Bayesians in a China Shop:

Statistical Properties and Stylistic Facts after 20 years of China's Stock Markets

A Huntsman Program Honors Senior Thesis

Spring Semester 2010

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论文简介

80 年代中期，中国恢复了股票的发行和买卖，先后在上海和深圳成立了证卷交易所。中国股票的发展与企业所有制改革有着密切的关系。通过改革，越来越多的公司从国有转向股份制，它们通过发行股票，在资本市场上筹集资金。

目前，按照股票上市地点和投资者的不同，中国企业的股票可分为 A 股，B 股，H 股和 N 股四种。A 股是以人民币标明面值，原本单供境内居民购买的股票；B 股又叫人民币特种股票，是以人民币标明面值，以外币认购和买卖，原本单供境外居民及机构购买的股票。中国的股票市场不停的改变。2001 年 2 月份起，B 股市场以全面向境内投资者开放。在 2005 年，A 股市场同样也想境外的投资者开放了。A 股和 B 股都有完整的投票权，与美国根据投票权不同而划分的普通股和优先股的概念不同。这可说是一种共产主义的平均主义实施。如今，虽然 A 股和 B 股有完全一样的权利，同一样企业的 B 股 A 股一般有 60%的溢价。

此论文经过统计分析中国股票市场的事实，并尝试说明及辩解实施的因素，比如：房地产市场的液体性很底，投资过程也复杂，使在股票市场投资对普通人而言很有吸引力。根据金融理论，因为中国境内的投资者没有其他投资渠道，这与资本资产定价模型一致。

中国证卷市场还处于发展阶段，相关的法律，法规和金融制度尚不健全，老百姓也缺乏投资知识和风险意识。中国的金融制度改革还不完善，但对任何投资者来看，可能是国际金融市场上最光明的投资渠道。

An Introduction

Although past is not prologue, Bayesian inference – the inductive "informed guess" – guides our investment decisions in situations of incomplete knowledge. Knowledge about Chinese stock markets is certainly incomplete; with a history going back only to 1990. Although new, they developed quickly. The Shanghai Stock Exchange now boasts a market capitalization of US$2.5 trillion (Chinese GDP is US$4.91 trillion), though in 2008 it surpassed the NASDAQ to become the second largest stock exchange *in the world* due to a brief stock bubble.

20 years have passed, but the Chinese equities investment scene is still little understood by foreign investors, and, arguably, local investors to a greater extent. There is a need for a consolidation of knowledge – quantitative and qualitative – about China's stock markets. However, process is important: On the one hand, a quantitative summary of the stylistic facts of Chinese markets cannot overemphasize specific relationships, as they will surely change over time. On the other, most qualitative histories of the Chinese economy are too general, and do not afford enough focus on the impact of Chinese government intervention in the stock market. Our challenge is thus to make the quantitative general and the qualitative specific.

Part I consolidates the relevant history of Chinese government regulation and intervention in the stock market. Part II details the stylistic facts uncovered in our 20 year data series. Part III combines Parts I & II and existing literature to produce 3 explanations of Chinese stock markets.

Because the paper is written for a broad audience, no knowledge beyond elementary finance and statistics is assumed. Statistical concepts are explained and the practical conclusions are emphasized over the mechanics of calculation.

A Primer on the Chinese Equities Environment

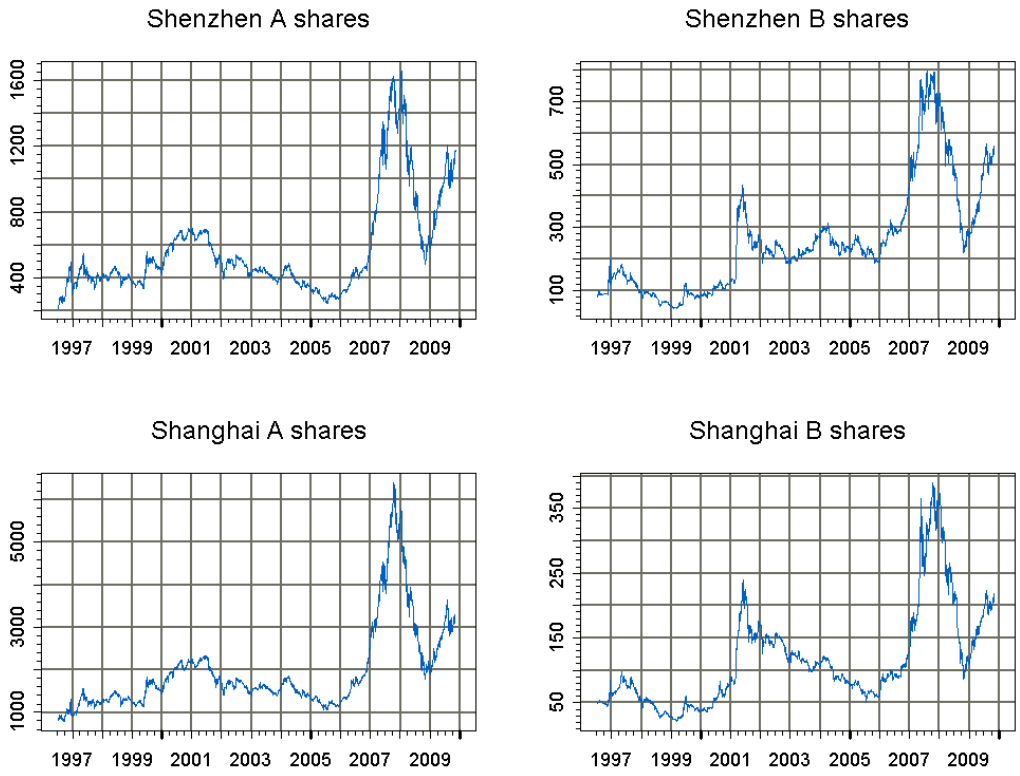


Figure 1. A plot of Chinese market[1] *indices over time, showing sharp rises and falls.*

The **China Securities Regulatory Commission (CSRC)** is the Chinese ministry with direct oversight of stock markets in **Shenzhen** and **Shanghai**. These split into submarkets due to the **A-share, B-share policy**, which originally only allowed companies issue two classes of otherwise identical shares with A shares for locals and B shares for foreigners (although these rules have been relaxed substantially). B shares are denominated in USD and HKD and generally trade at a discount to similar A shares.

[1] Due to a long history of autonomy and a very different economic regime (e.g. having its own currency), both Taiwan and Hong Kong, regarded as part of *greater* China, are not focused on in our study of *mainland* China.

Part I: A History of the Shanghai and Shenzhen Stock Exchanges

For a former command economy, nothing can be scarier than a stock market. The freewheeling allocation of resources, the apolitical tendency to enrich the rich, the sudden leaps and crashes in wealth and in cost of capital, are the antithesis to the carefully considered deliberations of government bureaucrats. However, with the Communist Party's famous pro-capitalist about-face in the 1980's, the Chinese economy was forced to transition rapidly in terms of how capital was to be allocated from savers to borrowers. Fittingly, this transition was led by Mao Zedong's successor, the pragmatic Deng Xiaoping, who in 1961 declared "I don't care if it's a white cat or a black cat. It's a good cat so long as it catches mice." (Li 1996) Over the decades leading into the beginning of the 21st century, China's "white cat" – its bank-based financial system – would make room for the "black cat" securities-based financial system in the hopes of China's ultimate goal of financing its rapidly expanding economy, its equivalent of "catching mice". The development of the stock exchanges can be characterized over three phases: in the first two years, relatively independent "self-regulation"; in the following five years, contentious and confusing "dual supervision"; and finally full governance by the national CSRC.

Phase One: The era of "self-regulation": December 1990 to October 1992

China's two stock exchanges were established in December 1990 and April 1991 as *de jure* self-regulatory organizations, but in practice they were overseen by the Shanghai and Shenzhen municipal governments (Green 2004). The exchanges got off to a slow start, and market participants were especially fearful in the post-Tiananmen period. The Tiananmen episode had shown that while the post-Mao Communist party was generally in favor of reform, they would not hesitate to crack down on drastic changes that were not to their liking or, more bluntly,

changes that were threatening to the continuation of their power. This theme of cautious reform informed the regulations of the exchange right from the beginning. The Shenzhen and Shanghai authorities were initially of the opinion that the flows of fickle capital would lead to excessive volatility in stock market prices, and imposed a daily price change limit of 1% on all stocks, which was probably 1% more than they were truly comfortable with.

Despite its initial caution, the market received an important signal when, in early 1992, Deng Xiaoping spoke publicly about the need to expand economic reform especially through securitization. On 21st February 1992, the first B share limited to foreign-ownership, for stake in a company called Shanghai Vacuum Electron, was launched in the Shanghai Stock Exchange, soon followed a week later by the offering of China Southern Glass B shares in Shenzhen (Bailey 1994). By March 1992, tens of thousands of state-owned enterprises sought permission to restructure into shareholding companies (Su and Fleisher 1999). In Shenzhen and Shanghai, this played into local leaders' desires for more financing for local industry, increasing revenues by privatization, and the development of an entirely new financial industry. To a great extent, this was incentivized by the local governments' ability to collect a stamp tax – 0.3% of the value of every share that changed hands would be collected as tax revenue by the government. This meant that promoting increased share issuance, inflated share prices, and above all high trading volumes was in the interest of local government. To encourage stock market activity, the daily price limit restriction was abruptly relaxed to 5% on 5th May 1992 and was completely removed on 20th May 1992 (Bailey 1994). This last action was remarkable in that removal of price limits led to a doubling of the locals-only Shanghai A-share index in one day (Su and Fleisher 1998).

Over time, the encouragement of local government as well as Deng's comments had also inspired tens of thousands of small investors to buy shares to the point of fever. By August 1992, one million people per day were queuing to buy IPOs. Problems of black markets and corruption became so rampant that street protests spontaneously broke out on 10th August, 1992, after dissatisfied investors were told that IPO application forms had been sold out despite the official supply being 5 times greater than demand (the government officials handing them out had kept them for bribes, friends, and family). This was the biggest social disturbance since Tiananmen, and the Chinese central government shut down all further share issuance after the 10th August riots (Green 2004).

