent state. However, the cut-off points in Fig. 3 suggest that it takes 15-20 months to return to regime 2 from the highly speculative regimes 1 and 4. The moderate bull market regime 3 is the least-persistent regime and is quickly overtaken by regime 2.

Figure 4- Dynamic properties of the Markovian process in the MSMH(4)-AR(3) model: the probabilities of being in each specific state converge to unconditional values



Our four-regime MSMH-AR specification also reveals interesting results in terms of how changes in the variance structure relate to mean values. On the one hand, if we compare the highly speculative bear and bull market regimes 1 and 4 in Table 1, we conclude that on average the volatility of the bear market is higher than that for the bull market under high speculation, i.e., $\sigma(1) > \sigma(4)$. On the other hand, comparing the moderate bull and bear market regimes 2 and 3, which are associated with less extreme reactions, suggests that the bull market regime is more volatile on average. These results should be compared with other results in the literature. Several authors such as Girardin and Liu (2003), Maheu and McCurdy (2000), Guidolin and Timmerman (2005) and Edwards *et al*. (2003) have found that stock market volatility is higher during bear market periods than during bull markets. In our case, this property does not hold for tranquil periods; however, this property does hold under extreme bull and bear markets.

5.2 Modelling SSE Capital Returns with Fundamental Variables

Movements in highly speculative bear or bull market regimes could be associated with three major factors: investors' uncertainty, characteristics of the business cycle, or some other fundamentals. First, it could be argued that if investors face high uncertainty, they tend to react quickly to news and become more impulsive in trading, adding to volatility. This view suggests that during tranquil periods, the moderate bull market is slightly more volatile than the bear market, although under extreme circumstances this trend reverses. Second, activity in bull and bear markets can be associated with the business cycle. During a recession, consumer confidence and the marginal propensity to consume may weaken (resulting in China's falling internal demand or falling demand for its exports) affecting firms' asset valuation. Furthermore, demand uncertainty may translate into uncertainty about the stock. It is also worth noting that as the business cycle is often asymmetric, we would expect distribution for bear and bull markets to differ. Finally, some of already discussed economic fundamentals may be relevant for explaining SSE A-share returns. With the univariate model in the previous subsection, it is not possible to establish a clear distinction between these three factors. Now, we attempt to distinguish between cases in which bear and bull markets emerge purely within the stock market *after accounting for* the effects of the business cycle and other fundamental factors. We start by discussing some alternative models that have been summarised in Table 2.

Table 2- Summary of findings using linear models (2) and (3): (×): Imposed restrictions

