ISSUES ON EXCHANGE RATE VOLATILITY & EXPORTS NEXUS – "A CASE FOR ASEAN"

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Abstract

This paper investigates the relationship between exchange rate volatility and exports during the recovery regime in ASEAN. By adopting an augmented model proposed by Baak (2007), this study successfully documented the significant result for ASEAN case. Estimates of the cointegration relations are obtained using method propose by Johansen and Juselius (1990) techniques. Furthermore, the short-run and the long run dynamic relationships between the variables are obtained for each country utilizing the error correction modelling. The major results show that increases in the volatility of the real bilateral exchange rate, approximating exchange rate risk, exert significant effects upon export demand in the short run in each of the ASEAN countries. Moreover, the findings are found to be significantly negative effects to Singapore and Philippines. The results further suggest for the mixed effects from the bilateral exchange rate volatility to exports flow to Malaysia and Thailand, throughout the regression estimations. However, the volatility-exports demand from Indonesia to the United States nexus is found to be positive.

Keywords *exchange rate, vitality, export, price competitiveness, importing country*

INTRODUCTION

For many years, studies of exchange rate volatility and its relationship on exports have made great issues to discuss. Besides, the issue has enormous impact on international trade, negatively and positively. Choudhry (2005) explained the precise mechanism by which exchange rate volatility affects trade internationally.

The exchange rate volatility (ERV) can be specifying as follows;

> *A source of concern as currency values partially determines the price paid or received for output of goods and consequently, this affects the profits and welfare of producers and consumers.*
>
> (Akhtar and Spencer, 1984)

In other words, the ERV can affect the volume of goods traded internationally by making prices and profits indeterminate. Hitherto, the exchange rate volatility-exports nexus has been investigated in a large number of empirical and theoretical studies. According to previous literature, there are two groups of ERV-exports nexus. The first group recommends that the ERV affect exports positively. This argument has been supported by Baron (1976) and De Grauwe (1988), among others. For example, De Grauwe (1988) shows, an increase in ERV will encourage the agents to increase their export volume. This may be due to the agent becoming *'very risk averse'* and too concerned about the worst possibility outcome to their investment. Therefore, when risk rises they tend to export more in order to avoid the possibility of a drastic decay in their profit. Additionally, previous empirical studies have also supported for the negative and positive relationships between ERV and international trade. Among others, Secru and Uppal (2000) showed the theoretical possibility of both positive and negative relationships, and Baccheta and Wincoop (2000) illustrated a theoretical model regarding no relationship between these variables. In contrary, the second group suggests that the high ERV impact exports negatively (see Cushman, 1983; Koray and Lastrapes, 1989). This negative impact may come directly through uncertainty and adjustment costs, and indirectly through its effect on allocation of resources and government policies (Cote, 1994). If the exchange rate movements are not fully anticipated, an increase in ERV may lead *risk-averse* agents to reduce their international trading activities. While reduce their international market, the agents will shift their sales to domestic markets. In addition, the presumption of a negative nexus between ERV and trade is an argument routinely used by proponents of managed of fixed exchange rates. This argument has also been reflected in the establishment of the Europe Monetary Union (EMU), as one of the stated purposes of EMU is to reduce ERV in order to promote intra-EU trade and investment (EEC Commission, 1990).

Moreover, numerous studies have shown that the higher degree of volatility of ERV has led policy makers and researchers to investigate the nature and extent of the impact of such movements on volume of trade, especially for exports (Hooi (2008), Maneschiold (2008), Ibrahim (2002), and Ahmad (2001), among others). Export expenditure actually has a close relationship with growth, through the export-led growth hypothesis (ELGH) channel. According to this hypothesis, exports are an essential macroeconomic determinant in stimulating economic growth. Therefore, export stability is vital in generating growth, due to a positive relationship is expected in the hypothesis (Balassa, 1985). Yet, the relationship is still essential enough to be explored especially for the principle ASEAN countries namely, Singapore, Malaysia, Thailand, Philippines, and Indonesia (hereafter: ASEAN5), due to various macroeconomic events, for instance the Asian financial crisis in 1997/1998. By giving this setting, the relationship between its major trading partners like the United States is of interest. In my knowledge, for most of these countries the export activity has been one of the major engines of economic growth. Furthermore, the United States is also known as ASEAN main trading partner, together with Japan, China, India and Europe countries. Thus, in the light of international trade, the main purpose of this chapter is to investigate the impact of ERV on exports from ASEAN5 countries to the United States.

According to new growth economics theory, exports in the developing countries (such as in ASEAN), depends on world demand for exports goods, at the same time the world demand depends on the price of goods and income of buyer. Consistent with the theory, we include the other variables such as the importing country income, which in our case is the United States. In this chapter, the income of the United States has been substituted by the industrial production index (hereafter: IPI). According to Cote (1994), there exists a positive relationship between these two variables. Therefore, the inclusion of the IPI of the United States is to observe its relationship with exports in ASEAN5 countries. In other words, if the incomes of the United States increases will their expenditure in exporting increases too.