Phase Two: The era of "dual supervision": October 1992 to July 1996

The advantage of centralized authority showed as China was able to reopen its IPO markets in under three months. Responding to the mismanagement of local government officials in Shanghai and Shenzhen, China's central government established the CSRC as a regulatory body with the specific purpose of overseeing the equities markets. However, many of the rules formulated by central government were manipulated, undermined, or simply ignored by local officials. This led to capital market crises from 1993-96, a confusing time with companies offering share dividends that were approved by the Shanghai Exchange but opposed and found illegal by the central government (Green 2004). By 1996 a full-on turf war had developed with the Shenzhen Stock Exchange actively competing for listings against the Shanghai Stock Exchange, against the express wishes of the CSRC, in particular defending price volatility as a natural phenomenon of the market, persuading and inducing companies to list in Shenzhen, and minimizing fines for member companies if they were caught breaking regulations. The

Shenzhen government also supported its stock exchange's efforts, providing loans to listed companies, Hong-Kong listing opportunities, professional consultation, and innovative convertible bond issues to companies that would list in Shenzhen. Since individual traders dominated in the early days on the exchanges, Shenzhen in August 1993 aggressively opened up to institutional investors, resulting in predominantly institutional trading occurring in Shenzhen (Mookerjee and Yu 1995). As a result of this, the value of the average lot size in A shares in Shanghai was RMB1000, while in Shenzhen the average lot size was about RMB10,000. Most egregiously, in June 1996 the Shenzhen authorities even allowed local Chinese to buy into the B-Share market, the underpriced class of shares exclusively reserved for foreign passport holders by the CSRC (Green 2004). Shenzhen securities firms persisted in allowing local Chinese to buy B-Shares even after the CSRC posted official notices to crack down on the action. By 1996 Shenzhen had overtaken the Shanghai exchange in terms of total market capitalization:

Market capitalisation of the Shenzhen and Shanghai exchanges, 1993-97

	1993	*1994*	*1995*	*1996*	*1997*
Shanghai	42.4	58.7	58.7	140.7	251.3
Shenzhen	43.8	38.2	35.1	145.8	269.1

Rmb billion
Source: CSRC.

Figure 2. Shenzhen overtook Shanghai by 1996, although this was not to last.

For its part, Shanghai was not content just sitting still. It instructed its banks to extend loans to securities companies, and allowed SOEs and insurance funds to enter its markets. This was a reflection of the dominance of the bank-based financial system still existing in Shanghai.

The era also brought with it the first extensive accounts of speculative practices, and divides between classes of investors. Institutional investors would buy large amounts (80%) of a company's stock, wait for retail investors to follow the artificial momentum, and then dump their shares (Green 2004). The politically-motivated increased share issuance combined with investor mania to drive up daily trading volume at both exchanges to RMB 35 billion, more than three times the similar-sized Hong Kong Stock Exchange on a high-volume day. This rapid expansion does not become so surprising when taken together with the fact that the municipal governments gained revenues from a stamp tax levied on each A- and B-share transaction, vastly boosting municipal budgets. These revenues were significant – by 1996, 28.9% of the city of Shenzhen's tax revenue came entirely from this trading stamp tax (Green 2004).

Phase Three: Central Take-Over of the Exchanges: August 1996 – January 2001

To cool off the market, the national government in 1996 was forced into taking ad hoc administrative actions within its authority. Resorting to propaganda, no less than Chinese Vice Premier Zhu Rongji published a front page editorial entitled "A correct understanding of the current stock market" in the People's Daily on 16th December 1996 (Zhu 1996), comparing Shenzhen stock market activity with the prelude to the American 1929 stock market crash. The CSRC followed up by temporarily reintroducing a 10% daily price change limit on stock price movements (Zhang 1998). It also introduced an 80:20 stamp tax sharing ratio to reduce local leaders' incentive for market-boosting measures.

These measures, though effective, only had a temporary impact, and by February 1997 trading activity was back to former levels, prompting a further set of actions from CSRC in April 1997 –

it increased the stamp tax to 0.5%, but reduced the national-local stamp tax sharing ratio to 88:12, decreasing somewhat local government's incentive to boost stock market activity.

Now wiser to the dangers of financial instability arising from the shortsighted actions of local regulators, the SCSC passed the Measures for the Administration of Securities Exchanges in August 1996, in theory abolishing the local leaders' jurisdiction over the exchanges and strengthening the CSRC's power over all regulatory functions. However, this failed in the implementation as local leaders successfully resisted the central government take-over for over a year. The State Council only managed to replace the influential heads of both exchanges in August-September 1997, finally consolidating control only in end 1997 (Green 2004). The October 1997 stock exchange management rules ended the exchanges' status as SROs and confirmed their newfound place as micro-managed organs of the CSRC. One example of the drastic change in powers is the authority over listings. Before 1997, the two exchanges lobbied against each other for firms to list there, at the firms' discretion. After 1997, once the CSRC had authorized a firm for issuance the firm was allocated to either the Shanghai Exchange or the Shenzhen Exchange for a listing, at the CSRC's discretion. From 2000, the government suspended all new listings at the Shenzhen Exchange, planning to transfer Shenzhen's A-shares to Shanghai in the widely expected conversion of the Shenzhen Exchange into the Growth Enterprise Board (a prospective third stock exchange for small and medium enterprises). This was later delayed, and then canceled. Lastly, the government permanently reimposed a 10% daily price limit on all stocks on December 16, 1996 (Su and Fleisher 1998).

Phase Four: Gradual Opening of Markets: February 2001 – Present

Government interventions notwithstanding, the next major regime shift came on 19th February 2001 when the CSRC announced that domestic investors could open trading accounts for B-shares, which until now were previously reserved for foreign investors. In the other direction, investment in the A-share market was opened up when UBS Warburg and Nomura Securities were awarded Qualified Foreign Institutional Investor status on 27th May 2003 during a sustained slump in Chinese stock markets (Lin, Menkveld and Yang 2009).

The overarching trend behind the actions of the CSRC and Chinese government has been for China to gradually loosen its restrictions on capital movement, in response to tremendous investor demand (as well as pressure from multinational groups like the WTO). Previously, if a Chinese A-share investor was only investing for dividend yield, he would be able to quadruple his returns by illegally gaining access to the B-shares, even without requiring the prices of comparable A and B shares to converge. This great incentive explained the "porous border" barring local investors from investing in Chinese B-shares – officially, Chinese government policy prohibited securities firms from allowing their Chinese-national clients to purchase B shares, but in practice there was strong anecdotal evidence that it was weakly enforced across the hundreds of securities firms proliferating throughout China. The incentives for crossing the A-B share border were great, but investors risked losing their entire investment if caught and successfully prosecuted. Thus for the vast majority of local Chinese, A-share investment had been the only viable stock market vehicle.

With its stock market system established, the CSRC has also turned its attention toward other securities regulations. In 8th September 2006 it launched the China Financial Futures Exchange, the mainland's first exchange specializing in derivatives trading.

However China does not have the liquid derivatives markets of the western world just yet, as the CFFX only offers futures contracts on market indexes and certain commodities. Going forward, one can expect increasingly sophisticated securities trading in China to meet the needs of its ever expanding businesses.

Part II: 1990-2009: Stylistic Facts

Introduction

The importance of stylistic facts in calibrating the expectations of the rational Bayesian investor cannot be understated. Although Alexander Pope, in his *An Essay on Criticism (1709)*, claims that "a little learning is a dangerous thing", the same cannot be said for learning informed by statistically significant historical data. While we take note of the usual caveats cautioning any forward expectation based on the past, we must accept that there are intrinsic differences in each asset class that make them more or less desirable as an investment, and to this extent, robust stylistic facts with a sufficient order of magnitude of difference and statistical significance will serve to help us separate out the superior assets as well as perform some degree of risk management. In this section of the paper we take to task the intuitive foreign (and locally-held) view that Chinese stocks have done well but have undesirably high volatility and political risk. We find that Chinese stocks have done well even adjusted for volatility, that political risk biases returns toward the positive, and that the many ways to profit from exploiting stylistic facts of Chinese stock markets make them attractive components of any investor's equity portfolio.

Data Specification

The Chinese market daily stock return data (for the Shanghai A share and B share and Shenzhen A share and B share indices respectively) used in this section was acquired from the China Stock Market & Accounting Research database designed and developed by GTA Information Technology. Data on S&P500 returns were obtained from the University of

Chicago's Center for Research in Security Prices. Lastly, data covering the MSCI World Index and Hong Kong's Hang Seng index was obtained from Global Insight Inc's database. All data sources were accessed through Wharton's WRDS service, and "total value" weighted returns with dividends reinvested were specified throughout. The intention is to reflect the fully reinvested performance of $1 placed in each market index as far as possible from December 1990 to the end of 2009.

Approach

This section adopts and adapts the informative approach used by Rama Cont (2001), presenting a set of stylized empirical facts emerging from statistical analysis of price variations in Chinese equity markets. A discussion of the impact of the development of Chinese equity markets on the time series of their returns is offered. Even though we are dealing with just a 20-year long time series, it is important to remember the likely nonstationarity hidden in the data series due to changes in the Chinese regulatory regime and the government's financial support policies.

Definitions

The standard definitions used in preparation of the results of this paper are supplied for the sake of precision; however, advanced statistical tests and concepts will be presented without definition as they are not easily explained within these pages without the necessary background (and the right instructor).

Price: S(t) denotes the price of a financial asset at a time *t*. In this study, this refers to the price series of the four mainland Chinese equity indexes from 1990 to 2009 inclusive.

Time: Δt denotes a change in time, or a time scale under study. In this study, this will be 1 day, though that assumption will be relaxed in our study of holding period returns.