Linear Models with Explanatory Factors

	t-Ratios									
	ϕ_s	$\beta_{RER.s}$	$\beta_{EXP.s}$	$\beta_{OP.s}$	$\beta_{CCI.s}$	F-Statistic	Log-Lik	Log-Lik Linear AR(3)	AIC	Nested LR Test Against Linear AR(3)
Model (2)										
i. Optimal Lag Structure ADL(3,3)										
Lag 0	-	-1.894	-1.070	1.971	0.966					
Lag 1	0.025	1.374	-0.969	0.219	0.220					
Lag 2	2.151	-0.156	-0.783	0.428	-1.273	1.1299	183.940	184.552	-1.8863	-1.224
Lag 3	-0.402									
ii. Contemporary Effects Only										
Lag 0	-	0.509	-0.346	2.410	1.057					
Lag 1	0.043	×	×	×	×					
Lag 2	2.190	×	×	×	×					
Lag 3	-0.525	-	-	-	-	1.9175	183.469	184.552	-1.9494	-2.166
iii. Alternative Specification										
Lag 0	-	-1.748	-0.569	2.411	×					
Lag 1	0.015	1.920	×	×	×					
Lag 2	2.209	×	×	×	-1.223					
Lag 3	-0.582	-	-	-	-	2.3310	185.573	184.552	-1.9621	2.042
Model (3)										
i. Optimal Lag Structure q=3										
Lag 0	×	-1.876	-0.863	2.347	0.972					
Lag 1	×	1.455	-0.713	0.250	-0.009					
Lag 2	×	-0.191	-0.692	0.848	-1.061	1.3875	181.319	-	-1.8906	-
ii. Contemporary Effects Only										
Lag 0	×	0.529	-0.1622	2.768	1.023	2.7750	180.871	-	-1.9538	-
iii. Alternative Specification										
Lag 0	×	-1.014	×	2.439	×					
Lag 1	×	1.115	×	×	×					
Lag 2	×	×	×	×	×	4.1009	188.810	-	-1.9150	-
Model (4)										
Full-Model MSMH(4)-ADL(3,3)										
Lag 0	-	-1.656	0.3657	2.021	1.506					
Lag 1	-3.644	1.051	0.2253	2.384	1.028					
Lag 2	-3.435	-1.207	-0.7565	0.9394	-0.058					
Lag 3	-4.602	-	-	-	-	-	211.076	184.552	-1.9896	53.048
Nested Model (5)										
Lag 0	×	-1.349	-1.049	2.366	-0.224					
Lag 1	×	1.366	-0.841	1.392	0.103					
Lag 2	×	-0.830	-0.828	1.499	-1.402					
Lag 3	×	-	-	-	-	-	194.1316	-	-1.8546	-
Nested Model (1)										
Lag 0	-	×	×	×	×					
Lag 1	-2.880	×	×	×	×					
Lag 2	-2.048	×	×	×	×					
Lag 3	-3.757	×	×	×	×	-	204.930	184.552	-1.9252	40.778

Nested LR Tests	**LR χ^2 Test Statistic**	**D.f.**	**Critical Value $\alpha = 0.05$**	**Non-nested Tests**	**t-Test Statistic**	**D.f.**	**Critical Value $\alpha = 0.05$**
				Model (3.ii) vs AR(3)	2.2188	75	1.992
Model (5) vs Model (4)	33.8888	16	26.296	Model (3.iii) vs AR(3)	2.7356	88	1.987
Model (1) vs Model (4)	12.292	64	65.171	Model (5) vs Model (1)	7.8565	31	2.040
				Model (1) vs Model (5)	0.5746	31	2.040

The models (2)-(5) estimated in Table 2 for optimal lag structures and different subsets of explanatory variables suggest that, overall, there is no strong evidence of relationships between the explanatory variables and SSE A-share capital returns; however, detailed testing is needed to make an assessment.

The different tests in Table 2 are interpreted as follows. For model (2), *t*- and *F*-tests suggest that none of the explanatory variables contribute to explaining movements in A-share capital returns, either individually or as a group, at the 5% significance level. Furthermore, conducting a nested LR test of a simple AR(3) model against model (2.i) suggests that there is no improvement in the log-likelihood function as to reject the model AR(3) specification. Furthermore, we test with different variants of model (2) including contemporary effects only (model 2.ii) and an alternative restricted specification (model 2.iii) selected by Akaike's information criterion; in all these models, the contribution of exogenous variables was found insignificant. The results for the model (3) variants (which exclude autoregressive terms) suggest that the exogenous variables do not offer explanatory power (except for oil price changes, which are weakly significant). Next, we turn our attention to the Markov-switching specifications (4), (5) and (1). We find that in models (4) and (5), none of the coefficients associated with the exogenous variables are significantly different from zero[8]. In Table 2, we report nested LR tests, which suggest that the restrictions imposed in model (4) are not justifiable whereas the restrictions in model (5) are. We also perform non-nested tests based on Davidson and McKinnon (1993)'s methodology. We run Model (5) adding the predicted

