Topic: A Study of Financial Risk Management in the South Korean Financial Market using VaR Methodology

Chapter One: Introduction

This work will focus on the use of some Value at Risk (VaR) techniques in studying financial risk management with main emphasis on the South Korean financial market. In particular, financial market data relating to the South Korean capital market will be utilized in the study. The result will be compared with those obtained from established cases drawn from other developed economies including the UK. Financial risk management is a practice that involves the process of using financial instruments in managing firms' exposure to risks (including market risk, credit risk, and volatility risk, to mention a few), thereby creating economic value for the firms (Charles, 2004). Therefore, as obtained in the general overview of risk management practice, there is the need to identify the sources of financial risks, measure the level of risks involved, and finding efficient ways to management the risks (Crockford, 1986; and Charles, 2004). Consequently, financial risk management is both quantitative and qualitative. In general, various approaches and policies are adopted in the management of financial risks. The pivotal guide, however, is to know when and how to manage costly exposure to risks. In current banking practices, financial risks management is facilitated by the adoption of the Basel II Accord supervisory framework and standards. Globally, many active banks have fully adopted the Basel II Accord standards for the purpose of keeping a track of operational, credit and market risks as well as giving appropriate reports on the risks facets. The Basel II

Accord stipulates the capital reserve requirements that should be maintained by the active banks in order to hedge against possible market and/or credit risks (Kaplanski and Levy, 2007). Basel II Accord makes it mandatory for banks to use VaR as a basis for determining the amount of capital adequately needed to cover market and/or credit risk. In its recommendations, the standard stipulates that the minimum capital requirement should be the constant multiple of previous day's VaR (Allen, et al, 2004).

Since the current collapse of the global financial market, a lot of discussions concerning the roles of financial risk management before and after the crisis have emerged. Although, over the years, different theories have been offered by many economists on how financial crises develop and ways of preventing them (Allen, et al, 2004; and Kaplanski and Levy, 2007), there is still no consensus reached yet. Moreover, financial crises still occurs regularly the world over. A lot of people have attributed the cause(s) of the current financial crisis to a number of factors, which include market instability owing to the dramatic change in the ability to create new credit lines that culminated to drying up of the flow of money and slowing down new economic growth as well as hijacking commercial activities; this also resulted to the decline of the housing market. The question then is: has the market been stable throughout the period of boom before the eventual collapse of the market? If no, how then did it get so bad? The bottom line is that the players in the market were overwhelmed by greed. Furthermore, in a recent report, the US Financial Crisis Inquiry Commission (FCIC) responsible for the establishment of the causes of the 2008 financial crisis has revealed that the crisis was avoidable (FCIC, 2011). The report pointed at excessive risk-taking by banks and neglect by financial regulators

as the major causes of the crisis, and citing ethical breaches as the main component of the causes. In particular, a number of factors were cited, namely:

- Failures in financial regulation, including the Federal Reserve's failure "to stem the tide of toxic mortgages"
- A breakdown in corporate governance that led to "reckless" actions and excessive risk taking by financial institutions
- Households taking on too much debt
- A lack of understanding of the financial system on the part of policymakers
- Fundamental breaches in accountability and ethics "at all levels".

In the US FCIC's report, it was also added that "the collapsing mortgage-lending standards and the packaging-up of mortgage-related debt into investment vehicles lit and spread the flame of contagion". Drawing from the US FCIC's claim, it is crystal clear that undermining the importance of financial risk management led to the precipitation of the current financial crisis. However, after the crisis the issue of financial risk management have maintained a lead in banking operations as well as the entire financial market activities. The financial crisis consequences are far-reaching and the lessons learned from its occurrence are now being embedded in (financial) risk management practices (Actuary, 2009). In addition, various regulatory measures are now been taken up.

Globally, most banking firms have now started to infuse various degrees of financial risk management in their operational activities (Kaplanski and Levy, 2007) whilst government regulators of these banks in the developed economies, including the US, UK, Germany, and France, have continued in their effort to resuscitate their

financial sectors by supporting the sector with various bail-out schemes and the introduction of tighter regulatory policies and measures. The same steps have also been taken up by big economies in the Asian market that were affected by the crisis including South Korea.

The South Korean banking sector adopted the Basel II capital standards in 2008 in order to strengthen its regulatory and supervisory framework; in June 2008, the capital adequacy ratio stood at 11.16. Furthermore, as part of the countries' banking sector regulatory efforts, a number of savings banks known to offer loans at higher interest rates to individuals that cannot get loans from the big commercial banks have been closed down after determining that the banks lacked sufficient liquidity needed to match recent spike in withdrawals – this number currently stands at seven (7) as at September, 2011 (Paper, 2011). On the other hand, the US banks have too much money in their control and are not willing to give loans due to low interest rates, even though it is costly to hold money. Financial risk management in banking firms in South Korea is being operated poorly and a lot less seriously than what is obtained in developed economies like the UK and the US, and regulatory activities within the sector are relatively low compared to what is obtained in the UK and other major developed economies. This is due, to a large extent, to the fact that the Korean economy heavily relies on its manufacturing industry so that its banking industry plays comparatively less prominent role in the economy (Pascha, 2010). Therefore, one would like to ask the following questions:

1. What are some of the reasons that made the South Korean banking firms maintain the status quo?
2. Should financial risk management be taken more seriously as much as developed countries or not?

3. If so, how?

The remaining part of the work is structured as follows: Chapter two will review some Background framework on financial risk management in relation to the South Korean financial market. An attempt will be made to compare the South Korean banking sector with that of other developed countries with regards to the sizes, credit ratings, and the implementation of the Basel II Accord standards as well as the effects of loss on their operating activities. In Chapter three, the value at risk (VaR) methodology will be discussed. In practice, different techniques are used to obtain VaR estimate. Two of these (including the parametric analysis technique and Monte Carlo simulation technique) will be covered – these techniques will be implemented subsequently. In Chapter four, the financial situations in South Korea in terms of market risk before and after the recent financial crisis using KOSPI index will be analyzed. Using the techniques described in Chapter three, two separate estimates will be obtained for the VaR - this will also involve running VaR computations/simulations using the index data and interpreting the result of the computations/simulations. These estimates will be compared using back testing technique via Binomial test statistics on some proportions of exceptions. The work will be summarized and concluded in Chapter five.

