

A Study on the Financial Effects on Korean Companies by Exchange Fluctuation around Global Financial Crisis

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Abstract

Today's companies face the risk of profit loss from foreign exchange rate. The financial loss caused by the fluctuation of exchange rate has significant impact to the company value on the short and long-term. Sometimes, it makes effect to the success or failure of a company. During the Asian financial crisis in 1997 and the global financial crisis in 2008, many Korean companies went bankrupt due to drastic fluctuation of exchange rate. This paper analyzes the impacts from the exchange rate fluctuation to the elements of the financial statement, with the manufacturing (non-financial) companies that were traded in KOSPI and KOSDAQ. The analysis of the panel data on the paper shows how FX fluctuation can make effects to companies as the interaction effects between foreign currency asset and foreign exchange profit. And it shows the effects of Korean economics during the financial crisis.

Keywords: Foreign Exchange Exposure, FX Hedge, FX effects, Panel data analysis

1. Introduction

The financial crisis that began in the United States in 2008 gave a lot of impacts on the world economy. In Korea, by this impact, radical fluctuations in the exchange rate took place, and many companies had experienced foreign exchange gains or loss. In addition, the financial state of the company became unstable. In Korea with high weight of exports and imports, the impact by fluctuations in exchange rates is very huge. When looking from <Table 1>, in Korea, compared to nominal GDP, the trade dependence on which was 51.7% in 2002 reached to 85.6% in 2008. After the financial crisis, the trade dependence fell for a while, and it was closer to 81.5% in 2010. Thus, depending on the currency fluctuation, companies can experience many losses.

Table 1: Foreign Trade Ratio of Nominal GDP for Korea

Year	Nominal GDP (\$ Million)	Export		Import		Foreign trade dependency (%)
		Amount (\$ Million)	Ratio (%)	Amount (\$ Million)	Ratio (%)	
2010	1,094,300	466,384	42.6	425,212	38.9	81.5
2009	902,300	363,534	40.3	323,085	35.8	76.1
2008	1,001,700	422,007	42.1	435,275	43.5	85.6
2007	1,122,700	371,489	33.1	356,846	31.8	64.9
2006	1,011,000	325,465	32.2	309,383	30.6	62.8
2005	898,000	284,419	31.7	261,238	29.1	60.8
2004	765,300	253,845	33.2	224,463	29.3	62.5
2003	680,400	193,817	28.5	178,827	26.3	54.8
2002	608,900	162,471	26.7	152,126	25.0	51.7

Source: Koran Trade Association

When the foreign exchange crisis had come in 1997, it also led many companies to bankruptcy (Kim, Y., 2003). To examine the effect of exchange rate-related corporate finance in such Korea situation has important meaning. So far, many papers have studied the exchange exposure of companies. However, in the conventional exchange exposure studies, since it is measured on the basis of the price-earnings ratio of the company, there is a limit in directly looking at the impact on the financial statements of the company. Factors influencing on the price-earnings ratio are very diverse. Depending on the cases, the effect of positive (+) or effect of negative (-) are relatively appeared. In the existing studies, that there is a limit to get the significant value of the exchange exposure is because of these reasons. Here, for the exchange rate of the company, this paper studies how the exchange rate fluctuation directly impacts on the financial statements of the company. This is because the performance of company shows through the financial statements of the company. In addition, the net income of company is related to the price-earnings ratio (Paek, Lee, & Park, 2001). And, in most companies, there are foreign exchange gains or losses, which shows that fluctuations in the exchange rate has had a direct effect on the income statement of company (Jeong, Bae, & Lim, 2012).

Here, this study tries to examine the foreign currency assets and foreign currency debt that affect the financial statements of companies, and the foreign exchange gains and losses through derivatives and the correlation. Through these, it is because it looks at how the effect of derivatives before and after the financial crisis shows actual impact on the company. In addition, it tries to examine the adjustment effect of exchange rate fluctuations in the influence of the foreign currency assets and foreign exchange gains and losses. This, together with the exchange exposure that has been many handled in the previous studies, is to explore the impact of exchange rate fluctuation by the foreign currency asset ratio.

Thus, in this study which includes listed company in Stock Exchange and companies registered in KOSDAQ, with the target of the companies in non-financial manufacturing industry, it is actually to analyze the influences between the relevant factors in the financial statements, through the exchange rate fluctuation from companies. It can provide different viewpoints from previous studies have been made of the exchange exposure. It can give an implication for companies to prepare for such financial crisis. Since the data used in this study is the data connected in time horizon for the cross-section data, the heteroscedasticity problem that can appear in the cross-section data, and the serial correlation problem of time-series data can occur at the same time. Therefore, this study will use the method of analyzing in forming the balanced panel data that combines the time-series and cross-section data. For the panel data used in this study, it is a balance panel data. The data has been structured the cross section unit of 443 companies in non-financial sectors that are listed in Korea Stock Exchange Market or registered in KOSDAQ market, from 2003 to the end of 2010, which of each company has a time series of eight years. For a statistical package for panel data analysis, it used STATA12.0. The data required for the analysis used each company's financial statements that have extracted from FNGUIDE.

This paper is constructed as follows. In 2, the previous research, it shows the previous papers. In 3, design of empirical study, it introduces a method of designing a study associated with the panel analysis, and in 4, empirical analysis results, it analyzes the empirical results. In 5, implication and limitation of study, it will discuss the conclusions and limitation of the study.

2. Previous Researches

Since Adler & Dumas (1984a) showed how to measure foreign currency exposure through the skewness of exchange rate fluctuation variable in the linear regression equation, the full-fledged research on the foreign currency exposure started. They considered the sensitivity to the changes in the value caused by exchange rate fluctuation as the foreign currency exposure and enabled a detailed empirical analysis. Through his research concerning American companies, Jorion (1990) confirmed that the exchange rate fluctuation affected the enterprise value, depending on the proportion of export. Khoo (1994) analyzed the foreign currency exposure that occurred in Australian companies due to payment for machinery and facility in foreign currency. Donnelly & Sheehy (1996) analyzed the foreign currency exposure of the British exporters. The research on foreign currency exposure developed into the alleviation strategy of foreign currency exposure for the companies to prevent the decrease in their value caused by foreign currency exposure. Bodnar, Hayt, & Marston (1998) investigated and studied the foreign currency hedging of American companies against the exposure to foreign currency. Miller (1998) introduced the strategies of multi-national companies to hedge against the risks through overseas production.

