

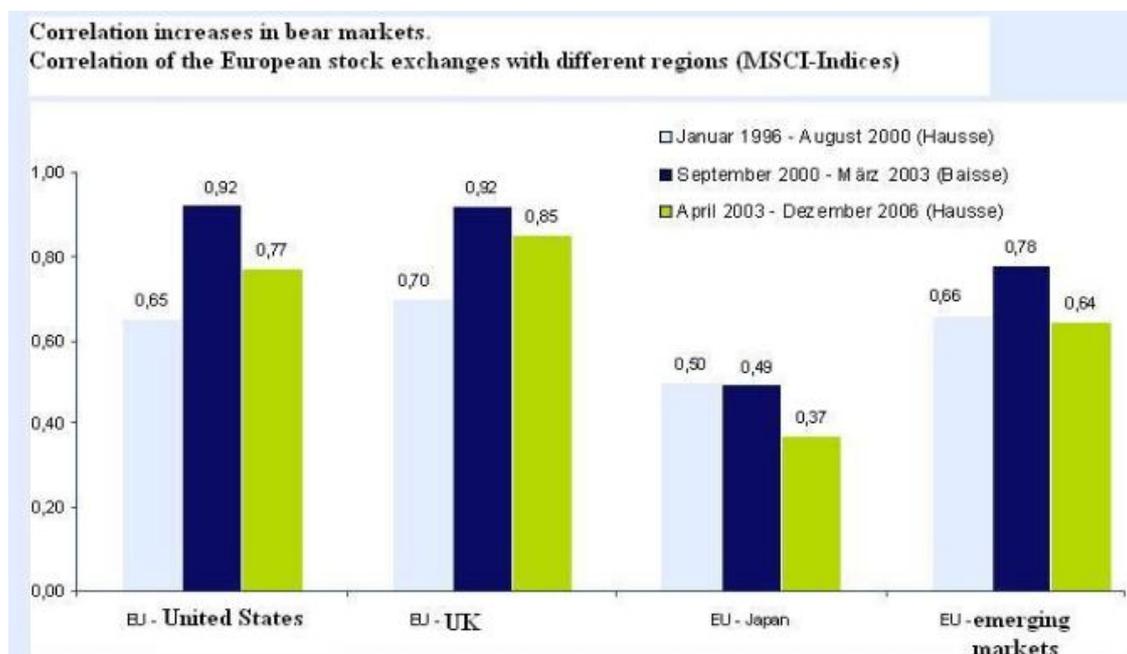


The dynamic evolution of stock market integration between China, Japan and South Korea.

What are the key determinants of regional stock market integration between these countries?

1. Introduction

The impact of increased globalization has resulted in an increasing interdependency between national economies as a by-product it has become very difficult for portfolio managers to achieve the diversification effect of not “putting all eggs in one basket” as proclaimed by the Modern Portfolio Theory established by Harry Markowitz (1952). The following graph on the correlation between European stock exchanges with different regions indicates the dilemma which investors and portfolio managers have to face.



The graph highlights the increase in the correlation between European stock markets and stock markets from other regions in an economic upturn (Hausse) and in an economic downturn (Baisse). For example in the economic upturn between January 1996 and August 2000 the correlation between the European stock exchanges the US stock exchanges was 0.65, between Europe and United Kingdom it was 0.70. The correlation between Europe and the emerging markets was slightly lower (0.66). In the event of an economic downturn the effect on the

correlation was more pronounced than in an economic upturn. From September 2000 until March 2003 the correlation was 0.92 between Europe stock markets and US stock market, as well as UK stock market, which means that there was almost a perfect positive correlation. Between European and emerging markets the correlation increases to 0.78, which is also a very high value and does not allow for an effective diversification.

1.1 Stock market integration between China, Japan and South Korea.

The economic development of emerging countries in East Asia, e.g. China, with its high growth rates has been unprecedented in world history. The rise of the emerging countries in East Asia also stimulates the development of the economies in the developed industrial countries Japan and South Korea. The Asian crisis in 1997 caused an abrupt end to the booming economic development in East Asia but rapidly returned to the growth path of the past in the first decade of the 21st century. Only in 2001 and 2008 there have been major financial shocks, starting in the United States with the bursting of the dot-com bubble and the triggering of the subprime crisis, which spread out worldwide. Especially the 2008 financial crisis had a very negative impact on the economies in East Asia since it caused a sharp rise in unemployment rates.

