THE EFFECT OF REAL EXCHANGE RATE VOLATILITY ON TRADE PERFORMANCE-THE CASE IN INDONESIA IN THE 1990'S

by
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Abstract

This study employs empirical method to investigate the link between real exchange rate volatility and Indonesian trade performance in 1990s. Being worst hit by the crisis of 1997-1998, Indonesian trade volume was not improved by devaluating its currency. This paper adopts Johansen multivariate cointegration and vector error-correction techniques to understand the implication of real exchange rate volatility for a country's exports and imports. The results, which includes only pre-crisis, indicate a negative effect of real exchange rate volatility for Indonesian exports and imports.

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1 Introduction

Exchange rates are important. Changes in exchange rates have a profound influence on the economy. Any variation in exchange rates will have consequences for economic fundamentals such as interest rates, prices, balance of payments and employment opportunities, and thus further affect the welfare of all economic participants. Because of their decisive role in the economy, exchange rate economics is constantly studied.

Since the collapse of the Bretton Woods system of fixed exchange rates, foreign exchange rates have exhibited large fluctuations. The volatility of exchange rates generates uncertainty, which can have a negative effect on the volume of trade.[1] At the same time, many studies of exchange rate volatility on the volume of international trade have been conducted during the time. However, almost no studies have focused on Asian developing countries until the financial crises in 1997. This painful experience drew economists and policy makers' attention to the factors causing the crisis. As one of the most important fundamental economic variables, therefore, the impact of exchange rate volatility on international trade in Asian developing countries becomes the hottest topic among the economists. The interesting issue arising in this paper is whether rising exchange rate volatility increases or decreases Indonesia's international trade volume.

[1] Hooper, Peter and Steven W.Kohlgagen argued in this contexts 1978 that the time lag between the payment and future delivery depressed the international trade if exchange rate become more volatile. (see Hooper (1978)).

There is, of course, the open question as to whether exchange rate volatility benefits or inhibits the growth of international trade. The conventional argument is that exchange rate volatility increases uncertainty and therefore dampens international trade volume. Clark (1973), Cushman (1986), Peree and Steinherr (1989) have shown that an increase in exchange rate volatility has a statistically significant negative impact on the volume of international trade. On the other hand, several recent studies have found evidence that exchange rate volatility can stimulate trade. Brade and Mendez (1988) and Asseery and Peel (1991) demonstrate that level of trade is significantly higher in a floating rate regime. Moreover, many empirical studies cannot establish a significant relationship between exchange rate volatility and international trade volume. Kumar (1992) and Froot and Klemperer (1989) obtained mixed result.

Although great attention has been paid to Asian developing countries since the financial crisis, few have focused on the impact of exchange rate volatility on the trade performance in Indonesia.[2] Indonesia, the country worst hit by the crisis of 1997-1998, has adopted a managed floating exchange rate since 1978, and a free floating exchange rate system since August 1999. However, the export sector of Indonesia was not boosted under the flexible exchange rate system. Rather than stimulating export growth, a depreciation of the rupiah against the US dollar, especially in 1997-1998, brought about a collapse of the country's exports.[3] Indonesian total exports (merchandise goods) were 8.5 percent lower in 1998 than in 1997. Although there are many possible reasons for the disappointing export performance of Indonesia, the floating exchange rate system

[2] Reza Siregar and Ramkishen S. Rajan did their studies on March 2002 in terms of this issue.

[3] In 1997-1998, Indonesia experienced a severe depreciation of the rupiah against the US dollar. Rupiah declined by an average of 0.8 percent per day in nominal term during the time.

seemingly has had a negative effect on export growth, at least it does not show any positive effects on export sector.[4]

The objective of this paper is to investigate the impact of exchange rate volatility on Indonesia's trade performance by testing price, income and exchange rate volatility. An estimated model of Indonesia's exports and imports will be constructed to help to understand the country's trade performance. The Johansen Cointegration tests and Error Correction Model are used to test the long run and short run relationship between trade volume and its determinants. The reminder of the paper will be structured as follows. Section 2 briefly explains the model, data and variables adopted by this paper. Section 3 discusses test results and related empirical questions. Section 4 concludes.

[4] When Indonesia devaluated its currency, the other countries also did so. In addition, unstable political environment played detrimental role in the poor export performance.

2 Model, Data and Variable Definition

2.1 Model Specification

The equilibrium export and import demand functions are specified as follows[5]:

$$X_t = \beta_{01} + \beta_{11} Y_t^{foreign} + \beta_{21} P_t + \beta_{31} E_t + \beta_{41} V_t + \varepsilon_{t1} \quad (1)$$

$$M_t = \beta_{02} + \beta_{12} Y_t^{local} + \beta_{22} P_t + \beta_{32} E_t + \beta_{42} V_t + \varepsilon_{t2} \quad (2)$$

Where:

X_t : the natural logarithm of real export volume;

M_t : the natural logarithm of real import volume;

$Y_t^{foreign}$: the natural logarithm of real foreign income;

P_t : the terms of trade;

E_t : the natural logarithm of real exchange rate;

V_t : volatility of the real exchange rate.