Miller and Reuer (1998) proved that the large companies alleviate the level of foreign currency exposure through foreign direct investment. Many Korean companies had been quite insensitive to the changes in the enterprise value caused by the exchange rate fluctuation before the 1997 Asian financial crisis. It was because the government defended against the drastic change in the exchange rate. However, since the financial crisis, they have witnessed that the exchange rate fluctuation has serious effects not only on the companies, but also on the survival of the country. Therefore, since 1997, many papers on the foreign currency exposure have been published, and many researchers have been carried out in Korea. The exchange rate, which used to be studied mainly from the economic perspective, has started to be researched in the field of business administration studies.

After the Asian financial crisis in 1997, papers have been conducted regarding the exposure, actively. Kwon (1998), while research on the effect of currencies and asymmetry in estimating foreign currency exposure, conducted a full-scale study. Kwon (1999a), with the KOSPI 200 companies, studied the scale effects and the characteristics of foreign exchange exposure characteristics, liquidity and currency risk exposure. In addition, Kwon (1999b) was trying to empirical analysis on the relationship between foreign exchange exposure and the cost of financial instability. The foreign exchange risk increased hedge ratio, turnover margin, total asset turnover ratio, equity ratio, and the relationship with the instability of financial status. Lee (1999) studied the relationship between foreign exchange exposure and characteristic variables of the Korean firms and industries. And Park (2001) researched the exchange rate volatility and the Korean exports. Kim & Park (2003) studied the relationship between foreign exchange risk of multinational corporations and their ADR and underlying stock returns.

Kim (2003) researched effects on expected default risk of small-sized firms induced by drastic changes of foreign exchange rate during the Korea's financial crisis with non-financial firms listed on the Korea Stock Exchange from 1997 to 2000. Lee (2004) carried out an analysis of the foreign exchange exposure and determinants through non-financial firms listed on the Korea Stock Exchange from 1987 to 2001. Yi (2004a) estimated exchange exposure of Korea's firms on dollar, and Bian, Park, & Cho (2006) studied exchange rate exposure of Korean companies during around the period of economic crisis. After financial crisis, Kang (2009) analyzed corporate cash flow exposures to foreign exchange rate and the determinants with companies listed on KRX and registered on KOSDAQ between 2000 and 2008. Nam & Xu (2011) reviewed The foreign currency risk and firm value with the non-financial firms listed on KRX from July 2005 to June 2009. Lately, Park, & Chang (2013) reviewed the exchange rate and interest rate exposures of Korean corporations with non-financial 233 firms listed on KRX between 1990 and 2011. Cho, Bian, & Park (2013) analyzed currency crises and exchange rate exposure through 2116 firms of 23 countries around the currency crises in the 1990s.

3. Design of Empirical Study

3.1 Selection of sample companies and analysis target period

This study selected 443 companies of non-financial industries which are listed in Korea Stock Exchange Market or registered in KOSDAQ market, from 2003 to the end of 2010.

- 1) As of the end of 2010, companies of non-financial industries which are listed in Korea Stock Exchange Market or registered in KOSDAQ market
- 2) Corporations that we can acquire the accounting data because they have continually published closing materials since 2003.
- 3) Corporations that have 8 years of export in their financial reports. It is because there are foreign accounts receivables on export. This chapter explains the relationship between foreign accounts receivables and foreign exchange gain.

The reason why excluded the companies in the bank, insurance, and securities industries, is because the foreign currency assets in the bank, insurance, and securities industries can be handled as normal products, and thus its characteristics can be different from that of the foreign currency assets that are resulted from business activities.

In this study, the analysis period is 8 years between 2003 and 2010, and it used the balanced panel data that each company has a time series of 8 years, by structuring 443 individual companies in the cross-section unit.

The reason why the data between 2003 and 2010 is be used because the exchange rate in 2003 to 2006 was relatively stable, and during the period of 2007 to 2010, we can have a look a clear influence relationship before and after the Financial Crisis caused by Lehman Brothers in 2008. It also seems to be meaningful to try to analyze these two periods as its target.

3.2. Setting of hypothesis

The relationship between the foreign exchange gains and corporate financial statements can be seen to as different in the effect depending on the types of items. Also, it could be different due to the causes that occur. Foreign currency assets, in general, are generated through the sales activities of the company. However, foreign currency liabilities are often foreign currency borrowing rather than coming from the purchase activity of company. <Table 2> shows the trend of the entire period of foreign currency accounts receivable amount. From 2003 until 2010, the amount of foreign currency accounts receivable of target companies grew by 352%. This can be understood that the foreign currency accounts receivable amount is getting bigger, as the weight of exports expands. <Table 2> shows that the foreign currency receivables were surging up in between 2005 and 2006, and between 2008 and 2009. Because the export ratio was stabilized in stable exchange rates. In 2008 and 2009, there seems to be an increase in the exchange rate which affected exports. <Table 1> shows the export to GDP ratio increased from 20% to 30% in 2004, and to 40% in 2008. In addition, the export amount had been also increased significantly.

Table 2: Trend of the amount of foreign currency accounts receivable for the entire period
Unit: 1 Billion won

Year	2003	2004	2005	2006	2007	2008	2009	2010
Foreign asset amount	6,557	6,891	9,481	12,357	13,628	18,393	24,469	23,087
Growth rate		5%	38%	30%	10%	35%	33%	-6%

Foreign currency accounts receivables are the balance amount as of the end of the fiscal year. It can also be understood as the financial items occurring through business activities of the company. Companies often collect in foreign currency for trade receivables while exporting goods. And foreign exchange gains also have relationship with derivatives profits. Companies buy derivatives by determining the extent of foreign currency assets. If derivatives are purchased, it also affects the derivatives profits to the foreign exchange gains. In the future, the more companies' exports, the more the foreign currency accounts receivable will increase. The foreign currency assets' impact on the foreign exchange gains is also believed to increase. It can expect the explanatory power by the below hypotheses.

