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Exports of SMEs against Risk? Theory and Evidence from Foreign Exchange Risk Insurance Schemes in Korea

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Abstract

Purpose – This paper examines the effectiveness of the foreign exchange risk insurance system in the promotion of SME exports in Korea. The purpose of this study is to analyze the short-term and long-term responses of SME exports to foreign exchange risk insurance support policies. Based on these empirical studies, we would like to present some operational improvements to the operation of the foreign exchange risk insurance system.

Design/methodology – In order to analyze the effect of exchange risk insurance on the exports of SMEs, a VAR model consisting of foreign exchange risk insurance underwriting values, export relative price, and domestic demand pressure, including export volume, was established. The study began with tests of the stationarity of time series data. The unit root tests showed that all concerned variables were non-stationary. Accordingly, the results of the cointegration test showed that the tested variables are not cointegrated. Finally, an impulse response function and variance decomposition analysis were conducted to analyze the impulse of foreign exchange risk insurance on exports of SMEs.

Findings – As a result of estimating the VAR (1) model, foreign exchange risk insurance was found to be significant at a 1% significance level for SME' export promotion. In the impulse response analysis, SMEs' export response to the impulse of foreign exchange risk insurance showed that exports gradually increased until the third quarter, and then slowed down. However, the impulse did not disappear, and appeared continuously.

Originality/value – This study analyzed the effect of foreign exchange insurance on exports of SMEs by applying the VAR model. In particular, this study is the first to analyze the short-term and long-term effects of foreign exchange risk insurance on exports of SMEs. The empirical evidence in the current study have a policy implication for the policy authority to support and promote the foreign exchange risk insurance in the effect of exchange rate volatility on Korea' export SMEs.

Keywords: Export Insurance, Export Promotion, Foreign Exchange Risk Insurance, Foreign Exchange Rate
JEL Classifications: F13, F32, F40

1. Introduction

In general, exporting enterprises need to prepare for currency loss due to foreign exchange fluctuation. The reality is that large enterprises respond to foreign exchange fluctuations with their own systematic systems, and SMEs do not have that capability. In the economic structure of Korea, with its higher dependency on trades, exposure to the U.S. dollar, international currency is higher, and exporting companies have managed foreign currency using various exchange risk hedge tools. One of these exchange risk hedge methods is the foreign exchange risk insurance system managed by the Korea Trade Insurance Corporation (hereinafter referred to as 'K-SURE').

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The foreign exchange risk insurance system was introduced to manage the foreign exchange risk for exporting companies as currency exchange fluctuation deepened after adopting the free fluctuating foreign currency system after the currency crisis in 1997. The system compensates exporting companies' losses and returns benefits depending on foreign currency fluctuation. Therefore, for exporting companies, by fixing the deposit amount in KRW through foreign exchange risk insurance, it removes both exchange losses and benefits from currency fluctuation. First, foreign exchange risk insurance aims to hedge the exchange risk of exporting SMEs vulnerable to conditions and abilities from managing foreign exchange risk. In compensating loss from exchange fluctuation, this is policy insurance to support exporting SMEs' active exportation activities.

As recent exchange fluctuation has been larger, the issue of exchange risk management attracts more attention, and there are many difficulties in exporting for SMEs because of external problems in trade. In these situations, exporting SMEs need to actively use the foreign exchange risk insurance system, and it is necessary to study the system. Even though the main purposes of the foreign exchange risk insurance system are exchange risk management and supporting exportation for SMEs, the there are few studies in the academic field. In particular, studies on the effects of foreign exchange risk insurance on exporting are limited to studies by Lee Jae-Hwa (2011/2018) and Lee Seo-Young (2008).

The studies by Lee Jae-Hwa (2011) and by Lee Seo-Young (2008) did not focus on SMEs suitable for the purpose of foreign exchange risk insurance. However, Lee Ja-Hwa's (2018) study analyzed the effects of foreign exchange risk insurance on the exporting of large enterprises and SMEs by corporate size. Yet, even though it tried to analyze empirically the effects of foreign exchange risk insurance of exporting of SMEs, it was limited to basic regression analysis only. In addition, as foreign exchange risk insurance is highly likely to have effects after the period of a time lag for underwriting because of its own characteristics, it is necessary to conduct empirical analysis reflecting this. For this, a method for analyzing both short- and long-term causalities at the same time is required.

Therefore, this study tries to conduct empirical analysis on the effects of foreign exchange risk insurance on increasing exportation for SMEs. For this, using a VAR (Vector Autoregression) Model, not used previously, would check if the foreign exchange risk insurance system contributes meaningfully to an increase in exporting for SMEs. Based on these empirical studies, suggesting improvements to the management of the foreign exchange risk insurance system, the study aims to make more efficient exporting promoting policies under the WTO prohibiting exporting subsidies.