Chapter Two: Literature Review

1. Introduction

This chapter covers background information on South Korean banking system. An attempt will be made to establish key facts regarding banking operations in South Korea in relation to what is obtained in other developed economies including the UK, the US, France, Germany, and Japan. Of particular interest in this chapter is to identify the primary reasons why South Korean banking firms care less about financial risk management as well as identifying their attitude towards banking regulations following the implementation of the Basel II Accord with regards to its implementation in other developed economies around the world.

2. Overview of the South Korean Banking Environment

The South Korean financial sector comprises of three groups, namely: (1) a central bank (BOK); (2) deposit money banks – commercial and specialized banks, which could be nation-wide banks, regional banks or foreign bank branches; and (3) non-bank financial institutions (NBFIs) – include savings, investment, development financial, and insurance institutions, and other institutions (Pascha, 2010). The savings institutions provide small loans to individuals and raise funds from monies received from time deposits; these include mutual savings and finance companies, trust accounts banks, community credit cooperatives, and postal savings. Investment institutions include the Korea Security Finance Corporation, merchant banking

corporations, and securities investment trust companies, and acts as financial intermediaries between the money market and the countries capital market.

The development financial institutions include the Korea Development bank and Export-Import bank (both banks engage in similar activities). They rely on the use of government funds, foreign capital, and/or funds generated from the issue of special debentures and provide medium-term to long-term loans and credit facilities to major economic sectors including the export, parts and components industries as well as high-tech businesses and research and development sectors. Furthermore, the insurance institutions consists of local/domestic life insurance companies, postal life insurance companies, joint ventures with foreign-based insurance companies, and foreign life insurance companies with branches and subsidiaries in South Korea. Other institutions acts as supplementary financial institutions but do not function as financial intermediaries; these include leasing companies, securities companies, and instalment credit companies (KPMG, 2009; and Pascha, 2010).

The Korean banking industry has experienced rapid growth in the past five decades preceding the era of global financial melt-down of the Asian market in the 1998, and contributed significantly to the country's economic growth indices through the mobilization of financial resources for the business sectors particularly in the 1960s and in the 1970s when it dominated the financial market before the establishment of NBFIs (which grew rapidly due to their high interest rates and greater dependence on the level of managerial autonomy they enjoy) by its government in the early 1970s and the development of the securities market with the bid to diversify investment funds sources and to persuade the 'unorganized curb market' to take full participation in the organized financial market (Wang, 2006; and Yao, 2009).

Despite the Korean banking sector's sustained growth in the past, it has suffered major setback mainly due to the sector's internal management inefficiency and exposure to moral hazard orchestrated by political manoeuvres (Pascha, 2010). Government incessant intervention in the country's financial sector has prevented the drive for market discipline. With the country's government primary economic development tools of selective credit allocation and prolonged interest control, there has been continual interference in the financial sector resulting to an inefficient and distorted financial system (Wang, 2006). Moreover, financial institutions' initiative and drive for innovation have been limited through the financial industry undue segmentation as well as high entry barriers.

Also, extensive government participation and interference in the internal management operations of financial institutions has undermined their autonomy and hampered accountability, thereby making the system's supervisory effort ineffective and allowing excessive risk taking by the financial institutions. Meanwhile, subsequent drive by the government to overhaul the financial sector to be market-oriented has dashed the rock due to political barriers and limited scope in eradicating the inimical distortions deeply rooted in the financial sector (Pascha, 2010). This has obviously left the banking sector to the brick of repeated unguided financial crisis periods. Moreover, the absence of proper prudential supervision has guaranteed moral hazard in the financial sector and ensured continuous hindrance in the pursuit for potential project for financial risk management.

3. Banking Regulations – Basel Capital II Accord Implementation in South Korea

In 1988, the Basel Accord committee on capital adequacy launched a framework for capital regulation of internationally active banks (KPMG, 2009). The committee considered existing accounting principles and practices in a group of ten countries, which goes by the name: “G-10”, while formulating the regulations that formed the accord with the main focus on (KPMG, 2009; and Microsoft, 2009): (1) defining regulatory capital requirement; (2) fixing minimum acceptable ratios for regulatory capital to risk-weighted assets; and (3) measuring risk-weighted assets including off-balance sheet exposures. In the committee meeting, minimum capital adequacy standards was defined based on the ratio of regulatory capital to risk-weighted assets. As part of the aim of the regulation, the internationally-active banking institutions were expected to adhere to two ratios, namely: (1) the ratio of Tier 1 capital to risk-adjusted assets, which should be at least 4 percent; and (2) the ratio of Tier 1 plus Tier 2 capital to risk-adjusted assets, which should be at least 8 percent (KPMG, 2009).

Not long after, due to concern of regulatory capital arbitrage, many regulators started to express increasing dissatisfaction with the effectiveness of the original Accord despite much efforts put in by the committee in formulating the Accord. Particular concern in the Basel I Accord was the divergence between the Basel I risk weights and the actual economic risks associated with some exposures (Microsoft, 2009). This was found to have provided opportunities for banks to repackage risks such that the ratio of regulatory capital to risk-weighted assets is increased. Many researchers and observers believed that with new financial innovations in form of credit derivatives and securitization techniques, it was very easy for banks to maintain certain level of risk exposures or even increase risk exposures with relative ease. This often amounts to lower level of regulatory measures for risk-adjusted assets.