In the existing studies, the studies on the foreign currency liabilities were many (Kwon, 2006a; Yu & Hong, 2009). However, the foreign currency assets of companies will affect the foreign exchange gains of companies (Song & Cho, 2011). This is because companies would have foreign currency assets due to the occurrence of trade receivables in foreign currency with such as exports, and through this, in the companies, the foreign exchange gains would occur naturally. In particular, to Korean companies that have higher export dependency than export dependency, it can be considered that the foreign currency assets had a bigger impact on the foreign exchange gains than the foreign currency liabilities did. As confirmed by <Table 13>, the hypothesis can be made that the foreign currency assets have had a significant impact on the foreign exchange gains as it increased rapidly.

[Hypothesis 1] The proportion of foreign currency assets during the period affected the foreign exchange gain ratio.

Lee & Park (2009) studied the effects that the exchange rate fluctuation gave to the exchange exposure determinants. The foreign currency assets that companies have will have a direct impact whenever the exchange rate fluctuation occurs. Accordingly, this research tries to check the adjustment effect of foreign currency assets ratio between the exchange rate fluctuation rate and the foreign exchange gains ratio for the impact of such exchange rates. Through this, we can weigh up the impact that the foreign currency assets ratio can give on the foreign exchange gain ratio, depending on the exchange rate fluctuation. Only with the fact that companies simply have foreign currency assets, the foreign exchange gains and losses do not occur. The foreign currency gains and losses are to be determined in accordance with the rise or fall of the exchange rate.

[Hypothesis 2] The foreign currency assets ratio would be moderated by the exchange rate fluctuation ratio in affecting the foreign exchange gain ratio during that period.

3.3. Analysis model

3.3.1. Setting of analysis model

In order to verify the hypotheses presented above, this research sets the following model. [Model 1], by using the panel data, in a situation in which controls the export ratio, foreign currency liabilities ratio, and derivatives profit ratio, is a model for the analysis of the foreign currency assets ratio and the foreign exchange gains ratio. In this case, t-phase error term of i company, to be able to reflect individual specific effect over the time, and the time specific effect for each company in a complex manner, was included in the model by dividing into the company effect (ηi), time effect(λt), and the error (qt).

$$[\text{Model 1}] \text{FXG}_{it} = \alpha + \beta_1 \text{FAR}_{it} + \beta_2 \text{EXP}_{it} + \beta_3 \text{FLR}_{it} + \beta_4 \text{DER}_{it} + \beta_5 \text{FXR}_{it} + \eta_i + \lambda_t + q_{it}$$

FXG_{it} : FX gain ratio in t-phase of i company (=foreign exchange gain /revenue)

FAR_{it} : Foreign currency dominated asset ratio in t-phase of i company (=foreign currency assets /total assets)

EXP_{it} : Export ratio in t-phase of i company (=export amount /revenue)

FLR_{it} : Foreign currency dominated liability ratio in t-phase of i company (=foreign currency liabilities amount /total assets)

DER_{it} : Derivatives profit ratio in t-phase of i company (=derivatives profit /total assets)

FXR_{it} : FX rate fluctuation rate in t-phase of i company (USD/KRW fluctuation rate compared to previous year)

ηi : Individual specific effect of i company

λt : Time specific effect of t-phase

qt : Remaining error

3.3.2. Suitability verification method of the analysis model

The panel data analysis methods are diverse whether the constant items are same as cross section or time-series, and the assumption about the structure of the error item. The first step to estimate the suitability of the model is to verify whether the individual specific effect (ηi) and the time specific effect (λt) exist within the model. In other words, when setting the null hypothesis (H0)σ=σ=0, and adopting the null hypothesis, since there is no individual specific effect and time specific effect, it is possible to obtain efficient estimates in the general least squares method (OLS). However, when the null hypothesis is rejected, the error term becoming to like ηi+λt+qit, and because of the presence of ηi and λt, it cannot obtain efficient estimates in the general least squares method (OLS). Test on these hypotheses can be made by Lagrange Multiplier Test that Breusch & Pagan (1980) presented, and the statistics, g, of the formula (1) shows asymptotically χ²(2) distribution.

When using the statistics g of formula (1) in separating by two terms, it can also test the null hypothesis of σ²η=2 and σ²ληχ² (1), respectively. If the presence of ηi and λt in the model can be identified, in the second step, it has to test to estimate ηi and λt by the fixed effect model or dummy variable model, or to do random effect model or variance components model. Fixed effect model is a model to use the least squares dummy variable (LSDV) as the parameter estimate method, by assuming that ηi and λt are fixed. Probability effect model, assuming ηi and λt as the probability variables, is a model that utilizes the generalized lease squares (GLS) as the parameter estimate method.

$$g = \frac{NT}{2(T-1)} \left[\frac{\sum_{t=1}^T (\sum_{i=1}^N \mu_{it})^2}{\sum_{t=1}^T \sum_{i=1}^N \mu_{it}^2} - I \right]^2 + \frac{NT}{2(N-1)} \left[\frac{\sum_{i=1}^N (\sum_{t=1}^T \mu_{it})^2}{\sum_{i=1}^N \sum_{t=1}^T \mu_{it}^2} - I \right]^2 \sim \chi^2(2) \quad (1)$$

N: number of companies, T: number of the years, μit: least squared residuals

In order to compare the suitability of two models, by setting the null hypothesis (H0: E (ηi/λt)=0) that there is no correlation between the individual specific variable(ηi) and time specific variable (λt), it is to carry out Hausman Test. If the null hypothesis that E (ηi/λt)=0 is adopted, it is desirable to estimate by the probability effect model because GLS estimates become to have the consistency and efficiency by the probability effect model. If the null hypothesis is rejected, since GLS estimates become to have the inconsistency, the estimation by the fixed effect model becomes desirable (Hausman, 1978).

