1 Korea

Korea's accession to the OECD in December 1996 represented the culmination of 35 years of extraordinary growth that transformed it from one of the poorest nations in the world to the 11th-largest economy and exporting country. Less than a year later, however, Korea was hit by one of the most severe financial crises ever experienced by an OECD member. The fact that this crisis occurred in the context of seemingly strong macroeconomic fundamentals made the crisis even more surprising (Visco, 1999).

Foreign investors were often blamed for the dramatic difficulties of the East Asian countries and for the collapse of their currencies and stock markets (see, Choe et al., 1999). In recent years, some studies have examined the impact of foreign investors, often large financial institutions, on small emerging stock markets. It remains a highly contested issue among policymakers as well as researchers. Some academics point to the benefits of financial liberalization and foreign participation. Others have pointed out that foreign investors could have a destabilizing effect for a variety of reasons. It is therefore crucially important to understand whether this is the case.

Aims:

First, analyze the volatility and volume dynamics of Korea. Estimate univariate AR-GARCH models

Second, to shed more light on the issue of temporal ordering of volume and volatility. To do this we estimate the univarite AR-GARCH models with lagged values of one variable included in the mean equation of the other variable.

Third, the total volume is separated into domestic investors' and foreign investors' volume.

Fourth:

The most commonly used measures of volatility are the absolute values of the returns, their squares and conditional variances from a GARCH-type of model.

One can employ the classic range-based intraday estimator of Garman and Klass (1980) (hereafter GK). Chen and Daigler (2004) point out that the GK estimator is more efficient than the traditional close-to-close estimator.

As pointed out by Kawaller et al. (2001), empirical evidence of an inverse relation between the two variables is rare in the literature, and it contrasts sharply with the widely held perception that the two are positively related (see also Daigler and Wiley, 1999). Therefore, one can investigate the significance and the sign of the causal effect.

Fifth:

The sample period for the data set is from 1995 to 2005 includes the AFC. It is sensible to distinguish volume traded before the crisis from that traded after the crisis. To check the sensitivity of our results to the AFC we use three alternative sets of dates for the post-crisis period.

2 Theoretical background

2.1 Economic rationale for the negative impact of volume on volatility

Daigler and Wiley (1999) found empirical evidence indicating that the positive volume-volatility relation is driven by the (uninformed) general public whereas the activity of informed traders such as clearing members and floor traders is often inversely related to volatility.

Moreover, the activity of market makers (liquidity providers) occurs independently of information arrival. Kawaller et al. (2001) argue that an increase in such noninformation-based trading mitigates the imbalances between liquidity suppliers and liquidity demanders by enhancing the market's capacity to absorb the information-induced trading. Accordingly, all else being equal, a marketplace with a larger population of liquidity providers (or a larger capacity to absorb demands for liquidity) will be less volatile than one with a smaller population, and vice versa (Kawaller et al., 2001).

In Andersen's (1996) Mixture of distribution hypothesis (MDH) model volume contains informed ($V_t^{(I)}$) and liquidity ($V_t^{(L)}$) components.In Andersen's model the covariance between squared returns and volume is given by: $\text{Cov}(r_t^2, V_t)=\text{Cov}(r_t^2, V_t^{(I)})+\text{Cov}(r_t^2, V_t^{(L)}) =\text{Cov}(r_t^2, V_t^{(I)})$. In other words Andersen's framework $\text{Cov}(r_t^2, V_t^{(L)}) = 0$.

Li and Wu (2006) relax this assumption by postulating that liquidity trading can reduce price volatility. They employ Easley et al. (1996) set up that includes informed and uninformed traders and a risk-neutral competitive market maker. They show that in this sequential trade model the higher the intensity of liquidity trading, the lower the price volatility. To incorporate the liquidity trading effect, Li and Wu (2006) allow $\text{Cov}(r_t^2, V_t^{(L)})$ to be nonzero. In their empirical investigation they find that it is significantly negative. In other words, controlling for the information flow, they find that volatility is negatively related to volume.

