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Segmentation and Seasonality within the Chinese Stock Market

Bachelor thesis in Development Economies (15 credits)
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Abstract

The purposes of this thesis are to investigate the integration of the Chinese stock markets with the world market as well as test for seasonality within the market. We have used the A-share indices on the Shanghai and Shenzhen stock markets and the five underlying sub-indices for each market. These indices have been compared to the MSCI world market index, which represents the global market. In our test for seasonality we find proof of seasonality in the main indices as well as for the sub-indices for the first two sub-periods but not for the third (2006-2013). This implies that the market is becoming more efficient and that arbitrage opportunities are diminishing. Regarding our test for market integration we have used a modified Jorion and Schwartz model where results suggests that the Chinese stock market is still heavily segmented from the world despite the liberalization of market regulations that have been implemented by the Chinese government over the last two decades.

JEL classification: G15, C50

Keywords: Finance, integration, seasonality, Chinese stock market, index

Contents

Preface

This Bachelor's thesis project was carried out during 2013. A thesis submitted in partial fulfillment of the requirements for the degree of Bachelor of Science in Financial Economics at the School of Business, Economics and Law, Gothenburg University in Gothenburg, Sweden. The project was conducted at the Department of Economics and the Centre for Finance. Mostafa Sharq and Hanna Petersson have been responsible for writing this thesis, Professor Jianhua Zhang for supervision.

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Gothenburg, December 2013
Mostafa Sharq and Hanna Petersson

1. Introduction

In a world where financial globalization is rapidly growing, investors have showed an increasingly interest of diversifying risks by placing their assets in foreign financial markets (Gupta - Donleavy 2009, pp.160-177). However, a more global integrated capital market makes countries more vulnerable for global risk, especially global financial crises. Another reason for why the republic of China does not want foreigners to invest in their mainland stock exchanges are because of their strong believes in social public ownership. To protect themselves from a more global stock market the Chinese government has issued heavy regulations on foreigners who wish to invest in the Chinese capital markets. Responsible for determining the regulations is the China Securities Regulatory Commission (Chinese Securities Regulatory Commission, 2013) the main securities regulatory body in China that was created in 1992. The last fifteen years some attempts have been made by the CSRC to open up the Chinese Stock Markets for foreign investors. In 2001 they introduced the B-share, a share that only foreign investors could trade (Lu, 2007, pp. 309-328). This was as an alternative to the A-share, a share strictly restricted for domestic trading. In differences to the A-share that is strictly denominated in RMB, the B-share was denominated in USD and only allowed for foreign investors to trade. This was however not a success and because of the low interest the Chinese government decided to open up the B-share market to domestic investors in 2001 (Lu, 2007, pp. 309-328).

The most ambitious attempt for integrating the two stock markets is the Qualified Foreign Institutional Investor, a program that was launched in 2002 that allow licensed foreign investors to buy and sell Yuan-denominated A-shares in China's mainland stock exchange (Chinadaily, 2006). Since 2002 the CSCR have made several increments of the quota, allowing foreigners to trade bigger volumes of the A-share (Lu, 2007, pp. 309-328).

Considering the deregulations combined with other integration attempts such as being granted membership in WTO year 2001 it is reasonable to think that the Chinese Stock exchange is less segmented today than it was twenty years ago. We will use the return of the five different Sub-Indexes (industrial, real estate, financial, energy and information technology) in a regression model and test them against the world market index, in our thesis represented by the Morgan

Stanley Capital International World Index (MSCI, 2013) to see if we find evidence for higher internationalization at the present date than twenty years back for the five Sub-Indexes. The reason for using the sub-indices is to see if we can find proof of differences in segmentation within different sectors. Could it be that for example the finance sector is more integrated with the MSCI World Index than the energy sector is? Since we want to investigate if specific regulations changes as well as the other important time events in China have had an effect on the integration we will perform the tests in different sub-periods.

We will also investigate how efficient the Chinese stock market is by testing to see whether seasonality is accruing in our time series. A common form of seasonality occurring in the financial markets is the January effect. This effect means that the return of the month of January is much higher than the other months. We will see if this can be traced to our five Sub-Indexes.

1.1 Objective

This thesis will have two main objectives. The first objective will be to investigate the integration/segmentation of the Shanghai and Shenzhen sector indexes with the world market, i.e. MSCI World Index. If the Chinese submarket indexes are highly integrated with the world market index and mean-variance efficient the only priced risk should be the systematic risk relative to the world market (in our case the MSCI) If this is not the case it would imply that national factors, e.g., the domestic systematic risk might also be affecting the pricing of the Chinese stocks. This segmentation can be a result of many barriers to international investments such as restriction of ownership and difficulty for foreigners to obtain information about Chinese stock markets, to mention a few reasons. By looking at regulation changes in the Chinese policies (mentioned in the introduction) we will evaluate if these changes have had economically and statistically significance on the integration and if we can see differences within different sectors as well as the two indexes as a whole.

The second objective will be to test for the presence of seasonality in the return series of China's A share indexes and the different portfolios or sector indexes, i.e. industrial, real estate, financial, energy and information technology. When testing for seasonality we further investigate the Chinese stock market by analyzing patterns of seasonality and if they can be traced to domestic factors or if the trends of seasonality is similar to the global market for each respectable sub index. Just as in our test for segmentation we aim to investigate how closely the Chinese stock market is moving with the global market and if differences can be find as time has evolved in the three sub periods.

1.2 Data description

The data used in this thesis is from 1990 to present date. Only the A-share indexes are used for representing the Chinese stock market since the market capitalization of the B-shares s is diminishingly small; As of the end of 2009, 109 companies had issued a total of 10.7 billion B shares capital and raised RMB 38.1 billion compared to 1,586 companies that had listed in the A-share market with a total share capital of 2.5 trillion and with RMB 380 billion raised (China Securities Investor Protection Fund Corporation, 2010).
The data for our time series have been extracted from DataStream and thereafter processed in Stata.

1.3 Main findings

Our findings of seasonality within the first two sub-periods suggest that the time period of 1990-2005 the Chinese stock market displayed a weak or semi-strong form of efficiency and arbitrageur opportunities could be gained. However, since there is no clear pattern in our test results when comparing sectors and months for the two time periods it is difficult to draw any reliable conclusions for possible underlying factors that could explain the findings of seasonality. In our final sub period, 2007-2013, the only sector displaying seasonality is the energy index. Since several deregulations were implemented by the Chinese government during this time period we conclude that the market is becoming increasingly more efficient and arbitrageur opportunities will gradually be eliminated.

Our findings for segmentation in the sub-periods imply an increased economic integration across time when looking at the Shanghai sub-indexes, especially in the real-estate, financial and energy sectors. Unfortunately we have no consistent data for the Shenzhen sub-indices to base our assumption upon, partially because of lack of data. When looking at the full sample period we find it difficult, based on our results, to reject the null hypothesis of market segmentation between the Chinese and the world's financial markets. We conclude that the market can still be used for diversification and offer a risk premium relative to systematic risk to foreigner investors.

1.4 Outline of Thesis

The disposition of the report is as follows, we first present the theory of the model used for the statistics models in Stata. The second part will be the method section. Here we will present the data and how the data has been used and processed. The methodology section will be followed by the result part where we will present the result, i.e. if we have found proof of seasonality and segmentation in the Chinese Sub-Indexes. The last part will be our discussion where we briefly will argue around our result and what conclusions we can retrieve from it.