The Chinese, Japanese and South Korean governments decided to implement economic stimulus programs in order to cushion the negative effects spilling over from USA and Europe. As a reaction to the most recent economic recession in 2008, after the collapse of Lehman Brothers, the governments of China, Japan and South Korea decided to hold annual China-Japan-South Korea trilateral summits, the first one held in December 2008. This Political cooperation is likely to strengthen the economic cooperation between the three countries. The question arises if

it had a positive impact on stock market integration between the three countries. According to Chiang et al. (2007) and Wang et al. (2009) findings it is the impact of financial crises that cause stock market correlations to increase substantially after they broke out. Besides the increased cooperation as a result of the China–Japan–South Korea trilateral summits is expected to lead to a convergence in economic and financial policies between the three countries, which should accelerate stock market integration. With the enhancing stock markets integration, information in one country tends to be transmitted to other countries more easily, therefore, it is expected that there are stronger spillover effects between financial markets, mainly in stock returns and volatilities.

2. Determinants of stock market integration

In this research about stock market integration between China, Japan and South Korea the following determinants of stock market integration are used: Bilateral foreign direct investment (FDI) intensity.

2.1 Bilateral FDI intensity

Bilateral FDI is a good measurement for stock market integration because the higher the imports and exports between two countries the higher the interdependency between the two countries, which should led to a high stock market integration. This variable makes economies to become more integrated by linking them to each other and this leads to higher stock market integration. There are two FDI statistics recorded, one is the Inward FDI (FDI in the reporting economy), the other is Outward FDI (or FDI abroad). A commonly used measure for bilateral FDI intensity is to take the average of inward and outward FDI flows divided by GDP, which is named as FDI intensity as % of GDP. A higher index indicates higher new FDI during the period in relation to the size of the economy as measured by GDP. If this index increases over time, then we can say that

the country/zone is becoming more integrated within the international economy. The calculation is expressed as:

$$\frac{\frac{\text{Inward } FDI_{ij} + \text{Outward } FDI_{ij}}{GDP_i} + \frac{\text{Inward } FDI_{ji} + \text{Outward } FDI_{ji}}{GDP_j}}{2}$$

where Inward FDI_{ij} and Outward FDI_{ij} are the values of the inward and outward FDI flows from country i to country j. GDP_i is the GDP in country i, GDP_j is the GDP in country j.

2.2 Inflation and interest rate

Pretorius (2002: 91–92) states that several local macroeconomic variables are influencing the stock market performance according to the cash flow model:

$$P = \frac{(1 + g) * D_0}{k - g}$$

where g is the constant growth rate, D_0 is the last dividend paid and k is the discount rate. Chen et al. (1986: 383) documented that macroeconomic variables such as interest rate, inflation and industrial production have an influence on the expected cash flows and therefore also on the stock prices since any factor that influences the stream of cash flows or the discount rate in the cash flow model will systematically influence the stock prices. Since the macroeconomic variables influence the stock market performance of a country the inference is that if the macroeconomic variables in two countries are similar than the stock market performance will also be similar. For example if the Central Banks of two countries follow the same monetary policy then the interest rate of the two countries will move in the same direction over time. For each pair

we calculated the absolute inflation differential value by the following formula:

$$\pi_{ij} = |\pi_i - \pi_j|$$

where π_i denotes the inflation rate in country i and π_j the inflation rate in country j. The absolute short-term interest rate differential value was calculated by:

$$r_{ij} = |r_i - r_j|$$

where r_i denotes the short-term interest rate in country i and r_j the short-term interest rate in country j. The larger the absolute difference values of inflation and interest rate between two countries, the larger the stock market divergence, which means that the two macroeconomic variables have a negative impact on the stock market integration between two countries.

2.3 Bilateral trade intensity

According to the theory of stock market integration bilateral trade intensity has a positive impact on stock market integration, e.g. Pretorius (2002). This is because the tighter the trade ties between two countries the higher the stock market integration. Bekaert and Harvey (1997: 38) argue that high trade intensity between two countries induces correlation between business cycles and consumption, and also results in asset pricing that reflects higher risk. This statement by Bakaert and Harvey (1997) is intuitive because if two countries are depending on each other because of tight trade linkages then an external shock, e.g. a recession in country j, which leads to a sharp decrease in imports of country j from

country i will cause a drop in exports of country i to country j and in this way the external shock will spillover from country j to country i.