An increase in foreign income will lead to an increase in exports and thus the coefficient β_{11} is supposed to be positive. Total exports ought to decrease when a country's terms of trade increases as the domestic goods become less competitive relative to the foreign goods. Equation (1) and (2) are assumed to represent demand, not supply. Hence, it is

[5] Notes, these equations ignore the feedback from trade flows to exchange rates. Hence, I am implicitly assuming that exchange rates mainly respond to capital flows (the capital account), with trade flows then making necessary adjustment via exchange rate changes.

implicitly assumed supply is infinitely elastic. Therefore, the coefficient β_{21} is expected to be negative. By vice versa, the sign of β_{12} and β_{22} would be positive. A depreciation of national currency against its trading partner's currency will stimulate the country's exports, while an appreciation of national currency will expand the country's imports. Therefore, β_{31} is expected to be positive and β_{32} is expected to be negative. As mentioned in the introduction section, the impact of exchange rate volatility on exports and imports is unclear. Therefore, the sign of β_{31} and β_{32} could be either positive or negative.

2.2 Data and Variable Definition

Most of the data used in this paper were obtained from *International Financial Statistics (IFS)* published by the International Monetary Fund and *United Nation Database*. In order to avoid any structural break, the data are quarterly covering only pre-crisis period from 1980:1 to 1997:2. Quarterly GDP data for Indonesia were not available and therefore the interpolated data done by Professor Tevel Abeysinghe of National University of Singapore are used.[6]

a) Export and Import Volume

Learner and Stern (1970) suggest that it is more appropriate to measure trade by volume than by trade valuc. Volume data for Indonesia exports and imports are not available. Therefore, to get total volume of Indonesia's exports, we use value of Indonesia's total exports to the world divided by its unit value of export. The same method is employed to

[6] See professor's web page : http://courses.nus.edu.sg/course/ecstabey/Tilak.html.

calculate the total volume of Indonesia's imports. As Indonesia's unit value of import cannot be directly observed, world unit value of exports is used as a proxy for its unit value of imports.[7]

b) Income

Quarterly real GDP of Indonesia is used as a proxy for its real income. The world real income cannot be directly observed. Therefore, we use the trade weighted sum of the GDP of Indonesia's ten major trading partners as a proxy for the world real income.[8].Assigned weighted to each trading partner can be found in Appendix F Table 8.

c) Terms of Trade

"Terms of trade" is the ratio of country's export price to its import price. Since Indonesia's import price is not observed, world export price is used as a proxy for its import price. Therefore the terms of trade of Indonesia is expressed as follow

$$p_t = \frac{Exportprice^{indonesia}}{Exportprice^{world}} \qquad (3)$$

d) Real Exchange Rate

The nominal exchange rate used in this paper is defined as the market price of Indonesia Rupiah against US dollars (Rupiah/US$). The real exchange rate of Indonesia Rupiah

[7] The export unit price is obtained from International Financial Statistics CD ROM.
[8] The weight assigned to each trading partner is based on their exports and imports share in 2002 provides by Statistical Bureau of Indonesia.

against the US dollar is calculated by multiplying the nominal exchange rate by the relative wholesale prices of Indonesia to the United States:

$$RER_t = NER_t \times \frac{WPI_t^{Indo}}{WPI_t^{US}} \qquad (4)$$

e) Volatility

There are numerous measures for exchange rate volatility. Standard deviation of exchange rate method is commonly used in the literature. A Moving Average standard deviation (MASD) was first adopted by Keneth and Rodirik (1986).[9] However, the exchange rate has a skewed distribution instead of a normal distribution. Therefore, Boothe and Glassman (1987) argued that it is inappropriate to use standard deviation of exchange rate as a proxy for volatility. This study employs a GARCH method to measure the exchange rate volatility. A model specification is shown as follows:

$$\ln RER_t = \beta_0 + \beta_1 \ln RER_{t-1} + e_t, \text{ where } e_t \sim N(0, h_t) \qquad (5)$$

$$h_t = \beta_0 + \delta e_{t-1}^2 + \gamma h_{t-1} + \mu_t \qquad (5b)$$

The equation (Equation 5b) is a conditional variance equation which is a function of three terms: i) the mean, β; ii) information about volatility from the previous period, expressed by lag of the squared residual from the mean equation, e_{t-1}^2 (the ARCH term); and iii) forecast error variance of last period, h_{t-1} (the GARCH term). Because GARCH

[9] It is computed by the formula: $V_t = \left[\left(\frac{1}{m}\right) \sum_{i=1}^{m} \left(\ln ER_{t+i-1} - \ln ER_{t+i-2} \right)^2 \right]^{1/2}$

model can capture time varying conditional variance, it can be a very good proxy for real exchange rate volatility.

3 Empirical Test and Results

3.1 Unit Root Tests

Cointegration tests have been a major tool in testing long run relationships between dependent and independent variables in time series analysis. However, before employing cointegration analysis, it is essential to examine the existence of unit roots in the variables. To test unit roots, this paper adopts the most popular method in the literature – the augmented Dickey-Fuller (ADF) test. A crucial part of this test is to decide whether an intercept or intercept plus trend should be included in the regression.[10] By looking at graphs in Appendix A, with the exception of the real exchange rate volatility, all the other variables indicate the presence of a trend. As a result, both an intercept and a time trend are included in conducting ADF tests for all variables except the variable of the real exchange rate volatility.