2. Theory

2.1 Market integrations versus segmentation

The importance of whether a national market is segmented or integrated with the global market is widely accepted as an important aspect to financial decisions. If a national market is segmented from the international markets, foreign investors can profit from risk diversification by creating portfolios that include stock traded in these markets (Li, 2013, pp. 88-105). Others reason for international investors to enter segmented emerging markets is for the chance of above-average, long-term capital appreciation and also the fear of missing a market development and a strong drive to enter the market early (Cornelius, 1992, pp. 289-99)

Reasons for why segmented markets often are cautious towards international investors are several. First, there is concern that an inflow of international equity investments is unstable and that if for instance the international investor is facing economic difficulties the payments will be reversed (Cornelius, 1992, pp. 289-99). The second reason for concern is that foreign investors often has a higher risk-to-reward ratio and that it is therefore more costly to let foreign investors into the market in form of interest and yield. Third, it is feared that equity investment provide foreigners with an avenue of control over domestic corporations and that foreign investors may simply come to dominate the market, key sectors of industry and the financial services sector (Cornelius, 1992, pp. 289-99).

China has for the last decade changed many of the regulations that was enforced for above reasons and is now one of the largest emerging markets for external portfolio investment (Li, 2013, pp. 88-105). Given this information it is easy to understand the great interest of foreign investors to monitor whether the Chinese stock market has become more integrated with the rest of the world.

There are several aspects that differs the Chinese stock market from a mature stock market in a developed country. For instance, the majority of investors, 99%, in the Chinese stock market are individuals in terms of opened accounts. The high number of individuals entering the market has led to very high P/E ratios, indicating over-speculative activities (Chen - Yongmiao, 2003, pp. 90-98). The high volatility is typical for a segmented market.

Several studies have been done in order to investigate whether the liberalization in policy changes has increased the correlation of the Chinese stock market with the global market. The results have not been completely consistent since different models and methods have been used for testing for segmentation but the general findings proclaims that the Chinese stock market is still highly segmented from the global market (Li, 2013, pp. 88-105).

2.2 The Arbitrage Pricing Theory and multiple factor models

Factor models are useful when there is an ambition to describe and quantify different factors that can impact the rate of return on a security given any time period (Bodie, 2011, pp. 609-645).
It is common to divide the factor models into two different types: single-factor models and multiple factor models. A single factor model only allows the decomposition of risk into market and firm-specific components whereas the multiple factor models allows for different sensitivities to different factors. Since the multiple factor models allow for several factors it is generally viewed as a better description of security returns. The multiple factor models advantage to measure all kinds of macroeconomic risk provide us with an ability to construct

portfolios to hedge against these risks. Example of macroeconomic risk can be inflation, business cycles, interest/rates etc. The CAPM uses a single factor model whereas the APT in general is constructed by a multiple factor model (it can be constructed by a single-factor model but it is very uncommon).

Stephen Ross developed the Arbitrage Pricing Theory (APT) in 1976. It is an asset pricing theory that is derived from a factor model by using diversification and arbitrage arguments. The APT has some similarities to the well known CAPM model, for instance they both link the expected return to risk by using the security market line, however there are several assumptions that sets them apart (Bodie, 2011, pp. 609-645). The CAPM formula requires the markets expected return whereas the APT uses the risky asset's expected return and the risk premium of a number of macro-economic factors. The APT relies on three key assumptions:

1. Security returns can be described by a factor model
2. There are sufficient securities to diversify away idiosyncratic risk
3. Well-functioning security markets do not allow for the persistence of arbitrage opportunities

An arbitrageur can use the APT model to profit by taking advantage of mispriced securities. A security is regarded as mispriced when its price on the market do not reflect the price given by the APT model. By going short on an overpriced security while concurrently going long the portfolio the APT calculations is based on, an arbitrageur is in a position to make a theoretically risk-free profit.

3. Literature review (The Jorion and Schwartz model)

The model that has been used in this thesis to test for market segmentation versus integration is the Jorion and Schwartz model. This model was first published in their paper "Integration vs. Segmentation in the Canadian Stock Market" in 1986 (Jorion - Schwartz, 1986, pp. 603-614). The purpose with the paper was to investigate the segmentation versus integration of the Canadian equity market towards a global market, in their case the North American market. Their way of testing for segmentation on the Canadian stock market was to focus on the restrictions imposed by the model on the pricing of assets.

The Jorion and Schwartz model was later used in (Wang - Di Iorio, 2007, pp. 277-290). This paper set out to test the level of integration for three China-related stock markets with both the Hong Kong stock market and world market. The part of their result that has relevance for this thesis is the evidence they found for segmentation in the A-share market during the time period 1995-2004.

In our thesis we will also test for integration on the Chinese A-share stock markets but we will not use the B-share or the Hong Kong market as in the work of (Wang - Di Iorio, 2007, pp. 277-290). Another difference from the papers mention above is that we will only use A-share indices from the Chinese stock market, both the main indexes and the sub-indexes, and not individual company shares.

The Jorion and Schwartz model used for our thesis is slightly remade from the one used in (Wang - Di Iorio, 2007, pp. 277-290) and is no longer testing for serial correlation. The reason for this is in (Wang - Di Iorio, 2007, pp. 277-290) where they stated that serial correlation between the markets was very low. The dependent variable in our model are the Sub-Indexes of the Chinese mainland stock exchanges and the domestic A-share indexes together with the MSCI index will be the independent variables. The model is as follows.

$$R_{it} = E(R_i) + \beta_i^D(R_{Dt} - E(R_{Dt}) + \beta_i^G(R_{Gt} - E(R_{Gt})) + \varepsilon_{it}$$

Where R_{it} is the monthly return on sector indexes, we will call this the return on portfolio $_i$, the R_{Dt} is the respectively A-share index, the $E(R_i)$ and the $E(R_{Dt})$ are the expected values of the portfolio $_i$ and the domestic A-share index, respectively, and β_i^D and β_i^G are the factor loadings. R_{Gt} is the return on the world market index (in our case the MSCI) minus the R_{Dt} (the respectively A-share index)

We are also to split our whole time period into three sub-periods (1990-1997, 1998-2005, 2006-2013) to test if the model is sensitive for specific time periods (Mittoo, 1992, pp. 2035–2054). Thus extending our analysis by three additional sub-periods. Previous works of (Groenewold et al., 2004, pp. 45–62) and (Hatemi, 2004, pp. 281-294), have suggested that there exists evidence that shows increased market integration between the Chinese and the world financial markets when tested for shorter time periods through correlation analyses.

4. Methodology

4.1 Log return of time series

If you transform the return on time series to log return (also called the continuously compounded return) you get the advantage of seeing relative changes in the variable and the opportunity to compare directly with other variables whose values may have very different base values (Wooldridge, 2013). The model is as follow

$$r(t) = \log(\frac{P_t}{P_{t-1}}) = \log[Pt] - \log[Pt - 1]$$

where P_t is the price on day t and P_{t-1} the price for previous time period (in our case the previous month).