The structure of this paper is as follows. Section 2 introduces the foreign exchange risk insurance scheme and a summary of previous research. Section 3 explains the model and method which examines the effectiveness of foreign exchange risk insurance in SME exports. Empirical evidence is shown in Section 4. Section 5 provides conclusions.

2. Theoretical Background

2.1. The Foreign Exchange Risk Insurance Scheme of Korea

In Korea, the major export promotion measure has been a governmental provision of export insurance services, which started in 1969. The Korean Government enacted the Export Insurance Law to promote exports and, as an export credit, the Korea Re-insurance Company which was a state-owned enterprise, was put in charge of export insurance services in 1969

(Mah Jai-Sheen, 2010). From 1977 to 1992, Korea Export-Import Bank operated export insurance. Realizing the necessity for an institution fully devoted to export insurance services, the government established the K-SURE in 1992 and it has been in charge of the export insurance system of Korea since then (Korea Trade Insurance Corporation, 2003; Mah Jai-Sheen, 2010).

As exchange rate fluctuations intensified due to foreign exchange liberalization in the early 1990s, it was required to implement an export insurance system that would allow exporters to hedge currency risks. Since the IMF crisis, the risk of exchange rate fluctuations has increased, and export companies have suffered increased losses from exchange rate fluctuations. Accordingly, K-SURE introduced a foreign exchange risk insurance system in February 2000.

The foreign exchange risk insurance system was introduced for easy exchange risk hedging for exporting companies, in particular for vulnerable exporting SMEs. The basic contents of the contract settle benefits from differences between a foreign exchange rate guaranteed by K-SURE (guaranteed exchange rate) and at the time of payment (payment exchange rate). Foreign exchange risk insurance is basically similar to forward exchanges by financial institutions, but has the characteristics of an insurance contract. Foreign exchange risk insurance consists of forward exchange for ordinary exporting companies, and bidding for construction companies abroad and those exporting plants (Lee Eun-Jae and Oh Tae-Hyung, 2007).

The forward type of foreign exchange risk insurance compares the exchange rate guaranteed by K-SURE and that at the actual payment time in cases of export transaction and import transaction for raw materials to be exported, or the exchange rate guaranteeing the difference and that in the actual payment time, then compensates or returns the difference, compensating the loss and returning the benefit to exporting companies due to currency exchange fluctuation. That is, when the exchange rate is down, the loss is compensated, and if it is up, the benefit is compensated as an exchange rate hedge. The merit of this system is in its availability for omitting procedures such as an evidence deposit and offering securities for executing a contract required for a forward exchange or transaction. In addition, there is no additional cost except for the premium. Also, any exporting company without any problems with its credit can be insured. The insurance period can be maximally guaranteed for 3 years and 6 months from the subscription, available for an exchange risk hedge for long-term export contracts, such as plants and vessels.

The range forward type of foreign exchange risk insurance exposes exchange risk in some range for future foreign currency exporting payments. However, if the market exchange rate at the due date is higher than some upper exchange rate determined in advance, the benefit should be returned to K-SURE, or if it is lower than some lower exchange rate, the insured amount shall be acquired. Therefore, it fixes a future exchange rate in range between upper and lower exchange rates.

For a put spread option type of foreign exchange risk insurance, the market exchange rate if the due is higher than the upper rate determined in advance, exporting companies do not need to settle with K-SURE. Exporting companies enjoy benefits from a higher exchange rate. If the market exchange rate at the due time (payment exchange rate) is between the upper and lower exchange rates determined in advance, the insured amount (differences between upper exchange rate and payment exchange rate) shall be acquired from K-SURE. However, if the payment exchange rate is lower than the lower rate previously determined, the insured amount shall be acquired; yet, the compensated amount is limited to the difference between the upper and lower exchange rates. That is, if the exchange rate is rising, all the difference

could be available and yet, if the rate is down, the insured amount is limited at some level.

For a put option type of foreign exchange risk insurance, if the market exchange rate at due (payment exchange rate) is higher than the predetermined upper exchange rate, exporting companies do not need to settle with K-SURE. Exporting companies may enjoy differences from a higher exchange rate. However, if the payment exchange rate is lower than upper one, the insured amount (the difference between upper exchange rate and payment exchange rate) shall be acquired from K-SURE. Namely, if the exchange rate rises, the full amount of the difference can be offered, while the entire amount of loss is compensated as the insured amount if the exchange rate falls.