The ADF test results are reported in Appendix B Table 1. The null hypothesis of a unit root cannot be rejected at both the 5 percent and 1 percent significance level for the levels of all the variables, except the real exchange rate volatility. However, the statistics from the first differences of all the variables easily reject the unit root hypothesis at the 1 percent significant level. Based on the results of the ADF tests, we can confirm that with the exception of real exchange volatility, which is stationary in levels, all the other

[10] John Elder and Peter E. Kennedy discuss the details in the article "Testing for Unit Roots: What Should Students Be Taught?"

variables are stationary in first differences and are integrated of order one. A cointegration analysis can then proceed based upon the test results

3.2 Cointegration Analysis

Cointegration analysis provides a framework to estimate whether there is a long- run relationship among economic variables. Cointegration tests in this paper are conducted by means of Johansen's (Johansen 1988; Johansen and Juselius 1990) maximum likelihood approach. The approach uses two likelihood-ratio test statistics: namely, the trace and the maximal eigenvalue (λ - max) statistics. In both statistics, the null hypothesis states that there are at most r cointegrating vectors. When applying Johansen cointegration test, the Schwarz information criterion (SC) is used to determine the number of lags applied in each equation.

A uniform lag structure of the system based on the Schwarz information criterion indicated a lag length of 2 for both exports and imports. The results of the Johansen cointegration test are reported in Appendix C Table 2 and 3 respectively, where r denotes the number of cointegrating vectors. For both exports demand function, the trace test and the λ-max test results rejected the null hypothesis r=0 in favour of r=1 at the 5 percent and 1 percent significance level. This finding suggests that there is a unique cointegrating relationship.

The cointegrating vector normalized with respect to export and import volume can be written as follows:

$$X_t = 0.46Y_t^{foreign} - 0.74P_t + 0.03E_t - 16.94V_t - 0.03 \quad (6)$$
$$(1.15) \quad (-5.08) \quad (0.15) \quad (-10.28) \quad (-3.59)$$

$$M_t = 0.70Y_t^{indonesia} - 0.41P_t + 1.01E_t - 32.69V_t - 0.06 \quad (7)$$
$$(0.36) \quad (-0.95) \quad (0.62) \quad (-7.60) \quad (1.42)$$

The signs of the independent variables in export demand function are as expected. The t-statistics (in parentheses) are statistically significant except the real exchange rate and the world real income. A one-percentage point increase in world real income increases real exports by 0.46%. A one-percentage point increase in terms of trade reduces real exports by 0.74%. If Indonesia rupiah depreciates by 1%, real exports will increase by 0.03%. The exchange rate volatility is highly significant. It implies that real exports in long run are depressed by 1.22% because of the exchange rate fluctuation.[11] If there is no exchange rate volatility, real exports will be 1.22% higher. As a result, we can conclude that real exchange volatility significant reduces Indonesia's exports.[12]

With regard to the import demand function, we find that Indonesia's income has played an insignificant role. Similarly, we find the terms of trade and exchange rate have either played an insignificant role or have a theoretically inconsistent sign. However, the real exchange rate volatility coefficient is statistically significant and theoretically consistent sign. It implies that real imports in long run are depressed by 2.65%.[13] If there is no real

[11] It is computed by -16.94 times the mean of real exchange rate volatility (V=0.072259).

[12] Actually, oil is a significant export for Indonesia (about 20% to 30%). Oil exports are included in the total exports in this paper. As world oil trade is denominated in dollars, our result might underestimate the exchange rate volatility.

[13] It is computed by -32.79 times the mean of real exchange rate volatility (V=0.072259).

exchange rate volatility, real imports will be 2.65% higher. It indicates that exchange rate volatility depresses Indonesia's imports in long run.

3.3 The Error-Correction Model

After observing the long run relationship, we also need to detect short – run relationship by estimating short-run exports and imports demand function by ECM:

$$\Delta X_t = \alpha_0 + \alpha_1 EC_{t-1} + \sum_i^n \beta_{1i} \Delta X_{t-i-1} + \sum_i^n \beta_{2i} \Delta Y_{t-i}^{foreign} + \sum_i^n \beta_{3i} \Delta P_{t-i} + \sum_i^n \beta_{4i} \Delta E_{t-i} + \sum_i^n \beta_{5i} \Delta V_{t-i} + \varepsilon_t \quad (8)$$

$$\Delta M_t = \alpha_0 + \alpha_1 EC_{t-1} + \sum_i^n \beta_{1i} \Delta M_{t-i-1} + \sum_i^n \beta_{2i} \Delta Y_{t-i}^{indonesia} + \sum_i^n \beta_{3i} \Delta P_{t-i} + \sum_i^n \beta_{4i} \Delta E_{t-i} + \sum_i^n \beta_{5i} \Delta V_{t-i} + \varepsilon_t \quad (9)$$

EC_{t-1} is the error correction term which is the one period lagged residual in the cointegration regression. If our variable in equations (1) and (2) are not cointegrated, EC_{t-1} will be eliminated from equations (8) and (9). ECM allows us to estimate the short – run relationship between trade volume with its determinants. Both short-run dynamics and long-run relationship captured by error correction term are included in the model.