In June 2004, the Basel II Capital Accord was finalized by the Bank for International Settlements (BIS) after over five years of industry and regulatory consultation, with the primary objective of providing better alignment of regulatory capital measures within the financial system with regards to addressing the inherent risk profile associated with credit, market, operational and other risks within the banking sector and resolving the lapses experienced in the Basel I Capital Accord (KPMG, 2009). This framework replaces the former 1988 Capital Accord. The Basel II framework is built on three pillars –

- **Pillar I:** Minimum Capital Requirements – internal models are used to measure market, credit, and operational risks, and also calculate the minimum required capital
- **Pillar II:** Supervisory Review – it engenders regulatory oversight in order to ensure that models used are valid through increased on-site inspections, and the establishment of standards for minimum required capital based on the quality of risks assessment conducted
- **Pillar III:** Market Discipline – it ensures that additional pieces of information regarding bank's risk profile are published transparently in the annual financial statements of the bank.

Table 1 summarizes the key differences between the two versions of the Capital Accord.

Table 1: The 1988 Capital Accord and the Basel II Capital Accord

The 1988 Capital Accord	The Basel II Capital Accord
• Focus on a single risk measure to	• Provides a more comprehensive

measure credit and market risk capital adequacy ratio • A 'one size fits all' approach with no material gradation of risk • A less detailed and definitive structure	and flexible approach to measuring and managing risk, in the process increasing risk sensitivity • Adds operational risk as a new charge • Promotes banks' internal risk management methodologies • Incorporates supervisory review and market discipline as part of risk assessment

Source: Bank for International Settlements (BIS)

With the objectives of: (1) eliminating incentives that encourage regulatory capital arbitrage; (2) aligning the regulation in order to engender best practices in credit risk management; and (3) the provision of incentives to banks that enhance the ease and capability of measuring and managing financial risks, the Basel II Capital Accord aims at eliminating regulatory capital arbitrage incentives by adjusting regulatory risk weights (Microsoft, 2009; and KPMG, 2009). This will enable accurate reflection of actual economic risks. Furthermore, the Basel II makes the effort of aligning banking regulations with best practices particularly in the area of credit risk management. Moreover, by aligning banking regulations with best practices in credit risk management, banks are provided with an incentive to invest in more refined capabilities of measuring and managing risks (Yao, 2009). In addition, the Basel committee has also imposed a new operational risk capital charge, which is

calibrated in a way that offsets the reduction in the capital charge for credit risk. This is also aimed at avoiding a reduction in the overall level of regulatory capital required. Notwithstanding, this approach of maintaining the average level of regulatory capital within the banking system comes with great deal of commitment to greater precision in the risk weights specification.

The South Korean banking industry adopted the Basel II Accord in 2008 with full implementation in June of that year (Yao, 2009; and Pascha, 2010). Like other member of the Asia Pacific countries and unlike the US and European countries, the Korean financial market faces unique challenges on how the Basel II Capital Accord is implemented. Firstly, the Basel II implementation across the Asia Pacific region is occurring at such a time when risks are heightened, and the region's economy and financial systems are confronted with increased level of uncertainties. These challenges also come as: impediment in enhancing internal management systems; changing credit culture and governance; constraint with data collection, integrity and accuracy issues; and building of strong and reliable enterprises – both internally and externally (Aziz, 2008). On the regulatory flank, regulators are saddled with the challenges associated with the stringent qualifying requirements associated with the Basel II advanced approaches – they need to address issues of resources and technical expertise implications also arises.

Finally, with the crave for more vigilant oversight responsibility over the liquidity and capital positions of banks by financial leaders and market players, it is more likely that the Basel II Capital Accord standards will continue to evolve; this is likely to bring in more changes to ensure effective and efficient financial risk management paradigm – it is no more news that the Basel III Capital Accord is underway.

Notwithstanding its shortcomings, the Basel II capital framework plays critical role and serves as a key mechanism in the advancement of the financial sector reforms, which promises the fortification of the overall corporate governance of the industry. In particular, its implementation envisages constant support for the continuous enhancement of the South Korean financial risk management efforts, which are very important in the provision of comprehensive management of the increasingly complex financial institutions within the country.

Chapter Three: Methodology

1. Introduction

In this chapter, the techniques used in estimating the Value at Risk (VaR) in the course of this study are explained. In particular, parametric analysis using variance/covariance matrix and the Monte Carlo simulation techniques are considered. Using back testing, the two techniques can be compared with regards to their effectiveness subject to the quality of data considered.

2. VaR Estimation Techniques

According to Lambadiaris, et al. (2003), VaR is the standard approach to measure the market risk of financial assets portfolio. This approach was also recommended by the Basel Committee on standard for Banking Supervision. However, the VaR also has a number of limitations, which has led some researchers to consider a few modifications of the VaR methodlogy (Kaplanski and Levy, 2003; and 2004). In Kaplanski and Levy (2003; and 2004), comparisons of the optimal portfolio policies of maximizing agents expected utility levels considered under VaR capital requirement regulation with the optimal policy considered under an exogenously-imposed VaR Limit and a limited-expected-loss VaR regulations, respectively, were made. From their findings, it is clear that the incentive for an agent to reduce the portfolio VAR at the expense of the worst insurance states has a direct correlation with the required level of eligible capital. This also corresponds to a requirement of the Basel II Capital Accord on Banking Supervision.

In general, three major techniques of computing VaR are recognized; these include: parametric technique, Monte Carlo simulation technique, and the historical simulation technique (RiskMetrics Group, 1999; and Morgan & Reuters, 1996). In Jorion (2001), a different classification has also been identified as the local-valuation and full-valuation techniques. The formal include all the various techniques identified with the parametric analysis, which value portfolio once and uses local derivatives for the modelling of possible movements in stocks, while the latter includes the historical and Monte Carlo simulations techniques, which imply that the portfolio is fully revalued over a range of market scenarios. Here, only parametric technique and Monte Carlo simulation technique will be considered.