4.2 Standard deviation

The standard deviation is used as a statistical measurement to find out the dispersion of a set of data from its mean. It is calculated as the square root of variance. In this thesis it applies to the annual rate of return of the indices to measure the volatility of the different indices.

$$\sigma = \sqrt{\frac{\sum(X - \bar{X})^2}{n}}$$

Where $\sum$ is the sum of, X is each value of the data set, $\bar{X}$ is the mean of all values in the data set and *n* is the number of observations in the data set (Wooldridge, 2013).

4.3 Serial Correlation

Serial correlation is the linear relationship between a given variable and itself over various time intervals. The formula used for the correlation

$$\rho_{A,B} = \frac{Cov\,(A,B)}{\sigma_A\,\sigma_B}$$

where A is the series or portfolio original return series, B is the series or portfolio return series lagged one period, ρ is the letter used to denote correlation and $\sigma_A\,\sigma_B$ are the standard deviation of series A and B respectively and $Cov\,(A,B)$ is the covariance between series A and B.

4.4 Testing for Unit Roots

The Dickey-Fuller test is used for testing if a unit root is present in time series. The null hypothesis in the test is that the index follows a unit root process. You reject the null hypothesis when the p-value is less or equal to a specified significance level, often 0.05 (5%), or 0.01 (1%) and even 0.1 (10%). Rejecting the test means that the time series is non-stationary.
The regression model used for the Dickey-fuller test is:

$$\Delta Y_t = (\rho - 1)Y_{t-1} + U_t = \Delta Y_{t-1} + U_t$$

where Δ is the first difference operator.
A description of the test is as followed. If the series y is stationary (or trend stationary), then it has a tendency to return to a constant (or deterministically trending) mean. Therefore large values will tend to be followed by smaller values (negative changes), and small values by larger values (positive changes). Accordingly, the level of the series will be a significant predictor of next period's change, and will have a negative coefficient. If, on the other hand, the series is integrated, then positive changes and negative changes will occur with probabilities that do not depend on the current level of the series; in a random walk, where you are now does not affect which way you will go next.

In our case we have processed the initial data that we retrieved of the indexes prices movements. Thus, since we have return series of the indexes, one could expect to get results that show stationarity. While on the other hand, if we were to use the price movements as a foundation for the Dickey-Fuller test we might have received proof that shows random walk to be evident.

4.6 Seasonality

If you can find patterns of change in a time series within a year that tends to repeat themselves each year you have found proof of seasonal variation. The formula used to test for seasonality is:

$$Y_t = \beta_0 + \propto_1 jan_t + \propto_2 feb_t + \propto_3 mar_t + \ldots \propto_{11} nov_t + \beta_1 x_{t1} + \ldots + \beta_k x_{tk} + u_t$$

Where feb_t, mar_t … nov_t are dummy variables telling us whether time period t are corresponding to any of the other months. In the formula used above December is base month and β_0 is the intercept for December. In case of no seasonality in Y_t then $\propto_1$through $\propto_{11}$are all zero. You can test for this via an F test (Wooldridge, 2013). In our thesis the base month used in the regression models is also December.
Most of the businesses in the world tend to have seasonal variation even if some sectors are more extreme than others. A common form of seasonality in the financial markets is the January effect. The meaning of the January effects is that the stock market shows a tendency to rise between December 31 and the end of first week in January. The reason for it is pure tax purposes. Investors choose to sell parts of their stock holding at the end of the year in order to claim a capital loss. They can then quickly reinvest the money when the tax calendar change year.

5. Data

5.1 Data description

All data has been retrieved from DataStream. The attempt has been to collect the data on a monthly basis for the last 23 years; however there are missing values in some of the time periods. We have chosen to split the time period into three sub-time periods since we expect the results to be different when isolating events such as those mentioned in the introduction (e.g. implementation of the QFII and admission in WTO). The first sub-period will be between 1990 and 1997, the second one between 1998 and 2005 and the final third one between 2006 and 2013. All of our A-share indexes and Sub-Indexes have been recalculated in United States Dollar (USD). The data includes the Shanghai A-share index, the Shenzhen A-share index, the five sub-indexes for the Shenzhen and Shanghai stock exchanges and the MSCI World index.

5.1.1 Sub-periods

In the following sections we will introduce the results from our three time periods. The reason for doing this is since we expect the results to be different when isolating events such as those mentioned below. It could be incidents, introduction of a certain policy or major macro economical events such as financial crises. Ranging from 1990 to 1997, 1998 to 2005 and 2006 to 2013, we expect to have more economically and statistically significant results, especially when we run our regression models in each of the shorter time periods.

Each sub-index will be presented and key statistics will be stated in tables. The main outline where we chose to put more emphasis on when analyzing and interpreting our results are,

- 1996: Initiation of the “grasping the large and letting go of the small” policy
- 1997 July: Return of Hong Kong to PRC and Asian financial crisis
- 2001 February: Introduction of B shares
- 2001 December: PRC admitted to World Trade Organization (WTO)
- 2002 December: Introduction of QFII-program

5.1.2 Stock Market Indices

The Shanghai A-Share Index

The Shanghai A-Share Stock Price Index is a capitalization-weighted index. The index tracks the daily price performance of all A-shares listed on the Shanghai Stock Exchange that are restricted to local investors and qualified institutional foreign investors. The index was developed with a base value of 100 on December 19, 1990 (Bloomberg, 2013)

The Shenzhen A-Share Index

The Shenzhen A-Share Index is a Total Return Index of SZSE. The index tracks the daily price performance of all A-shares listed on the Shenzhen Stock Exchange and is restricted to local investors and qualified institutional foreign investors. The index was developed with a base value of 1000 on December 19, 1990. (Shenzhen Stock Exchange, 2013)

The MSCI World Index

The Morgan Stanley Capital International World Index captures large and mid-cap representation across 23 developed market countries. With 1,612 constituents, the index covers approximately 85% of the free float-adjusted market capitalization in each country (MSCI, 2013)

The SSE Sub-Indexes

Listed companies in the Shanghai Stock Exchange are divided into 5 sectors: industrial, real estate, financial, energy, and information technology (IT). Constituents for a sector index are all listed stocks (both A and B shares) of that sector. The Base Day for SSE Sector Indices is April 30, 1993. The Base Period is the total market capitalization of all stocks of respective sector of that day. The Base Values for all sector indices are 1358.78(closing value for SSE Composite Index on April 30, 1993). The indexes were launched on May 3, 1993 (Shanghai Stock Exchange, 2013)

6. Results and Analysis

The results and the analysis below is constituted of four parts where we have divided the output in the order of first introducing the descriptive statistics, here we introduce the main bulk of the data. Then we will show each and every case of seasonality that we can find over the 4 sets of time-periods, 2 main indexes and ten sub-indexes. We will also test for unit root and have thus carried out the Dickey-Fuller test on our data, this will be covered in part three in our results. In the last part we will discuss the basis in our paper, namely, whether if there is segmentation or integration in the Chinese stock market with the rest of the world's stock market. Here we will execute the Jorion and Schwartz model (Jorion - Schwartz, 1986, pp. 603-614), to see if we find any significance or co-integration between our Chinese indices and the MSCI world index. These results are also divided into four time-periods and each and every sub-index will also be regressed individually on its respective main index and the MSCI world index. The MSCI represents our world portfolio.