Returns: The "log return at scale Δt", is defined as r(t, Δt) = X(t + Δt) – X(t) where X(t) = ln S(t). In this study, daily return series are given and not calculated from price series to avoid issues with dividend and stock split calculations.

Mean: As the return series is already logarithmic, the arithmetic mean of sample returns ($\bar{x}$) will suffice to estimate the "average" returns over multiple observations: $\bar{x} = \frac{1}{n} \cdot \sum_{i=1}^{n} x_i$

Variance: The sample variance of returns, s^2, is thus given by $s^2 = \frac{1}{n} \cdot \sum_{i=1}^{n} (x_i - \bar{x})^2$.

Volatility Dragged Mean Return: All else equal, an asset that returns some average μ with standard deviation σ will over the long term tend to return $0.5\sigma^2$ less, per period, than an asset that simply returns μ each period with 100% certainty. The longer we hold an asset for which its mean return is measured, the more we tend towards its volatility dragged mean return. Because we can estimate these values with $\bar{x}$ and s, this allows us to contemplate one defensible way in which to compare risk-adjusted returns between different assets.

Skewness: The skewness of a distribution is defined by $\gamma = E\left[\left(\frac{X-\mu}{\sigma}\right)^3\right]$ and estimated for our sample return series by $\hat{\gamma} = \frac{\frac{1}{n} \cdot \sum_{i=1}^{n} (x_i - \bar{x})^3}{\left(\frac{1}{n} \cdot \sum_{i=1}^{n} (x_i - \bar{x})^2\right)^{3/2}}$. A distribution with positive skew differs from the normal distribution by having a longer right tail, with its distribution seeming to "lean" left:

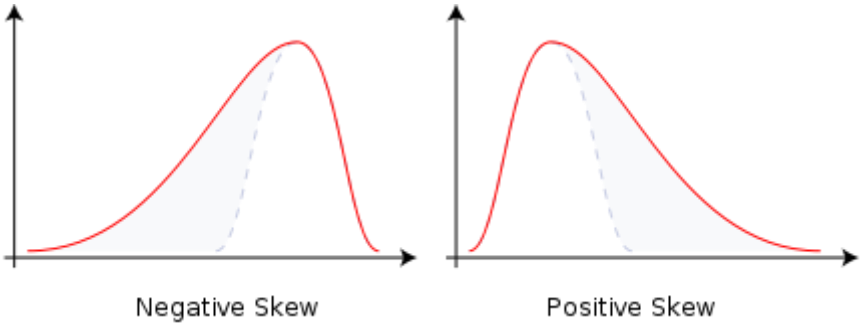


Image Credit: Godot, Wikimedia Commons, 16 August 2006

Excess Kurtosis: The kurtosis of a distribution is defined by $\kappa = E\left[\left(\frac{X-\mu}{\sigma}\right)^4\right]$ and excess kurtosis is estimated for our sample return series by $\hat{\kappa} = \frac{\frac{1}{n}\cdot\sum_{i=1}^{n}(x_i-\bar{x})^4}{\left(\frac{1}{n}\cdot\sum_{i=1}^{n}(x_i-\bar{x})^2\right)^2} - 3$. A distribution with positive excess kurtosis is called leptokurtic, meaning that, compared with the normal distribution, it generally has a more acute peak about its mean, and fatter tails (higher than normal probability of extreme values):

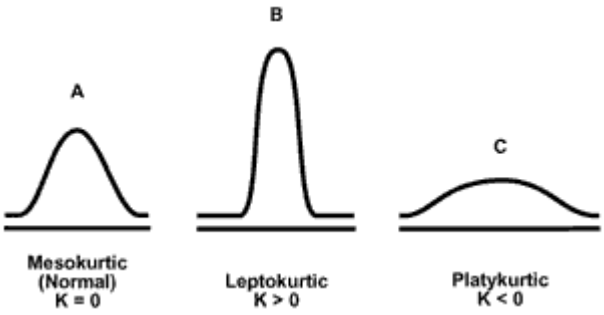


Image Credit: Quality eLINE, Feb 2001, Vol. 3, No. 2

Issues of statistical estimation

Stationarity. As Rama Cont (2001) noted, "the most basic requirement of any statistical analysis of market data is the existence of some statistical properties of the data under study which remain stable (*stationary*) over time, otherwise it is pointless to try to identify them". Thus in trying to estimate the stylistic facts arising from the experience of 20 years of Chinese equity markets, it is important to check if datasets show "stationarity", and to adjust conclusions accordingly. This hypothesis was tested using the augmented Dickey-Fuller Test. Upon inspection, all return series used in this study fail to reject the hypothesis of a unit root about a constant, but strongly reject the unit root hypothesis when modeled allowing for a constant with trend (indicating stationarity). This leads to an important stylistic fact that will be later discussed.

Ergodicity. What with the complex interplay of interdependent and time-dependent factors analyzed in Part III of this paper and the observed trendlines noted in the above section, the time series that we are dealing with are anything but ergodic. That is to say, despite the "sample size advantage" of a 20-year long time series as opposed to the 1-to-10-year series of the other papers discussed in Part III, we cannot with any increased or at all reasonable certainty say that our estimation of the statistical properties of Chinese stock markets will converge to the quantities that they are intended to estimate. In the most extreme form of skepticism, we may even note that, for non-ergodic data, a 20-year time series is just as (un)informative as a 1-year time series, because each represents a singular traipse down a path of history that, thanks to non-ergodicity, has no guarantee of being representative of the unknown mean. Therefore we must of necessity take many of the instinctive conclusions drawn

from the analysis with a pinch of skeptical salt. However, in the words of no less than Mark Twain, for whom “history never repeats itself – but it rhymes”, we emphasize the broad themes over the specific numbers of our findings, and in this manner contribute by noting stylistic facts that are likely to persist for some time to come, if only by sheer force of human nature and its institutions. Arguably, quantitative analysis is strengthened by a qualitative understanding of the surrounding environment, and we make efforts in this direction in Part III by combining Parts I and II.

Results

Results Part 1: The distribution of returns

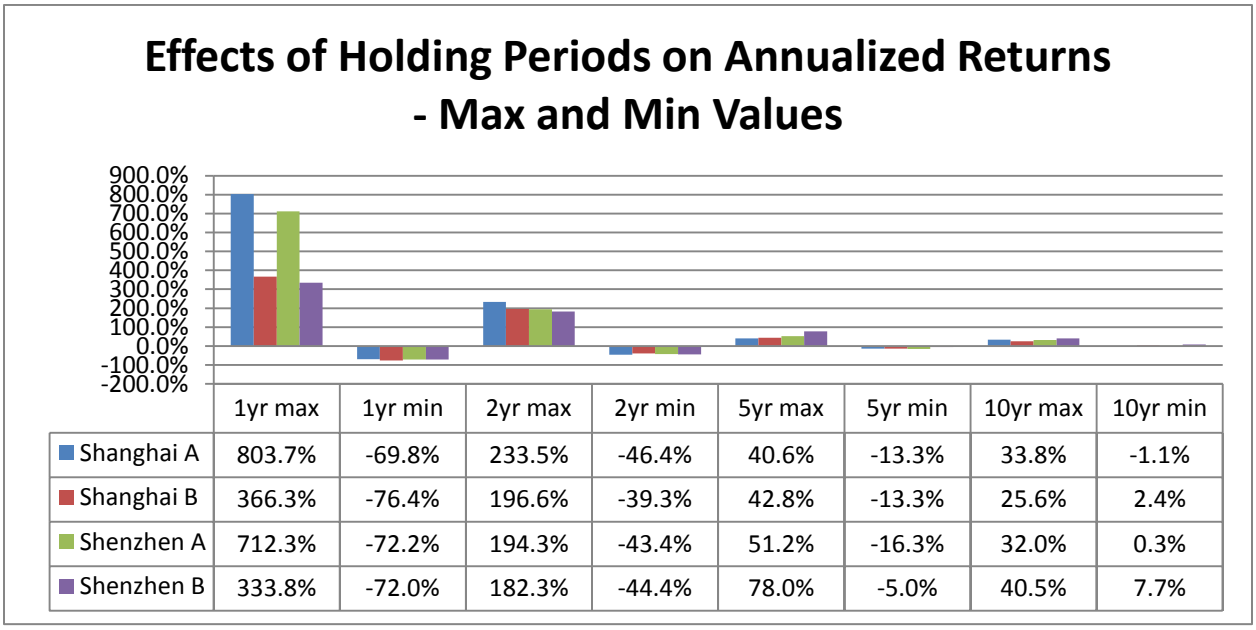
Daily returns	Shanghai A	Shanghai B	Shenzhen A	Shenzhen B	MSCI World	S&P500	Hang Seng
Mean	0.099%	0.050%	0.083%	**0.125%**	**0.013%**	0.038%	0.032%
Std. dev	2.74%	2.26%	2.55%	**3.00%**	**0.89%**	1.17%	1.74%
Vol. drag	0.062%	0.025%	0.051%	**0.080%**	**0.008%**	0.032%	0.017%
Minimum	-17.0%	-12.8%	**-18.7%**	-16.1%	**-7.0%**	-9.0%	-14.7%
Maximum	73.1%	14.8%	44.2%	**123.1%**	**8.4%**	11.5%	17.2%
Skewness	5.83	0.48	2.39	**17.40**	**-0.36**	-0.20	0.013
Ex. Kurtosis	132.49	**5.09**	36.04	**686.44**	9.21	12.18	9.523

Figure 3. Summary of daily returns, 1990-2009. Extreme values bolded, worst value underlined.