The ECM results are reported in Appendix E Table 6 and 7. The "speed –of –adjustment" parameter α is -0.062 and -0.0519 for exports and imports respectively, which means the disequilibrium can be corrected at rate of 6.20% and 5.19% for exports and imports respectively. As anticipated, the short- run coefficient of exchange rate volatility is smaller than the one in long-run for export and import demand function. However, the t-statistics are not significant enough to make the conclusion that exchange rate volatility has affected country's export and import growth in short run.

4 Conclusion

The paper analyzes the long-run and short-run relationship between export and import volume and real exchange rate volatility in Indonesia. The question in this paper is whether exchange rate volatility has had a detrimental impact on Indonesia's exports and imports. The interesting period has spanned 1980: Q1 to 1997:Q2. Although a necessary condition for a country's growth is expansion in the export sector, this paper has proved that the fluctuation in Indonesia's rupiah does not see any positive effect on country's export sector. Maybe this paper can help to explain why a severe depreciation of the rupiah against the US dollar in 1997-1998 destroyed the country's exports. Although we cannot conclude that there is a short-run relationship between trade volume and exchange rate volatility, the negative long-run relationship between them is obviously detected. From a managed floating exchange rate system in 1978 to a completely free floating exchange rate system in 1999, Indonesia's economic performance has demonstrated the adverse impact of exchange rate volatility to its trade volume especially in the export sector. One can easily understand the "fear of floating" in many developing Asian developing countries.