Table 1. Types of Foreign Exchange Risk Insurance

		Contents	Characteristics
Forward		If the exchange rate falls, K-SURE pays the foreign exchange loss (insurance), and if the exchange rate rises, the company pays foreign exchange gains (clawback). * Insurance : Guaranteed exchange rate > Payment exchange rate * Clawback : Guaranteed exchange rate < Payment exchange rate	If the exchange rate falls, the guarantee is excellent. Currency : USD/JPY/EUR/CNY
Option Type	Range Forward	Exposed to foreign exchange risk up to a certain range, but pays insurance when it falls below a certain exchange rate, and pays a clawback when it rises above a certain exchange rate.	The burden of the clawback is eased, and the premium is the same as a general futures exchange. A range of exchange risks are exposed. Currency : USD/JPY/EUR
	Put Spread Option	If the exchange rate falls, insurance payments (up to 20-80 won per foreign currency) are exempt from a clawback in the case of an exchange rate rise.	No burden on companies even if exchange rate rises. Currency : USD/JPY/EUR
	Put Option	If the exchange rate falls, insurance payments (full compensation), are exempt from a clawback when the exchange rate rises.	No insurance payment limit in case of an exchange rate fall. Currency : USD/JPY/EUR

Source: K-SURE.

The application status of foreign exchange risk insurance introduced for the purpose of promoting export through currency risk hedging is as follows. The values of foreign exchange risk insurance underwriting have increased from a mere 4,834 billion won in 2000 to 67, 497 billion won in 2006. However, values of underwriting have continuously reduced 85,550 billion won in 2008 to 12,262 billion won in 2015 and then 7,749 billion won in 2018.

The coverage ratio, defined as the amount of export contracts insured by the export insurance services, increased from less than 1 percent throughout in 2000 to 6.83 percent in 2006. However, the coverage ratio of throughout most of the 2010s is less than 1 percent, as shown in Table 2. As such, foreign exchange risk insurance has a very low share of support for SMEs' exports. Many export SMEs are not properly managing currency risks using foreign exchange risk insurance. Therefore, export SMEs need to manage currency risk easily by actively utilizing foreign exchange risk insurance, which is advantageous in terms of cost and procedure, as well as external growth such as export performance.

Table 2. The Tendencies of Values of Underwriting and Coverage Ratio, 2000-2018

(Unit: Billion won, %)

	2000	2003	2006	2009	2012	2015	2018
Coverage Ratio	0.79	2.21	6.83	0.77	0.56	0.57	0.34
Values of Underwriting	4,384	23,198	67,497	13,435	17,139	12,262	7,749

Source: K-SURE (2019).

2.2. Previous Research

Previous studies on foreign exchange risk insurance include those by Lee Seo-Young (2008), Lee Yoo-Woo and Song Jeong-Seok (2015), Lee Jae-Hwa (2011/2018) and Song Jeong-Seok (2017). Lee Yoo-Woo and Song Jeong-Seok (2015) and Song Jeong-Seok (2017) provided empirical evidence for the foreign exchange risk insurance, and Lee Jae-Hwa (2011/2018) and Lee Seo-Young (2008) conducted an empirical study on the effects of foreign exchange risk insurance on exports.

Lee Yoo-Woo and Song Jeong-Seok (2015) analyzed the dynamic determinants of foreign exchange risk insurance using a vector error correction model. As the determinants of demand for foreign exchange risk insurance, variables such as the US interest rate, exchange rate, export, and foreign exchange risk premium were selected. The empirical results showed that the exchange rate and US interest rate had a significant effect on foreign exchange risk insurance demand. Song Jeong-Seok (2017) adapted a structural VAR (SVAR) approach and explored dynamic response foreign exchange risk insurance on the structural innovations of the Won-Dollar exchange rate, exchange rate volatility, export, and foreign exchange risk insurance money. The results showed that insurance money had a strong effect on insurance demand, while the Won-Dollar exchange rate and its volatility had moderate effects.

On the other hand, studies related to this study are those of Lee Jae-Hwa (2011/2018) and Lee Seo-Young (2008). Lee Seo-Young (2008) examined whether or not foreign exchange risk insurance promoted Korean exports. The empirical analysis was carried out by applying the export supply function model. The variables used in the analysis were the export relative price, unemployment rate, and foreign exchange risk insurance. This study conducted empirical analysis using OLS based on the use of difference methods. The results of empirical analysis suggested that the foreign exchange risk insurance system was not significant for Korea's export promotion.

Lee Jae-Hwa (2018) analyzed the effect of foreign exchange risk insurance on export performance by company size. In this study, an export demand function model was set up using monthly data from 2000 to 2017. Empirical analysis was carried out including foreign income, export price, exchange rate, and foreign exchange risk insurance as independent variables affecting the export of large firms and SMEs. In particular, the effects of foreign exchange risk insurance were classified into direct and indirect effects, and the effects on exports by company size were compared and analyzed. The results of empirical analysis showed that foreign exchange risk insurance contributed to the export growth of SMEs, although it was not significant for the export growth of large enterprises. Lee Jae-Hwa (2011), on the other hand, performed an empirical analysis on the effect of exchange rate risk insurance on total exports without company size. The results confirmed that foreign exchange risk insurance did not have a direct or indirect effect on Korea's export growth.