Table 1: **Descriptive Statistics**

Time period	1990 to 2013			1990 to 1997			1998 to 2005			2006 to 2013		
Variable	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
SSE A	253	0,005	0,115	62	-0,008	0,186	94	-0,001	0,063	93	0,006	0,096
SZE A	253	0,005	0,107	62	-0,005	0,145	94	-0,005	0,068	93	0,013	0,110
MSCI	253	0,005	0,055	62	0,017	0,059	94	0,002	0,047	93	-0,001	0,061
SSE IND	246	0,001	0,101	55	-0,007	0,144	94	-0,001	0,064	93	0,006	0,103
SSE RLE	246	0,004	0,122	55	0,007	0,167	94	-0,008	0,080	93	0,013	0,128
SSE FIN	83	0,010	0,139	0			0			83	0,010	0,139
SSE ENERGY	106	0,006	0,119	0			11	-0,008	0,084	93	0,006	0,124
SSE IT	106	0,009	0,116	0			11	-0,032	0,086	93	0,011	0,119
SZE FIN	106	0,010	0,120	0			11	-0,010	0,073	93	0,011	0,124
SZE IND	106	0,008	0,114	0			11	-0,028	0,074	93	0,010	0,118
SZE RLE	148	0,013	0,115	0			53	-0,014	0,085	93	0,012	0,128
SZE ENERGY	106	0,013	0,137	0			11	-0,017	0,079	93	0,015	0,143
SZE IT	148	0,003	0,106	0			53	-0,017	0,080	93	0,013	0,117

6.1 Descriptive statistics

The table 1 shows the number of observations of the stock indices', mean (returns) and standard deviation (risk). The different stock indices are made up of the Shanghai Stock Exchange A index returns (R SSE A), the Shenzhen Stock Exchange A index returns (R SZE A) and the Morgan Stanley Capital International World Index (R MSCI). These three indices make up the independent variables we use when we run our models.

The dependent variables are constituted of the following Shanghai Stock Exchange's sub-indexes, industrial sector returns (R SSE IND), real estate sector returns (R SSE RLE), financial sector returns (R SSE FIN), energy sector returns (R SSE ENERGY) and information technology sector (R SSE IT). We also have the Shenzhen Stock Exchange's respective five sub-indexes, in order, financial sector (R SZE FIN), industrial sector (R SZE IND), real estate sector (R SZE RLE), energy sector (R SZE ENERGY), and information technology sector (R SZE IT).

As we can see there are different values in the observation fields, which basically mean that we were unable to retrieve data for the whole period for all of the different stock indices. We can see that we only have data for the whole period for our three independent variables SSE A Index, SZE A index and the MSCI World Index. The sector with the least data is the Shanghai financial sub-index with only 83 individual observations, followed by the RSSEENERGY, RSSEIT, RSZEFIN, RSZEIND and RSZEENERGY with 106 observations. Last we have the RSZERLE and RSZEIT with 148 observations respectively.

The mean observations are a measure of each of the different indices' average return over the course of 23 years (1990-2013). Here we have the highest values in the Shenzhen energy sub-index and the Shenzhen real estate with an average return of 0.013 % and the lowest return in the Shanghai industrial index 0.001 %. The mean return for the Chinese main indices does not differ from the mean return for the MSCI, this tells us that we will need to concentrate more on the sub-periods to better understand differences in returns for the time period.

In terms of risk or standard deviation we have the Shanghai financial sector with a 0.055 % standard deviation around the mean and the lowest in the MSCI World Index. Not very surprisingly since according to economic reasoning we would expect the risk of a "world" portfolio, which the MSCI comes closest to resembling, to have the lowest variance and thus also the lowest risk. We refer to our time series graphs in the appendix depicting returns per month over the course of time, to see how much more the domestic stock exchange fluctuated in comparison to the rest of the world stock exchanges up until the end of the 20^{th} and beginnings of the 21^{th} century.

For the period 1990-1997 we have only been able to collect data for two for the five sub-indices; the real estate and the industrial index for SSE. The Shanghai industrial index have had a negative mean return of -0.007 % while the Shanghai real estate index has showed a positive mean return of 0.007 % for the same period. The data for the three main indexes have all 62 observations; the reason for this is because the data was not collectable until November 1992. The base period for the two sub-indices is May 1993. The mean return for the two main indexes is both negative, the mean return for the SSE index is -0.008 % and for the SZE the mean return is -0.005 %. For the same period the MSCI World Index shows a positive mean return of 0.017 %.

The standard deviation of the four Chinese indexes is quite similar; the index with the highest Std. Dev is SSE main index, 0.186 %. If we look at the return time series graphs in the appendix we can see our analysis depicted graphically with the Chinese indices projecting far higher levels of volatility during the period of 1990 to 1997 than the MSCI World Index. An explanation to the high volatility could be the lack of maturity in the market and with experienced foreign investor not yet allowed as market participants, most of the investor in the sub-period would have been inexperienced Chinese speculators.

For the period 1998 to 2005 we find that we only have collectable data for the whole period in the three main indices and in two of the sub-indices (the SSE industrial index and the SZE real estate index). These five indices all have 94 observations. The Shenzhen real estate index and IT index both have 53 observations. The base period of these two indexes is May 2001. The rest of the sub-indices only have observations for the final year (2005) in the sub-period, which will make it difficult for making a proper analysis.

The two domestic main indices (SSE A and SZE A) have had a negative mean return, -0.01% for the SSE index and -0.005% for the SZE index. The MSCI World Index return for this sub period positive, 0.002 % compared to previous period where the index showed a positive mean return of 0.017 %. All of the sub-indexes, except the IT index (RSSEIT) for SSE, show negative mean returns. Since all the Chinese indices projects negative return while the MSCI provides a positive mean return for the sub-period it is likely that segmentation were still present between the markets.

The Std. Dev is higher in the Chinese indexes also in this period (1998-2005). The highest Std. Dev is observed in the Shanghai IT index (R SSE IT), 8.57 %. This is however almost ten percent lower in standard deviation than what the Shanghai A index showed in the previous period (where it was 18.56 %). The differences in Std. Dev between the three main indices are 1.67 % for the SSE A versus the MSCI and 2.11 % for the R SZE A versus R MSCI. Note that the previously high volatility of the Chinese indices has come to decrease by almost three-fold. This implies, observing the time series once again, that approximately during the aftermath of the Asian financial crisis and the return of Hong Kong to the PRC we see a slow, but yet, more obvious beginning of integration between the two Chinese main stock exchanges and the rest of the world, i.e. the MSCI world index. We expect the Chinese economy to integrate successively more since several major economical events took place specifically during the sub-period. Besides Hong Kong being returned, the Chinese B share was also introduced to the Chinese public (Lu et al., 2007, pp. 309-328), China got admitted into the world trade organization, WTO (Wang - Wang, 2013, pp. 53-69) and in late 2002 the initial companies under the Qualified Foreign Institutional Investor program got permission to access the Chinese capital markets (Tam et al., 2010, pp. 425-448). We find these events being largely, if not exclusively, the major drivers of the co-integration between the graph lines during the end of the 20th century and the beginnings of the 21th century.