Appendix A: Graphs

Figure 1: Export Volume

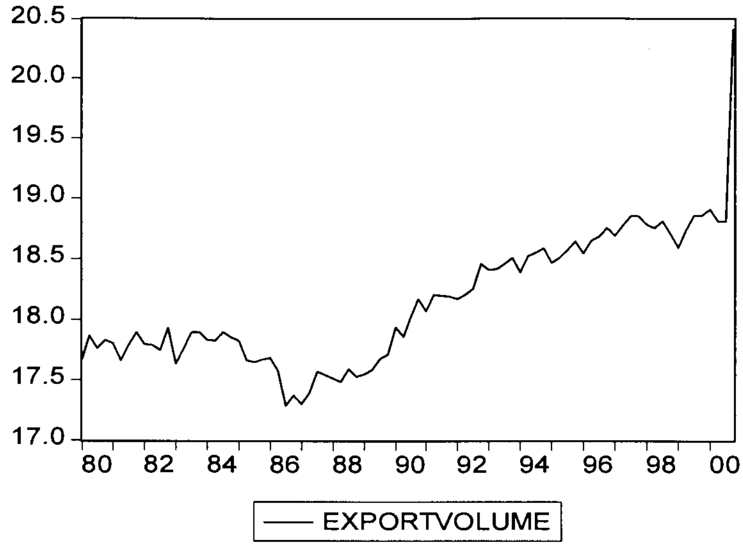


Figure 2: Import Volume

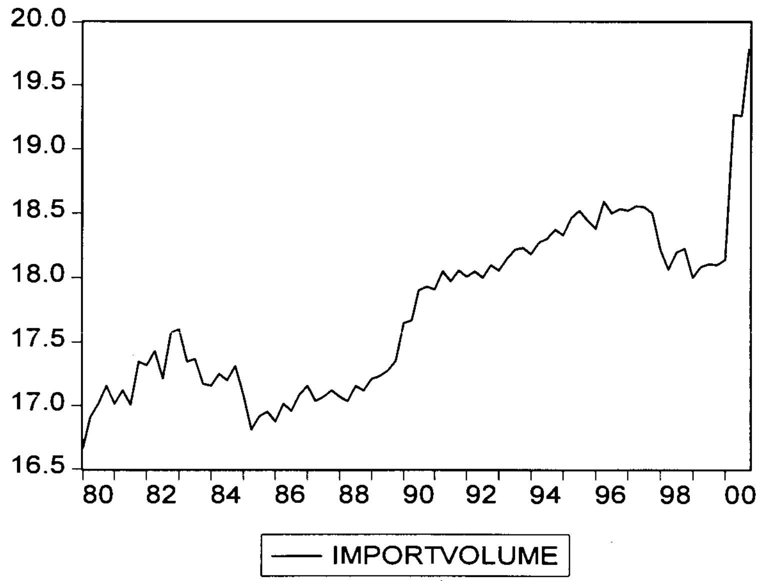


Figure 3: Indonesia GDP

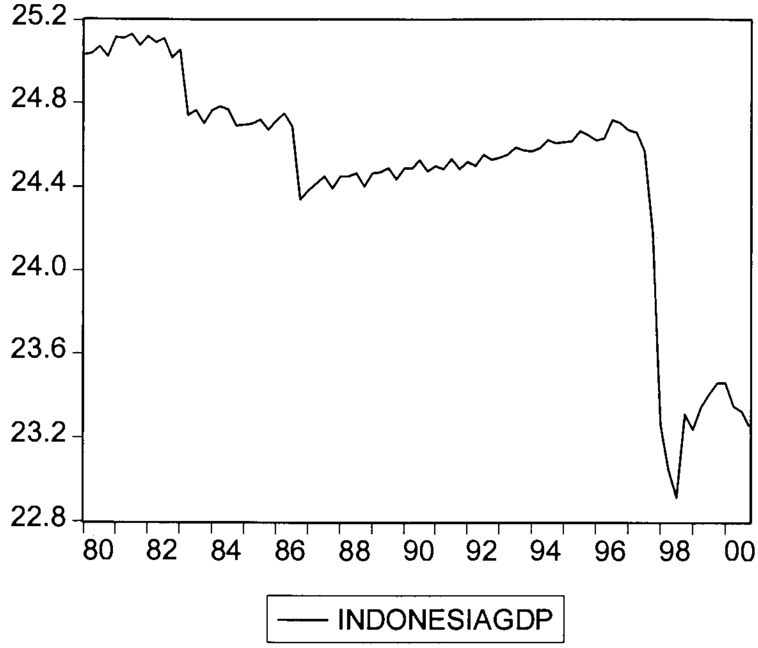


Figure 4: Exchange Rate Volatility

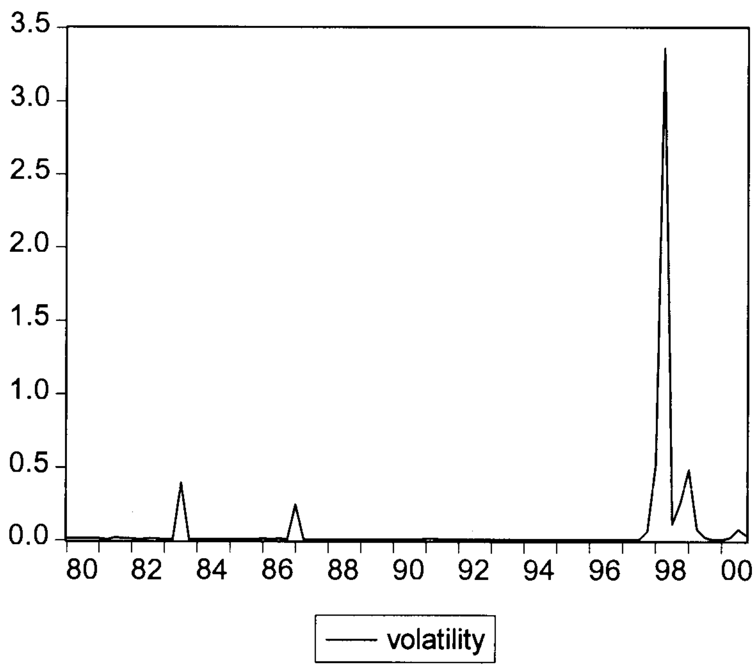


Figure 5: World GDP

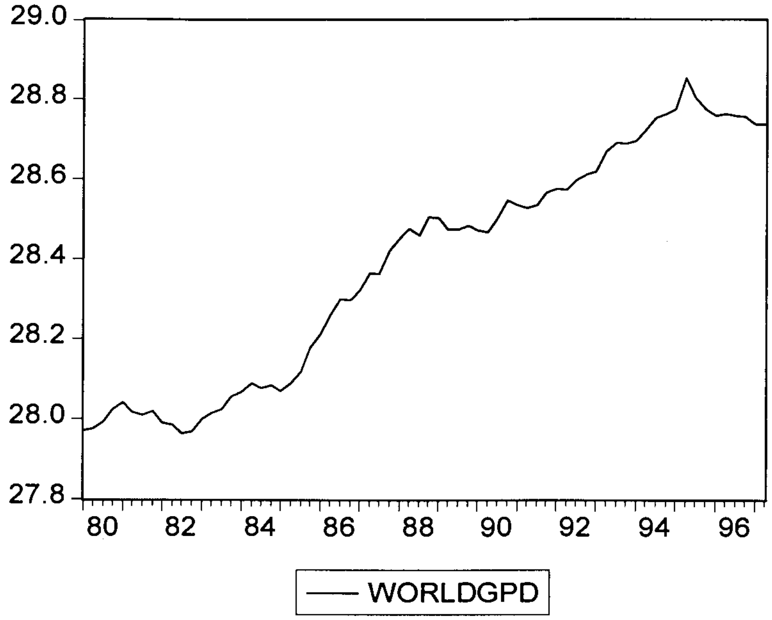
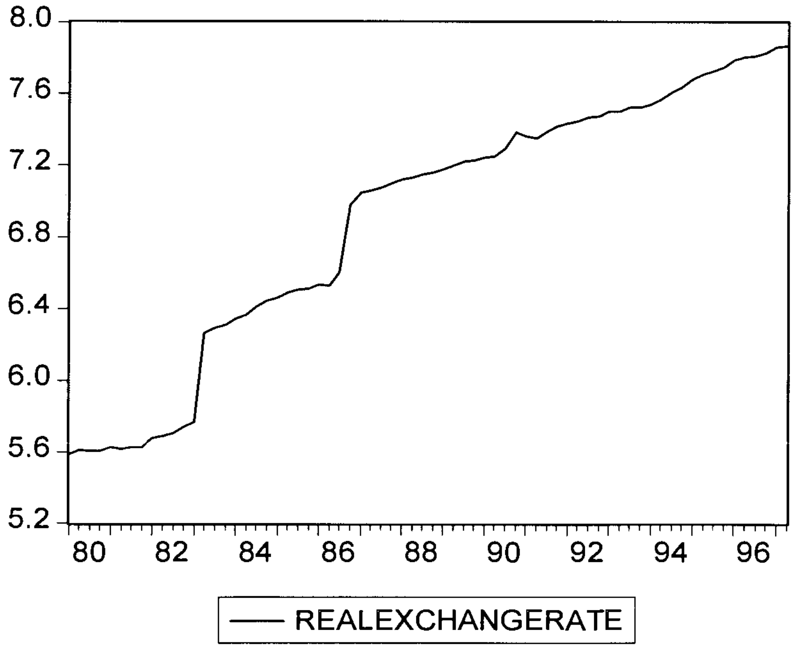