Papers that study the effects of foreign exchange risk insurance on exports have many

problems, although they try empirically analysis. They have only a very basic regression analysis, and they did not consider the non-stationarity problem of time series data, and thus do not provide meaningful results. In addition, Lee Seo-Young (2008) has a problem with empirical research methods. Although the cointegration test was carried out in the course of research, the small sample in the model has a problem in that the degree of freedom through the cointegration test became very small. In other words, the Johansen cointegration test, which is commonly used in the case of applying a small sample cointegration test method, has a problem, casting doubt on the reliability of the research results. In addition, foreign exchange risk insurance is likely to have an effect in the subsequent period with the time lag of insurance underwriting. Accordingly, empirical analysis that reflects this situation should be conducted. Therefore, a research method is needed to analyze both short-term and long-term causality at the same time.

3. Model and Data

3.1. Data

The purpose of this study is to analyze the effect of foreign exchange risk insurance on the exports of SMEs. To this end, we use SME export performance, foreign exchange risk insurance underwriting values, export relative prices, and domestic demand pressures as endogenous variables.

The data used for the empirical analysis were quarterly data. The analysis period was from Q2 of 2000 to Q4 of 2018, when the foreign exchange risk insurance system was implemented. The exports variable was computed as the total exports divided by the export price index as the proxy variable of total exports, and the foreign exchange rate insurance data used real foreign exchange risk insurance underwriting values converted to a GDP deflator. Export relative price was calculated as the export price index divided by the producer price index. For domestic demand pressure, the unemployment rate was used as a proxy variable.

The data used in this study was assumed to have seasonality, and therefore seasonal adjustments were made using the X-11 ARIMA method to remove this. The logarithmic value was then used for analysis. This is shown in Table 3.

Table 3. Description of Data Used for Analysis

Variables	Variable Description	Source
Total Exports (lnEXQ)	Natural logarithmic conversion of quarterly exports	Statistics of Korea
Foreign Exchange Risk Underwriting Values (lnREI)	Natural logarithmic conversion of quarterly foreign exchange risk underwriting values	K-SURE Database
Export Relative Price (lnRP)	Natural logarithmic conversion of quarterly export relative price (export price index / producer price index)	Bank of Korea
Domestic Demand Pressure (lnDP)	Natural logarithmic conversion of quarterly unemployment rate	Statistics of Korea

3.2. Methodology

This study analyzes the effect of foreign exchange risk insurance on exports of SMEs using

analysis methods such as VAR model analysis, impulse response function analysis, and variance decomposition analysis using a vector autoregressive model.

Before empirical analysis, a unit root test was performed to test the stability of the time series variables. If the unit root test proves that a unit root exists, it is converted to a stable time series through the first difference.

If the concerned variables are I (1), it is necessary to check whether there exist any long-run equilibrium relationship(s) between the concerned variables using cointegration tests. If there exists at least a cointegrating vector among the concerned variables, we can conclude that there are long-run equilibrium relationship(s) between these variables, even if they are non-stationary. This paper used Johansen's (1988/1991) method to test the cointegration relationship. If the cointegration test reveals that there does not exist such a relationship, then it is necessary to use the VAR model.

After verifying the stability of the time series data through a unit root test and cointegration test, in order to verify the causality among random variables, the Granger causality test was conducted. Finally, in order to precisely analyze the effects of each variable on SME exports, an impulse response function analysis and VDA of the forecast errors were conducted. In particular, an impulse response function analysis and VDA of forecast errors through a VAR model enable the checking of the short-term and long-term effects of foreign exchange risk insurance on SME exports for the following period after a one unit impulse on the foreign exchange risk insurance.

3.3. Research Model

In order to analyze the effects of foreign exchange risk insurance on the exports of SMEs, a VAR model consisting of the variables of foreign exchange risk insurance underwriting values, export relative price, and domestic demand pressure, including exporting amount, was set. VAR model was developed by Sims (1980) and back then it was a multiple variable time series model for figuring out inter-dependence among time series variables in macroeconomics, excluding a priori judgment by economic theories. In this study, in order to set the forecast model, variables affecting the exports of SMEs were extracted by verifying causality. Even though there is a significant relationship between two variables, if a similar variable is included in the model, there may be a problem of multicollinearity. With the quantitative analysis results, among the variables having theoretical reliability, considering the significance and appropriateness of the model, the following variables were included in the VAR model.