As a result the business cycles of the two countries will converge. Therefore trade intensity has a positive effect on stock market integration between two countries but investors face higher risks since the performance of the stock index in country i is also depending on the state of the economy of the country j, which is a negative byproduct of increased trade intensity. Trade intensity is measured using two different formulas in order to get a robust regression result. can be measured by several formulas. We use two formulas in order to get a robust result for our regressions. The first formula for calculating bilateral trade intensity is:

$$\frac{x_{ij} + z_{ij}}{X_i + Z_i} + \frac{x_{ji} + z_{ji}}{X_j + Z_j}$$

where x_{ij} and z_{ij} are the value of bilateral exports and imports from country i to country j while X_i and Z_i are the value of total exports and imports of country i. By using this formula we can measure how important country j is to country i as trading partner and export market for country i's products and vice versa. A high number of the sum of the two parts indicates a strong bilateral trade relationship between country i and country j, which should result in convergence between the stock markets of the two countries.

The second formula for calculating trade intensity is:

$$\frac{x_{ij} + z_{ij}}{GDP_i} + \frac{x_{ji} + z_{ji}}{GDP_j}$$

In this formula we use the GDP of country i and country j as denominator in order to normalize the bilateral exports and imports. The higher the

sum of the two parts the higher the bilateral trade intensity and the higher the stock market integration.

3. Methodology

The method applied in this research is Engle's (2002) dynamic conditional correlation (DCC) model from the multivariate generalized autoregressive conditional heteroskedasticity (MGARCH) model. This model is suitable for financial time series to capture the volatility spillover effects and to estimate time-varying conditional correlations. It is not linear and can be estimated by the likelihood function using univariate GARCH or two-step methods.

3.1 Bivariate DCC model

According to Lu (2013) the DCC model assumes that the correlations between assets are time-varying.

$$y_t = \mu + u_t$$
$$u_t = H_t^{1/2} \epsilon_t, \epsilon_t \mid \varphi_{t-1} \sim N(0, H_t)$$

where y_t is the return of the stock index. u_t is the random variable and φ_{t-1} is the set of information at time $t-1$.

4. Data Description

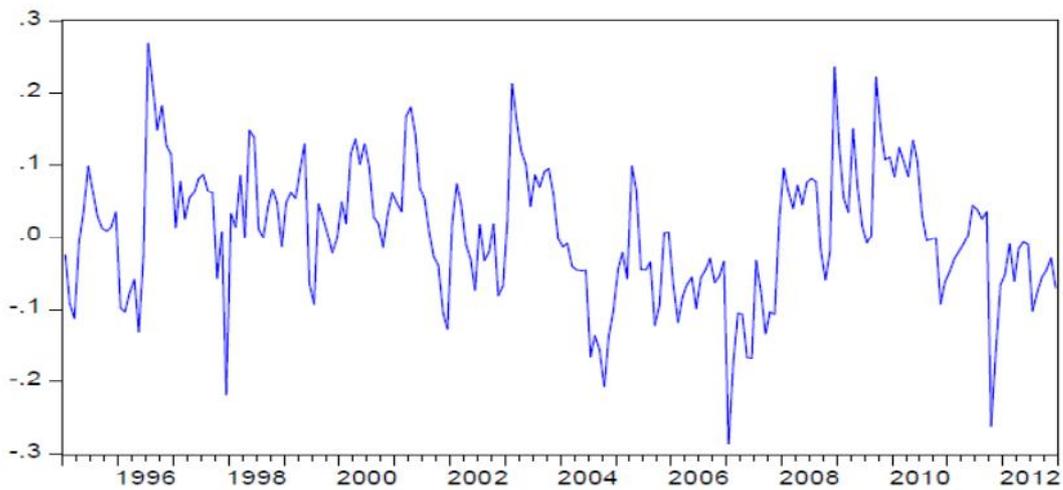
In order to test the impact of the determinants on stock market integration a data set of monthly observations of the main stock market indices in China, Japan and South Korea from November 1994 until December 2012 was used. Monthly data of the SSE Composite Index, Nikkei 225 Stock Average Index and Korea KOSPI Composite Index in local currency was collected. The monthly observations avoid the noise coming from the daily effect, and since we have a period of 18 years, we focus on the long-term stock markets' co-movement and spillover

effects. Data on the rate of inflation, short-term interest rate, bilateral and total exports and imports are monthly data of which the bilateral and total exports and imports are expressed in US dollar.