Figure 6: Real Exchange Rate



Appendix B

Table 1: Results of Augmented Dickey fuller Unit Root Tests

Series		ADF statistics*	Test Type	Order of integration
X_t	Level	-1.27	t and c	I (1)
	1_{st} difference	-5.46	---	
M_t	Level	-1.49	t and c	I(1)
	1_{st} difference	-5.08	---	
$Y_t^{foreign}$	Level	-1.56	t and c	I(1)
	1_{st} difference	-3.63	---	
$Y_t^{indonesia}$	Level	-1.33	t and c	I(1)
	1_{st} difference	-6.50	---	
P_t	Level	-1.08	t and c	I(1)
	1_{st} difference	-4.38	---	
E_t	Level	-1.42	t and c	I(1)
	1_{st} difference	-4.94	---	
V_t	Level	-4.86	c	I(0)

Note: * Significant at the 5% level; and ** t = trend and c = constant

Appendix C

Table 2: Results of the Johansen Cointegration Tests

(Export Demand Function)

Hypthesized No. of CE(s)	Eigenvalue	Trace Statistic	5% Critical Value	1% Critical Value
r=0**	0.65	124.57	87.31	96.58
r≦1	0.31	53.92	62.99	70.05
r≦2	0.21	29.20	42.44	48.45
r≦3	0.10	12.99	25.32	30.45
	Eigenvalue	**λ-max Statistics**	**5% Critical Value**	**1% Critical Value**
r=0*	0.65	70.66	37.52	42.36
r≦1	0.31	24.71	31.46	36.65
r≦2	0.21	16.20	25.54	30.34
r≦3	0.10	7.35	12.25	23.65

Notes: *(**) denotes rejection of the hypothesis at the 5%(1%) level

Table 3: Results of the Johansen Cointegration Tests

(import demand function)

Hypthesized No. of CE(s)	Eigenvalue	Trace Statistic	5% Critical Value	1% Critical Value
r=0**	0.49	106.08	87.31	96.58
r≦1	0.34	61.26	62.99	70.05
r≦2	0.23	33.15	42.44	48.45
r≦3	0.17	15.24	25.32	30.45
	Eigenvalue	**λ-max Statistics**	**5% Critical Value**	**1% Critical Value**
r=0*	0.49	44.81	37.52	42.36
r≦1	0.34	28.12	31.46	36.65
r≦2	0.23	17.91	25.54	30.34
r≦3	0.17	12.13	12.25	23.65

Notes: *(**) denotes rejection of the hypothesis at the 5%(1%) level

Appendix D

Table 4: Var lag Order Selection Criteria for Export Demand Function

Lag	LogL	LR	FPE	AIC	SC	HQ
0	175.8342	NA	3.30E-09	-5.338568	-5.169905	-5.272123
1	468.9299	531.2360	7.62E-13	-13.71656	-12.70458	-13.31789
2	592.3632	204.4365	3.6E-14*	-16.79260*	-14.93731*	-16.06171*
3	602.3506	14.98101	5.91E-14	-16.32346	-13.62485	-15.26034
4	634.0369	42.5785*	5.16E-14	-16.53240	-12.99049	-15.13706
5	652.4169	21.82619	7.17E-14	-16.32553	-11.94030	-14.59796
6	678.7341	27.13969	8.36E-14	-16.36669	-11.13815	-14.30690

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table 5: Var lag Order Selection Criteria for Import Demand Function

Lag	LogL	LR	FPE	AIC	SC	HQ
0	120.5133	NA	1.86E-08	-3.609791	-3.441128	-3.543346
1	426.2340	554.1188	2.89E-12	-12.38231	-11.37034	-11.98365
2	535.7244	181.3433	2.09E-13	-15.02264	-13.16735*	-14.29174*
3	553.6515	26.89076	2.71E-13	-14.80161	-12.10301	-13.73849
4	603.0190	66.3375*	1.4E-13*	-15.56309*	-12.02118	-14.16775
5	625.1460	26.27581	1.68E-13	-15.47331	-11.08808	-13.74575
6	648.4628	24.04547	2.15E-13	-15.42071	-10.19217	-13.36093