Risk vs. Return. Figure 3 adapts and updates the findings of Su and Fleisher (1998), comparing the Chinese stock markets to developed world markets as well as the closely related Hong Kong market. Overall, Chinese shares have returned much better than the rest of the world on a non-risk-adjusted basis:

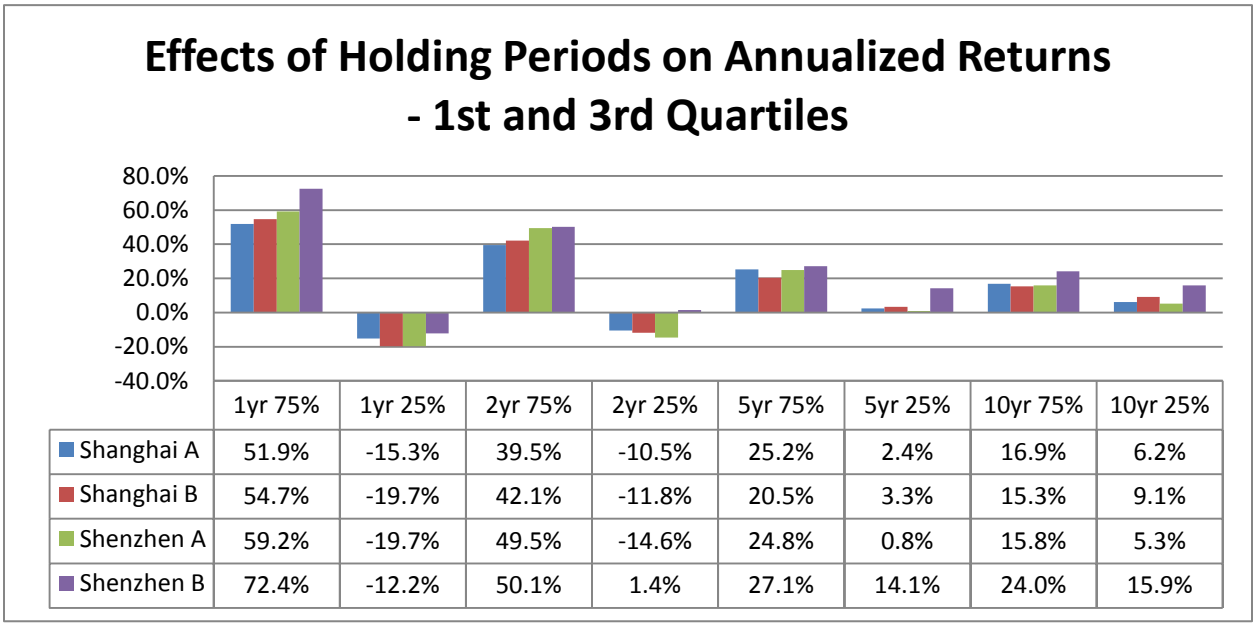
- In particular, both Shanghai and Shenzhen A share markets have returned between 2 and 3 times the average daily return of the S&P500 and the Hang Seng, and up to 7 times that of the MSCI World index.
- This edge, however, diminishes once volatility is taken into account. Chinese shares, in general, also have 2-3 times the daily volatility of other more developed markets. Based on volatility-dragged returns, at best, the Shenzhen B and Shanghai A markets outperform the S&P by a factor of 2 (and MSCI World by 10).
- The Minimum and Maximum return observations also highlight this riskiness feature of Chinese markets: nowhere else in the world can you win, or lose, as much money in a day than in Shenzhen.

- However it would be a mistake to paint Chinese markets with a broad brush – Shanghai's B share market stands out among the 4 markets with its developed-market-like stylistic features: having 50-70% lower volatility-dragged-returns than the other markets, and the lowest mean return, the lowest standard deviation of returns, and the least extreme of the Chinese minima and maxima figures.
- *Overall, compared to other developed markets, Chinese markets return more with a higher volatility, although the Shanghai B-share market does so to a lesser extent.*



	1yr max	1yr min	2yr max	2yr min	5yr max	5yr min	10yr max	10yr min
Shanghai A	803.7%	-69.8%	233.5%	-46.4%	40.6%	-13.3%	33.8%	-1.1%
Shanghai B	366.3%	-76.4%	196.6%	-39.3%	42.8%	-13.3%	25.6%	2.4%
Shenzhen A	712.3%	-72.2%	194.3%	-43.4%	51.2%	-16.3%	32.0%	0.3%
Shenzhen B	333.8%	-72.0%	182.3%	-44.4%	78.0%	-5.0%	40.5%	7.7%

Figure 4a. The returns to successful market timing are significant…



	1yr 75%	1yr 25%	2yr 75%	2yr 25%	5yr 75%	5yr 25%	10yr 75%	10yr 25%
Shanghai A	51.9%	-15.3%	39.5%	-10.5%	25.2%	2.4%	16.9%	6.2%
Shanghai B	54.7%	-19.7%	42.1%	-11.8%	20.5%	3.3%	15.3%	9.1%
Shenzhen A	59.2%	-19.7%	49.5%	-14.6%	24.8%	0.8%	15.8%	5.3%
Shenzhen B	72.4%	-12.2%	50.1%	1.4%	27.1%	14.1%	24.0%	15.9%

Figure 4b. … and these results are robust to outliers.

Return vs Holding Period. Now that we have decently long-run data series for Chinese stocks, it is also instructive to imagine what may have happened if there had been a *Stocks for the Long Run* written in China in 1990. Adapting the holding period approach popularized by Siegel (1994), the Chinese maximum and minimum real holding period returns are similarly compiled in Figure 4a[2]. These are compared with US figures from Siegel (2008) in Figure 4c.

Stocks	Best 1 yr	Worst 1 yr	1yr Edge	Best 10 yr	Worst 10 yr	10yr Edge
China	803.7%	-76.4%	10.5	40.5%	-1.1%	36.8
US	66.6%	-38.6%	1.73	16.9%	-4.1%	4.12

Figure 4c. If investing were a bet with binary results – China wins. Edge = Best/-Worst.

We observe that, compared to Siegel's (updated) study of US markets from 1802 to 2006, that in China the maximum gain in a 1 year holding period was 803.7% vs. 66.6% in the US, and the

[2] Siegel also compares stock returns to Bonds and T-Bill returns, which are not available in this dataset for reasons discussed in Part III.

maximum loss in a 1 year holding period was -76.4% vs -38.6% in the US. This finding is consistent with the story of China being a higher investment risk with a higher return. However, on the other end of the spectrum, the maximum gain over 10 years in China was 40.5% p.a. vs 16.9% p.a. in the US, and the maximum loss/minimum gain for the same period was -1.1% in China and -4.1% in the US. This last is an interesting result. All else equal, for the long term investor, *investing in China is a game with 2-3 times bigger upside than in the US, while the downside is as much as 4 times lower*[3].

Stocks	Best 1 yr	Worst 1 yr	1yr Edge	Best 10 yr	Worst 10 yr	10yr Edge
China*	72.4%	-19.7%	3.68	24.0%	5.3%	No Loss
US	66.6%	-38.6%	1.73	16.9%	-4.1%	4.12

*Figure 4d. *"Best" calculations indicate the 75th percentile, "Worst" indicate the 25th.*

Of course, we do not want our perceptions to be skewed by outliers that are unlikely to repeat, so we also want to see something that may be more representative of our experience had we invested in China in any given year. Figure 4b throws out the best and worst 25% of all observed holding periods in China, and Figure 4d repeats the analysis. The results are striking. *Even without its best 25% time periods*, Chinese market returns did beat the best US market performances in both 1 and 10 year timeframes. Assuming one was lucky or skilled enough not to invest among the 25% worst periods, the China investor faced fully half the possible loss of an American investor, or in the case of 10 year holding periods, no loss at all. From this crude analysis*, long-term investment in Chinese stocks would have generally outperformed long-term investment in American stocks from 1990-2009*. The overall decreasing win/lose profile from left to right is also a feature of mean reverting series, assuring us that returns are not pure

[3] Assuming currency risk is fully hedged at an actuarially fair price, and returns independent of currency fluctuations. This is a nontrivial assumption.

random walks and that we are observing some form of stationarity, as discussed in the next section.

ADF Test	Shanghai A	Shanghai B	Shenzhen A	Shenzhen B	MSCI World	S&P500	Hang Seng
Test Stat	-64.32	-56.1	-65.18	-59.4	-59.28	-74.97	-66.69
P-value	4.8e-31	3.8e-68	4.0e-27	3.9e-52	5.3e-57	1.5e-7	5.6e-21
Constant	**0.0023**	**0.0003**	0.0018	0.0024	0.0006	0.0007	0.0011
Trend	-0.0027	**0.0003**	-0.0020	**-0.0028**	-0.0010	-0.0006	-0.0015
Res. Std. Err.	0.02736	0.02242	0.0255	0.02924	0.008745	0.0117	0.01736

Figure 5a. Coefficients of trends, 1990-2009. Extreme values bolded, worst value underlined.

Trend Stationarity. From Figure 5a, all return series could be fit onto a time series model of a trend line showing a changing mean over time, with the resulting statistic rejecting the hypothesis of a unit root. In plain English, trend stationarity implies that daily returns, following a sizeable shock, eventually revert to a mean adjusted by some long-term trend factor. This indicates the persistence of long term trended means, although it does not protect investors from suffering or benefiting from shocks. This is demonstrated in Figure 5b, which displays the time series of rolling 5 year mean returns. If the long term trends indicated in Figure 5a are to guide our intuitive knowledge of the stylized facts of Chinese stock markets, then we ought to see a more or less steady decline in 5 year mean returns over time (except for Shanghai B).