The final sub period data is for 2006 -2013. The data consists of a full set of 93 observations for every index except for the Shanghai financial sub index with 10 fewer observations.

It is interesting that the two Chinese main indices show positive mean return, 0.006 % for the Shanghai index and 0.013 % for the Shenzhen index, while the MSCI world index projects a slightly negative mean return -0.001 %. Previous sub periods have given us return series with the opposite result; negative mean return for the Chinese main indices and positive for the MSCI World Index. The financial crisis in 2008 most likely is the explanation to this. Since the Chinese markets had only gradually opened up to the global market in 2008 it is reasonable to think that the financial crisis did not affect the Chinese stock markets to the same extent as it did to other highly integrated stock markets.

All the sub-indexes project a positive mean return for the third sub-period. The highest mean return belongs to the Shenzhen real estate index, the Shenzhen IT index and the main Shenzhen A share index. The lowest mean return for the sub-indices we find is the Shanghai financial index, the mean return here is 0.01 %. In the previous period eight out of nine sub-indices projected negative mean returns while in this case we have every sub-index showing positive numbers which suggest a strong period for the Chinese stock market. Since this sub-period's only negative index return is the MSCI it suggests that market segmentation is still present.

Looking at the standard deviation we observe that it is higher during this period for all three main indices, in comparison to the previous time period. It is reasonable to think that this is related to the financial crisis in 2008. The standard deviation is however still lower than it was in 1992 for the two Chinese main indexes. The standard deviation of the Shanghai A-share index is 0.09 % lower in this period than it was in 1992 and the Shenzhen A share index is around 0.03% lower.

6.2 Seasonality

In this section we look for seasonality in our A share indexes and our sub-indexes. Note that our base month is December (m12). We start with the same period ranging from 1990 to 2013 and then the three consecutive sub-periods.

The first case of seasonality during the whole period of time we find in the Shanghai main index. If we assume a significance level of 10% the SSE A index projects small statistical significance in months January (m1), July (m7), October (m10) and November (m11) – and we can reject the null hypothesis. At a 5% significance level we find no variables with statistical significance. Observe that we simply are looking for statistical significance since, no matter what the coefficient is; we are discussing fluctuations in returns in percent concerning stock market exchanges and sub-indexes. A beta of simply 0.005 could be translated into hundreds of millions of RMB and leaves us with all beta coefficients being economically significant.

Table 2: **Seasonality**

Time period	1990 to 2013		1990 to 1997		1998 to 2005					2006 to 2013		
	SSE A	SSE RLE	SSE A	SSE IND	SSE A	SZE A	SSE IND	SZE RLE	SZE IT	SZE A	SSE ENERGY	SZE IND
	-0.064*	-0.085**	-0.272**	-0.213**	0.052	0.065*	0.045	0.121*	0.129**	-0.001	-0.056	0.010
m1	(-1.8)	(-2.20)	(-2.43)	(-2.36)	(1.53)	(1.81)	(1.31)	(2.01)	(2.25)	(-0.01)	(-0.86)	(0.16)
	-0,022	-0,049	-0,092 (-	-0,066	0.051	0.068*	0.048	0.092	0.088	0.042	-0.051	0.029
m2	(-0,61)	(-1,28)	0,83)	(-0,74)	(1.56)	(1.95)	(1.45)	(1.54)	(1.54)	(0.72)	(-0.81)	(0.47)
	-0,029	-0,024	-0,158	0,003	0.058*	0.073**	0.056	0.079	0.044	-0.026	-0.025	-0.049
m3	(-0,81)	(-0,64)	(-1,42)	(0,03)	(1.77)	(2.09)	(1.66)	(1.31)	(0.77)	(-0.45)	(-0.4)	(-0.8)
	-0,029	0,005	-0,139	0,002	0.019	0.023	0.013	-0.006	-0.008	0.025	0.001	0.006
m4	(-0,80)	(-0,13)	(-1,24)	(0,002)	(0.58)	(0.66)	(0.4)	(-0.1)	(-0.14)	(0.43)	(0.01)	(0.1)
	-0,021	-0.066*	-0,099	-0,044	0.028	0.041	0.024	-0.016	0.046	-0.016	-0.044	-0.032
m5	(-0,60)	(-1.72)	(-0,89)	(-0,49)	(0.86)	(1.18)	(0.71)	(-0.26)	(0.81)	(-0.27)	(0.7)	(-0.51)
	-0,053	-0,062	-0,171	-0,044	0.058*	0.064*	0.056*	0.058	0.050	0.066	-0.128**	-0.088
m6	(-1,5)	(-1,64)	(-1,53)	(-0,51)	(1.78)	(1.85)	(1.67)	(0.97)	(0.88)	(-1.13)	(-2.02)	(-1.42)
	-0.068*	-0.069*	-0.229**	-0,110	0.028	0.035	0.024	0.048	0.036	0.034	0.001	0.009
m7	(1.91)	(-1.81)	(-2.06)	(-1,29)	(0.87)	(1)	(0.7)	(0.85)	(0.67)	(0.58)	(0.02)	(0.14)
	-0,004	-0,019	-0.040	0.094	-0.003	0.013	-0.007	0.031	0.051	-0.045	-0.092	-0.063
m8	(-0,12)	(-0,49)	(0.36)	(1.11)	(-0.11)	(0.38)	(0.7)	(0.54)	(0.93)	(-0.77)	(-1.45)	(-1.02)
	-0,046	-0,049	-0.063	0.044	0.019	0.032	0.018	0.011	0.031	-0.018	-0.007	-0.019
m9	(-1,28)	(-1,29)	(-0.56)	(0.52)	(0.57)	(0.93)	(0.54)	(0.2)	(0.58)	(-0.32)	(-0.11)	(-0.31)
	-0.064*	-0.084**	-0.238**	-0.105	0.008	0.017	0.005	0.007	0.010	0.017	-0.018	-0.026
m10	(-1.78)	(-2.20)	(-2.13)	(-1.24)	(0.25)	(0.48)	(0.14)	(0.13)	(0.19)	(0.058)	(-0.28)	(-0.42)
	-0.064*	-0.069*	-0.225**	-0.206	0.032	0.039	0.028	0.036	0.064	0.000001	0.057	0.00003
m11	(-1.81)	(-1.83)	(-2.12)	(-0.3)	(0.96)	(1.12)	(0.83)	(0.63)	(1.18)	(1)	(-0.87)	(1)
Obs.	*253*	*246*	*62*	*55*	*94*	*94*	*94*	*53*	*53*	*93*	*93*	*93*

T-values are reported in parentheses. *, **, *** indicates significance at the 90%, 95%, and 99% level, respectively.

For the same period we only find one more statistically significant regressand, the Shanghai real estate sub-index. January and October shows unambiguous statistical significance in this test for seasonality. While the January and October variables are significant at 5 and 10 % significance levels, we also have May, June and November being statistically significant at the 10 % level. As mentioned in table 2 the number of asterisks represents the levels at which the regressor is found to be statistically significant.

In both cases we find monthly effect in the monthly variable January. This is in accordance to the theory of January effect as described in (Burton, 2003, pp. 64). However, the effect is negative which contradicts the usually positive January effect that occurs in stock markets.
In the next time period we find evidence of seasonality in the Shanghai A share index, more specifically in the months of January, July, October and November. The t-values for all four months are statistically significant and the p-values are below 0.05, therefore statistically significant and are marked with two asterisks.