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Appendix E

Table 6: Results for Error Correction Model

(Export Demand Function)

Cointegrating Equation:	CointEq1				
X_{t-1}	1.000				
$Y_{t-1}^{foreign}$	0.303 (0.674) [0.450]				
P_{t-1}	-1.063 (0.215) [-4.953]				
E_{t-1}	-1.010 (0.282) [-3.581]				
V_{t-1}	-40.942 (4.377) [-9.355]				
C	-17.887				
Error Correction:	ΔX_t	$\Delta Y_t^{foreign}$	ΔP_t	ΔE_t	ΔV_t
CointEq1	-0.062 (0.032) [-1.969]	-0.008 (0.008) [-1.035]	-0.023 (0.032) [-0.724]	-0.002 (0.021) [-0.117]	0.028 (0.004) [6.314]
ΔX_{t-1}	-0.382 (0.163) [-2.349]	-0.008 (0.039) [-0.208]	0.139 (0.164) [0.849]	-0.299 (0.109) [-2.757]	0.056 (0.023) [2.474]
ΔX_{t-2}	-0.330 (0.178) [-1.857]	0.031 (0.043) [0.718]	0.026 (0.179) [0.147]	0.051 (0.119) [0.432]	-0.007 (0.025) [-0.299]
$\Delta Y_{t-1}^{foreign}$	-0.219 (0.539) [-0.408]	0.178 (0.131) [1.363]	-0.157 (0.544) [-0.288]	0.355 (0.361) [0.983]	-0.067 (0.075) [-0.894]
$\Delta Y_{t-2}^{foreign}$	-0.295	-0.051	-0.961	-0.075	0.040

	(0.552)	(0.134)	(0.556)	(0.369)	(0.077)
	[-0.535]	[-0.382]	[-1.727]	[-0.204]	[0.521]
ΔP_{t-1}	0.099	-0.028	-0.260	-0.1071	-0.067
	(0.165)	(0.040)	(0.167)	(0.111)	(0.023)
	[0.599]	[-0.701]	[-1.555]	[-0.963]	[-2.92]
ΔP_{t-2}	0.467	-0.0297	-0.062	-0.125	0.027
	(0.185)	(0.045)	(0.186)	(0.124)	(0.026)
	[2.529]	[-0.663]	[-0.332]	[-1.016]	[1.047]
ΔE_{t-1}	0.190	0.033	0.066	0.139	0.718
	(0.205)	(0.050)	(0.206)	(0.137)	(0.028)
	[0.931]	[0.663]	[0.320]	[1.013]	[25.195]
ΔE_{t-2}	-1.563	-0.139	-0.533	-0.154	0.074
	(0.882)	(0.214)	(0.890)	(0.591)	(0.123)
	[-1.77]	[-0.650]	[-0.599]	[-0.261]	[0.600]
ΔV_{t-1}	-0.231	-0.083	-0.169	0.025	-0.020
	(0.336)	(0.081)	(0.339)	(0.225)	(0.047)
	[-0.687]	[-1.020]	[-0.500]	[0.111]	[-0.422]
ΔV_{t-2}	0.072	-0.084783	0.007904	0.002154	0.003336
	(0.234)	(0.057)	(0.236)	(0.157)	(0.033)
	[0.306]	[-1.493]	[0.033]	[0.014]	[0.102]
C	0.080	0.013	0.018	0.033	-0.0272
	(0.034)	(0.008)	(0.034)	(0.023)	(0.005)
	[2.338]	[1.519]	[0.531]	[1.442]	[-5.724]
R-squared	0.193	0.144	0.127	0.298	0.973
Adj. R-squared	0.031	-0.027	-0.045	0.158	0.968
Sum sq. resids	0.567	0.033	0.577	0.254	0.011
S.E. equation	0.102	0.025	0.102	0.068	0.014
F-statistic	1.193	0.843	0.727	2.126	182.724
Log likelihood	64.789	159.715	64.192	91.693	196.881
Akaike AIC	-1.576	-4.409	-1.558	-2.379	-5.519
Schwarz SC	-1.181	-4.015	-1.163	-1.984	-5.124
Mean dependent	0.015	0.011	-0.007	0.034	-2.60E-05
S.D. dependent	0.103	0.024	0.100	0.074	0.079

Determinant Residual Covariance	2.40E-14
Log Likelihood	608.314
Log Likelihood (d.f. adjusted)	575.257
Akaike Information Criteria	-15.232
Schwarz Criteria	-13.093

Table 7: Results for Error Correction Model

(Import Demand Function)