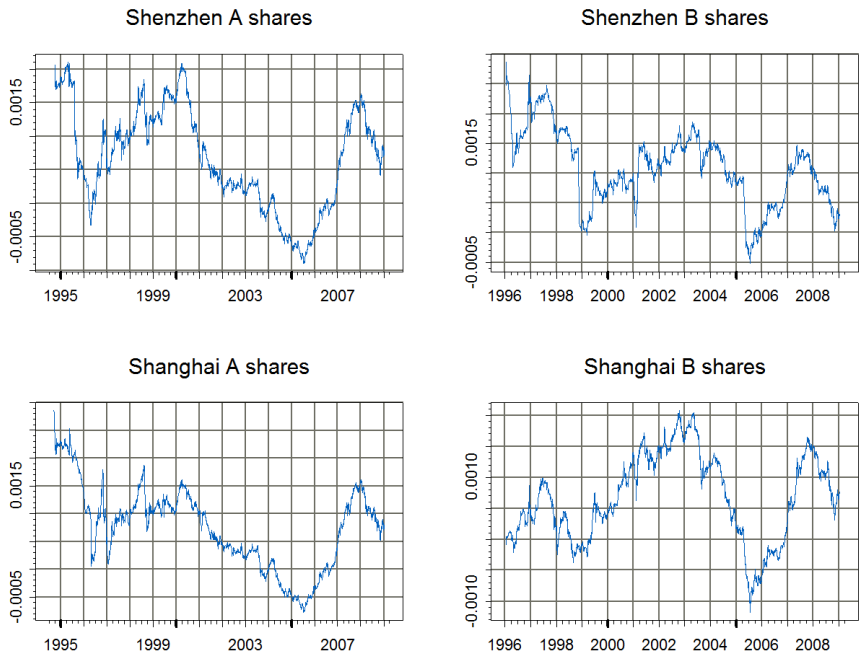


Figure 5b. 5 year rolling mean daily returns, 1990-2009.

With effort, the trends are observable, but from year to year the trend is as good as nonexistent. The rolling return series demonstrate wide variances in returns over time, including dips into negative territory as well as sharp upswings. It is also worthwhile noting that, *with the exception of Shanghai B shares*, the last year or so of returns fell from their 2008 peaks, while at the conception of the markets in 1995-6 returns were noticeably high compared to historical levels. These features coincide with the well-documented stock boom in the rest-of-world categories in the 1990's and the relatively disappointing 2000's, which ended flat on the decade. Thus there is evidence suggesting that the negative trends picked up in Figure 3a across all markets (except Shanghai B) may be no more than an artifact of the time period studied, and we should not make a strong inference about the intrinsically changing nature of stock returns decreasing over time due to effects like increasing investor sophistication and diminishing

overall return-on-equity. If we had had data including returns beyond 2009, we may just as easily have observed zero or even positive trends depending on what happens in 2010 and after.

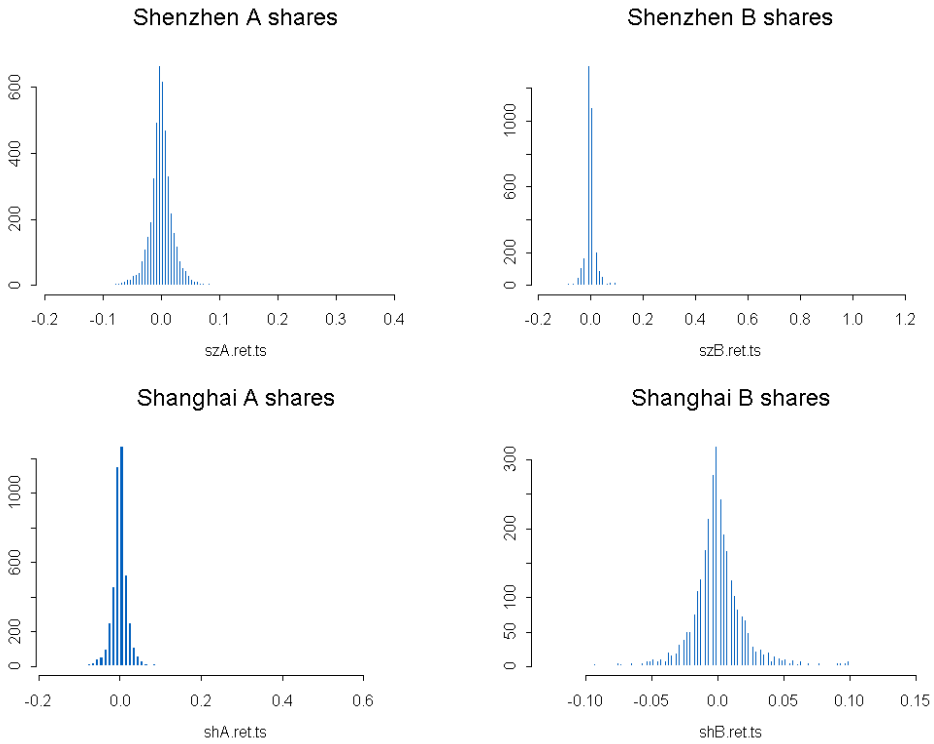


Figure 6. Frequency histograms of daily returns, 1990-2009.

Positive skewness and Leptokurtosis. We turn our attention to the third and fourth statistical moments observed in the distribution of returns in the four markets studied. Figure 3 quantified the much higher skewness and kurtosis experienced in Chinese markets relative to others, and Figure 6 visualizes this with a frequency histogram plot of daily returns. The Shanghai B share market sticks out like a sore thumb with noticeably lower skewness compared to the others.

Results Part 2: Dependence properties of returns

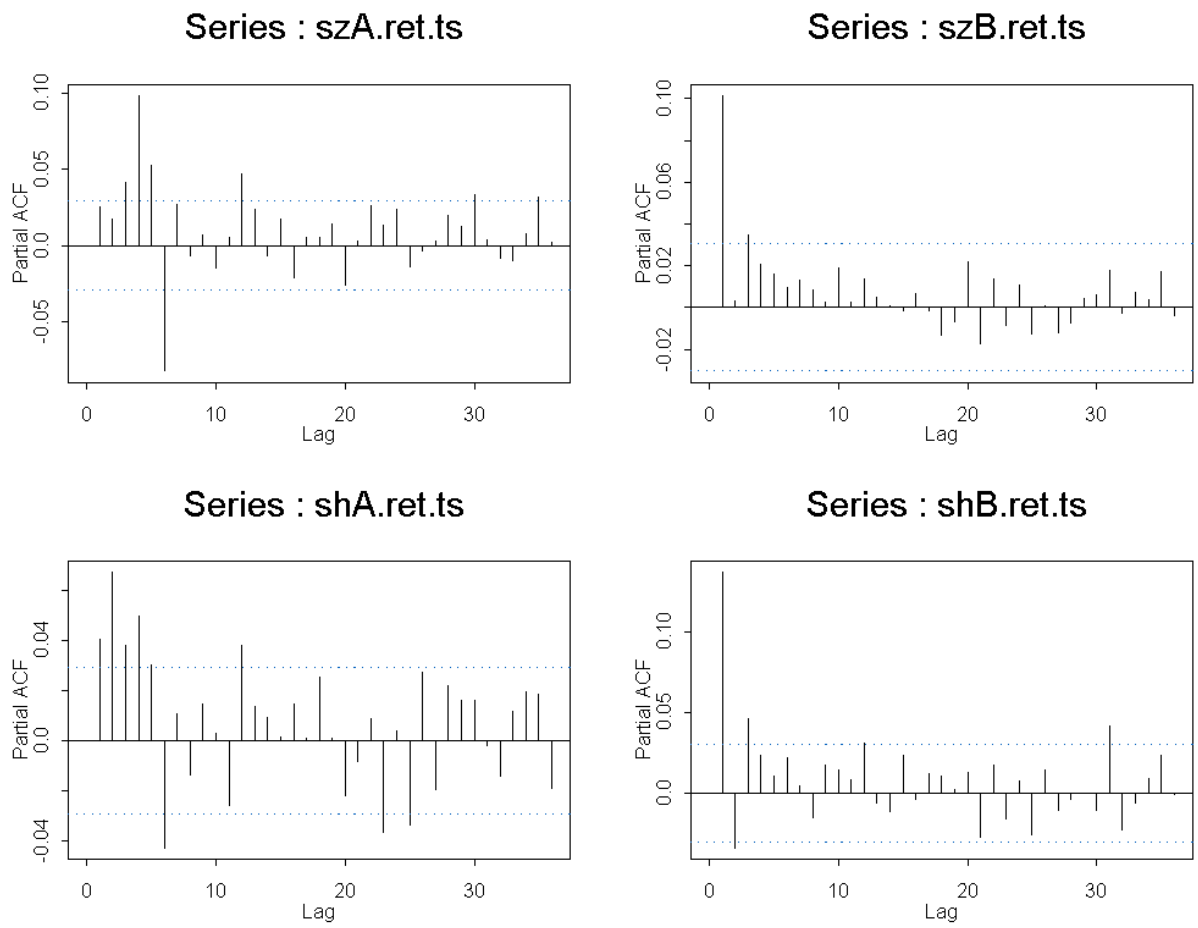


Figure 7. Partial Autocorrelation Plots, Shanghai & Shenzhen A & B shares, 1990-2009.

Autocorrelation. Since all time series studied handily reject the Ljung-Box test for autocorrelation, it is worthwhile to further investigate the more precise properties of autocorrelation. Figure 7 illustrates the partial autocorrelation findings of over more than 4500 observations of daily returns in each of our 4 markets. Since the blue dotted line represents statistical significance at the 95% level, we can make statistically founded statements about the past-dependent behavior of returns. We observe positive autocorrelations in the first five lag orders of both A share markets, negative autocorrelation on the 6th day of lag, and another

strong positive autocorrelation on the 12th day of lag. However, this behavior is absent in the B share markets, with remarkably high positive autocorrelation on the first lag order, and lower but still significant positive autocorrelation on the third day.