In order to check the suitability of the fixed effect model, by setting the null hypothesis (H0): $\eta_1 = \eta_2 = \dots = \eta_N - 1 = 0$ and $\lambda_1 = \lambda_2 = \dots = \lambda_T = 0$, it can perform F- test. In this case, if the null hypothesis is rejected, it can be interpreted that the fixed effect exists.

3.4. Analysis target variables

3.4.1. Foreign Exchange Gain

For the impact on the foreign exchange gains of company by the fluctuations in foreign exchange rates, it used the foreign exchange gain ratio (FXG). The foreign exchange gain ratio was measured by dividing the foreign exchange gains of company by the total sales of company. Foreign exchange gains correspond to a non-operating profit in the financial statements of company, and it directly affects on the corporate profits. The foreign exchange gains might affect the corporate value as the result. In the existing exchange exposure studies (Kwon, 1998), they utilized the price-earnings ratio of company as the dependent variable. Here, since it is a study on the exchange rate fluctuation impact on the financial statements of company, it is supposed to measure the foreign exchange gains rather than price-earnings ratio.

3.4.2. Foreign Currency Asset

The foreign currency-denominated bonds are increased in accordance with the export of company. Foreign currency-denominated bonds, which account for most of the foreign currency assets, depending on the fluctuations in the exchange rate, increase or decrease the foreign exchange gains. The foreign currency assets can be an important factor in the exchange exposure determinants. Through this study, I tries to confirm this. Song & Cho (2011) have revealed that foreign currency assets were significant factors, depending on the times. Here, this study attempted to examine in the foreign currency assets ratio. This is because the influence of the scale, rather than the influence of amount in each company, can give impact on the foreign exchange gain ratio. Foreign currency assets ratio was measured by dividing the foreign currency assets by the total assets of the company.

3.4.3. Control variables

The variables that give changes to the foreign currency gains, not only currency assets, but some other variables can exist. As the control variables, it used the export ratio, derivatives profit ratio, foreign currency liabilities ratio, and exchange rate fluctuation rate. These are items that have been mentioned as determinants of exchange exposure in existing studies (Kwon, 1998).

(1) Export ratio

Depending on the export ratio of companies, the foreign exchange gain ratio of companies can be affected. When the export weight of company increases, the foreign currency accounts receivables are generated. This is what can give an indirect effect on the exchange exposure (Lee, 2003). As shown in <Table 12>, Korea's trade dependence is high, and it has higher degree of dependence in exports than imports. In other words, rather than the impact of foreign currency fluctuations coming from imports, the effects coming from exports can be guessed to be bigger.

(2) Foreign currency liabilities ratio

Foreign currency liabilities are a factor that gives a lot of influence on the exchange exposure like the foreign currency assets. Kwon (2007) studied on the asymmetry of exchange rate and the foreign currency-denominated liabilities, and Kwon (2013b) studied the influence that the use of foreign currency liabilities gives on the corporate value. Depending on the degree of foreign currency liabilities, the impact on the foreign exchange gains can be very big.

(3) Derivatives profit ratio

Companies, if the risk of exchange exposure is increased, register derivatives as a financial strategy in order to avoid the risk. This is intended to have a role as a hedge by increasing the derivatives too when the foreign currency assets increase. If the foreign currency assets have a positive (+) effect on the exchange exposure, the derivatives profit ratio can give the negative effect on the exchange exposure (Roh, Yun & Kim, 1998).

(4) Exchange rate fluctuation ratio

Fluctuations in foreign currency give a direct impact on the foreign exchange gains of company. If owning foreign currency assets, when the exchange rate increases, the company will have the foreign exchange gains. Looking in <Table 3>, it is possible to check the fluctuations in the currency during the entire period.

Table 3: Fluctuation rate for three currencies in the entire sample period (2003-2010)

Year	USD	YEN	EUR
2003	-1.2%	11.2%	17.8%
2004	-12.4%	-8.7%	-3.7%
2005	-2.5%	-15.7%	-14.6%
2006	-9.9%	-8.7%	0.9%
2007	0.5%	5.2%	10.4%
2008	41.0%	64.1%	32.0%
2009	-15.5%	-13.7%	-7.5%
2010	-1.3%	6.3%	-11.3%

For the exchange rate used here, it showed the annual average exchange rates of the currency that the Bank of Korea notified. Although the exchange rate fluctuations are frequently performed, it is possible to check that USD, YEN, and EUR have caused a big change in 2008. USD, YEN, EUR are sometimes also seen as that have appeared different in their fluctuation direction. Although USD was relatively stable period with -0.2% in 2003, YEN and EUR increased to 10.5% and 19.5%, respectively. In addition, although, in 2006, EUR was relatively stable time with 1.9%, USD and YEN decreased to -8.2% and -9.1%. The foreign currency assets that companies have are very diverse, but here, I used the fluctuation rate in the exchange rate for USD, as a statistical variable. This is because most of the companies use USD as the settlement currency.

This study divided and compared the entire period (2003 to 2010) into two periods, sub-period from 2003 to 2006 and from 2006 and 2010. Being divided into two periods into account come from the financial crisis in 2008. Since 2003 the exchange rate was relatively stable downward trend. Korean economics which finished the IMF early had been increasing, and various economic indicators were stable. Since 2007, the sign of the financial crisis was occurred. The global economy was starting to get nervous. Stabilized exchange rates were being started up to increase around 2007. Finally, global economy fell in darkness from the bankruptcy of Lehman Brothers in 2008. So, this study sets up two sub-periods from 2003 to 2010. It makes sense to look into both periods from 2003 to 2006 as the first sub-period and from 2007 to 2010 as a sub-period 2. It has the meaningful comparison.