The other case of seasonality is found in the Shanghai industrial sub-index regression results for the month of January. The result is statistically significant and projects significance at a 0.05 % level.

During the time period 1998 to 2005 we first find seasonality in the Shanghai A-share index. Both March and June are statistically significant at the 10 % level.

In the case of the Shenzhen A-share index we find March with a t-value 2.09 and a p-value of 0.04, which makes it statistically significant at a 5 % level. January, February and June also projects significance, but only at the 10% level.
When regressing the Shanghai industrial sub-index in this period, the closest thing to statistical significance would be June with a p-value of 0.099, thus being minimally significant at the 10% level. And even less, we have March with a t-value of 1.66 and p-value of 10.1 thus being marginally significant at most.

The first case of seasonality regarding the Shenzhen stock market we find is its real estate sub-index in January month, being marginally significant at the 10% level. The only month with seasonality in the SZE IT index is January. The low p-value at 0.03 gives is statically significance at a 5 % level.

Neither the Shanghai nor the Shenzhen A share main index show any signs of statistical significance during the period 2006 to 2013. In fact we find a rather peculiar form of the opposite of statistical significance. The Shenzhen November month variable shows the ultimate form of insignificance with a p-value of 1.00. Leading us to the conclusion that there is the strongest proof of non-monthly effect we can find in the case of November with December as base monthly variable.

The only case of seasonality within this time period for the Shanghai energy sector is the month of June. We find a monthly effect with significance at the 5% level.

Apart from the Shenzhen main index we also find the Shenzhen industrial sub-index's November variable projecting the same p-value of 1.00. We expect this to be a solid argument as to why we observe the same findings in the Shenzhen main index.

Conclusively we find that the case of the monthly effect of January is re-occurring, the same applies to the end of the year month October and November. Besides these times during the year there are also signs of monthly effect around the summer months of June and July.

6.3 Unit root test

As mentioned in the theory part a Dickey-Fuller (df-test) test is made to see whether seasonality can be found in our main indexes and sub-indexes. Our decision of using zero lags is because we do not expect any of the results from the df-test to show non-stationarity, i.e. that the return values should or will follow a random walk. This is based on the fact that all our time-series data is index data that naturally leads to stationarity.

Table 3: **Dickey-Fuller test results of the SSE**

		Signficance levels		
	t	1%	5%	10%
Z(t)	-18.23	-3.460	-2.880	-2.570
p-value for Z(t)	0.000			
No. Obs.	252			

The Dickey-Fuller test (df-test) results, as we displayed in table 3, have a t-value higher than each critical value at the 1, 5 and 10% significance levels and a p-value of 0.00, which means that we can reject the null hypothesis. Rejecting the null-hypothesis, as expected, leads to the conclusion that the data is stationary and unit-root is not present.

Table 4: **Dickey-Fuller test results of the SZE**

		Signficance level		
	t	1%	5%	10%
Z(t)	-15.152	-3.460	-2.880	-2.570
p-value for Z(t)	0.000			
No. Obs.	252			

In table 4 we are presented with the same result as in the table before i.e. the t-value is highly statistically significant and thus unit-root is not present.

In the table 5 we have listed all of the sub-index df-test results with their number of observations, respective t-values and p-values with the different critical values at the 1,5 10% significance levels.

Table 5: **Dickey-Fuller test results of the sub-indexes**

lags(0)			Significance level			
SSE	p-values	Z(t)	1%	5%	10%	No. Obs.
IND	0.00	-15.343	-3.462	-2.880	-2.570	245
RLE	0.00	-15.498	-3.462	-2.880	-2.570	245
FIN	0.00	-8.517	-3.535	-2.904	-2.587	82
ENERGY	0.00	-9.794	-3.508	-2.890	-2.580	105
IT	0.00	-10.683	-3.508	-2.890	-2.580	105
SZE						
FIN	0.00	-9.423	-3.508	-2.890	-2.580	105
IND	0.00	-10.347	-3.508	-2.890	-2.580	105
RLE	0.00	-11.185	-3.494	-2.887	-2.577	147
ENERGY	0.00	-9.970	-3.508	-2.890	-2.580	105
IT	0.00	-13.107	-3.494	-2.887	-2.577	147

6.4 Segmentation

By using the Jorion and Schwartz model a regression for each sub index have been conducted on its equivalent main index, i.e. Shanghai SE sub indexes regressed on the SSE A index, and on the MSCI index since it represents the world portfolio. The purpose with the test is to see if there is market integration or segmentation in the Chinese indices with the rest of the world.

Table 6: **Correlation matrix**

	SSE A	SZE A	MSCI
Whole sample period			
SSE A			
SZE A	0,839		
MSCI	0,074	0,089	1
Sub-period 1990 to 1997			
SSE A			
SZE A	0,787		
MSCI	-0,106	-0,0799	1
Sub-period 1998 to 2005			
SSE A			
SZE A	0,967		
MSCI	0,089	0,100	1
Sub-period 2006 to 2013			
SSE A			
SZE A	0,9174		
MSCI	0,299	0,234	1

Table 6 displays the correlation between the main indexes for all time periods. As we can see, for the whole time period, there are insignificant signs of correlation between the Chinese indices and the MSCI world index. For the equivalent time period divided into three sub-periods a gradual movement can be found from segmentation to integration.

In the first sub-period from 1990 to 1997 we find negative correlation coefficients, from this we can draw the conclusion that the three main indices must have had opposite directional movements, i.e. when the MSCI index had positive returns the Chinese indices went negative and vice versa. Why we have these results we expect to be caused by, at the time, the Chinese economy had yet to open itself up and expose itself to the rest of the world's economy. This conclusion is also supported by the gradual increase of the correlation coefficients, going from a negative value to a positive one over time. Caution is still advised when interpreting a covariance matrix, the work of (Adler, 1983, pp. 925-984) and (Solnik, 1974, pp. 537–554) states that a more rigorous method is needed to test for integration versus segmentation, in our case that is the Jorion and Schwartz model.

Table 7: **Jorion and Schwartz model results for SSE**

Time period	**1990 to 2013**					**1990 to 1997**				
	IND	RLE	FIN	ENERGY	IT	IND	RLE	FIN	ENERGY	IT
	0.004***	0.007	0.014*	0.007	0.008	0.002	0.018			
_cons	(3.18)	(1.46)	(1.77)	(1.50)	(1.14)	(0.469)	(1.61)			
	1.007***	1.015***	1.276***	1.157***	1.021***	0.970***	1.018***			
SSE A	(84.9)	(22.38)	(15.02)	(23.67)	(13.33)	(42.95)	(13.26)			
	-0.007	-0.0002	-0.244*	0.189**	-0.053	-0.071	0.36**			
MSCI	(-0.31)	(0)	(-1.87)	(2.39)	(-0.42)	(-1.35)	(2.01)			
R^2	0.968	0.675	0.746	0.865	0.651	0.973	0.772			
No. Obs.	246	246	83	106	106	55	55	0	0	0