In Duffie and Pan (1997), estimates of the risk of changes in the spreads of publicly traded corporate and sovereign bonds were obtained using the three techniques identified above and found that Monte Carlo simulation and variance-covariance techniques are the best techniques for approximating short and long versions of the reference option portfolio – in particular, the Monte Carlo simulation and delta-approximation were found to be the best approximations for 1-day and 2-week horizons, and the Monte Carlo simulation and delta-gamma approximations are found to be the best for the range of confidence intervals approximation.

2.1 VaR Construction

From Jorion (2001), the following more general steps can be used to construct the VaR:

1. Formulate the current portfolio (i.e., comprising of foreign currencies and stocks) level;
2. Obtain a measurement of the risk factors variability;
3. Set the time horizon (in days, weeks, or months);
4. Set the confidence level; and
5. Report the worst loss by processing all the preceding information.

Following Kravets (2007) the following steps will be adopted in this study:

1. Model stock prices and exchange rates volatilities and covariances using GARCH;
2. Set the time horizon and the confidence level;
3. Use the variance-covariance/Monte Carlo simulation technique to compute the market VaR;
4. Choose the most adequate VaR from two techniques computed in step 3 using the Binomial test;
5. Define market risk as the most adequate VaR from step 4; and
6. Set capital reserve requirement regulation using the relation:

?7= ?7?7?7á, ?7?7?3 =7?7=74 (3.1)

According to the Basel II Capital Accord recommendation, the amount of money to be reserved in the bank for a specific period of time must be the value of money three or four times more than the obtained VaR. Since the time series of security prices are usually non-stationary such that their volatilities change in time, then the

GARCH model is used for the heteroscedastic series volatilities and covariances estimations. In order to avoid the challenge of non-stationarity, the log-form of the first differences of all the time series are considered. In the model considered in this work, stock prices are taken as risk factors for which their volatilities and variances can easily be computed. Given that the time series of the returns computed from the stock prices are described by the GARCH (1, 1) process, the variance of returns is given by:

$$h_t = \alpha + \beta h_{t-1} + \gamma \varepsilon_{t-1} \quad (3.2)$$

Where: h_t is the conditional variance of the risk factor at time t;

ε_{t-1} is the unexpected returns (residuals).

To ensure that the conditional variance estimates remain nonnegative, nonnegativity constraints need to be imposed on the variance parameters; moreover, and for stationarity, it is required that have $\alpha + \beta < 1$.

2.2 Parametric Analysis

This includes variance-covariance matrix, delta, delta-normal, delta-plus, and delta-gamma analysis. The parametric technique uses specific parameters such as volatility (and mean drift), delta, gamma, and correlation in estimating the VaR equation's parameter. Although the technique is fast and simple in implementation and does not require extensive collection of historical data, however, it needs the assumption of Normal distribution of returns of any financial market instruments considered. Here, the variance-covariance matrix analysis will be used. The

variance-covariance method of estimating VaR can be adapted to a number of regression models in estimating variances and covariances, which are required to estimate the volatility and the VaR subsequently. The most popular of them is the GARCH model. Engel and Gizycki (1999) posited that GARCH models are very good in estimating variances and covariances of exchange rates and gave two approaches of incorporating GARCH to VaR methodology. Confidence level for parametric analysis is usually 95%.

Using the variance-covariance parametric approach, then for each risk factor, the VaR is computed using the following formula:

$$VaR_i = \alpha_c \times \sigma_i \times \sqrt{t} \times MV_i \quad (3.3)$$

Where: MV_i is the currency/stock position;

α_c is the critical level of the Normal distribution corresponding to c confidence level;

σ_i is the risk factor unconditional standard deviation;

μ_i is the risk factor mean; and

t is the time horizon (number of days).

Therefore, the bank's total VaR is computed using the following formula:

$$VaR_{portfolio} = \sqrt{\sum_i \sum_j VaR_i \rho_{ij} VaR_j} \quad (3.4)$$

Where: ρ_{ij} - the Variance-Covariance matrix risk factors;

VaR implies the vector of VaR for all risk factors.

2.3 Monte Carlo Simulation Techniques

Using the Monte Carlo simulation technique (unlike the historical simulation technique that uses actual historical rates), random scenarios are generated and used in revaluing portfolio positions for VaR estimation. Moreover, the technique can be adopted for all forms of financial instrument; it gives a full distribution of portfolio values and works with any distribution. Furthermore, the technique does not require extensive collection of historical data but requires a large amount of computations, which makes it more time-consuming; the result of Monte Carlo technique cannot be reproduced.

3. Back Testing Technique

The Binomial test statistic is needed to verify the adequacy of the VaRs obtained using the variance-covariance and Monte Carlo simulation techniques. The Binomial test statistic is computed using the formula:

$$Z = \frac{P - P_0}{\sqrt{\frac{P_0(1-P_0)}{N}}} \sim N(0,1) \qquad (3.5)$$

Where: P – actual observed proportion of exceptions above VaR given by X/N (X – number

of exceptions, N – the number of observations);

P_0 – expected proportion of exceptions (for confidence level 95%, P_0=5%).

Subsequently, a test is conducted on the following hypothesis:

H_0: $P_0 = P$

Versus

H_1: P_0 ?á P

Decision: if the absolute value of the statistic, B, is less than the corresponding critical value of the Normal distribution, then H_0 is not rejected for which it will be concluded that the VaR is adequate. Otherwise, the model would require a reconstruction; consequently, the volatilities of financial elements would be recomputed using the variance-covariance technique or the distribution of financial elements would be reconstructed using the Monte Carlo simulation technique.

Chapter Four: Result and Analysis

1. Introduction

Using the methods described in Chapter three, results on the VaR of the KOSPI financial market data is obtained and analyzed.