Furthermore, we include the bilateral exchange rate in the system equation in order to measure the sensitivity of this variable to exports. Essentially, the relationship between these two variables is assumed to be positive. In fact, the rise in the bilateral exchange rate value will give a favorable impact on exports. Finally, this chapter imposes an Asian Financial Crisis Dummy in the model from July, 1997 to December, 1999 in order to capture the impact of the structure break in the model. We assume that, the crisis gives a significant impact on countries' exports.

LITERATURE REVIEW

Largely the ERV can be defined as a state of doubt about future rates at which various currencies will be exchanged against each other (Akhtar and Hilton, 1984). Thus, the ERV is a source of concern because currency values partly determine the price paid or received for output and consequently affect the profits and welfare of producers and consumers. In fact, in the international market the ERV can affect trade volume directly or indirectly. The exchange rate volatility can directly affect the volume of international trade by making prices and profits indeterminate or uncertain. For example, consider a firm choosing between buying a foreign-made product and a similar domestic substitute when both are equally valued in local currency terms using current exchange rate levels. While it can indirectly affect the trade flows by making product prices and profits indeterminable, or at least more uncertain, for either importers or exporters when an order is placed.

As stated earlier, the effect of the ERV on trade volume can be positive or negative. However, the effect based on the role played by the agents in the market. The impact of ERV on trade volume (in this case, exports) has been investigated in a significant number of studies, both theoretically and empirically. Some detailed literature survey on the effects of ERV on trade has been outlined by previous researchers among other, Cote (1994), Mckenzie (1999) Clark, Tamirisa and Wei (2004) and Ozturk (2006). According to these surveys, the ERV can encourage the export volume through various factors. Yet, from these factors the ultimate relationship between ERV and the export volume can be categorized into three types of relationships as follows;

Type 1: The ERV affects exports negatively (significant or not significant).
Type 2: The ERV affects exports positively (significant or not significant).
Type 3: There is no relationship between these variables.

Broad discussion of this topic has been covered by previous researchers, namely, Hooper and Kohlhagen (1978), Gotur (1985), Brada and Mendez (1988), Peree and Steinherr (1989), Klein (1990), Feenstra and Kendall (1991), Hook and Boon (2000), Doyle (2001), Baak (2004), among others. For more recent studies, see Arize et al. (2005), Lee and Saucier (2005), Baak et al. (2007), Chit et al. (2008), Aize (2008) and Baak (2009). However, most of these studies have rarely investigated the issue according to the exports of ASEAN countries. So far, only a small number of studies e.g. Arize et al. (2000), Baum et al. (2001), Doganlar (2002), Bahmani-Oskooee and Goswami (2004), Baak et al. (2007) have focused or included ASEAN countries in their analysis.

Some empirical evidence from these surveys such as Akhtar and Hilton (1984), Cushman (1986), Peree and Steinherr (1989), Bini-Smaghi (1991), Savvides (1992), Chowdhury (1993), Hook and Boon (2000), Baak (2004), Arize et al. (2005), Lee and Saucier (2005), Baak et al. (2007), Chit et al. (2008), Augustine (2008) and Baak (2009) shows that an increase in exchange rate risk will have negative effect on the volume of exports.

In contrast, the evidence from other researchers such as Sercu and Vanhulle (1992), Baccheta et al. (2000), Aristotelous (2001), Bahmani et al. (1993), Gagnon (1993), Doyle (2001) and Bredin et al. (2003) demonstrated that the effect between exchange rates volatility and trade is either positive or ambiguous. Following the work of Das (2003), Kasman and Kasman (2006), Arize et al. (2005), Baak (2007, 2008) and Augustine et al. (2008) among others, examines the long-run and the short-run relationship between ERV and exports by implementing cointegration tests and Granger causality tests in vector error correction model in their study.

MODEL SPECIFICATION AND ECONOMETRIC APPROACH

As studies of Baak (2007), the long-run and short-run relationship between ERV and exports by performing Granger causality test in the vector error correction (VECM) framework are applied in this paper. According to typical specification of others, and with additional specification as stated earlier in the introduction, the long-run equilibrium relationship between exports and other economic variables in this paper is examined based upon the following export demand equation:

$$\ln A_{ijt} = \alpha_0 + \alpha_1 \ln G_{jt} + \varepsilon_2 \ln P_{ijt} + \alpha_3 \ln\left(\sigma_{ijt}^2\right) + \alpha_4 CD_t + v_{ijt} \quad (1)$$

The A_{ijt} means as real exports from a country *i* (for example, Malaysia or Singapore) to a country *j* (the United States); G_{jt} is the GDP of an importing country, *j* ;P_{ijt} is the real bilateral exchange rate, reflecting the price competitiveness; σ^2_{ijt} is the volatility of the bilateral real exchange rates; CD_t is representing the crisis dummy due to the Asian financial crisis in July, 1997 to December,1999; finally v_{ijt} denotes as a disturbance term. All variables are in natural logarithms and the subscript *t* indicates the time period.