The VAR model has a structure of variables becoming dependent in order, and the time lag variable of all variables, including those dependent, as description variables. The VAR model set for the empirical analysis in this study is as follows.

$$Y_t = C + \sum_{i=1}^{k} \beta_t Y_{t-1} + \varepsilon_t$$

Where $Y_t = Y_{1t}, Y_{2t}, Y_{3t}, Y_{4t}$

Y_{1t}: Total Exports of SMEs

Y_{2t}: Foreign exchange risk insurance underwriting values of SMEs

Y_{3t}: Export relative price

Y_{4t}: Domestic demand pressure

C : Constant

ε_t : Error term

4. Empirical Evidence

4.1. Unit Root Test

If the time series data used in analysis are unstable, the analysis becomes unreliable. Since regression analysis using non-stationary variables may lead to spurious regression, it is necessary to check the stationarity of the concerned variables (Nelson and Kang, 1981). Therefore, a unit root test is necessary to determine the time series data's stability. The unit root test used was an augmented Dickey-Fuller (ADF) method, and a Phillips-Perron (PP) method to analyze the data (Dickey and Fuller, 1979; Phillips and Perron, 1988). Also, for lag selection, the Akaike Information Criterion (AIC) was applied. Optimal lags in the unit root tests were chosen by applying the Akaike Information Criterion.

The Mackinnon critical values for the 10%, 5%, and 1% significance levels for the "H_0 : Has unit root" null hypothesis are –2.589, –2.903, and –3.527, respectively. The Mackinnon critical values are the same for the ADF test and the PP test. The results of the unit root test for each variable used in this study are shown in Table 4 below.

Table 4. Unit Root Test Results

	Level Form		First-Differenced Form	
	ADF	**Phillips-Perron**	**ADF**	**Phillips-Perron**
lnEXQ	-2.01	-2.87	-13.70***	-13.77***
lnREI	-2.49	-2.56	-13.99***	-19.65***
lnRP	-2.09	-2.12	-7.67***	-7.65***
lnDP	-2.48	-2.37	-10.81***	-10.69***

Notes: 1. A linear trend term is included in the data.
2. *** means significance at the 1% level.

The ADF and PP unit root test results show that the levels of the concerned variables are not stationary at any reasonable level of significance. Therefore, it is necessary to examine whether or not the first differenced forms of the concerned variables are stationary.

Table 4 shows that the first differenced forms of all concerned variables are stationary at a 1% level of significance, although their level forms are revealed to be non-stationary at any reasonable level of significance. The results are the same regardless of inclusion of a trend term in the unit root test.

4.2. Cointegration Test

According to Engle and Granger (1987), even if individual economic time series changes are unstable, and if there is a linear combination for a long-term stable balance among these time series, this combination could be normal, and it is a cointegration relationship. Engle and Granger limited this with the ADF verification method, and yet with ADF verification, depending on standardization with variables (using which variable as the dependent one), the results could not be matched. Also, in the case of more than three variables, it is difficult to apply. However, Johansen (1988/1991/1992) and Johansen and Juselius (1991) suggested a method to presume and verify numbers in cointegration and parameters in the model with MLE (Maximum Likelihood Estimation). This is generally called the Johansen procedure,

and it is understood as an extension of the ADF test with multiple variances (more than three variables).

Table 5. Results of Johansen's Cointegration Test

H_0: Number of Cointegrating Equations	Eigenvalue	Trace Statistics	5% Critical Value	Maximum Eigenvalue Statistics	5% Critical Value
None	0.1710	30.7611	47.8561	12.9464	27.5843
At most 1	0.1254	17.8177	29.7970	9.24712	21.1316
At most 2	0.0882	8.57058	15.4947	6.37215	14.2646
At most 3	0.0313	2.19843	3.84146	2.19843	3.84146

Notes: 1. The calculated statistics are those on one lag and no trend term in the data.
2. $H_0 : r = 0$ (If the null hypothesis is adopted, there is no cointegrating vector).

According to Engle and Granger, we performed a cointegration test using the Johansen test method. The test results are presented in Table 5. The existence of long-run equilibrium relationships among the concerned variables is examined by the Johansen cointegration procedure. The inequality for the null hypothesis of the Johansen cointegration test is that "the number of cointegration vectors is less than or equal to". As shown in Table 5, the test value is $\lambda_{\text{trace}}(0)$=30.76, indicating that the null hypothesis cannot be rejected at the 5% significance level. In the cases of r≤1, r≤2, and r≤3, the null hypothesis also could not be rejected. That is, according to Johansen's trace test and maximum eigenvalue test statistics, the null hypothesis that there does not exist any cointegrating vector among log EXQ, log RP, log DP, and log REI is not rejected at the 5% level of significance, as shown in Table 5. Although Table 5 reports the cases without a trend term, the inclusion of a linear trend term does not change the result qualitatively. Therefore, we can conclude that the concerned variables are not cointegrated.