2. Data Description

Time series of the daily market stock prices have been considered. This is sourced from the Yahoo! finance wed page for the period covering January 2008 – December 2009. Since the focus is on the market risk of the South Korean financial sector, then the open positions of the daily market index is extracted. Table 1 below collects some descriptive measures of the initial data (market price of stock) and the corresponding descriptive measures of the returns on the market stock.

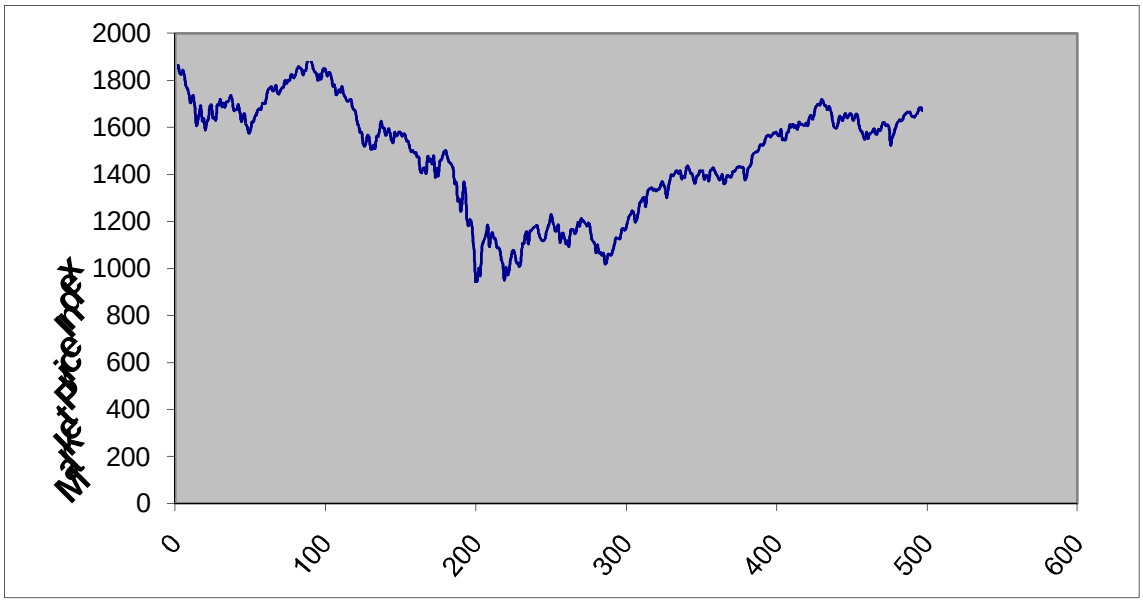

Figure 1: Dynamics of Daily Market Index for KOSPI

Table 1: Descriptive Statistics for the KOPSI Market data

	Mean	Standard deviation	Min	Max	No of Obs.
Market Index	1478.045	237.2932	938.75	1888.88	499
Log Returns	-0.00019	0.02063	-0.11172	0.11284	499

In Figure 1 above, the dynamics of the daily market price index is captured. A cursory look reveals that the times series of the daily market price index have trends, hence, might be non-stationary. Further test to reveal this “stationarity” property will be cited in a later part of the work. Figure 2 below shows the movement of the daily market volatility for the KOSPI market price index. A maximum volatility level of 0.062 is observed around day 200 with lowest value of 0.005.

Figure 2 – Next Page

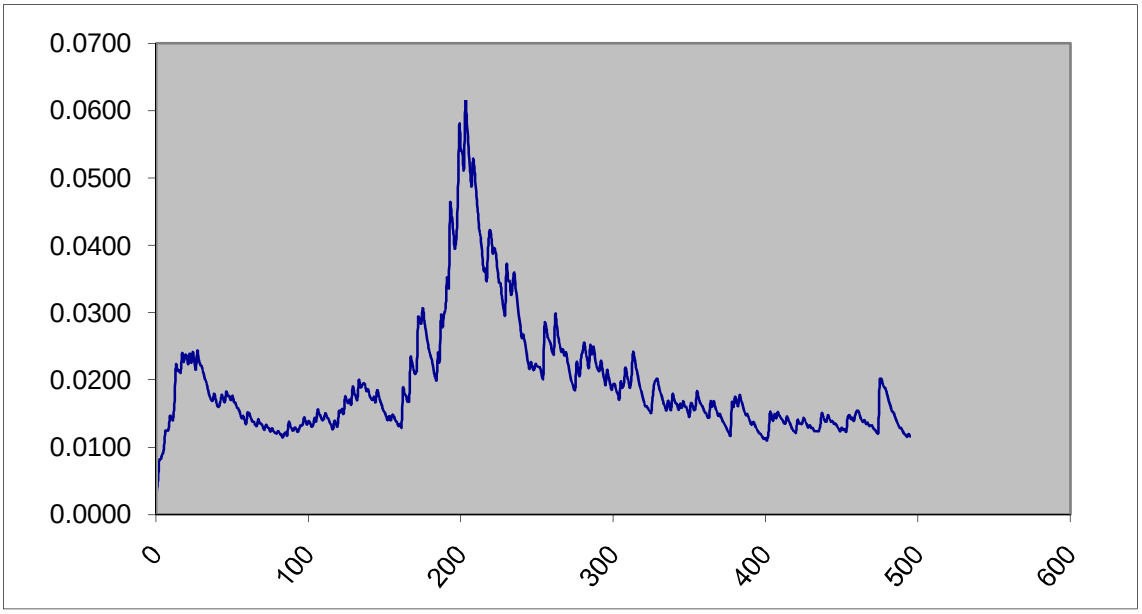

Figure 2: Dynamics of Daily Market Volatility for KOPSI

3. Empirical Results

In this study, the time series of the market price index for the KOPSI market is considered as a risk factor in an autoregressive model. It is required that the series be stationary (i.e., it should have a random term with constant mean and variances), which can be established using the Dickey-Fuller test for unit root (Dickey & Fuller, 1979). However, this is not true. Therefore, a new series of return expressed as relative changes of the market price index is obtained. This is given by the natural log of the ratio of the current market price to the market price of the previous day (otherwise known as log returns). The log return series is consistent with time. According to the Dickey fuller tests for stationarity, the log return time series have the stationarity property. This is revealed in Figure 3; clearly, the time series data are

distributed around the origin and have variance in time. This implies that the GARCH model can be fully adopted in fostering a good description of the process obtained from the time series data.