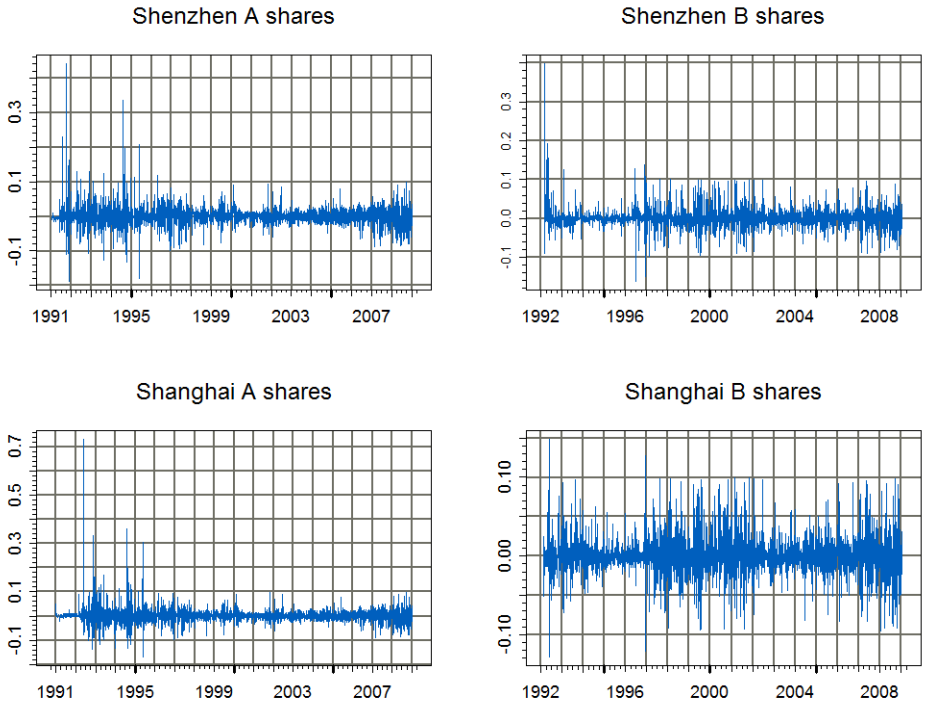


Figure 8. Plot of daily return time series to visualize clusters of volatility.

Volatility Clustering. In terms of ARCH effects, we would expect stocks in China display the same tendency as stocks everywhere else: a volatile day leads one to expect more future volatility than average. Visually, this is confirmed in Figure 8, where we do observe that large deviations from the mean are more closely followed by other large deviations. However, this interestingly does not come to bear in quantitative analysis:

ARCH Fit	Shanghai A	Shanghai B	Shenzhen A	Shenzhen B	MSCI World	S&P500	Hang Seng
Test Stat	37.353	554.800	350.284	0.0367	1790.187	1607.79	1006.166
P-value	0.407	0.000	0.000	1.000	0.000	0.000	0.000
C		-0.0182% (0.0243%)	0.0112% (0.0184%)		-0.0435% (.00851%)	.0629% (.0116%)	0.0791% (0.0195%)
AR (1)		14.5% (1.72%)	2.00% (1.46%)		18.9% (1.58%)	-0.300% (1.57%)	6.73% (1.64%)
A		0.00221% (.00001%)	0.00116% (.00005%)		0.00009% (.00001%)	0.00007% (.00001%)	0.0004% (.00004%)
ARCH (1)		23.3% (0.927%)	19.5% (0.216%)		9.70% (0.627%)	6.52% (0.457%)	8.68% (0.605%)
GARCH (1)		75.5% (0.780%)	81.8% (0.221%)		89.1% (0.696%)	92.9% (0.494%)	89.8% (0.706%)

Figure 9. Tests of ARCH Fit and AR(1), GARCH(1,1) fit coefficients. Std. Errors in parentheses.

Interestingly, Shanghai A and Shenzhen B share markets do not pass our initial test for ARCH effects. Of the Chinese markets that do exhibit ARCH effects, compared to other markets, we see higher ARCH effects (past innovations are twice as important in explaining future innovations) but lower GARCH effects (past standard deviations are slightly less important in explaining future innovations). We also observe a higher "A" term, better known as the "A-zero" term that starts off ARCH and GARCH processes, which is noticeably higher in China than in other markets. From this we may conclude that, even adjusting for ARCH effects, which are stronger in China, Chinese markets are about 2 – 3 times more volatile than non-Chinese markets.

EGARCH	Shanghai A	Shanghai B	Shenzhen A	Shenzhen B	MSCI World	S&P500	Hang Seng
Gamma (1)		3.56%	11.9%		14.6%	11.6%	10.1%
		(1.58%)	(0.509%)		(0.903%)	(0.730%)	(0.874%)

Figure 10. TGARCH Coefficients indicating strength of leverage effects. Std. Errors in parentheses.

The "Leverage Effect". A subtle derivative of volatility clustering is the stylized fact of "leverage effects" – stocks are much more volatile just after a down move than after an up move. This is a manifestation of the typical investors' panic – with a generally long position, investors will not cause large day-to-day changes in sale prices if they can be reasonably sure of the preservation of their investment's value. However, once an investment's value drops, a lack of confidence about future prospects, a desire to lock in gains, a tendency to sell winners to offset losers, and all sorts of behavioral phenomena set in to generally increase stock return volatility immediately following a downward price move. As much as 10-14% of stock return volatility can be explained by this effect in developed markets. However, as we can see in Figure 10, the strength of this effect varies in China. The Shenzhen A share market seems comparable to the S&P500 in its "leverage effect" qualities, but the Shanghai B share market has a very small, although statistically significant, "leverage effect". Tests for the leverage effect on the other 2 Chinese markets are inconclusive since they are based on the assumption of fit with GARCH. The absence of a good fit would present difficulties in comparing Gamma values from fitting the 2 markets to TGARCH with the fit from other markets.

Results Part 3: Cross-asset correlations

Correlations	Shanghai B	Shenzhen A	Shenzhen B	MSCI World	S&P500	Hang Seng
Shanghai A	37.57%	**70.19%**	32.64%	0.95%	1.20%	-0.80%
Shanghai B	100%	43.08%	51.30%	0.048%	1.94%	-0.13%
Shenzhen A		100%	**31.58%**	0.78%	1.70%	0.82%
Shenzhen B			100%	-0.94%	2.14%	-2.11%
MSCI World				100%	-0.88%	2.26%
S&P500					100%	2.51%
Hang Seng						100%

Figure 11. Correlations of returns, 1992-2009. Extreme values bolded, worst value underlined.

Correlations of returns. Moving on to multivariate analysis, the standard correlation matrix is given in Figure 11. Within China (the left half of the table), the highest correlation is between Shanghai A and Shenzhen A shares. The lowest correlation is between Shenzhen A and B shares. The observable stylistic fact is that correlations arise among share types rather than exchanges. This is a significant observation because we are guaranteed that different companies are being represented between the Shanghai A-share market and the Shenzhen A-share market, as there are no cross-listings, but we know that at least some of the A-share market in Shenzhen is a direct overlap of the B-share market (all companies with B-shares trading also have A-shares on the same exchange) which should lead directly to higher correlation. From a correlation standpoint, we can thus conclude that the market is more driven by investor demand than company fundamentals.

Outside of China (the right half of the table), the story becomes more positive. We observe close to zero correlations with the three other developed world markets, in some cases even going into negative correlation.

The "B Share Discount". Because our reliable dataset provides return time series for market indexes, we are unable to substantively produce any new insight into the different price levels that trade for corresponding A and B shares. However it would be grossly negligent to omit any mention of the stylistic fact of the "B share discount" as it has served as the source of a great deal of research and speculation, and is surely a factor in considering cross-share market correlations.

Innovatively, Bailey (1994) presented a time-series for the B share *discount* instead of comparing time series for A and B shares, making possible a univariate analysis of this unique demand-side factor. From their first years of existence in China, B shares suffered between 44.6% to 64.7% discounts from their A share counterparts. Bailey (1994) noted the puzzling difference between the Chinese experience and that of Thailand and Singapore, where foreign shares traded at an average *premium* of 19.1%-31.6% to local shares.

While, at present, one can generally obtain a B share for about 25% the price of the A share (with exactly similar rights to dividends, voting, etc.), the size of the discount has certainly varied over time. However the existence of the discount is certainly a stylistic fact of Chinese stock markets that set it apart from other dual-class structures experienced in developing economies.

Stylistic Facts (1990-2009)

In subjective order from most to least surprising:

- In terms of distribution of returns, the Shanghai B share market behaves much more like a developed market than the other three, including the Shenzhen B share market, which theoretically should have similar behavior due to similar ownership. However this is not the case (Shanghai B shares behave similarly to other Chinese stock markets) when we examine dependence or correlation properties of returns.
- Surprisingly, ARCH effects are not observed in Shanghai A and Shenzhen B shares, but for the remaining Shanghai B and Shenzhen A share markets, ARCH effects appear stronger than in developed markets.
- Again contrary to expectations, in the subset of stock markets with observable ARCH effects, Shanghai B shares do not demonstrate very strong "leverage effects", although Shenzhen A shares exhibit developed-market-like "leverage effects".
- Mean reversion holds in Chinese equity markets (to be precise, *trended* mean reversion) – the difference between highest and lowest annualized return decreases as one goes from 1 year to 10 year holding periods – and as holding periods get longer China presents upsides up to twice as high as in the US and downsides about four times as small.
- There are a number of significant autocorrelations in the A-share markets, and only lag-1 autocorrelations in the B-share markets.
- Chinese shares are uncorrelated with other global markets, and are more correlated because of investor type than by fundamental value.

- There are slight downward trends in returns in all Chinese markets except the Shanghai B shares, but with large year-to-year variations that do not give us confidence that we are not being simply “fooled by randomness”.
- Across all four markets, volatility and mean returns are higher than developed markets, and overall returns as measured by volatility-dragged returns are about twice as high as developed markets.
- There is higher positive skew and kurtosis in China than in other markets.