2.2 Foreign and domestic investors

Kim and Wei (2002) point out that in the context of the recent AFC, it has been argued that foreign portfolio investors may have been positive feedback traders so that they rush to buy when the market is booming and rush to sell when it is falling. Another popularly claimed behavior by foreign investors is herding. That is the tendency for investors to mimic each other's trading. For at least two reasons, however, positive feedback trading and herding are not necessarily destabilizing. First, investors trading on fundamentals may be sufficiently powerful in the markets to prevent prices from moving away from fundamental values. Second, positive feedback traders may be trading in response to information about fundamentals, so that their trading does not drive prices away from fundamentals (Choe et al., 1999).

Choe et al. (1999) examine the impact of foreign investors on stock returns in Korea over the period from November 30, 1996, to the end of 1997. They found evidence that, before the Korean crisis over the last months of 1997, foreign investors engage in positive feedback trading and herd. During the crisis, the evidence of positive feedback trading was much weaker. There was no evidence that herding was more important during the crisis period, and some evidence that it was less important. They concluded that neither positive feedback trading nor herding, however, were necessarily destabilizing.

Dvořák (2001) points out that even when foreigners are noisy and irrational, their activity does not necessarily have a destabilizing impact. Domestic investors may be powerful enough and the market as a whole sufficiently liquid to accommodate selling or buying pressures from noisy foreigners. It is also possible that, controlling for total volume, foreign trading has a negative effect on volatility. This may be the case if foreign trading activity supplies liquidity to local markets or that local investors destabilize markets more than foreign ones. In this case, foreign participation is highly beneficial (Dvořák, 2001).

Furthermore, in a market with partially informed investors, broadening the investor base increases risk sharing and stock prices. A simple extension of this analysis shows that broadening investor base improves the accuracy of market information and stabilises stock prices (see Wang, 2007 and the references therein). Therefore foreign purchases tend to lower volatility by increasing the investor base in emerging markets. This is especially the case in the first few years after market liberalization when foreigners are buying into local markets, and is consistent with findings of stable stock markets after liberalization. In sharp contrast, foreign sales reduce investor base and increase volatility. Finally, Wang (2007) points out that trading within foreign and domestic investor groups does not change investor base, therefore does not affect volatility.

3 Data description and sub-periods

The data set used in this study comprises 2850 daily trading volume and prices of the Korean Composite Stock Price Index (KOSPI), running from 3rd of January 1995 to 26th of October 2005. The data were obtained from the Korean Stock Exchange (KSE). The KOSPI is a market value weighted index for all listed common stocks in the KSE since 1980.

3.1 Measurement of price volatility

Using data on the daily high, low, opening, and closing prices in the KOSPI index we generate a daily measure of price volatility. We can choose from among several alternative measures, each of which uses different information from the available daily price data. One can employ the classic range-based estimator of Garman and Klass (1980) to construct the daily volatility (y_{gt}) as follows

$$y_{gt} = \frac{1}{2}u^2 - (2\ln 2 - 1)c^2, \quad t \in \mathbb{Z},$$

where u and c are the differences in the natural logarithms of the high and low, and of the closing and opening prices respectively. Figure 1 plots the GK volatility from January 1995 to October 2005.

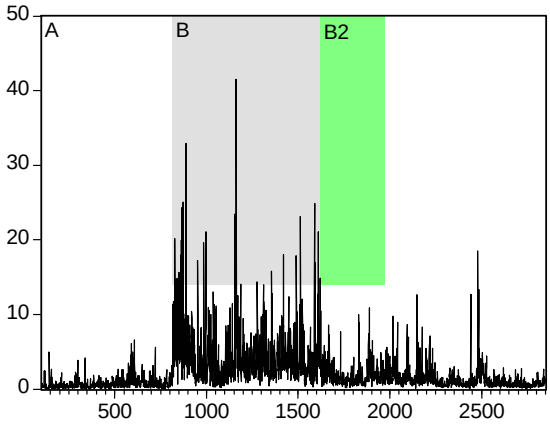

Figure 1. GK Volatility

3.2 Turnover volume

Since January of 1995 the KSE has recorded the daily trading volume of foreign investors and of 8 different domestic investors, including financial institutions, pension funds, individuals and so on. The domestic volume is constructed by adding all the different domestic investors' trading volumes.