	1998 to 2005				**2006 to 2013**				
	IND	RLE	ENERGY	IT	IND	RLE	FIN	ENERGY	IT
	0.002**	-0.005	0.017	-0.027	-0.006**	-0.00001	0.002	-0.007	-0.001
_cons	(2.36)	(-1.11)	(1.57)	(-1.58)	(-2.59)	(-.00)	(0.24)	(-1.51)	(-0.10)
	1.012***	1.037***	1.394***	0.741**	1.042***	1.080***	1.276***	1.152***	1.013***
SSE A	(84.59)	(13.90)	(7.84)	(2.42)	(42.89)	(11.73)	(15.02)	(22.10)	(12.56)
	0.001	-0.026	-0.942	1.929*	0.016	-0.253*	-0.244*	0.199**	-0.064
MSCI	(0.08)	(-0.26)	(-1.68)	(2.01)	(0.42)	(-1.74)	(-1.87)	(2.41)	(-0.50)
R^2	0.988	0.679	0.892	0.692	0.958	0.611	0.746	0.865	0.653
No. Obs.	94	95	11	11	93	93	83	93	93

T-values reported in parentheses

*, **, *** indicates significance at the 90%, 95%, and 99% level, respectively.

Table 8: **Jorion and Schwartz model results for SZE**

Time period	1990 to 2013					1998 to 2005		
	IND	RLE	FIN	ENERGY	IT	IND	RLE	FIN
_cons	0.006 (1.25)	0.009 (1.58)	0.009 (1.65)	0.012* (1.83)	0.007 (1.30)	0.004 (0.34)	0.013** (2.47)	0.006 (0.36)
SZE A	1.136*** (20.47)	1.089*** (15.49)	1.175*** (19.10)	1.271*** (16.52)	0.949*** (13.73)	1.208*** (6.53)	1.173*** (15.72)	0.800** (2.74)
MSCI	-0.154* (-1.71)	-0.119 (-1.09)	-0.169* (1.70)	0.032 (0.25)	-0.038 (-0.83)	-1.180* (-2.01)	0.058 (0.54)	0.619 (0.67)
R^2	0.811	0.633	0.788	0.746	0.746	0.846	0.836	0.607
Nr. Obs.	106	148	106	106	106	11	53	11

	2006 to 2013					1990 to 1997		
	IND	RLE	FIN	ENERGY	IT			
_cons	0.010*** (3.38)	0.013 (1.43)	0.011 (1.60)	0.015** (2.49)	0.013** (2.57)			
SZE A	1.045*** (36.81)	0.852*** (9.93)	0.951*** (14.44)	1.155*** (19.83)	0.964*** (19.63)			
MSCI	-0.050 (-0.97)	-0.034 (-0.22)	-0.025 (-0.21)	0.154 (1.45)	-0.015 (-0.17)			
R^2	0.939	0.532	0.706	0.826	0.817			
Nr. Obs.	94	94	94	94	94	0	0	0

T-values reported in parentheses

*, **, *** indicates significance at the 90%, 95%, and 99% level, respectively.

In the tables 7 and 8 we see the results for integration and segmentation. The results imply whether or not it is possible to reject the null hypotheses of segmentation. As we see the different columns the first one consists of the results for the whole time period 1990-2013 followed up by the three consecutive sub-periods. Note that we only have two sub-periods for Shenzhen. We can observe, in accordance to the covariance matrix, that the Shanghai main index's t-value and coefficient is far bigger than the MSCI's t-value. This relationship is also reflect by each indexes' p-value. In fact the MCSI's coefficient shows a negative beta, which leads us to the conclusion that the sub-index has a negative correlation with our world portfolio.

Looking at the full sample periods for both Shanghai and Shenzhen we can conclude that there is strong evidence for market segmentation. Exceptions would be for the Shanghai financial sector, the Shenzhen financial sector and the Shanghai energy sector. The coefficients for the integration test between financial sub-indexes and the world market is statistically significant at a 90 % level. However, the correlation is negative which means that when the financial sector in China is displaying growth the world market does the opposite.

The sector with the highest integration with the MSCI World Index is the SSE energy index. When looking at the full sample period the statistics shows significance at the 95 % level between it and the MSCI World Index. In accordance to the paper (Li Liu, 2013, pp. 364-373) we find evidence to support the theory of how energy prices are set by the world market and that even, as the world's second largest energy consumer, China is still depended on the prices set on the international energy markets.

In the works of (Mittoo, 1992, pp. 2035–2054) the results of the original studies of (Jorion - Schwartz, 1986, pp. 603-614) was challenged by splitting the initial time period into sub-periods, his study showed evidence of increased integration over the individual sub-periods. We also conducted this in order to test our results under sub-periods. The results for the Shanghai sub-indexes supports the notion established by the works of (Groenewold et al., 2004, pp. 45–62) and (Hatemi, 2004, pp. 281-294), we also found evidence of increasing integration over the sub-periods. Exceptions in our findings would be the real estate index that shows an initial shift from significance in the first period (1990-1997) to insignificance in the second (1998-2005) and back to significance in the final third period (2006-2013). The reasoning in this case, we assume it to be because of difference in data availability where in the first period we only have 55 observation and then 94 in the second. In the end we have 93 observations and thus we conclude that there is in fact a movement from insignificance to significance from the second to the third sub-period. Another anomaly would be the IT sector, with no data in the first period, 11 observations in the second and a full set of 93 observations in the final sub-period where we find no proof of integration. Remaining indexes all show signs of a gradual movement from segmentation to integration and thus rejection of the null hypothesis in our Shanghai sub-index results is applicable.

The results for the Shenzhen sub-indexes we find are mixed with no substantial proof of increased integration. With no observations for any of the sub-indexes in the first period, only 11 observations for the industrial and financial sector in the second and 53 observations for the real estate, we find that any conclusions would be rather unqualified. Thus we only have the final sub-period results for 2006-2013 with no signs of increased or any integration at all.

7. Conclusions

Findings of seasonality in the Chinese stock market would imply that heavy profits could be made since the market does not follow a random walk. Our tests for seasonality during the full time period from 1990-2013 suggests that a weak form of negative January effect exists in the Shanghai A index, mainly derived from the period 1990-1997. There are two major reasons for why the effect is negative and not positive as you would expect from a stock market, firstly the calendar year in China ends in February so a normal January effect is not to be expected, secondly China does not have any taxes for capital gains so tax-loss selling is irrelevant (Gao & Kling, 2005, pp. 75-88).

When examining the data from our seasonality test for the rest of the months in the whole period series and sub-periods test we can conclude that there are no clear patterns in the months that project seasonality when examining the different indices. For the first time period (1990-1997) four of the months in the Shanghai A share index projects negative seasonality but the next sub-period two other months projects seasonality, in weak positive form this time. In the second time period (1998-2005) the Shenzhen A share index also projects weak form seasonality in four of the months. The findings of seasonality for the first two time period suggests that the Efficient

Market Hypothesis was not yet fully implemented on the Chinese stock market. Since the A share market wasn't accessible for foreigners until the initiative of the QFII program in 2002 the market was up until then dominated of domestic speculators with irrational behavior which possibly can explain the results of seasonality for the first two sub-periods.