In the equation, the variable G_{ijt} is used as a proxy for the level of economic activity in the importing country, in this case is the United States. It is expected that the higher the economic activity in the importing country, the higher the demand for exports (Cote, 1994). Therefore, the value for α_1 is expected to be positive. Since the higher real exchange rate implies a lower relative price, the value for α_2 is also expected to be positive (Arize et al. (2000). As stated earlier, ERV may effects trade negatively or positively. However, if the economic agents are moderately risk averse, as De Grauwe (1988) shows, it is generally expected that the impact of ERV is negative. Thus, in this study because of the assumption of the economic agents is avoiding the risk, so the value for α_3 will be negative. Finally, a dummy variable (CD_t) is included in the model to represent the Asian financial crisis in 1997/1998. In this case, CD=1 for the period from July, 1997 to December, 1999, and zero otherwise.

A second distinguishing feature of this chapter pertains to the measurement of exchange rate variability. Here, the measurement of ERV is employed – the generalized autoregressive conditional Heteroscedastic (GARCH 1,1) model of Bollerslev (1986). Jansen (1989) stated the unconditional measure of volatility lacks a parametric model for the time varying variance of a time series. Therefore, referring to Arize (1995), the exchange rate volatility may be modeled by the Autoregressive Conditional Heteroscedastic (ARCH) model of Engle (1982). Furthermore, in this chapter the conditional variance of the first difference of the log of the exchange rate is applied as volatility. The conditional variance is estimated by means of the Generalized Autoregressive Conditional Heteroscedastic (GARCH) model of order (1,1). Conferring to Kroner and Lastrapes (1993), Caporate and Doroodian (1994, Lee (1999) and Choudhry (2005), also apply the GARCH model to estimate the volatility of exchange rate. The beneficial of using GARCH for the ERV, because the measurement is standard, therefore the result given through this method is optimum and is the best (Choudhry, 2005).

In order to archive the objective of the paper, the study mixed the time series econometric methods. Firstly, its utilizes the univariate unit root test proposed by Dickey and Fuller (1979). Then, in order to capture the long-term relationship between the variables, the test procedure continues by adopting the cointegration tests recommended by Johansen and Juselius (1990). Lastly, it expands the analysis by utilizing the Granger causality tests in vector error correction model (VECM) proposed by Engle and Granger (1987).

In general, the unit root test is a formal preparation test before we proceed to cointegration tests. Here, in order to tests for presence or absence of unit root we employ the Augmented Dickey Fuller (ADF) test proposed by Dickey and Fuller (1979), basically, the ADF unit root test genuinely from Dickey Fuller (DF) unit root test proposes by Dickey, (1976). Based on the previous reading (Gujarati, 2003), pp: 817) stated that, in conducting the DF unit root tests, we assumed that the error term (U_t) is uncorrelated. In addition, for the case where the U_t is correlated, Dickey and Fuller (1979) have developed a test known as ADF unit root tests. The well known Augmented Dickey Fuller tests use a parametric autoregression to approximate the Autoregressive Moving Average (ARMA) structure of the errors in the test regression. The ADF tests structures are however are as follows. Consider a simple general AR (p) process given;

$$e_t = \alpha + \beta_1 e_{t-1} + \beta_2 e_{t-2} + \ldots + \beta_i e_{t-i} + v_t \tag{2}$$

If this is the process generating the data but an AR (1) model is fitted, say

$$e_t = \alpha + \beta_1 e_{t-1} + \varepsilon_t \tag{3}$$

Then,

$$\varepsilon_t = \beta_2 e_{t-1} + \ldots + \beta_i e_{t-i} + v_t \tag{4}$$

Here, the autocorrelations of ε_t and ε_{t-k} for k>1; will be nonzero, because of the presence of the lagged 'e' terms. Thus, an indication of whether it is appropriate to fit an AR (1) model can be aided by considering the autocorrelations of the residual from the fitted models. To illustrate how the DF test can be extended to autoregressive processes of order greater than 1, consider the simple AR (2) process below.

$$e_t = \alpha + \beta_1 e_{t-1} + \beta_2 e_{t-2} + \ldots + \beta_i e_{t-i} + v_t \tag{5}$$

Then notice that this is the same as:

$$e_t = \alpha + (\beta_1 + \beta_2) e_{t-1} - \beta_2 (e_{t-1} - e_{t-2}) + v_t \tag{6}$$

And subtracting g_{t-1} from both sides gives:

$$\Delta e_t = \delta_1 + \delta_2 e_{t-1} + \delta_3 e_{t-1} + v_t \tag{7}$$

Where the following have been defined:

$$e_t = \beta_1 + \beta_2 - 1 \tag{8}$$

And

$$\delta_1 = 1/\beta_2 \tag{9}$$

Therefore, to perform a Unit Root test on an AR (p) model the following regression should be estimated:

$$\Delta e_t = \delta_1 + \delta_2 e_{t-1} - \sum_{j=1}^{p} \delta_i \Delta e_{t-i} + v_t \tag{10}$$