We use turnover as a measure of volume. This is the ratio of the value of shares traded to the value of shares outstanding (see, Campbell et al., 1993; Bollerlsev and Jubinski, 1999).

Other measures of volume used:

i) Value of shares traded; ii) Number of shares traded.

Because trading volume is nonstationary several detrending procedures for the volume data have been considered in the empirical finance literature (see, for details, Lobato and Velasco, 2000). We form a trend-stationary time series of turnover (y_{vt}) by incorporating the procedure used by Campbell et al. (1993) that uses a 100-day backward moving average

$$y_{vt} = \frac{\mathrm{VLM}_t}{\frac{1}{100}\sum_{i=1}^{100} \mathrm{VLM}_{t-i}},$$

where VLM denotes volume. This metric produces a time series that captures the change in the long run movement in trading volume (see, Brooks, 1998; Fung and Patterson, 1999). The moving average procedure is deemed to provide a reasonable compromise between computational ease and effectiveness.

One can also extract a linear trend from the volume series.

In what follows, we will denote volume by $y_{vt}^{(s)}$ (s =total, domestic, foreign) respectively.

Figure 2 plots the turnover volume from January 1995 to October 2005.

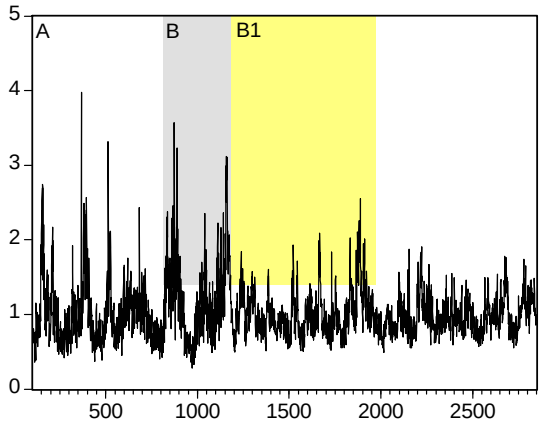

Figure 2. Turnover Volume

3.3 Structural Breaks

We choose the break points by employing a number of recently developed tests for structural breaks.

The overall picture dates two change points for volatility. The first is detected on the 15th of October 1997. Accordingly, we break our entire sample into two sub-periods: 1st) 3rd January 1995– 15th October 1997 (sample A hereafter), and 2nd) 16th October 1997- 26th October 2005: the post-crisis period (sample B hereafter).

The second change-point for volatility is detected on the 6th of October 2000. For the total/domestic volume they reveal the existence of a single change-point that is detected on the 20th of January 1999 whereas (see Figures 1 and 2). That is, the results of the break test do not support the null hypothesis of homogeneity in the two variables.

In order to ensure that the results of this study are not influenced by the break in volume and the second break in volatility, we also examine the post-crisis period excluding the 16th October 1997-20th of January 1999 period (afterwards sample B1).

3.4 Korean economy and sub-samples

The first change point in volatility is associated with the financial crisis in 1997. As mentioned earlier on, we break our entire sample into two sub-periods:

1st) 3rd January 1995– 15th October 1997 (the first break in volatility): the tranquil and pre-(currency) crisis period. This was the time when Korea was regarded as one of the miracle economies in East Asia, and foreign investors were enthusiastic about investing in Korea. While Korea's own currency crisis would come later in November of that year, the currency of Thailand, Baht (and maybe other currencies in Asia) was under several speculative attacks in June. The Thai Baht collapsed at the beginning of July, marking the beginning of what we now call the AFC. The Thai crisis sent repercussions throughout the region. 2nd) 16th October 1997- 26th October 2005: the post-crisis period (sample B hereafter).