Since it was found that there is no cointegration relationship between variables with unit roots, an OLS (Ordinary Least Squares) analysis of level variables was not possible (Engle and Granger, 1987). If there is a cointegration relationship, empirical analysis should be performed via VECM (Vector Error Correction Model). However, based on the analysis results thus far, it cannot be estimated by VECM. In this case, it is more appropriate to use a VAR model.

4.3. Granger Causality Test

As a VAR Model could be different depending on the order of variables, it is important to analyze this order. In this study, the order of variables was determined by a Granger Causality test for figuring out whether it was exogenous, namely whether there is independence or causality in regression model. When using a Granger causality test, one should be cautious about the test assuming the normality of variables. Therefore, as each variable has a unit root, the Granger Causality test was done by using variables at the first difference.

As a result of the Granger Causality test, within a significance level of 1%, export relative price showed Granger Causality with values of foreign exchange risk insurance underwriting. The relationships of *lnRP←lnREI*, *lnRP←lnDP*, and *lnDP←lnREI* showed Granger Causality as well, while the causality of *nRP←lnDP←lnREI* could not be determined.

Table 6. Results of the Granger Causality Test

Null Hypothesis	F Statistic	P-Value
lnRP does not Granger Cause lnREI***	6.61641	0.0024
lnREI does not Granger Cause lnRP	0.70990	0.4955
lnREI does not Granger Cause lnDP	0.68094	0.1905
lnDP does not Granger Cause lnREI	1.70203	0.1905
lnRP does not Granger Cause lnDP	1.88021	0.1609
lnDP does not Granger Cause lnRP	0.16629	0.8472

Note: *** means significance at the 1% level.

4.4. Vector Autoregressive Model Analysis

A VAR model has different results depending on the order of time lag. Table 7 suggests the results of FPE (Final prediction error), AIC (Akaike information criterion), SC (Schwarz information criterion) and HQ (Hannan-Quinn information criterion) for determining the order of time lag in the VAR model.

Table 7. Lag Order Selection Criteria of the VAR Model

Lag	FPE	AIC	SC	HQ
0	1.692506	-1.940833	-1.805903	-1.887677
1	5.213509	-7.722952	-7.048301*	-7.504696*
2	4.041209	-7.983098	-6.768726	-7.457173
3	4.904509	-7.805406	-6.051313	-7.114380
4	4.484109	-7.924586	-5.630773	-7.020937
5	3.003129	-8.372330	-5.538796	-7.256058
6	3.322109	-8.347464	-4.974209	-7.018568
7	3.513509	-8.401182	-4.488206	-6.859663
8	2.672409*	-8.829132*	-4.376436	-7.074990

Note: * indicates lag order selected by the criterion.

For the AIC criterion, it is desirable to include a time lag of the VAR model of 8, and for SC criterion, a time lag of 1 is appropriate. It is known that AIC tends to identify more parameters than SC. In general, proper time lag shall be determined based on SC information. If time lag is included too much, a problem of series correlation in the error term might be solved, and yet the model becomes complex with lower efficiency, having a trade-off. Accordingly, the time lag of the VAR model in this study seems to be one (1) based on SC criteria.

In order to the analyze the dynamic effects of foreign exchange risk insurance on the exports of SMEs, the purpose of this study, impulse response function analysis and variance decomposition analysis were conducted through a VAR (1) model. That is, for the focus of this study, VAR (1) estimation is about impulse response analysis and variance decomposition analysis. The empirical analyses on the effects of foreign exchange risk insurance on the exports of SMEs was conducted by concentrating on both analyses.

Table 8 shows the results of the estimation of the VAR (1) model, and except for domestic demand pressure, all the variables were found to affect exports. The amount of exports (lnEXQ) and the values of foreign exchange risk insurance underwriting (lnREI) showed

positive effects within the 1% significance level, while the export relative price (lnRP) showed a positive effect within the 10% significance level.

Table 8. Results of Vector Autoregressive Model Analysis

	lnEXQ	lnRP	lnDP	lnREI
lnEXQ(-1)	3.509***	-0.008	0.07	-2.80***
	(4.48)	(-0.38)	(1.56)	(-3.62)
lnRP(-1)	2.413*	0.956***	0.08	-2.81**
	(2.01)	(9.36)	(1.11)	(-2.38)
lnDP(-1)	-0.256	-0.03	0.68***	0.30
	(-0.20)	(-0.90)	(8.76)	(-0.23)
lnREI(-1)	3.116***	-0.007	0.07	-2.42***
	(3.71)	(-0.30)	(1.44)	(-2.91)
C	-51.93***	0.19	-1.08	57.77***
	(-3.26)	(0.45)	(-1.12)	(15.72)
R-squared	0.59	0.80	0.58	0.47
F-statistic	24.15	722.28	23.2	15.07

Notes: 1. Values within the parentheses below the estimated coefficients denote the calculated t-statistics.
2. *, *** indicate significance at the 10% and 1% levels, respectively.