4. Empirical analysis Results

4.1. Descriptive statistics of each variable

When summarizing the descriptive statistics for each variable for the total samples, in this study, are as <Table 4>. In <Table 4>, the mean of the foreign exchange gain ratio (FXG) in the entire period was -0.04%. It was +0.04% in the sub-period 1, but -0.11% in the sub-period 2. This is because the contrast effects appeared in the sub-period 1 and 2. Although it seemed that there is no major difference to the entire between the sub-period 1 and 2, in the sub-period 2, the foreign exchange gain ratio appears in a minus. The foreign currency assets ratio (FAR), during the entire period, is almost 0% in minimum to 100% in maximum, and the mean showed as 6.49%.

Table 4: Descriptive statistics of each variable

Variable	Period	Obs	Mean	Std. Dev.	Min	Max
FXG	Entire period	3544	-0.0004	0.0284	-0.5990	0.4674
	Sub-Period 1	1772	0.0004	0.0214	-0.3760	0.4674
	Sub-Period 2	1772	-0.0011	0.0340	-0.5990	0.3778
FAR	Entire period	3544	0.0649	0.0813	0.0000	0.9170
	Sub-Period 1	1772	0.0630	0.0822	0.0000	0.9170
	Sub-Period 2	1772	0.0667	0.0805	0.0000	0.6870
EXP	Entire period	3544	0.3910	0.2955	0.0000	1.0000
	Sub-Period 1	1772	0.3794	0.2941	0.0000	1.0000
	Sub-Period 2	1772	0.4026	0.2965	0.0003	1.0000
FLR	Entire period	3544	0.0712	0.0892	0.0000	0.9061
	Sub-Period 1	1772	0.0689	0.0848	0.0000	0.8645
	Sub-Period 2	1772	0.0735	0.0934	0.0000	0.9061
DER	Entire period	3544	-0.0061	0.0451	-0.7170	0.2751
	Sub-Period 1	1772	0.0019	0.0097	-0.0677	0.0921
	Sub-Period 2	1772	-0.0111	0.0564	-0.7170	0.2751
FXR	Entire period	3544	-0.0014	0.1653	-0.1547	0.4104
	Sub-Period 1	1772	-0.0650	0.0479	-0.1243	-0.0117
	Sub-Period 2	1772	0.0621	0.2105	-0.1547	0.4104

Note. The data, by targeting the non-financial industries' companies out of the listed companies and registered company in FNGUIDE, was extracted the related contents in the financial statements between 2003 and 2010. Export ratio (EXP) shows approximately 39% as the average. It was slightly decreased into 37.94% in the sub-period 1, but it was slightly increased to 40.26% in the sub-period 2. <Table 4> explains the rate in the sub-period 2 is higher than sub-period 1. It is assumed that the export rates of the companies were increased.

Foreign currency liabilities ratio (FLR) was about 7.12% in the entire period. Considering that the FAR was 6.49%, FLR was somewhat high. I could guess what the proportion of the import was as high as the proportion of the export. Because there was no data for the turnover rate of the foreign currency assets and foreign currency liability, it is difficult to guess how big the trading scales were. Derivatives profit ratio (DER) was 0.61% in the entire period. However, it was 0.19%. And it was increased to -1.11% in the sub-period 2 significantly. This was that companies purchased derivatives for the risk management. It is assumed that DER was the bigger impact from the fluctuation of exchange rate during the financial crisis period particularly.

The mean of the Exchange rate fluctuation rate (FXR) was -0.14% in the entire period, -6.5% in the sub-period 1, and +6.2% in the sub-period 2. Looking for FXR, the standard deviation was 4.8%, but 21% in the sub-period 2. It can be assumed that the exchange rate fluctuation was great in the sub-period 2. <Table 4> explained the fact.

The correlation between variables that were calculated using the data of the entire sample periods (2003 to 2010) of each variable included in this study is as <Table 5>. During the entire period, the weight of exports (EXP) is significant as 52.63% to the foreign currency assets ratio (FAR), and the derivatives profit ratio (DER) was significant with the foreign exchange gain ratio (FXG), foreign currency assets ratio (FAR), and the weight of exports (EXP). Foreign exchange rate fluctuation ratio (FXR) appeared as significant with the foreign exchange gain ratio (FXG) and derivatives profit rate (DER). In the sub-period 1, it appeared that the foreign currency assets ratio (FAR) is significant with the foreign exchange gain ratio (FXG), and the foreign currency liabilities ratio (FLR) is appeared to be significant with the weight of exports (EXP), which is guessed that the exports are connected to the purchase in the foreign currency. The derivatives profit ratio (DER) and foreign currency liabilities ratio (FLR) were significant in the sub-period 1 and the sub-period 2.

**Table 5: Correlation coefficient between variables during the period
Entire period (2003-2010)**

	FXG	FAR	EXP	FLR	DER	FXR
FXG	1					
FAR	-0.0337*	1				
EXP	-0.0002	0.5263***	1			
FLR	0.0024	0.2710***	0.1511***	1		
DER	-0.1904***	-0.0765***	-0.0921***	0.0337	1	
FXR	-0.0167	0.0177	0.0168	0.0331*	-0.3116***	1

Note. These are tables of the correlation coefficient between the variables which were calculated for the entire sample period between 2003 and 2010.

*Significant at $p < .01$. **Significant at $p < .05$. ***Significant $p < .001$.

Sub-period 1 (2003-2006)

	FXG	FAR	EXP	FLR	DER	FXR
FXG	1					
FAR	-0.2361***	1				
EXP	-0.0884***	-0.5268***	1			
FLR	0.1607***	0.2854***	0.1689***	1		
DER	0.1957***	0.1525***	0.2089***	0.0045	1	
FXR	-0.0074	0.0124	-0.0133	0.0045	-0.1272***	1

Note. These are tables of the correlation coefficient between the variables which were calculated for the entire sample period between 2003 and 2006.

*Significant at $p < .01$. **Significant at $p < .05$. ***Significant $p < .001$.