Since there is not a common break in volume and volatility we break the post-crisis period into three sub-periods:

i) 16th October 1997- 20th January 1999 (the break in total/domestic volume): the in-crisis period. On November 18 1997, the Bank of Korea gave up defending the Korean Won. On November 21, the Korean government asked the International Monetary Fund (IMF) for a bail-out. There were also some instances of labor unrest and major bankruptcies during the period. The end of the crisis in Korea is set at the end of 1998. Even though in October 1998 there was significant uncertainty related to emerging markets in Russia and South America as well as in Asia, the worst of the Asian crisis was clearly over, the markets and the economies had begun to recover.

ii) 21st January 1999- 6th October 2000 (the second break in volatility): the economic recovery period. In 1999-2000 the Korean economy achieved an early and strong recovery from the severe recession.

iii) 7th October 2000- 26th October 2005: the world recession period. Since the end of 2000 the Korean economy faced many challenges, economically and politically, compounded by a global economic slow down with hesitant recovery, terrorist attacks, regional wars, avian flu outbreaks in Asia, and domestic and global uncertainty ahead. A 2005 World Bank research paper on Korea concluded that "the national economy is now suffering from weak investment, slow growth and slow job creation and rising unemployment" (Crotty and Lee, 2006).

The share of foreign trading activity in total stock market volume increased tremendously during the last few years. The internationalization of capital markets is reflected not only in the addition of foreign securities to otherwise domestic portfolios, but also in active trading in foreign markets (Dvořák, 2001).

There is surprisingly little evidence, however, on the impact of foreign trading activity on local equity markets. In Korea foreign stock ownership increased dramatically in the post-crisis period. The share of foreign ownership of Korea's publicly held stock increased from 15% in 1997 to 22% in 1999, 37% in 2001 and 43% in early 2004 (see Chung, 2005).

The foreign ownership share of the eight large urban banks grew from 12% in 1998 to 64% in late 2004. By mid-2005, Korea had higher foreign bank ownership than almost all Latin American and Asian countries. Korea's central bank issued a report underscoring a growing wariness in the country about the role of foreign investors.

Finally, in addition to sample B1, we also examine the post-crisis period excluding the world recession period (afterwards sample B2).

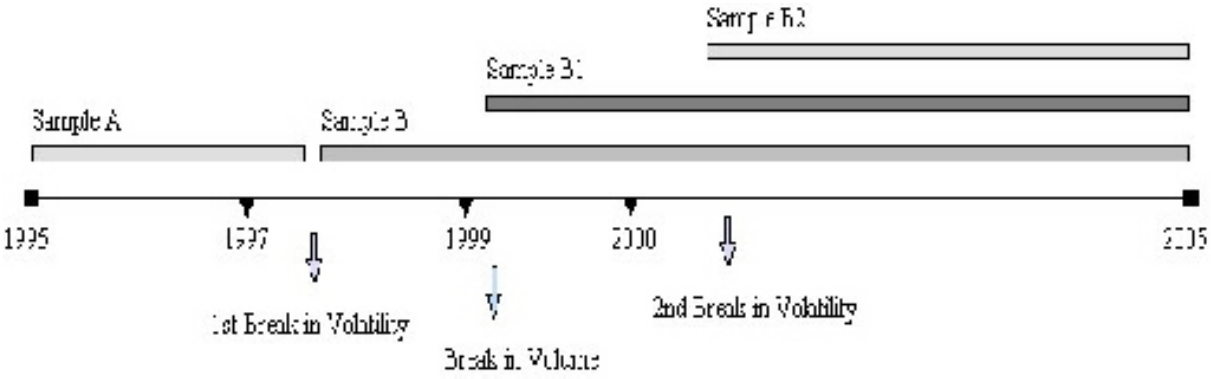

Figure 3. Pre- and Post-Crisis Periods

4 GARCH Model

We will estimate an autoregressive(AR) GARCH model: AR-GARCH.

The model is givne by

$$y_t = \phi_0 + \phi_1 y_{t-1} + \cdots + \phi_p y_{t-p} + x_t + \lambda_1 x_{t-1} + \lambda x_{t-2} + \lambda_3 x_{t-3} + \varepsilon_t,$$

where the conditional variance of the error term denoted by ($h_t = V_{t-1}(\varepsilon_t)$) is given by

$$h_t = \omega + \beta h_{t-1} + \alpha \varepsilon_{t-1}^2,$$

where $\omega > 0$, $\alpha > 0$ and $\beta \geq 0$. We also need $\alpha + \beta < 1$.