Cointegrating Eq:	CointEq1				
M_{t-1}	1.000				
$Y_{t-1}^{indonesia}$	-2.045 (1.121) [-1.824]				
P_{t-1}	-0.132 (0.648) [-0.204]				
E_{t-1}	-1.374 (0.199) [-6.898]				
V_{t-1}	-47.758 (6.510) [-7.337]				
C	43.206				
Error correction:	ΔM_t	$\Delta Y_t^{indonesia}$	ΔP_t	ΔE_t	ΔV_t
CointEq1	-0.0519 (0.028) [-1.840]	-0.006 (0.015) [-0.364]	-0.0329 (0.025) [-1.302]	0.013 (0.016) [0.846]	0.020 (0.003) [5.921]
ΔM_{t-1}	-0.223 (0.152) [-1.470]	-0.042 (0.083) [-0.508]	0.116 (0.136) [0.853]	0.1683 (0.084) [1.993]	-0.007 (0.018) [-0.388]
ΔM_{t-2}	-0.069 (0.152) [-0.452]	-0.204 (0.083 [-2.448]	0.074 (0.136) [0.541]	0.293 (0.085) [3.461]	-0.033 (0.018) [-1.759]
$\Delta Y_{t-1}^{indonesia}$	-0.018 (0.441) [-0.041]	-0.486 (0.241) [-2.015]	-0.056 (0.394) [-0.141]	0.048 (0.245) [0.195]	0.061 (0.053) [1.141]
$\Delta Y_{t-2}^{indonesia}$	-0.312 (0.417) [-0.748]	-0.147 (0.228) [-0.643]	0.014 (0.373) [0.038]	-0.019 (0.232) [-0.083]	0.098 (0.051) [1.942]
ΔP_{t-1}	0.068 (0.168) [0.408]	0.283 (0.092) [3.087]	-0.179 (0.150) [-1.195]	-0.384 (0.093) [-4.112]	-0.046 (0.020) [-2.256]

ΔP_{t-2}	0.313	0.208	-0.012	-0.287	0.029
	(0.211)	(0.116)	(0.189)	(0.118)	(0.026)
	[1.478]	[1.798]	[-0.061]	[-2.439]	[1.117]
ΔE_{t-1}	0.276	-0.260	0.086	0.020	0.765
	(0.414)	(0.227)	(0.371)	(0.231)	(0.050)
	[0.667]	[-1.146]	[0.233]	[0.089]	[15.212]
ΔE_{t-2}	-2.451	-0.330	-0.865	0.653	-0.041
	(0.959)	(0.525)	(0.859)	(0.534)	(0.117)
	[-2.555]	[-0.629]	[-1.007]	[1.223]	[-0.348]
ΔV_{t-1}	-0.113	-0.022	-0.250	-0.248	0.020
	(0.431)	(0.236)	(0.386)	(0.240)	(0.052)
	[-0.263]	[-0.092]	[-0.647]	[-1.034]	[0.389]
	-0.021	0.125	0.019	-0.221	0.031
ΔV_{t-2}	(0.304)	(0.1666)	(0.272)	(0.169)	(0.037)
	[-0.070]	[0.747]	[0.069]	[-1.305]	[0.841]
C	0.103	0.020	0.013	-0.004	-0.023
	(0.036)	(0.020)	(0.032)	(0.020)	(0.004)
	[2.874]	[0.992]	[0.415]	[-0.213]	[-5.180]
R-squared	0.2490	0.297	0.075	0.347	0.973
Adj. R-squared	0.0988	0.156	-0.110	0.216	0.9673
Sum sq. resids	0.762	0.2287	0.612	0.236	0.011
S.E. equation	0.118	0.064	0.105	0.066	0.014
F-statistic	1.658	2.113	0.406	2.6537	178.440
Log likelihood	54.873	95.214	62.261	94.095	196.108
Akaike AIC	-1.280	-2.484	-1.500	-2.451	-5.496
Schwarz SC	-0.885	-2.089	-1.105	-2.056	-5.101
Mean dependent	0.023	-0.006	-0.007	0.033817	-2.60E-05
S.D. dependent	0.124	0.070	0.100	0.074	0.079

Determinant Residual Covariance	1.09E-13
Log Likelihood	557.662
Log Likelihood (d.f. adjusted)	524.604
Akaike Information Criteria	-13.720
Schwarz Criteria	-11.581

Appendix F

Table 8 Trade Weights of Indonesia Major Trading Partner in 2002

Country	Export Share	Import Share	Average Share**	Assigned Weights**
Japan	21.07%	14.09%	17.58%	30.74%
USA	13.22%	8.44%	10.83%	18.94%
Singapore	9.36%	13.10%	11.23%	0.00%**
S.Korea	7.19%	5.26%	6.225%	10.88%
China(Mainland)	5.08%	7.76%	6.24%	10.91%
Malaysia	3.55%	3.32%	3.44%	6.01%
Australia	3.37%	5.07%	4.22%	7.38%
Netherlands	2.83%	1.13%	1.98%	3.46%
Germany	2.22%	3.91%	3.07%	5.36%
UK	2.19% ΔV_{t-1}	2.105	2.15%	3.75%
HK	2.17%	0.77%	1.47%	2.57%

*(**) Average share means the average of export and import share.
*(**)Assigned weight is computed by country's average share divided by 100%.It is used to calculate the world real income.
*(**) No quarterly GDP data of Singapore is available. Therefore, we did not assign any weight to it.

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