Sub-period 2 (2007-2010)

	FXG	FAR	EXP	FLR	DER	FXR
FXG	1					
FAR	0.1101***	1				
EXP	0.0566**	0.5251***	1			
FLR	-0.1012***	0.2572***	0.1334***	1		
DER	-0.2531***	-0.1198***	-0.1576***	0.0426	1	
FXR	-0.0073	0.0116	0.0056	0.0337	-0.2856***	1

Note. These are tables of the correlation coefficient between the variables which were calculated for the entire sample period between 2007 and 2010.

*Significant at $p < .01$. **Significant at $p < .05$. ***Significant $p < .001$.

4.2. Suitability test results of the model

<Table 6> is a result of testing the suitability of the model for the entire period (2003 to 2010). Also, it tried to examine the suitability of the model even in the sub-period 1 and sub-period 2 together.

Table 6: Suitability test results of the model for the period

[Model 2] $FXG_{it} = \alpha + \beta_1 FAR_{it} + \beta_2 EXP_{it} + \beta_3 FLR_{it} + \beta_4 DER_{it} + \beta_5 FXR_{it} + \eta_i + \lambda t + \epsilon_{it}$

Note. *Significant at $p < .01$. **Significant at $p < .05$. ***Significant $p < .001$.

Category	Lagrange multiplier Test ($H_0 : \sigma^2=0$)	Hausman Test ($H_0 : E(\eta_i/\epsilon_{it})=0$)	F-Test ($H_0 : \eta_i=0$)
	g statistics	m statistics	F value
Entire period	5.59***	9.92*	1.43***
Sub-period 1	7.56***	15.04**	2.12***
Sub-period 2	0.00	13.96**	0.68

Looking at the Lagrange multiplier test results for the entire period in the first column, it shows the result that g statistics rejects the null hypothesis. This means that $\eta\eta_i$ exists in all of the two periods, which can know that there is a need to test the suitability of the fixed effects model and the probability effects model by Hausman Test. In addition, the sub-period 1 in a significance level of 1%, and the sub-period 2 in a significance level of 10%, can reject the null hypothesis.

The second column, under the null hypothesis that $E(\eta\eta_i/\chi\chi_{it})=0$, is a result of performing Housman Test for each model. Looking at the Housman Test results for the entire periods, m value of the model is 9.92, which shows the result that the null hypothesis is rejected at the significance level of 10%. Therefore, since it can be said that it has a significant correlation between the individual specific effects and independent variables, it is possible to know that the coefficient estimation by the fixed effects model. It was confirmed that the sub-period 1 and sub-period 2 were also significant.

Looking at the third column, that is, the result that performed the F-test by setting the null hypothesis $\eta\eta_i = 0$ in order to confirm the suitability of the fixed effects model, the F values of each model showed the results that rejected the null hypothesis. The F value is 1.43 in the entire period and with 2.12 in the sub-period 1. However, 0.68 in the sub-period 2, respectively, rejects the null hypothesis. So far, in the entire period (2003 to 2010) and the sub-period 1 (2003 to 2006), it performed Lagrange Test, Housman Test, and F-test, since it confirmed that the coefficient estimation by the fixed effects model is all suitable, and the sub-period 2 (2007 to 2010) is only through Hausman. If it is considered the financial crisis during the period, there is no problem in analyzing by the fixed effects model.

4.3. Results of the empirical analysis of fixed effects model

<Table 7> is the results that analyzed the relationship between the foreign currency assets and foreign currency gain by the fixed effects model for the target of the entire period (2003 to 2010). The regression coefficient of the foreign exchange gain ratio (FXG) that was measured by the foreign exchange assets ratio (FAR) is found to be significant at 5% significance level with 3.58% ($t=2.51$). In the case of the control variables, as the variables that significantly affect the foreign exchange gains, the weight of exports (EXP) and derivatives profit ratio (DER) appeared to be significant. This is because companies, in general, by registering derivatives for foreign currency assets or foreign currency liabilities, are in a trend of hedge for the foreign exchange gain. In relation to the negative, the regression coefficient of the foreign exchange gain ratio (FXG) that was measured by derivatives profit rate, was appeared to be significant at the 1% significance level, with -0.1232 ($t = -7.85$).

Table 7: The result of panel analysis between the foreign currency asset ratio and the foreign exchange profits ratio using the fixed effects model

Category	Entire period	Sub-period 1	Sub-period 2
Constant	.0009 (0.22)	.0110 (-0.91*)	.0076 (1.01)
FAR	.0358 (2.51**)	-.0114 (-0.55)	.0558 (2.13**)
EXP	-.0112 (-1.50)	-.0235 (-2.25**)	-.0269 (-1.82*)
FLR	.0171 (1.32)	.0371 (1.66*)	.0023 (0.10)
DER	-.1232 (-7.85***)	.5998 (0.53)	-.1348 (-7.09***)
FXR	-.0135 (-3.46**)	.0098 (0.53)	-.0164 (-3.48***)
F value	14.39***	7.08***	11.53***
R ²	.0341	.0894	.0549

Note. *Significant at $p < .01$. **Significant at $p < .05$. ***Significant $p < .001$.

In <Table 7>, As a result of panel analysis for the entire period between the foreign currency assets ratio and foreign exchange gain ratio using the fixed effects model, it has a relationship (+). Through this, it can be guessed that the exchange rate fluctuation gave a bigger impact on which period. If looking in the sub-period 1, as the exchange rate fluctuation rate (FXR) has a positive relationship, FAR also becomes a negative relationship, and if looking in the sub-period 2, although the foreign currency asset ratio (FAR) has a negative relationship, as the exchange fluctuation rate in the sub-period 2 gives bigger impact on the exchange rate fluctuation rate (FXR), it shows a negative (-) relationship in the entire period. This, as seen in <Table 5>, in the sub-period 1, the exchange rate fluctuation appears mainly in Negative, and in the sub-period 2, it appears in Positive, which is seemed that the foreign exchange gain ratio (FXG) was affected by the exchange rate fluctuation rate (FXR).