Part III: Three Explanations for the Facts

Capital Asset Pricing in China

For Foreign Investors: The Chinese Equity Risk Premium. In this paper's Introduction, we noted the typical stylized fact observed by investors that Chinese returns were high but volatility (and political risk) was correspondingly higher. We have now refined those stylized facts in several important dimensions (summarized in Part II). We observe that equity investors who have been willing to bear the pain of higher short-run volatility (annualized return volatility actually decreases as holding periods increase) get the reward of long-run returns that are about twice those experienced in developed stock markets. Further, we observe various accounts of the "B-share discount", which contrasts with similar ownership restriction regimes in other countries where foreign investors typically pay premiums compared to local investors for similar shares because of diversification benefits. Though Chinese daily returns are higher than, and uncorrelated with, those of foreign markets, we see that they are in relatively low demand than we would expect even allowing for a reasonable level of risk adversion in foreign investors. If the equity risk premium puzzle exists in global stock markets, it exists to a greater degree in Chinese stock markets. This conclusion, as well as the results found in this paper, run counter to the direct experience of earlier literature based on smaller datasets.

Bailey (1994) first summarized the univariate behavior of the first year of Chinese B shares from March 1992 to March 1993 on behalf of foreign investors. Working with weekly return series due to limitations of his dataset, Bailey observed that while mean returns varied

from negative to positive in an unremarkable manner, there was a weekly return standard deviation of between 7.06%-9.07%, similar to small China-related Hong Kong stocks but much larger than the volatilities of well-known China-related stocks traded in New York.

Separately, using daily index level information from earliest possible date (December 1990) to December 6, 1996, Su and Fleisher (1998) found that although A share returns were 2 times higher than those found in developed markets, B share returns were not significantly higher, and in both share types the risk-adjusted mean stock-market returns were low and volatility high in China relative to developed markets (MSCI World, NYSE, and Hong Kong). With a view to updating their conclusions, this paper has adopted a similar approach in Part II. Comparing our results with Su and Fleisher (1998), we see that since 1996, B share returns in Shenzhen and Shanghai have risen significantly, and returns for developed markets and A shares have fallen slightly. The resulting effect is that on our timescale, the risk-return relationship has shifted dramatically in favor of China.

We make two contributions to the equity risk premium puzzle as it applies to China:

1. Since we observe superior risk-adjusted returns in both A share and B share markets (and since foreign institutional investors can participate in both markets anyway) as compared to developed equity markets, investors in Chinese equities add an additional premium on top of the 6-7% already observed in world markets including the US.
2. Building upon the conclusions of Siegel (2008), as holding periods increase, so does the equity risk premium in the US. However, we see that as holding periods increase, Chinese stock market performance outdoes US stock market performance. By

commutative inequality, this implies that the Chinese equity risk premium, if it exists, only increases with holding period.

The equity risk premium debate is contentious and resolving it is beyond the ability of this author – but if it does exist, and foreign investors demand far too much return for their revealed risk tolerances – then the last point delivers the startling suggestion that the investing public who seek returns for longer holding periods are more irrational than those who lock up their funds for a lesser amount of time. (This does not imply that investors who are invested for long holding periods are themselves irrational – on the contrary they are availing themselves of one of the greatest free lunches known to mankind – but it does imply that the larger set of investors who are setting aside savings for investment for extended periods are generally not maximizing their investment opportunities to a greater degree than a hypothetical other set of investors who are setting aside savings for a comparatively shorter period.)

Resorting to a "Chinese equity risk premium" as an explanation for the superior returns observed in China is almost tautological – it is an almost unfalsifiable assertion on the one hand, but on the other it serves as a nice catch-all for the unquantifiable aspects of Chinese investment: everything from transaction costs to lack of transparency to patriotic emotions. One very interesting indicator of this fact is the analysis of the B-share discount put forward by Bailey (1994). Despite the different directions of foreign-local share price discrepancies in different countries, Bailey noted positive correlations of the discrepancies themselves, with their geographic distribution suggesting that international investors simultaneously trade Southeast Asian and Chinese markets in a manner that makes the "premium" or "discount" rise

and fall in accordance with an overall international "Asia sentiment" – surely a component of the overall "Chinese equity risk premium" that we have observed.

For Local Investors: the Lack of Alternative Assets. The consensus is that local investors would overparticipate in the A-share market consistent with what one would expect from the Capital Asset Pricing Model story. Bailey (1994) first explained the point of view of local investors, noting that the opportunity cost of capital for Chinese citizens may be lower than for foreigners, with the stock exchanges representing the only investment alternative to bank deposits. Separately, as 95% of B share investors are primarily Hong Kong residents, they may perceive Chinese political and economic risks as undiversifiable and thus discount B share prices heavily for systematic risk. This sentiment is confirmed by anecdotal interviews in the Chinese financial media – in one example, a local stock market expert compared the A share market to "junk" that Chinese only invest in because "real estate is too complicated" (Weishi 2009)[4].

However, some interesting refinements to this broad approach to A shares as an asset class can be found. Poon, Firth and Fung (1998) showed that the outlook for the subset of A share companies that also offer B shares is poorer than normal. They attribute this to the Merton investor recognition theory, which suggests that an increase in the size of the firm's investor base in a segmented market will lower investors' expected returns and increase the market value of the firm's shares, and the Amihud liquidity hypothesis, which suggests that

[4] This comparison leaves open a potentially profitable investigation into whether real estate booms and crashes consistently lead or lag Chinese stock market activity, which is beyond the scope of this paper but is very promising.

segmented share markets may lead to lower liquidity and thus higher prices simply due to higher bid-ask spreads.

Investor and Issuer Sophistication

"Making money uncomplicatedly". China's A-share market is widely regarded to be extremely speculative, and the sophistication of its investors is a concern. However our data also tells us that the B-share market for Shenzhen has similar return distribution characteristics to the "speculative" A share market, which is a surprising result at the outset until we consider the fact that 95% of B-share investors are from Hong Kong (and may be directly or indirectly controlled from China). We need not simply restrict ourselves to commenting on sophistication differences between holders of A shares and B shares. The Shanghai and Shenzhen exchanges are in themselves also far from homogenous in the makeup of their A and B share market participants, as noted in Part I. We also note significant partial autocorrelations in all share markets, with Lag 1 coefficients of about 10% or more, indicating significant momentum profits.

The Extent of Retail Investor participation. According to its latest annual report, the Shanghai Stock Exchange (2009) had 85% of participants who did not have a college education. The number of trading accounts increased at a compound annual growth rate of about 20% per year, coming to 8 million open accounts by end 2008. Measures of trading volume to market capitalization frequently put Chinese stocks and stock markets at the top of the speculative ranks. Thanks to Eun and Huang (2007), we also know that at least 90% of turnover on the Shanghai stock exchange consist of trades by retail investors with limited funds, and that investors in China pay a premium for more liquid stocks, consistent with the hypothesis that

they have a short trading horizon. Fittingly, the Chinese colloquial expression describing arbitrary stock picking based on market rumors is directly translated as “stir-frying stocks” in Kang, Liu, and Ni (2002). Many of the stylistic features of Chinese stock market returns can be attributed to the (generally irrational) behavior of investors rather than the result of fundamental changes to the business prospects of the company represented by the stock, which in China are typically stable, government-related businesses.

High volatility. Chen, Du and Zhang (2008) decomposed variances to report evidence of investor overreaction to cash-flow news from 1994 to 2006. In China’s highly speculative A-share market, we thus observe that a significant portion of observed variation and kurtosis arises from investors trading between themselves and not efficiently incorporating new information. The overreaction is also possibly due to the word-of-mouth spread of information from investor to investor. Cash-flow news, to Chinese investors, represent a direction to trade in more than they do a certain price target, which makes the stock prone to overshooting its adjusted fundamentally-justified value. This presents a possible contrarian trading strategy in response to overreactions to news.

Method in the Madness. Our investigation into 20 years of data uncovered significant positive autocorrelation in both the A share and B share markets going up to lag 6 for the A shares and lag 1 for the B shares. This adds to an established literature documenting the effect of prior returns on future returns. Bailey (1994) found little evidence of autocorrelation in the early years of the B-share market. But with data going to December 1996, Su and Fleisher (1998) found highly significant Ljung-Box statistics showing a higher level of autocorrelation than in

developed markets. In an even more direct test of autocorrelation, Kang, Liu, and Ni (2002) found statistically significant abnormal profits for short-horizon (1-8 weeks) contrarian and intermediate-horizon (20-26 weeks) momentum strategies. Importantly, they attributed the contrarian profits to individual investor overreaction to firm-specific information combined with a herding effect.

Seasonal Effects. The literature on day of the week effects also give us some hints as to how Chinese investors behave over observation windows of more than one day. Tsui and Yu (1999) find statistically significant evidence that Shanghai and Shenzhen markets have negative returns on Monday and Tuesday, and positive returns on Friday. This study limited by the fact that their study only included the period from 21 May 1992 to 13 October 1995, omitting periods when a 1-5% daily price change limit was imposed. However, the study of a period without a daily price change limit enabled them to conscientiously compare these day of the week effects to similar effects that were observed in the US, Canada, Singapore, Hong Kong, Japan, and Australia.

Extending the analysis to other calendar effects, Mookerjee and Yu (1999) used daily return data over a similar timeframe to find statistically significant evidence that turn of the month returns are negative and lower than returns on other days of the month in Shanghai, but with exactly the opposite results in Shenzhen. Turn of the quarter returns are negative and lower than the rest of the year as well.

Interestingly, Mookerjee and Yu (1999) use their findings to assert an observable investor sophistication effect: the consistency of differences in seasonal patterns between Shanghai and Shenzhen, with no market microstructure differences, may arise from the fact

that individual traders dominate in Shanghai and institutional traders dominate in Shenzhen (Mookerjee and Yu 1995), with the hypothesis that institutional traders incorporate information more quickly and efficiently than individual traders.

Issuer Sophistication is a tough nut to crack. It is easy, *ex ante*, to argue that managers of small state-owned enterprises and others not used to a share-issuance regime would be unsophisticated in pricing their securities. For example, if A shares are indeed overpriced and B shares underpriced, why not issue more A shares and use the proceeds to buy some B shares? Unfortunately this analysis is confounded by government restrictions on capital structure split between A and B shares that take the choice of share issuance out of the hands of the former state-owned enterprise, at least for now.