The Standard Dickey-Fuller model has been 'augmented' by Δe_{t-i}. In this case the regression model and the '*t*' test are referred as the ADF unit root test. In equation (2.19) above, Δe_t is set of variable under observation including, real GDP, real export, real import and real exchange rate. And, Δ is differencing operator, *t* indicates as time series data. While v_t is the white noise residual of zero mean and constant variance. Set of parameter to be estimated including, δ_1, δ_2, θ_i, ..., θ_m. Both of the null and alternative hypotheses in unit root tests are;

Hypothesis null:
Hαδ = 0 (etis non-stationary/a unit root process)

Hypothesis alternative:
Hαδ ≠ 0 (et is stationary)

The unit root hypothesis of the ADF can be rejected if the t-test statistic from these tests is negatively less than the critical value tabulated. In other words, by the ADF test, a unit root exists in the series e (implies non-stationary) if the null hypothesis of delta equal zero is not rejected (Gujarati 1995, p: 719-720).

Moreover, the cointegration test procedure can be proceed into two main approaches namely, Engle and Granger (1987) two steps procedure and the Johansen and Juselius (1990). In this study, we performed latter approach, since this particular method is claimed to be one of most superior to the regression based to former method. Lag truncation under this method propose by Vahid and Engle (1989) is applied. Here, the cointegration tests have been employed to tests for the long-run equilibrium between economic growth, exports, imports, and exchange rate in Malaysia. The cointegration refers to the possibility that non-stationary variables may have a linear combination that is stationary. The existing of a cointegration vector implies that there is long-run equilibrium relationship among these variables.

A brief discussion on the Johansen Juseliuscointegration approach is present below. Suppose the vector of n-variables, $Y_t = (Y_{it}, Y_{2t}, Y_{3t}, ..., Y_{nt})$ is generated by the kth order vector autoregressive process with Gaussian errors;

$$Y_t = \Phi + \phi_1 Y_{t-1} + \phi_2 Y_{t-2} + \phi_3 Y_{t-3} + \ldots\ldots\ldots + \phi_4 Y_{t-k} + \varepsilon_t \tag{11}$$

And,

$t = 1, 2, 3, 4, 5, \ldots t$

Where Y_t is a ($p \times 1$) vector of stochastic variables, and, $\varepsilon_1, \ldots, \varepsilon_T$ are i.i.d with normal probability ($0, \sigma^2$), mean zero and constant in variance. Since we want to distinguish between stationary by linear combination and by differencing this process may be written in vector error correction VECM framework form as equation below:

$$\Delta Y_t = \Phi + \Gamma_1 \Delta Y_{t-1} + \Gamma_2 \Delta Y_{t-2} + \Gamma_3 \Delta Y_{t-3} + \ldots\ldots\ldots + \Gamma_{k-1} \Delta Y_{t-k+1} + \Pi y_{t-1} + \varepsilon_t \tag{12}$$

And,

$t = 1, 2, 3, 4, 5, \ldots t$

Based on equation above, the matrix of Π contain information about the long run relationship between the variables in the vector. Information about the number of cointegrating vectors is found in the rank of Π. In other words, the rank of cdetermines how many linear combinations of Y_t vector are stationary. If the ($p \times p$) matrix Π has rank equal to zero, then r = 0 means all elements of Y_t are non-stationary. Thus, there are no cointegration relationships between the variables. If Π is of full rank $r = p$, then all elements of Y_t are stationary. Thus, any combination of the variables results in a stationary series is cointegrated. In the intermediate case, when $r < p$, there are r non-zero cointegrating vectors among the elements of Y_t and $p-r$ common stochastic trends. If a non-zero relationship is indicated by the test, a stationary long-run relationship is implied. In the case where $0 < r < p$, Π can be factored as $\alpha\beta'$ (or $\Pi = \alpha\beta'$) where α and β are both (p × r) matrices. The matrix α contains the adjustment parameters while β is called the cointegrating matrix and has the property that $\beta Y_t \sim I(0)$, where I(0) indicates integrated of order zero. Thus we can interpret the relations of βY_t as the stationary relations among potentially non-stationary variable that is, as cointegrating relations. (Johansen, 1990) developed a maximum likelihood estimation procedure for Φ, Γ, α and β. This method also provides tests for a number of cointegration vectors; λ_{trace} and λ_{max} formulation as follows;

$$\lambda_{trace} = -T \sum_{i=r+1}^{n} \ln(1 - \hat{\lambda}_i) \tag{13}$$

Where T is the sample size and $\lambda_{r+1}, \ldots, \lambda_{r+i}$, is the ordered $p - r$ smallest Eigen values. The λ_{trace} statistic tests the null hypothesis that there are not at most r cointegrating vectors against a general alternative. However, the second statistics tests, λ_{max} statistics, test the null hypothesis that there are $r$cointegrating vectors against the alternative that there are cointegrating vectors. This statistic is written as;

$$\lambda_{max} = -T \ln\left(1 - \hat{\lambda}_{r+1}\right) \tag{14}$$

Here in equation above, $^{\lambda}$r+1 is an estimated Eigen value. The critical values for λ_{trace} and λ_{max} statistics are provided in (Johansen, 1990) and (Osterwald-Lenum, 1992).