Here, it can be guessed that the exchange rate fluctuation rate (FXR) has the moderating effect between the foreign currency assets ratio (FAR) and foreign exchange gain ratio(FXG).

<Table 8> is the result of having performed the stepwise panel analysis in order to reconfirm the relationship between the foreign exchange gains and each variable that have been shown from the results of the entire period panel analysis by the fixed effects model. In the stepwise, this research tries to verify the interaction effect (FAR * FXR) of the foreign currency assets ratio and exchange rate fluctuation rate, together. As the verification result, the interaction effect of the foreign currency assets ratio and exchange rate fluctuation rate was found to be significant. In the Step 4, the value of the entire R² indicates 0.1966.

Between 2003 and 2010, the foreign currency assets ratio affected the foreign exchange gain ratio, and the effect can be seen to become bigger depending on the exchange rate fluctuation. R², as shown in <Table 8>, can be seen as sharply increased in Step 4. It can be found that the foreign exchange gain ratio should consider the adjustment effect of the exchange rate fluctuation rate to the foreign currency assets ratio.

Table 8: Result of stepwise panel analysis using the fixed effects model Entire period (2003-2010)

Note. *Significant at $p < .01$. **Significant at $p < .05$. ***Significant $p < .001$.

Sub-period 1(2003-2006)

Category	Step 1	Step 2	Step 3	Step 4
Constant	0.0019 (-2.13**)	0.0020 (-0.49)	0.0009 (-0.22)	-0.0016 (-0.46)
FAR	-0.0314 (-2.78***)	0.0342 (-2.39**)	0.0358 (2.51**)	0.0345 (2.75***)
EXP		-0.0130 (-1.73*)	-0.0112 (-1.50)	-0.0068 (-1.03)
FLR		0.0148 (-1.13)	0.0171 (1.32)	0.0236 (-2.06*)
DER		-0.1042 (-7.05***)	-0.1232 (-7.85***)	-0.0836 (-5.96***)
FXR			-0.0135 (-3.46***)	-0.0592 (-13.40***)
FAR*FXR				0.57 (-16.39***)
F value	7.72***	14.81***	14.39***	60.24***
R ²	0.0011	0.0249	0.0341	0.1966

Note. *Significant at $p < .01$. **Significant at $p < .05$. ***Significant $p < .001$.

Sub-period 2 (2007-2010)

Category	Step 1	Step 2	Step 3	Step 4
Constant	0.0014 (-1.5)	0.0106 (-1.86)	0.0110 (-1.91*)	0.0052 (-0.88)
FAR	-0.0172 (-1.34)	-0.0109 (-0.53)	-0.0114 (-0.55)	0.0195 (-0.89)
EXP		-0.0241 (-2.32**)	-0.0235 (-2.25**)	-0.0184 (-1.78*)
FLR		0.0367 (-1.64)	0.0371 (-1.66*)	0.0423* (-1.93)
DER		0.5917 (-5.22***)	0.5998 (-5.24***)	0.6517 (-5.78***)
FXR			0.0098 (-0.53)	-0.0445 (-1.90*)
FAR*FXR				0.6488 (-3.64***)
F value	1.79***	8.81***	7.08***	8.38***
R ²	0.0557	0.0865	0.0894	0.1312

Category	Step 1	Step 2	Step 3	Step 4
Constant	-0.0037 (-1.95)	0.0089 (-1.16)	0.0076 (-1.01)	0.0039 (-0.59)
FAR	0.0461 (-1.8)	0.0514 (-1.94*)	0.0558 (-2.13**)	0.0407 (-1.81*)
EXP		-0.0302 (-2.03**)	-0.0269 (-1.82*)	-0.0186 (-1.47)
FLR		-0.0005 (-0.02)	0.0023 (-0.1)	0.0147 (-0.77)
DER		-0.1118 (-6.20***)	-0.1348 (-7.09***)	-0.0972 (-5.88***)
FXR			-0.0164 (-3.48***)	-0.0595 (-11.42***)
FAR*FXR				0.5437 (-13.14***)
F value	3.24*	11.3***	11.53***	41.86***
R ²	0.0121	0.0326	0.0549	0.2726

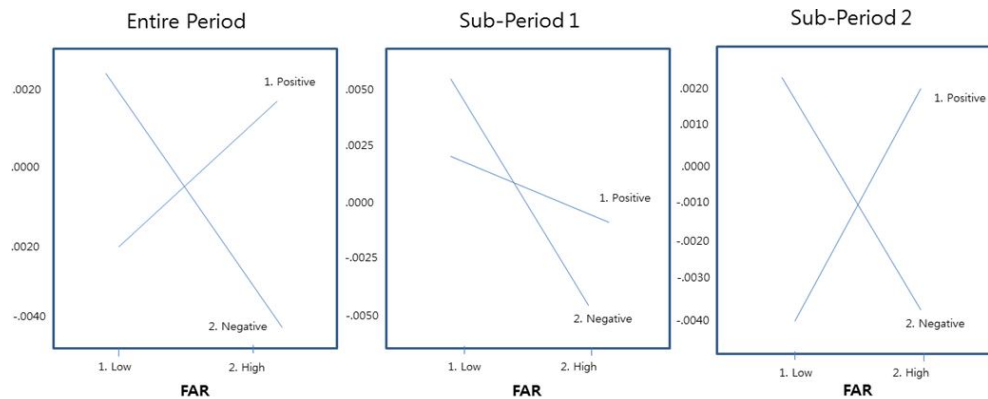
Note. *Significant at $p < .01$. **Significant at $p < .05$. ***Significant $p < .001$.

4.4. Analysis on the interaction effects through two-way ANOVA

It is clear that the foreign exchange fluctuation on foreign currency assets makes the effect as moderating effect. Depending on foreign currency assets, foreign exchange gains can be explained by changes in accordance with the foreign exchange fluctuations. In order to confirm this interaction, this paper conducted a two-way ANOVA. <Figure 1> shows the significant interaction clearly. Here this paper classified foreign asset rate (FAR) with two categories. The foreign currency assets ratio of the target company was based on 4.6% against total assets. Foreign currency assets was classified as low from less than 4.5%, more than 4.6% was classified as high.