4.5. Impulse Response Function Analysis

In the VAR model, the impulse response function is an average motion model drawn from the model when there is an unexpected impulse on the economy, it shows every variable in the model's response to an impulse as time passes. For continuity, it is easily seen in graphs. Basically, for the impulse response function, when there is an impulse of standard deviation on specific variables within the model, it analyzes the responses of these variables in the model according to time flow.

In this study, using the impulse response function, the effects of foreign exchange risk insurance on the exports of SMEs and how long they were affected were analyzed. From Fig. 1 to 4, if there was an impulse on exports, export relative price, domestic demand pressure, and values of foreign exchange risk insurance underwriting, it shows the impulse response function standing for the response of the exports of SMEs. The horizontal axis of the graph shows the period (quarter), and the vertical is the coefficient of the effects of the impulse of standard deviance 1 on exports.

For the dynamic effects of an export relative price impulse on exports, after the first impulse, it was largest until Period 2, and then it decreased quickly. In particular, by Period 6, it showed a positive (+) effect, and in the next period, there was a negative (-) effect. Domestic demand pressure's dynamic effects on exports of SMEs were seen in the early stage of the impulse, and then disappeared.

For the response of exporting SMEs (lnEXQ) on an impulse of values of foreign exchange risk insurance underwriting (lnREI), from the impulse to Period 3, it can be seen that exports are rising gradually, and then the rise is alleviated. However, even if the rise slows, the impulse effects did not disappear. In fact, it shows indefinite positive effects of an impulse of foreign exchange risk insurance on exports. As the values of foreign exchange risk insurance underwriting increases, the increasing effect of exports of SMEs appears based on middle-term and long-term perspectives. On the contrary, if the values of underwriting is reduced,

this implies negative effects on exports of SMEs. Therefore, it is said that SMEs' exports are increasing, as the values of foreign exchange risk insurance underwriting increases, and this shows that exporters have reduced risk as they cover the insurance, and as a result, exports are increasing.

Fig. 1. Response of lnEXQ to lnEXQ

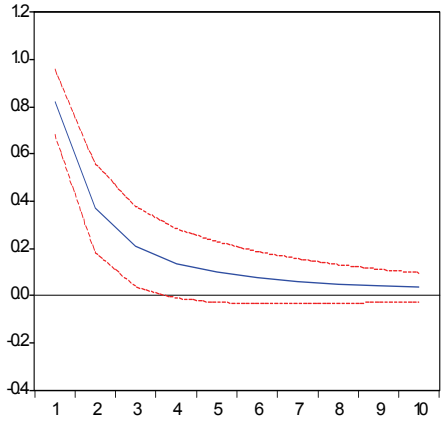


Fig. 2. Response of lnEXQ to lnRP

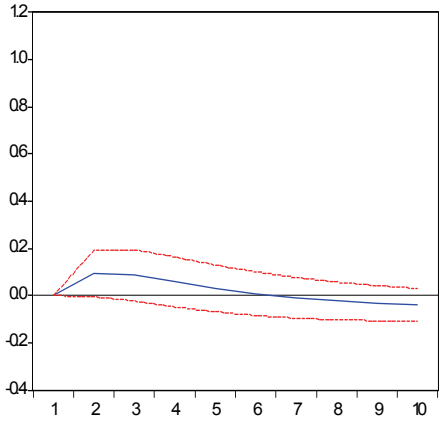


Fig. 3. Response of lnEXQ to lnDP

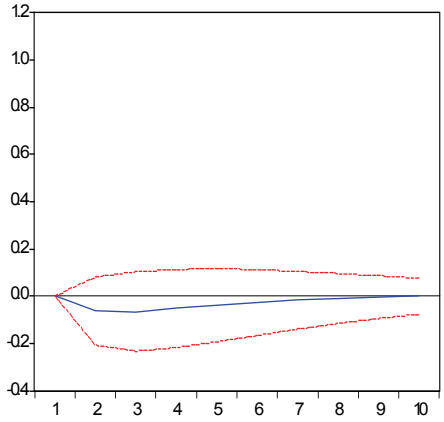
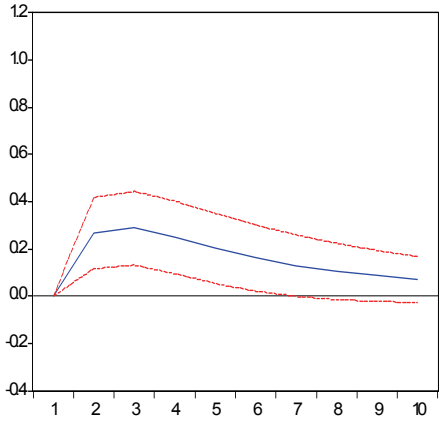


Fig. 4. Response lnEXQ to lnREI



4.6. Variance Decomposition Analysis

Variance decomposition analysis shows the relative contribution by calculating the share of fluctuation of individual description variables in the model with the percentage of forecast error variance from increasing the forecast period of an endogenous variable. That is, the relative importance on the fluctuation of endogenous variables of the VAR model's error terms can be measured by forecast error VDA.