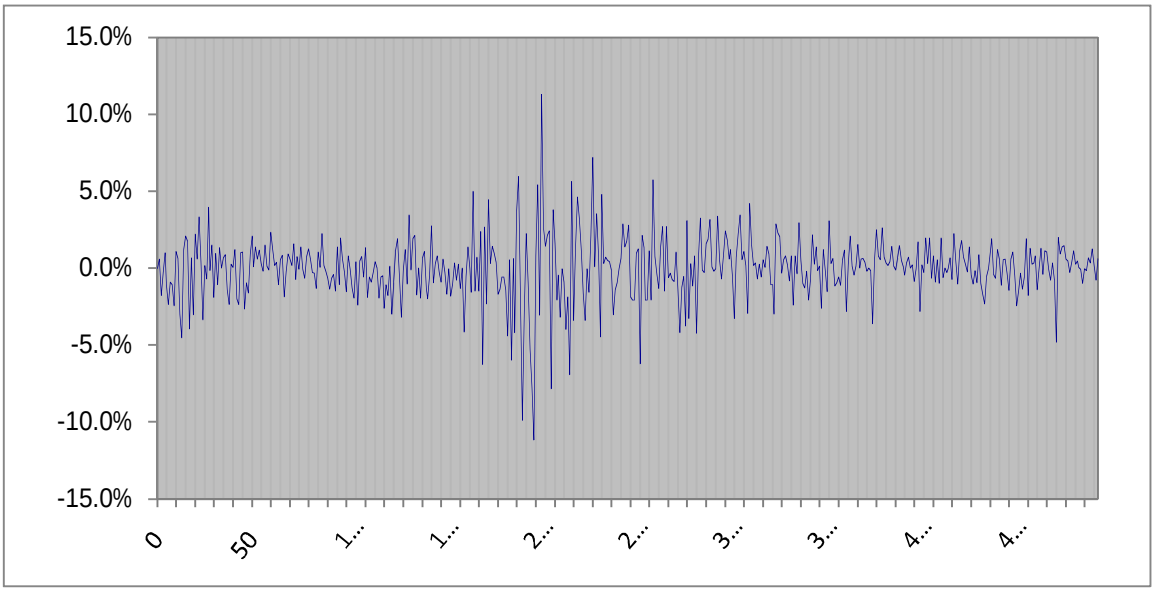

Figure 3: Dynamics of Daily Market Returns for KOPSI

3.1 Variance Estimation using GARCH

The GARCH (1, 1) model is used to obtain an estimation for the variance (and hence, the volatility) of the time series data for the KOSPI daily market return. This is obtained using the formula:

$$\sigma_{t+1}^2 = \omega + \alpha \varepsilon_t^2 + \beta \sigma_t^2 \qquad (4.1)$$

The result obtained for the variance estimation using the GARCH (1, 1) model is shown in Table 2 below.

Table 2: Variance Equation Parameters Estimation using GARCH (1, 1)

Parameters	Estimates
?á	9.74E-06
?¸	0.116
?Ø	0.869

Log-likelihood: 3525.2661

The coefficients of variance equation (i.e., ?Æ?Æand ?Æare all nonnegative; the sum of açand ßçare less than one – this is necessary in order to ensure that the conditional variances are positive and stationary. Moreover, it can be deduced that the coefficients are equally statistically significant. The conditional variance forecast is made for the market return after conducting the GARCH (1, 1) model parameter estimation, and unconditional variance is found as the mean of the conditional variance; this is obtained as: ?. = 2.59%.

4. Market Risk Estimation and Capital Reserve Requirement

Here, the estimate for the VaR parameter is obtained. To compute an estimate for the VaR, the confidence level as well as the time horizon needs to be stated a priori. Following the Basel II Capital Accord requirements, a confidence level of 95% is recommended when using either of parametric analysis or Monte Carlo simulation to estimate the VaR. Furthermore, although the Korean stock market is not so liquid in Ukraine, however, the time horizon is set at 1 day. Therefore, using equation (3.3) in Chapter three, the value at risk for the KOSPI market index is given by ???$_{?\text{ð}xxxx}$= 86.8922.

Using the Monte Carlo simulation technique, a set of 1000 random data were simulated, from which anticipated market price index levels were computed. Figures 4 and 5 below show the market dynamics of daily market index price and corresponding returns for KOSPI using the Monte Carlo Simulation technique. Consequently, a VaR estimate of 1.9279 is computed.