The econometric estimation of causality between economic variables began with Granger (1969) and Sims (1972). They hypothesized that, if two variables are cointegrated, the finding of no causality in either direction one of the possibilities with the standard tests, is ruled out. In other words, if two variables are found to possess a common stochastic trend (moving together), causality (in Granger sense) must exist in at least one direction, either unidirectional or bi-directional. However, although cointegration indicates presence or absence of Granger causality between the variables, it does not provide the direction of causality between the variables. This direction of the Granger causality can only be detected through the VECM framework derived from the long run cointegrating vector. In addition, to indicating the direction of causality among variables, the VECM framework distinguishes between the short run and long run Granger causality.

EMPIRICAL RESULTS

In this section there will be discussions of empirical results for this study. In the beginning, we discuss all the results in general, starting from ADF unit root tests to the Johansen and Juseliuscointegration tests, vector error correction modelling and regression equations of each country. Detail discussion is provided at the end of this section.

The Augmented Dickey Fuller (ADF) Test Results

The univariate Augmented Dickey Fuller (ADF) unit root test is conducted in all systems under this study has concluded that all the data are I(1) process. The unit root tests are employed to investigate the stationarity of the macroeconomic series at level and then at first difference of each series. To ensure the disturbances in all these equations are white noise, a sufficient number of lagged dependent variables have been estimated. Based on Table 1 (in the next page), the t-test statistic for all series from ADF tests are statistically insignificant to reject the null hypothesis of non-stationary at 0.01 significant levels. This result indicates that this series are non-stationary at their level form. Whereas, the result fail to reject the null hypothesis of unit roots in their level form in the autoregressive representation of each variable, thus, they are all not I(0). Therefore, these variables are containing a unit root process or they share a common stochastic movement. Thus, the tests being continue to the first differencing stages. When the ADF test is conducted at first difference of each variable, the null hypothesis of non-stationary is easily rejected at 0.01 significant levels as shown in Table 2. Obviously, this result consistent with some of the previous studies, name a few, Das (2003), Kasman and Kasman (2005), Arize et al. (2005), Baak (2007, 2008) and Augustine et al. (2008) among others. As claimed by Nelson and Plosser (1982), most of the macroeconomics and financial series are expected to contain unit root and thus are integrated of order one, I(1), at their differencing level. Therefore, this study concludes that the series are integrated of order one, and a higher order of differencing is not required to execute.

Table 1 The Augmented Dickey Fuller (ADF) Test Results

Singapore				
Data Series	**At Level**		**At First Difference**	
	Without Time	**With Time**	**Without Time**	**With Time**
AS_ijt	-2.537878 (4)	-2.520144 (4)	-8.964511 (4)a	-9.010142(4)a
GS_jt	-1.511249 (4)	-1.054364 (4)	-6.952419 (4)a	-7.041146 (4)a
PS_ijt	-0.897839 (4)	-0.723620 (4)	-6.237290 (4)a	-6.242019 (4)a
σ_ijt	-2.319720 (6)	-3.061475 (4)	-9.479093 (4)a	-9.460165 (4)a
GARCH_ijt	-1.918365 (4)	-2.006650 (4)	-6.795549 (4)	-6.800304 (4)a
Malaysia				
Data Series	**At Level**		**At First Difference**	
	Without Time	**With Time**	**Without Time**	**With Time**
AM_ijt	-2.392370 (2)	-1.919868 (4)	-7.933085 (4)a	-8.275650 (4)a
GM_jt	-1.511244 (4)	-1.054364 (4)	-6.952419 (4)a	-7.041146 (4)a
PM_ijt	-1.511563 (4)	-1.322453 (4)	-6.261529 (4)a	-6.299796 (4)a
σ_ijt	-2.537869 (9)	-3.008364 (12)	-9.168874 (4)a	-9.154050 (4)a
GARCH_ijt	-1.536856 (4)	-1.996264 (4)	-5.777183 (4)a	-5.768497 (4)a
Thailand				
Data Series	**At Level**		**At First Difference**	
	Without Time	**With Time**	**Without Time**	**With Time**
AT_ijt	-2.334833 (4)	-3.132127 (4)	-8.729152 (4)a	-8.79133 (4)a
GT_jt	-1.511249 (4)	-1.054364 (4)	-6.952419 (4)a	-7.04114 (4)a
PT_ijt	-1.495946 (4)	-1.180035 (4)	-5.915259 (4)a	-5.96630 (4)a
σT_ijt	-2.56567 (12)	-3.012114 (12)	-8.622305 (4)a	-8.60864 (4)a
GARCH_ijt	-2.384251 (5)	-2.984798 (4)	-10.11501 (4)a	-10.1146 (4)a
Philippine				
Data Series	**At Level**		**At First Difference**	
	Without Time	**With Time**	**Without Time**	**With Time**
AP_ijt	-2.011978 (4)	-1.457708 (4)	-9.014934 (4)a	-9.24750 (4)a
GP_jt	-1.511249 (4)	-1.054364 (4)	-6.952419 (4)a	-7.04114 (4)a
PP_ijt	-1.389683 (4)	-1.239872 (4)	-5.964669 (4)a	-5.98730 (4)a
σP_ijt	-3.279130 (4)	-3.271945 (4)	-6.944054 (4)a	-6.92946 (4)a
GARCH_ijt	-1.592908 (4)	-1.437663 (4)	-8.308243 (4)a	-8.36916 (4)a
Indonesia				