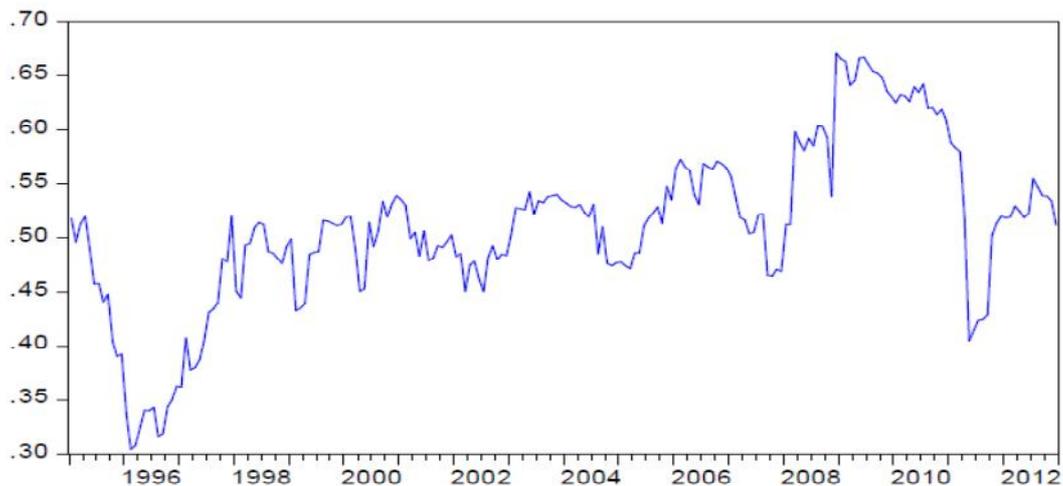
5. Empirical results

The three following graphs plot the development of conditional correlation between the Chinese, Japanese and South Korean stock markets respectively:

Correlation between China and South Korea



Correlation between Japan and South Korea



Correlation between China and Japan



As can be seen from the graphs the correlation between China and South Korea is slightly negative in 2012 and the bandwidth of the correlation is between -0.3 and 0.3 . Between China and Japan there is also a slightly negative correlation in 2012. Over time the correlation between Japan and South Korea has increased in the period between 1998 and 2008. It even increased more immediately after the collapse of Lehman Brothers but then sharply declined until 2011 before rising again to a correlation of 0.5 in 2012.

Regarding the determinants of stock market integration the following table summarizes the key determinants of stock market integration for each sample pair:

| Pair | China–Japan | China–South Korea | Japan–South Korea |
|-----------------|---|---|-------------------|
| Key determinant | Interest rate and Bilateral Trade Intensity | Bilateral FDI Intensity and Bilateral Trade Intensity | Interest rate |

6. Conclusion

In this study we analyzed the dynamic evolution of the conditional correlation between the stock markets of China, Japan and South Korea by using the DCC model and we also investigated the key determinants of regional stock market integration by using a linear equation framework. We find that there is weak stock market correlation between the three most important industrial countries in East Asia. There is an independent co-movement between the stock markets of China and South Korea, as well as between China and Japan. For the pair Japan-South Korea there is a correlation of 0.5 at the end of 2012. We therefore think that Chinese stock markets are a very attractive market since it allows investors from Japan and South Korea to benefit from the diversification effect by investing a part of their money in China. According to the Modern Portfolio Theory this will lead to a decrease in the systematic risk of the portfolio.

Regarding the determinants of stock market integration between the three countries we find that for China and Japan interest rate and bilateral FDI intensity are the single key determinants explaining the R-squared to a very large extent. For China-South Korea bilateral FDI intensity and bilateral trade intensity are the key determinants for explaining stock market correlation, whereas for Japan-South Korea interest rate is the single key explanatory variable. Overall we think that the current weak stock market correlation, especially between the pairs China-Japan and China-South Korea results from the weak economic integration and the different monetary policies which the countries adopt, which leads to a divergence in the business cycles of the respective countries and in the end results in a weak stock market integration.

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