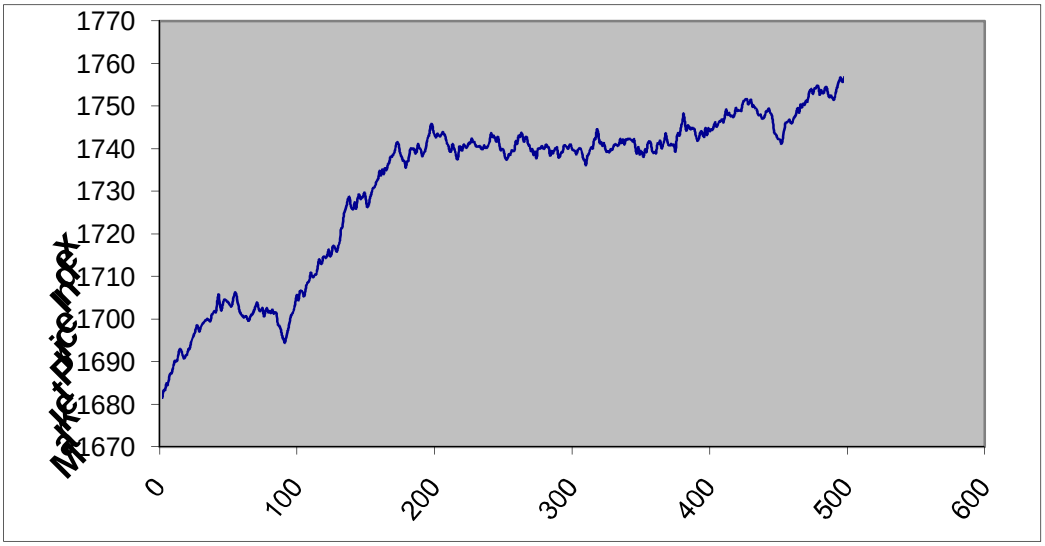

Figure 4: Dynamics of Daily Market Index for KOSPI using Monte Carlo Simulation

Figure 5 – Next Page

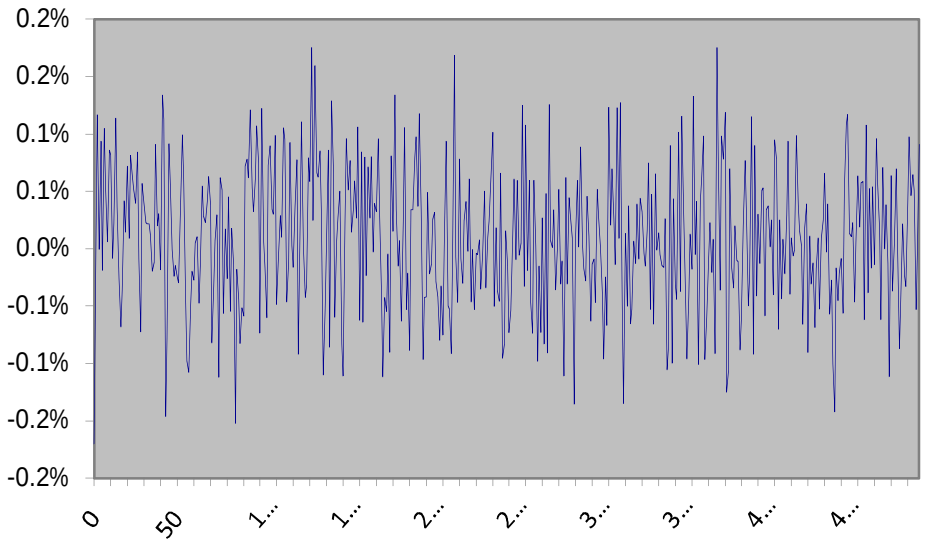

Figure 5: Dynamics of Daily Market Returns for KOSPI using Monte Carlo Simulation

From the results on the VaR estimate using both the parametric analysis and Monte Carlo simulation technique, it can be seen that the Monte Carlo simulation technique gives a smaller VaR estimate than that obtained using the parametric analysis technique but the better estimate is decided by the Binomial test. This can be obtained by using formula (3.5) in Chapter three. Hence, using a small selection of real observations from the South Korean market index, real proportions of exceptions are found not to differ significantly from the expected proportions of exceptions (5% is typically considered) using both methods. This implies that both techniques give adequate estimate of the KOSPI VaR. However, the Binomial test reveals that for any selection of the observations, the parametric analysis technique gives a better result; a particular selection of a 30-day market observation gave a Binomial test statistic of 0.75 “the best case occurs whenever the real proportion of exceptions is exactly the expected proportion of exceptions, and the Binomial test

statistic is equal to 0, and the worst case occurs whenever the absolute value of Binomial test statistic is equal to the critical value (i.e., 1.96 for 5% level of significance)".

According to the Basel II Accord recommendation, it is mandatory for banks to utilize VaR as a basis in ascertaining the amount of capital adequate enough to cover potential market risk. Following the recommendations of Bank for International Settlement (BIS), the minimum capital requirement should be the "constant factor between 3 and 4 multiplying the previous day's VaR" (Kraverts, 2007). The value of the constant depends on the result of the back testing conducted on the model. Since the parametric analysis technique is selected over the Monte Carlo technique in this study such that the Binomial test statistic of this technique gives a smaller absolute value, therefore, VaR is equal to KRW 86.8922. Given that the Binomial test statistic for the parametric analysis technique is equal to 0.75, which is 38% of critical value 1.96, then the constant of capital reserve requirement should be corrected by this addition (i.e., 38% of the back testing). The constant is calculated by using the formula:

p = lowest capital reserve factor + Binomial test statistic/critical value = 3.38.

Therefore, the capital reserve for the next day (i.e., 28-09-2011) is given as

*R = p*VaR = 3.38*86.8922 = 293.70.*

That is, banks must have capital reserve of KRW 293.70 million the next day to cover risk.

Lastly, it is remarked that the smallest possible value of capital reserve should be defined if the best case of Binomial testing occurs - this is equal to the 3 multiplying the VaR. Also, on the other hand, if the worst case occurs, the largest possible value of capital reserve should be defined as equal to 4 multiplying the VaR

Chapter Five: Conclusion

In this study, the issue of financial risk management has been evaluated with particular emphasis on the South Korean market. The country's financial market has been criticized for not attending to the true ethics of managing financial risks. For instance, although the country's banking sector had sustained growth in the past, it has also been revealed that the sector has suffered major setback. Major reason resulting to the scenario is opined on the fact that the sector's internal management suffers severe level of inefficiency and exposure to moral hazard orchestrated by political manoeuvres as posited by Pascha (2010). Moreover, government incessant intervention in the country's financial sector has prevented the drive for market discipline - there has been continual interference in the financial sector resulting to an inefficient and distorted financial system (Wang, 2006). Furthermore, financial institutions' initiative and drive for innovation have been limited through the financial industry undue segmentation as well as high entry barriers.