Table 1 *cont...*

Data Series	At Level		At First Difference	
	Without Time	**With Time**	**Without Time**	**With Time**
AI_ijt	-2.019012 (4)	-2.792339 (4)	-8.973682 (4)a	-9.00140 (4)a
GI_jt	-1.511249 (4)	-1.054364 (4)	-6.952419 (4)a	-7.04114 (4)a
PI_ijt	-1.966732 (4)	-1.813688 (4)	-5.747611 (4)a	-5.77177 (4)a
σI_ijt	-2.521850 (4)	-2.945748 (5)	-9.610636 (4)a	-9.60436 (4)a
GARCH_ijt	-2.66509 (11)	-3.102286 (3)	-5.579170 (4)a	-5.56999 (4)a
Critical values (1% level of significance)				

Notes: Figures in parentheses are the lag order selected based on the SIC where 'a' indicates significance at the 1% significant level.

The Johanson & Juselius Cointegration Test Results

The summary result of cointegration for each country is reported in Table 2 to Table 6. As stated earlier, the number of cointegration vector(s) is determined by two likelihood ratio test, namely maximum eigenvalue and trace eigenvalue statistics. The critical values for each test are from Osterwald-Lenum (1992) statistic table. Overall, we found the similar results for every country under consideration. Where, we are concluded that, at least one cointegration vector in the cointegration systems. This conclusion is applied for Singapore, Malaysia, Thailand, Philippine and Indonesia.

As an example, for the case of Singapore, the result of trace statistic test obviously demonstrate that the null hypothesis of r=0 against its alternative r>1, is easily rejected at 0.01 and 0.05 significant level. The computed value is 77.07210 is obviously larger then the critical value at 0.05 and 0.01, 68.52 and 76.07, respectively. Nonetheless, if we test the null hypothesis of r≤1, we definitely fail to reject the hypothesis due to the computed value at 39.36122 is smaller then the critical value at 0.05 and 0.01, 47.21 and 54.46, respectively. Therefore, based on the trace statistic test result, we concluded that there exists a single cointegrating vector in the model. Consistent with that, we also found the maximum eigenvalue test suggest a similar result.

Moreover, based on the trace and maximum statistic test, the results reveal the null hypothesis of r=0 against its alternative r>1 is rejected at 0.01 and 0.05 significant level. By using the Eviews v6 software as our estimating engine, the computed value 37.71088 is obviously larger then the critical value at 0.05 and 0.01, 33.46 and 38.77, respectively. Nonetheless, if we test the null hypothesis of r≤1, we definitely fail to reject the hypothesis due to the computed value at 15.98193 is smaller then the critical value at 0.05 and 0.01, 27.07 and 32.24, respectively. Overall, we finally summarize for Singapore case, there is presence at least one cointegrating vector in the system. Based on this conclusion, this study furthermore suggests that the economic growth and its macroeconomic determinants exhibit a long-run relationship in Singapore cointegrating system. This means the series in the system are moved together and cannot moved far from each other. The same conclusions can also be applied for Malaysia, Thailand, Philippine and Indonesia.

Table 2 The cointegration result for Singapore

Hypothesis		Lambda Trace	5% critical value	1% critical value	Lambda Max	5% critical value	1% critical value
H_0	H_1						
r=0	r>0	77.07210$^{*(**)}$	68.52	76.07	37.71088*	33.46	38.77
r≤1	r>1	39.36122	47.21	54.46	15.98193	27.07	32.24
r≤2	r>2	23.37929	29.68	35.65	13.10595	20.97	25.52
r≤3	r>3	10.27334	15.41	20.04	8.859741	14.07	18.63
r≤4	r>4	1.413595	3.76	6.65	1.413595	3.76	6.65

Note that the notation 'r' denotes the number of cointegrating vectors. The superscript (**) indicates statistically significant at 5% and (*) at 1%. The critical values for the Johansen Juselius test were obtained from (Osterwald-Lenum, 1992).