[8] We choose not to compute *F*-statistics or Markov-switching specifications because their estimation may be trivial. Unlike ordinary regressions, MS models produce multiple predictions; thus, computing the unconditional mathematical expectation of the dependent variable requires additional assumptions. For instance, given a multi-modal density function, one could choose the mode of the density that is closest (delay convention), the mode that is highest (Maxwell convention) or the expected value conditional on the Markov process.

values $[\widehat{R_t - \mu_R}]_1$ from model (1) as an explanatory variable; if model (5) has better explanatory power than model (1), then the coefficient for $[\widehat{R_t - \mu_R}]_1$ should not be statistically significant. Our results suggest that the univariate model (1) has more explanatory power than model (5), which includes exogenous variables only. In addition, using the Davidson and McKinnon (1993) test for comparison of linear models suggests that autoregressive parameters produce substantial improvement in predicting A-share returns. Overall, we conclude that none of the models used so far produces any significant improvement on model (1).

5.3 Solving the Puzzle: Further Analysis

So far, the data suggests no strong associations between explanatory variables and SSE A-share returns in the sample under consideration. Only the oil price becomes weakly significant in some specifications but has the wrong sign (see Table 2, we would expect a negative sign for oil price because China is a net oil importer). Visibly, Figure 1 shows a large spike in 2007/2008 that could be *a priori* linked to the evolution of the global business cycle and the Chinese economy; however, incorporating the fundamentals associated with share returns (exports, domestic consumer confidence, real exchange rate and oil price produce) in models (2)-(5) provides no result.

To solve this puzzle, we now propose looking into the more extreme reactions in the SSE market that were originally identified with model (1). The highly speculative bull and bear regimes prevail in the sub-periods 01:1995-05:1997 and 01:2006-12:2009 (Figure 2). If we estimate a two-regime MS(2)-ARX model for each of these two sub-periods, the results may shed some light on how much of the speculative regime shift originated from fundamental variables and how much is due to unexplained factors in the model ('pure' bull and bear markets). Considering this idea, we estimate two additional sub-period models; the results are summarised in Table 3.

Table 3- Alternative MS-ADL specification for sub-periods

MS(2)-ADL(3,1) Models for Highly Speculative Sub-periods				
	Sub-period 01:1995 – 05:1997		Sub-period 01:2006 – 12/2009	
	Full Model	Constrained	Full Model	Constrained
$\mu(1)$	0.0838 (0.8460)	-0.0058 (-0.1716)	-0.0800 (-7.6192)	-0.0749 (-6.9681)
$\mu(2)$	0.0846 (0.8715)	0.1008 (3.7509)	0.0987 (11.2657)	0.0960 (11.2677)
ϕ_1	-0.2547 (-0.9298)	-	-0.8642 (-7.3088)	-0.8235 (-6.5814)
ϕ_2	0.0712 (0.3538)	-	-0.8194 (-6.2601)	-0.8015 (-6.8466)
ϕ_3	0.1315 (0.6077)	-	-0.6649 (-6.7959)	-0.6292 (-6.5120)
β_{RER}	0.5411 (0.4579)	-	**-1.1536 (-6.0339)**	**-1.0063 (-5.4855)**
β_{EXP}	6.0222 (1.2235)	-	-0.6371 (-0.7959)	-
β_{OP}	0.1092 (0.3405)	-	-0.9056 (-1.0804)	-
β_{CCI}	**0.0619 (3.3015)**	**0.0595 (4.0852)**	-0.0130 (-1.1182)	-
$\sigma(1)$	0.078876	0.11171	0.090661	0.088940
$\sigma(2)$	0.079139	0.07858	0.035057	0.038544
p_{11}	0.6868	0.9449	0.7562	0.7588
p_{12}	0.3132	0.0511	0.2438	0.2412
p_{21}	0.2946	0.0210	0.1508	0.1523
p_{22}	0.7054	0.9790	0.8492	0.8477
Log Likelihood	17.9075	25.0818	51.3116	49.4692
AIC	-0.6134	-1.2470	-1.5963	-1.6446