Also, extensive government participation and interference in the internal management operations of financial institutions has undermined their autonomy and hampered accountability, thereby making the system's supervisory effort ineffective and allowing excessive risk taking by the financial institutions. Meanwhile, subsequent drive by the government to overhaul the financial sector to be market-oriented has dashed the rock due to political barriers and limited scope in eradicating the inimical distortions deeply rooted in the financial sector (Pascha, 2010). Moreover, the absence of proper prudential supervision has guaranteed moral hazard in the financial sector and ensured continuous hindrance in the pursuit for

potential project for financial risk management. Therefore, in response to the question raised earlier, one cannot but agree with the fact that financial risk management should be taken with all seriousness owing to its awful consequences.

In the course of this study, financial market data were gathered and analyzed in line with the Basel II Capital Accord recommendations. In particular, market risk of the country's banking sector was investigated (other risks identified by the Accord include credit and operational risks). As recommended by the Basel II Accord, Value at Risk (VaR) methodology is used to conduct the investigation. In particular, two very competing techniques (parametric analysis and Monte Carlo simulation techniques) were used to estimate the VaR parameter, and a choice was made between the two techniques using some back testing technique via Binomial test statistic. It was found that given the nature of data used in this study, the parametric analysis technique is preferred over the Monte Carlo simulation technique. From the VaR estimate obtained using the parametric technique, hypothetical capital reserve requirement for the South Korean banks was obtained.

References

Allen, L., Boudoukh, J., and Saunders, A. (2004): "Understanding Market, Credit and Operational Risk - the Value at Risk Approach". Blackwell Publishing Ltd

Aziz, Z. A. (2008): "Basel II Implementation and the development of Asia's Financial System – Experiences, Challenges and Regional Coorperation". A Keynote Address at the 4th SEACEN/ABAC/ABA/PECC Public-Private Dialogue for the Asia Pacific Region, Kuala Lumpur, 18 August 2008; available online at: http://www.bis.org/review/r080819a.pdf?frames=0

Charles, T. (2004): "Risk and Financial Management: Mathematical and Computational Methods". *John Wiley & Son*

Crockford, N. (1986): "An Introduction to Risk Management (2nd Ed.)". *Woodhead-Faulkner*

Dickey, D.A. and Fuller, W. A. (1979): "Distribution of the Estimators for Autoregressive Time Series with a Unit Root". *Journal of the American Statistical Association*, 74: 427–431

Duffie, D. and Pan, J. (1997): "An overview of value at risk". *Journal of Derivatives*, 4, 7-49

Enders, W. (2004): *Applied Econometric Time Series*, Second Edition. John Wiley & Sons: United States

Engel, J. and Gizycki, M. (1999): Conservatism, Accuracy and Efficiency: Comparing Value-at-Risk Models, *Working Paper 2*, Australian Prudential Regulation Authority

Fama, E. F. (1965): "The Behavior of Stock Market Prices". *Journal of Business*, 38, 34-105

FCIC (2011): "The Financial Crisis Inquiry Report Authorized Edition: Final Report of the National Commission on the Causes of the Financial and Economic Crisis in the United States". *US Public Affairs*

Glasserman, P., Heidelberger, P. and Shahabuddin, P. (2002): "Portfolio Value-At-Risk with Heavy-Tailed Risk Factors". *Mathematical Finance*, 12(3), 239-269

Jorion, P. (2001): "Value at Risk: the new benchmark for managing financial risk", 2nd edition, McGraw-Hill

J. P. Morgan/Reuters (1996): *"*RiskMetrics – Technical Document*",* 4th edition, New York

Kraverts, I. (2007): "Value at Risk for Capital Reserve Requirement Regulation in Ukranian Banks". MSc thesis submitted to National University "Kyiv-Mohyla Academy", Ukraine

Kaplanski, G. and Levy, H. (2007):"Basel's Value-at-Risk Capital Requirements Regulation: an Efficient Analysis". *Journal of Banking & Finance*, 31 (6): 1887-1906

KPMG (2009): "Basel II in the Asia Pacific Banking Sector Survey 2008 – Implementing Operational Risk Management". *KPMG International Advisory Paper;* available online at: http://www.kpmg.com/CN/en/IssuesAndInsights/ArticlesPublications/Documents/aspac_banking_survey_2008_O_0805.pdf

Lambadiaris, G., Papadopoulou, L., Skiadopolous, G. and Zoulis, Y. (2003): *"*VAR: history or simulation?" Available online at: www.risk.net

Microsoft (2009): "Basel II Implementations: Convergence with Customer Insights and Risk-Based Financial Management". *Microsoft White Paper;* available online at: http://www.satmbaf.com/uploads/docs/BaselIIFinaninsMSDCRM.PDF

Pascha,W. (2010): “South Korea Country Report”. In: Bertelsmann Stiftung (Ed.), *Managing the Crisis*. *A Comparative Assessment of Economic Governance in 14 Economies;* Gütersloh: Bertelsmann Stiftung

Wang, H. (2006): “Basel II Challenges and Implications for Asia”. *The Asian Development Bank Annual Meeting*; available online at: http://www.adb.org/annualmeeting/2006/seminars/presentations/huaqing-wang-baselii.pdf

Yao, W. (2009): “Basel II Implementation in Asia”. *Federal Reserve Bank of San Francisco,* Asia Focus; available online at: http://www.frbsf.org/publications/banking/asiafocus/2009/asia_focus_april_09.pdf

Data Source: Yahoo! finance: http://uk.finance.yahoo.com/q?s=^KS11&ql=0