Table 3 The cointegration result for Malaysia

Hypothesis		Lamda Trace	5% critical value	1% critical value	Lambda Max	5% critical value	1% critical value
H_0	H_1						
r=0	r>0	88.36177$^{*(**)}$	68.52	76.07	41.53120$^{*(**)}$	33.46	38.77
r≤1	r>1	46.83056	47.21	54.46	18.54683	27.07	32.24
r≤2	r>2	28.28373	29.68	35.65	13.41724	20.97	25.52
r≤3	r>3	14.86649	15.41	20.04	11.49842	14.07	18.63
r≤4	r>4	3.368069	3.76	6.65	3.368069	3.76	6.65

Note that the notation 'r' denotes the number of cointegrating vectors. The superscript (**) indicates statistically significant at 5% and (*) at 1%. The critical values for the Johansen Juselius test were obtained from (Osterwald-Lenum, 1992).

Table 4 The cointegration result for Thailand

Hypothesis		Lamda Trace	5% critical value	1% critical value	Lambda Max	5% critical value	1% critical value
H_0	H_1						
r=0	r>0	101.5702$^{*(**)}$	68.52	76.07	58.44194$^{*(**)}$	33.46	38.77
r≤1	r>1	43.12830	47.21	54.46	16.92207	27.07	32.24
r≤2	r>2	26.20623	29.68	35.65	14.05542	20.97	25.52
r≤3	r>3	12.15081	15.41	20.04	9.563480	14.07	18.63
r≤4	r>4	2.587330	3.76	6.65	2.587330	3.76	6.65

Note that the notation 'r' denotes the number of cointegrating vectors. The superscript (**) indicates statistically significant at 5% and (*) at 1%. The critical values for the Johansen Juselius test were obtained from (Osterwald-Lenum, 1992).

Table 5 The cointegration result for Philippine

Hypothesis H0	Hypothesis H1	Lamda Trace	5% critical value	1% critical value	Lambda Max	5% critical value	1% critical value
r=0	r>0	86.41198*(**)	68.52	76.07	40.81620*(**)	33.46	38.77
r≤1	r>1	45.59578	47.21	54.46	17.46097	27.07	32.24
r≤2	r>2	28.13480	29.68	35.65	14.86239	20.97	25.52
r≤3	r>3	13.27241	15.41	20.04	9.544347	14.07	18.63
r≤3	r>3	3.728066	3.76	6.65	3.728066	3.76	6.65

Note that the notation 'r' denotes the number of cointegrating vectors. The superscript (**) indicates statistically significant at 5% and (*) at 1%. The critical values for the Johansen Juselius test were obtained from (Osterwald-Lenum, 1992).

Table 6 The cointegration result for Indonesia

Hypothesis H0	Hypothesis H1	Lamda Trace	5% critical value	1% critical value	Lambda Max	5% critical value	1% critical value
r=0	r>0	86.93364*(**)	68.52	76.07	47.10336*(**)	33.46	38.77
r≤1	r>1	39.83028	47.21	54.46	19.36090	27.07	32.24
r≤2	r>2	20.46938	29.68	35.65	12.46644	20.97	25.52
r≤3	r>3	8.002940	15.41	20.04	5.369981	14.07	18.63
r≤3	r>3	2.632959	3.76	6.65	2.632959	3.76	6.65

Note that the notation 'r' denotes the number of cointegrating vectors. The superscript (**) indicates statistically significant at 5% and (*) at 1%. The critical values for the Johansen Juselius test were obtained from (Osterwald-Lenum, 1992).

The Error Correction Model Results

In this part, since the cointegration tests in the earlier section identify for the one long-run relationship for each of the export equation, the error correction models were estimated to observe for the short-run relationship in the models. In order to find the reasonable structure equation for exports models, we performed many estimation experiments. In this stage, there will be two parts of estimations (Baak, 2008). Firstly, the regression equation included each explanatory variable up to 12 lags. Then, each variable which was not found to be insignificant will be omitted from the systems. The full results for this stage are reported in Table 7.