Note: *t*-values are reported in brackets

The above estimations suggest that economic fundamentals do matter in the SSE A-share market but only under extreme regimes that last short periods of time. For the period 01:1995-08:1997, we find that consumer confidence was an influential factor determining SSE returns. We also find that changes in the real exchange rate are influential during the period 01:2006-12:2009. As explained earlier, the effects of a real exchange rate appreciation on imports could go in two directions. As Table 3 suggests, the positive effect of a real exchange appreciation on imports (i.e., imports rise) dominates because the appreciation has damaged SSE excess returns. During tranquil periods outside these intervals, we conclude that the A-share returns are not associated with any of the fundamental variables but do matter when the A-share market is in turmoil. This observation is consistent with the hypothesis that fundamentals are used as 'signals' or best predictors of SSE A-share prices in times of turmoil, given the informational constraints of this particular market. Overall, the univariate model in Table 1 and the sub-period estimations in Table 3 provide interesting insights into the dynamics of the SSE A-share market and the influence of macroeconomic fundamentals.

6 Conclusions

The macroeconomic-based analysis in this paper contributes to solving part of the SSE A-share puzzle. With data up to 2004 and firm-specific fundamentals, Eun and Huang (2007) had claimed that SSE A-share prices did respond to some type of 'rationality' in that period. A later study by Yao and Luo (2009) had indicated that firm-specific fundamentals cannot fully explain the peak around 2007, which these authors attribute to psychological factors. Our results offer an alternative interpretation for the 2007 peak and for the turbulence in the early development stage of the Shanghai stock market. We argue that during these periods, the 'sentiment' pushing A-shares can be associated with macroeconomic fundamentals. Overall, the big picture suggests that firm-specific fundamentals explain the price of A-shares in tranquil periods and that macroeconomic fundamentals (domestic consumption and changes in monetary policy) explain the sentiment driving the price during more turbulent periods. The periods with more extreme returns and variance are found to be influenced by changes in consumer confidence and the exchange rate policy. The conjunction of all these elements suggests that A-shares respond to some 'rationality' despite the widespread perception to the contrary. This analysis provides some answers to a difficult question: what drives prices or excess returns of A-shares in the Shanghai stock market?

Despite these findings, our model may be subject to some limitations. We have considered monthly data over a relatively long period of time. For higher-frequency data over shorter periods, it cannot be rejected that herding behaviour or short-selling speculation plays an important role. The characteristic of this particular market, which is dominated by a large number of small resident investors who make short-term gains, may support the 'casino' hypothesis in the short run. After all, the SSE still suffers from dubious accounting practices, lack of transparency, market manipulations, insider trading problems and unsatisfactory corporate governance with limited disclosure of information about firms' balance sheets.

Further conclusions can be derived from our results. Our evidence does not identify any overall long-lasting relationship between A-share returns and macroeconomic fundamentals during tranquil periods, rejecting the hypothesis that fundamentals can be used as signals of expected overall profitability. However, we find that during extreme regimes of short duration, the exchange rate and consumption are influential. The latter provides ground for the idea that strong changes in monetary policy and domestic consumption may be used as a signal for predicting future profitability of A-share constituents.

An interesting finding relates to the dynamic properties of A-share excess returns in our univariate regime classification. The finding suggests that moderate bull markets push returns up quickly, generally followed by a slow moderate bear market. Hence, the moderate bull market is found to be the most persistent and recurrent state. This finding might be useful for future research on the behaviour of A-shares during tranquil periods.

Finally, with China's latest five-year plan, the Chinese economy is notably becoming more oriented towards internal consumption and less export dependent. If this trend deepens in the future, the SSE will develop and mature to become an important and perhaps more stable and less uncertain institution in China's domestic economy. It will be interesting to repeat this exercise in ten years' time to re-assess the role of macroeconomic fundamentals. This paper has set a precedent for future research on A-shares and China's domestic economy.

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