The final sub-period only projects seasonality for the Shanghai energy index. Less presence of seasonality would suggest a more mature market that projects a higher efficiency compared to previous sub-periods. Arbitrage opportunities are to a larger extent eliminated and the Chinese government's attempt to create a less regulated market seem to have succeeded. However, we recommend future research to be conducted on the indexes when more sub-periods are available. It would be interesting to see if the next seven-year period supports our conclusion on a more efficient Chinese market.

Previous work regarding segmentation on the Chinese stock market has in general concluded that the market is segmented. As the basis for our thesis has been to closely examine new reforms and events that have taken place after previous work in this area of study we still find evidence of a largely segmented Chinese financial market. The work of (Wang - Di Iorio, 2007, pp. 277-290) had a limited time frame to thoroughly examine the effects of the QFII-program that was initiated in 2002. Since their work consisted of the time range 1995 to 2004 we now can complement with our work and results that we have attained.

The work of (Wang - Di Iorio, 2007, pp. 277-290) showed that the correlation between the Chinese A-share indexes and the MSCI world index were very low, the results in our case we have, as stated previously in the paper, exempted the correlation coefficients when testing for market integration. This is also opposed to the original model of (Jorion - Schwartz, 1986, pp. 603-614). Nevertheless our hypothesis is in line with previous null hypothesises, namely whether or not we find enough proof of statistical significance in our beta coefficients during the test. Apart from our whole time-period ranging from 1990 to 2013 we have, like previous studies, divided the observed data into subperiods in order to further investigate and isolate individual events and policy changes that could have an effect on the integration of the Chinese financial market and that if the tests were to be sensitive to different time periods.

Our results of the whole time period shows proof of only the energy sector in Shanghai of being rather integrated with the rest of the world's financial markets. Two other cases with less significant evidence of integration, the financial sectors in both cities projects signifcance at a 90% level which implies that we find small but undeniable evidence of integration between the Chinese financial sector and the world financial markets, as opposed to previous findings. Our results for the sub-periods verifies the notion of increased economical integration across time when looking at the Shanghai sub-indexes. Especially in the real-estate, financial and energy sectors. When it comes to Shenzhen we have no consistents data to base our assumptions upon, this is partially because of lack of data. The only sector with sufficient availability to data was the real easte sector. But this was to no avail since the results shows no signs of integration.

Conclusively, when looking across all the sectors and the whole sample period we find it difficult, based on our results, to reject the null hypothesis of market segmentation between the Chinese and the world's financial markets. Thus the Chinese stock market still offers a risk premium relative to the country's national risk factors, i.e. systematic risk. But above all, the country still offers opportunities of diversification for international portfolio managers and investors.

References

Adler, Michael - Bernard Dumar, 1983. “International Portfolio Choice and Corporation Finance: A Synthesis”, *The Journal of Finance*, Vol. 38, nr. 3, pp. 925-984.

SHASHR Quote - *Shanghai Stock Exchange A Share Index* - Bloomberg. [ONLINE] Available at: http://www.bloomberg.com/quote/SHASHR:IND. [Accessed 23 December 2012].

Burton, Malkiel, 2003. “Efficient Market Hypothesis and Its Critics”, *The Journal of Economic Perspectives 17*, Vol. 17, nr. 1, pp. 64.

Chen, Max – Hong Yongmiao, 2003. “Has Chinese Stock Market Become Efficient? Evidence from a New Approach”, *International Conference on Computational Science* , Vol. 2658, pp. 90-98.

Introduction of China's Securities Market, 2013. *Introduction of China's Securities Market*. [ONLINE] Available at: http://www.sipf.com.cn/en/chinassecuritiesmarketoverview/securitiesmarket/index.shtml. [Accessed 15 December 2013].

Cornelius, Peter, 1992. “Capital Controls and Market Segmentation of Emerging Stock Markets”, *Seoul Journal of Economics*, Vol. 5, nr. 3, pp. 289-99.

Gao, Lei – Gerhard Kling ,2005. “Calendar Effects in Chinese Stock Market.”, *Annals of Economics and Finance*, Vol. 6, pp. 75-88.

Groenewold, Nicolas et al., 2004. “The dynamic interrelationships between the greater China share markets”, *China Economic Review*, Vol. 15, nr. 1, pp. 45–62.

Gupta, R – Donleavy, G.D, 2009.“Benefits of diversifying investments into emerging market” *Journal of Multinational Financial Management*, Vol. 19, nr 2, pp 160‐177

Hatemi, Hatemi – Eduardo D. Roca, 2004. “The case of the Chinese states equity markets”, *Journal of International Financial Markets, Institutions and Money*, Vol. 14, pp. 281–294.

Jorion, Philippe – Eduardo Schwartz, 1986. “Integration vs. Segmentation in the Canadian Stock Market”, *Journal of Finance*, Vol. 41, nr. 3 pp. 603-14.

Li Liu, et al., 2013. “Is world oil market “one great pool”?: An example from China's and international oil markets”, *Economic Modelling*, Vol. 35, pp. 364-373.

Li, Hong, 2013. “Integration versus segmentation in China's stock market: An analysis of time -varying beta risks”, *Journal of International Financial Markets, Institutions and Money*, Vol. 25, pp. 88-105.

Lu, Changjiang et al, 2007. “Integrating A- and B-Share Markets in China: The Effects of Regulatory Policy Changes on Market Efficiency”. *Review of Pacific Basin Financial Markets and Policies*, Vol. 10, nr. 3, pp. 309-328.

Mittoo, Usha, 1992. “Additional Evidence on Integration in the Canadian Stock Market”, *The Journal of Finance* , Vol. 47, nr. 5, pp. 2035–2054.

MSCI, *MSCI World Index*, [ONLINE] Available at: http://www.msci.com/resources/factsheets/index_fact_sheet/msci-world-index.pdf. [Accessed 23 December 2013].

Shanghai Stock Exchange, *Index Introduction*, 2013. [ONLINE] Available at: http://edu.sse.com.cn/sseportal/index/en/singleIndex/000004/intro/intro.shtml, [Accessed 23 December 2013].

Shenzhen Stock Exchange, *Sector Indices*, 2013. [ONLINE] Available at:http://www.cnindex.com.cn/en/indices/CNI/sector/. [Accessed 23 December 2013].

Solnik, Bruno, 1974. "An International Market Model of Security Price Behavior", *Cambridge University Press* , Vol. 9, no. 4, pp. 537–554.

Tam, O. Kit et al., 2010. "Foreign Investment in China and Qualified Foreign Institutional Investor", *Asian Business and Management*, Vol. 9, pp. 425-448.

Wang, Yuenan- Amalia Di Iorio, 2007. "Are the China-related stock markets segmented with both world and reginal stock markets?", *Journal of International Financial Markets, Institutions and Money*, Vol. 17, no. 3, pp. 277-90.

Huijiong, Wang et al., 2013 "China's ten years in the WTO: review and perspectives", Journal of Chinese Economic and Foreign Trade Studies, Vol. 6 Iss: 2, pp. 53 – 69.

Wooldridge, Jeffrey, 2013. *Introductory Econometrics*, 5th ed., South-Western College Publishing.

Bodie, Zvi, 2011, *Invesments and Portfolio Management,* 9th ed., McGraw Hill.

Appendix

Return time series graphs of main indexes and sub-indexes over the whole time period from 1990 to 2013.