This classification is divided on the number of observation. This is for reviewing how the interaction appears to the independent variables with the controlled variable. Foreign exchange fluctuation rate (FXR) was divided into positive group and negative group. If the rate of the current year is increased from the rate of the previous year, it is classified as positive group. If the rate of the current year is decreased from the rate of the previous year, it is classified as negative group. <Table 7> shows all of the negative foreign exchange fluctuations in the first sub-period of four years. Relatively less exchange rate fluctuation was in 2003 (-1.2%) and 2005 (-2.5%). So, FXRs of the years are classified to positive group. The reason is that this is for showing only the interaction with foreign exchange fluctuation rate (FXR) and the foreign currency asset rate (FAR) through the two-way ANOVA. <Figure 1> clearly shows that the slopes are different from about two groups. In the entire period, the difference appears clearly between positive group and negative group.

The positive group has less change than the negative group which has a significant change. The foreign exchange gain rate (FXG) is falling down very significantly on the high group of the foreign currency asset rate (FAR). Negative group is not different from the direction of the entire period and sub-period 1 and sub-period 2. But in the positive group, the direction is changed in the sub-period 1 and period 2 lower. The line is downward-sloping in the sub-period 1, and upward-sloping in the sub-period 2. The results are reasonable, because 2003 (-1.2%) and 2005 (-2.5%) are set to positive in the sub-period 1, even they are negative, actually. The foreign exchange gain rate is reduced in the sub-period 1. It means that the more foreign currency assets increase, the lesser the exchange gain decrease, because foreign exchange fluctuation rate is negative. However, the low foreign currency assets ratio makes low foreign exchange gain in the positive group of the sub-period 2. And the high rate of foreign currency assets has a high foreign exchange profit. In particular, foreign exchange fluctuations in 2008 increased to 41% against the previous year. Through this, it seems no wonder of soaring foreign exchange gain. This paper shows the foreign currency asset rate (FAR) as independent variable has the impact of the interaction through foreign exchange fluctuation rate (FXR) as the moderating variable, on the foreign exchange gain rate (FXG) as dependent variable.

Figure 1: The results of two-way ANOVA during the period

This method shows the interaction effect to foreign exchange gain rate between foreign currency asset rate and foreign exchange rate. As a result, <Figure 1> supports for both hypotheses.

[Hypothesis 1], the foreign currency assets ratio during the period affected the foreign exchange gain ratio.
[Hypothesis 2] The foreign currency assets ratio would be moderated by the exchange rate fluctuation ratio in affecting the foreign exchange gain ratio during that period.

5. Implication and limitation of Study

5.1 Implication of study

In this study, in order to analyze the effect of the foreign exchange currency assets for the foreign exchange gains, by targeting the period before and after the financial crisis, it is verified by using the panel data analysis. As the sample companies, it targeted 443 companies that have continuously, from 2003 to 2010, been listed on the Korea Stock Exchange, or registered in KOSDAQ, and it was eight years of 2003 to 2010. For the panel data, it structured the cross section unit of 443 individual companies, and it used the balanced panel data in which each company has a time series of eight years. If the existing studies on the exchange exposure have examined the change in the corporate values by the exchange rate fluctuation, this study has confirmed a direct impact of the corporate financial statements which become an indicator of corporate value. However, there are not many studies that have attempted to financial analysis via panel analysis. Companies, in response to the decrease in profits by the exchange rates fluctuations, buy derivatives. Although this does not have a big impact at ordinary time, in the time when the exchange rates fluctuation appears in big like the financial crisis, the derivatives play the role of hedge of exchange risk. However, such efforts of companies are not actually a big help. As it was confirmed before, the company, at ordinary times, seems not to be sensitive about the role of exchange rate hedge. Although using derivatives in matching the foreign currency assets and foreign liabilities that are increased or decreased by business activities, it is possible to confirm that it has not played the role of exchange hedge in the financial crisis. Companies seem to need in more practical to manage the correlation between the foreign currency assets and foreign exchange gains and losses in stable period of exchange rate.

Indeed, considering that fact that the amount of damage by KIKO in the period of the financial crisis reached 3 trillion and 200 billion (October 2010, Financial Supervisory Service), it is doubtful whether the function of derivatives had been performed properly. This seems that at a time when the exchange rate fluctuates in great, although the foreign currency assets have a significant impact on the exchange gains, the companies were not appropriate for the exchange hedge. Of course, when checking the correlation coefficient through the study earlier, it was confirmed that the function of derivatives has been performed to some extent in most companies.

However, the registration of derivatives in which some companies enough to lead to bankruptcy is determined to have an adverse effect on the financial status of the company. This is a part that was also confirmed in the paper of Kim & Jun (2012). This paper examined the direct impact of exchange rate fluctuation on the corporate accounting value, and the indirect effects through the adjustment effect too. In a situation that there are not many papers summarizing the impact of the exchange rate fluctuations on the corporate finance, this will be able to provide sufficient implication in that companies have to consider the impact of corporate finance in the exchange hedge.

5.2. Limitation of study

The materials used for this study was carried out through the financial statements data of companies that were extracted from FNGUIDE for the non-financial manufacturing companies out of the listed or registered companies. Although it could get the information of financial statements, the information such as the registered size of derivatives, the profit amount by each currency, and settlement currency of the companies could not be obtained. Since they are companies' information that is not disclosed, it is difficult to view. In addition, the study on the foreign currency liabilities also has not been carried out properly. If the exports had an impact on the foreign currency assets, the import or foreign currency borrowings affected the foreign exchange liabilities. However, it was not possible to get the significant values for this. Thereby, this study had no choice but to have limitations. For a more meaningful study, I hope the future analysis can be performed based on various data. If possible, I hope that the study be made in target of small and medium-sized companies not listed, and the paper can come out that can be used as a reference for even small and medium-sized companies to respond effectively to the exchange risk.

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