The results of VDA showing how the error terms of export relative price, domestic demand pressure, and values of foreign exchange risk insurance underwriting explaining forecast errors in the VDA of the exports are shown in Table 9. In particular, the fluctuations due to

the effects of the values of foreign exchange risk insurance underwriting on variance of SME exports are shown.

Table 9. Results of Variance Decomposition Analysis

Period	lnEXQ	lnRP	lnDP	lnREI
1	100.00	0.0000	0.0000	0.0000
2	90.616	0.9519	0.4524	7.9789
3	82.701	1.5361	0.8104	14.951
4	77.973	1.7145	0.9997	19.312
5	75.292	1.7128	1.0853	21.909
6	73.740	1.6705	1.1175	23.471
7	72.793	1.6514	1.1244	24.430
8	72.172	1.6778	1.1208	25.029
9	71.727	1.7523	1.1138	25.406
10	71.379	1.8688	1.1071	25.644

For summarizing the results of the VDA, the fluctuation of exports themselves by period 10 explained over 70% of the forecast errors. In early exporting fluctuation, impulse effects of exporting relative price, domestic demand pressure, and the values of foreign exchange risk insurance underwriting was small, but as time passed, the impulse effects of the values of foreign exchange risk insurance underwriting became bigger. Specifically, the impulse effect of the values of foreign exchange risk insurance underwriting were about 25%. For the VDA of SME exporting, in the middle-term and long-term perspectives, the results of the values of foreign exchange risk insurance underwriting had bigger effects than other factors.

5. Summary and Conclusion

The current paper examined whether foreign exchange risk insurance provided by the Korean government promoted SME exports in Korea considering export relative price, domestic demand pressure, and foreign exchange risk insurance as possible determinants of SME exports. In particular, empirical analysis was conducted on how long-term and short-term impulses of the foreign exchange risk insurance system affect the exports of SMEs using a VAR model, which had not been attempted in previous studies.

Unlike previous studies revealing the effectiveness of foreign exchange risk insurance in SME exports, the current study examined the non-stationarity nature of the concerned variables. The unit root tests showed that all concerned variables were integrated at order one. The Johansen cointegration test results showed that all concerned variables were not cointegrated.

The empirical results using a VAR (1) model showed that the coefficient of foreign exchange risk insurance is significant at the 1% level of significance, and its elasticity was 3.116. The empirical evidence in the current study is consistent with the study of Lee Jae-Hwa (2018).

Using the impulse response function, the results of analyzing the short-term and long-term effects of foreign exchange risk insurance on SME exports are as follows. For the response of SME exports on the impulse of foreign exchange risk insurance, from the time of an impulse to Period 3, exports increased gradually, and then the increase was somewhat alleviated. However, even though the increase was slowing down, the impulse effect did not disappear.

This fact shows indefinite positive effects of the impulse of foreign exchange risk insurance on exports. According to the increase of the values of foreign exchange risk insurance underwriting, it was confirmed that the effects of increasing SME exports appeared based on the middle-term and long-terms. Therefore, it is said that the exports of SMEs are increasing. As the values of foreign exchange risk insurance underwriting increases, this means that exporters have reduced risk as they cover the insurance, and as a result, exports are increasing.

It was shown that the foreign exchange risk insurance system is well used as a tool for minimizing SME damages by foreign exchange risk and for managing foreign exchange risk effectively, and plays an important role for policies as a system for supporting increasing exports. Accordingly, it is necessary to respond continuously in policies through positive guidelines about foreign exchange risk insurance and extending support for it to SMEs vulnerable to foreign exchange risk management in a times of extended and dramatic changes in foreign exchange fluctuation.

Even though the foreign exchange risk insurance system is suitable for exporting SMEs, its use is considerably low due to its complex procedures, difficulties in use, and lack of recognition. Therefore, in order to allow exporting SMEs use it more easily, it should be improved to be more convenient, and for increasing its use, it is necessary to promote the foreign exchange risk insurance system. In addition, this necessitates the enhancing competitiveness of the foreign exchange risk insurance by reducing the premium, or other solutions.

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