However, Chen, Firth, and Kim (2004) looked at IPO underpricing in stock markets and found significant underpricing in the A-share market: the median initial return on A-share IPOs is 145%, while the same for B-shares is just 10%. Although they suggest some legitimate reasons for the A-share underpricing phenomenon (namely: a long lag between issue of shares and their actual listing requiring compensation to investors for assumed risk, and a desire to create favorable investor sentiment for subsequent seasoned equity offerings), the fact remains that the majority of issuing companies are not minimizing their cost of equity capital at IPO. This would go some way toward explaining the high positive returns observed in our data series, although the effect is mitigated by the fact that a newly listed company does not immediately enter the market index.

The Political Dimension

Politics[5] and statistics make strange bedfellows. The American Gallup organization practices the high art of rating government official job approval through constant statistical measurement, becoming such an institution in the American political tradition that it makes a strange feedback loop that influences policy decisions as much as those same decisions influence it. The same bidirectional feedback process could also describe the Chinese government's relationship with the activity level of its stock markets. The government has been observed to explicitly intervene to both push down and hold up share price levels, for motivations ranging from economic to politically expedient. However it is generally possible to observe that, over an extended observation period, the tendency is for Chinese political risk to tend upwards, implying some extent of causal connection to the observed positive skewness in return distribution. The persistent undervaluation of the Chinese yuan also biases expectations for Chinese asset returns toward the positive as China faces constant pressure to allow appreciation of the yuan.

Political Risks lead to positive skew. In our study, we found skewness in daily returns in Chinese stock markets to be significantly more positive than more developed markets. This may be attributable to the "Beijing Put", comparable to the American "Greenspan Put", for which there is at best anecdotal evidence.

For example, Green (1998) tells about a raft of measures unleashed to artificially boost price levels. On November 17, 1992, Shanghai and Shenzhen both reached their lowest historical

[5] In this case, the broadest definition of "politics" is intended, as in "political risk" – covering the full range of government-related regulations, laws, and other actions that impact markets.

values. In response, the People's Bank of China increased borrowing limits for brokers and opened new closed-end mutual funds, prompting the market to rocket up to historical high levels in December 1992. On July 19 1994, the CSRC announced a raft of market support policies: 1) a ban on new listings of A shares for the rest of 1994, 2) the provision of a US$1.15 billion credit line for securities firms to encourage trading, 3) the establishment of new mutual funds and possible foreign participation in the domestic A-share market, and 4) a promised merger of the A- and B-share categories within 5 years, all of which resulted in a tripling of the Shanghai A-share index within two months. Finally, in June 1995, the CSRC suspended market trading of futures on government bonds and, at the same time, the PBoC set an interest-rate ceiling for corporate and municipal bonds. As a consequence, a large amount of funds were transferred from the bond markets into the stock markets.

Political Factors affect volatility in both directions. Su and Fleisher (1998) found that large volatility hikes are associated with exogenous changes in government stock-market regulation and liberalization. Between May 1992 and December 1996, each of the four observed volatility spikes was attributable to major changes in regulation. Su and Fleisher (1998) also found kurtosis was also higher in Chinese stock markets than those in more developed equity markets.

However, political discomfort with volatile prices may directly lead to policies that clamp down on volatility, lime the daily price limits that have been intermittently imposed on Chinese markets. Su and Fleisher (1998) showed through an empirical model that the removal of the 5% price limits on May 5, 1992 raised daily A Share return variance by a statistically strongly significant 20% in Shenzhen and 45% in Shanghai. Mookerjee and Yu (1999) studied both

markets since inception to 11 April 1994, inclusive of the 2 years of daily price limits, and 2 years following the lifting of daily price limits, with similar results.

Political Risks may diminish ARCH effects. The Political Dimension may also serve to explain the *lack* of ARCH effects noted by several scholars. *Ex ante*, we may arrive at a logical causal connection if we account for certain facts:

1. That ARCH implies some level of predictability of future volatility from prior volatility, and
2. Government interventions are at least partially exogenous to the return series, and
3. Government interventions have a significant impact on returns (outside the conditional standard deviations experienced in observations immediately preceding intervention), and
4. Government interventions signal a credible regime change that does not lead investors to have any rational basis for expecting future conditional volatility to increase substantially as a direct result of the one-off volatility experienced as a result of the intervention itself.

If these 4 postulates hold true, then government interventions will be *deleterious* to observed ARCH effects over a time series spanning these interventions. It is worthwhile noting that all 4 are necessary conditions for this conclusion to hold true: if volatility increases immediately after an exogenous and impactful government intervention, then although the initial "volatility spike" due to government intervention is not causally related to increases in volatility prior to the intervention (contra ARCH), the behavior of conditional volatility following intervention would increase the strength of the ARCH effect hypothesis.

Various studies are conflicted on the presence of ARCH effects in Chinese stock market returns, and confounded by a panoply of different approaches. Yeh and Lee (2000) document no

significant ARCH effects on all 4 Chinese stock markets from May 22, 1992 (immediately following the end of the first daily price limit regime) to August 1996. However, Covering a wider, overlapping period from December 1990 to December 1997, Lee, Chen and Rui (2001) finds that these ARCH effects are robust to regulatory regime changes. Most recently, Lin, Menkveld and Yang (2009) studied weekly index returns for our 4 markets from December 1992 to December 2006, noting significant ARCH parameters throughout. However, only about half of the individual stock return series tested by Seddighi and Nian (2004), over the full year from January to December 2000, show ARCH effects. The Shanghai stock index does not show significant ARCH effects in their study. The empirical results of this paper confirm that there are at least certain periods in which ARCH effects is not observed, but there remains room for a systematic discovery of what truly limits ARCH effects.

Conclusion: News You Can Use (and some you can't)

In our attempt to comprehensively "cover all bases" in considering the Chinese investment climate, we have explored the history of Chinese stock market development, the stylistic facts observed from its daily return series, and three possible explanatory themes underlying these facts. To give us extra confidence in the hope that our stylistic facts point to some underlying cause that is likely to lead to the persistence of the stylistic fact, findings have also been substantiated by historical analysis, academic research, and anecdotal evidence where necessary. We guard against overemphasizing statistical coincidences and spurious relationships by requiring an explanation of the underlying economic story.

Over this process, we have unearthed several useful tidbits of information that are both likely to hold true as well as actionable, that would delight both the buy and hold investor as well as the short-run speculator.

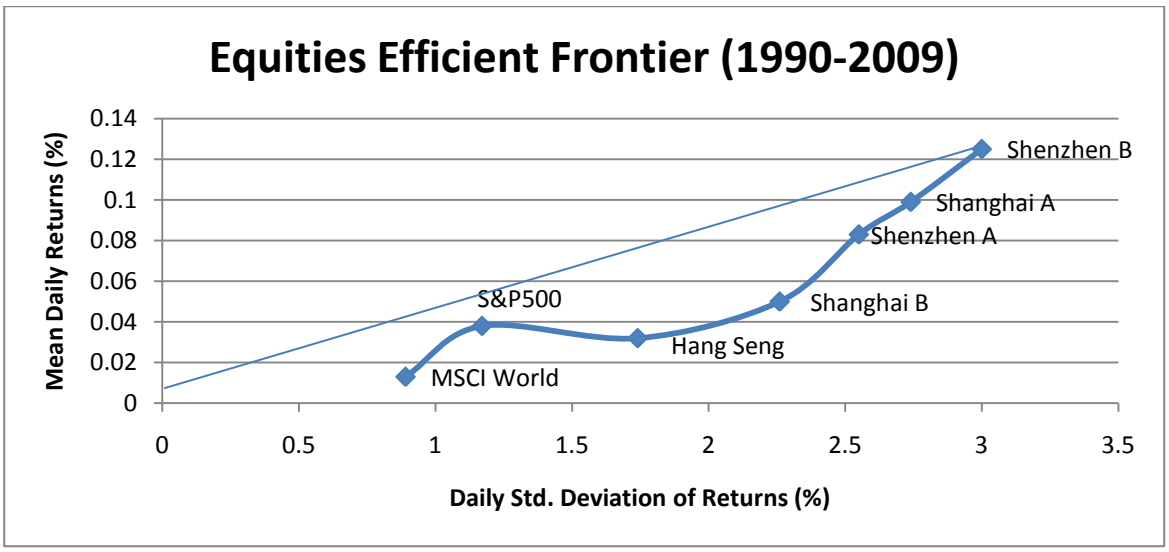


Figure X. Results in the form of a Markowitz Efficient Frontier. Risk-free rate = 1% annualized

The buy-and-hold investor would take note of the strong evidence that the Chinese stock market is likely to outperform developed markets in the long term, both due to the mysterious Chinese equity risk premium as well as due to the tendency of political factors to skew extreme returns toward the positive. If the dictates of Modern Portfolio Theory are to be followed, then Figure X shows us that we ought to heavily bias our portfolio's equity allocations towards Chinese stocks. Since correlations are zero and not strongly negative, the main reason we would include stocks from the S&P500 and MSCI World in our portfolio is if we questioned the ability of Chinese shares to continue producing their stellar results. Since Shanghai B shares are trending upwards in returns and the other return series are trending downward, there is also a possibility of a very long-term profitable pairs trade to take advantage of this fact.

The short-run speculator will have much to gain from simply following momentum – investing after large positive shocks and shorting after negative ones, and closing out positions when momentum peters out. The noted day of the week and seasonality effects will also lend an extra dimension to the speculator's profit opportunities.

We have also explored some interesting reasons why some research over certain time periods fail to detect ARCH processes, although this provides little more than food for thought, at least until Chinese derivatives markets are sufficiently advanced for traders to buy and sell volatility.

Armed with this information, it is hoped that Bayesian investors receptive to well-analyzed data will be better suited to making global investment allocation decisions including Chinese equity markets.

Acknowledgements

The author would like to thank Prof. J. Michael Steele for his invaluable help in preparing this manuscript, and the Huntsman Program for the opportunity to gain, develop, and master a wide variety of skills in completing this work.

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