In Table 7, the results suggest for the long-run equilibrium relationship among the variables in each export function. These results are further supported with the negative sign of the each of error terms coefficient (ECT_{ijt-1}) in the exports function. On the other hand, all systems passed the diagnostic tests. Moreover, some of the estimated coefficients of the explanatory variables were consistent with the previous studies. Nevertheless, the results in overall effects of a variable contradict our expectations in just a few cases. Firstly, the effects of the GDP of the importing country (in our study this is the United States), are estimated to be both negative and positive in the systems. But, for Thailand the relationship between exports and GDP are positive. Therefore, the overall effects of the relationship are positive and ambiguous. Secondly, the result suggests for the positive relationship in the short-run between exports and the bilateral exchange rate for Singapore and Malaysia. This result denotes that, when depreciation of the exporting country's currency (depreciations of the domestic currency, i.e; Ringgit Malaysia (RM) for the Malaysia case) usually leads to an increase in exports (from the United States). However, this finding is not applied for Indonesia, Thailand and Philippines, where the results are mixed and lead to sign ambiguity. Third, the short-run effects of the exchange rate volatility are more complicated. There are positive effects in the exports of Indonesia to the United States. Besides, the results further suggest for the negative relationship between exports and exchange rate volatility, from Philippines and the United States. The results are found to be mixed in the Singapore, Malaysia and Thailand systems. Therefore, as a conclusion, the effects of the exchange rate volatility to Singapore, Malaysia and Thailand are ambiguous, while the same relationship for Indonesia and Philippine are positive and negative, respectively. Finally, the table also shows significant effects from the crisis dummy to exports. Therefore, to take into account the crisis dummy in the systems is vital in order to capture for the structure break that occurred during the 1997/1998 Asian Financial crisis.

Table 7 The Error Correction Model Results for ASEAN Countries

Variables	ASEAN Countries				
	Singapore	Malaysia	Thailand	Philippine	Indonesia
Constant	-0.0009 (-1.58)	0.006 (1.66)c	0.018 (4.674)a	0.004 (0.99)	0.012 (2.29)b
ECT_{ijt-1}	-0.2296 (-5.00)a	-0.018(-1.78)c	-0.0254(-7.42)a	-0.028 (-5.70)a	-0.013 (-1.57)c
ΔA_{ijt-1}	-0.681 (-11.33)a	-0.279 (-4.41)a	-0.599 (-9.56)a	-0.375 (-6.18)a	-0.444 (-7.46)a
ΔA_{ijt-2}	-0.262 (-3.80)a	-0.088 (-1.59)	-0.557 (-7.66)a	-0.324 (-5.34)a	-0.203 (-3.20)a
ΔA_{ijt-3}	0.104 (1.57)	-	-0.438 (-6.19)a	-0.177 (-3.21)a	-0.175 (-2.926)a
ΔA_{ijt-4}	0.161 (2.73)a	0.019 (0.34)	-0.508 (-7.97)a	-0.302 (-4.94)a	-0.194 (-3.14)a
ΔA_{ijt-5}	-	-	-0.463 (-7.43)a	-0.271 (-4.41)a	-0.222 (-3.521)a
ΔA_{ijt-6}	-	-0.138 (-2.32)b	-0.526 (-8.95)a	-0.214 (-3.74)a	-0.226 (-3.697)a
ΔA_{ijt-7}	-0.199 (-3.55)a	-0.144 (-2.40)b	-0.581 (-9.65)a	-0.156 (-2.82)a	-0.109 (-1.705)c
ΔA_{ijt-8}	-	-	-0.584 (-9.29)a	-0.268 (-4.31)a	-0.087 (-1.47)
ΔA_{ijt-9}	0.102 (1.77)c	-	-0.482 (-7.22)a	-0.28 (-4.65)a	-
ΔA_{ijt-10}	0.100 (1.72)c	-	-0.404 (-5.98)a	-0.187 (-3.39)a	-0.093 (-1.761)c

Table 7...*cont*

ΔA_{ijt-11}	-	0.129 (2.17)b	-0.248 (-4.23)a	-	-
ΔA_{ijt-12}	0.144 (2.61)a	0.257 (4.27)a	-	0.206 (3.48)a	0.242 (4.44)a
ΔG_{jt-1}	0.009 (2.57)b	0.008 (2.86)a	0.008 (2.86)a	0.016 (4.40)a	0.015 (3.48)a
ΔG_{jt-2}	0.020 (4.69)a	0.016 (4.62)a	0.019 (6.22)a	0.012 (3.316)a	0.014 (3.59)a
ΔG_{jt-3}	0.012 (3.21)a	0.002 (0.69)	0.011 (3.08)a	-	-
ΔG_{jt-4}	-	-	0.007 (2.16)b	-	-
ΔG_{jt-5}	-0.013 (-3.38)a	-	0.007 (2.44)b	0.003 (1.27)	0.009 (2.29)b
ΔG_{jt-6}	-0.021 (-5.34)a	-0.005 (2.12)b	-	-	-0.007 (-1.93)c
ΔG_{jt-7}	-	-	0.012 (4.21)a	-	-
ΔG_{jt-8}	-	-0.015 (-4.92)a	-	-0.015 (-4.70)a	-0.0089 (-2.19)b
ΔG_{jt-9}	0.014 (3.64)a	-0.005 (-1.68)c	0.013 (4.49)a	0.005 (1.67)c	-0.004 (-1.08)
ΔG_{jt-10}	0.007 (1.91)c	-	0.009 (3.01)a	-	-
ΔG_{jt-11}	-	-	-	-	-
ΔG_{jt-12}	-	-	-	0.009 (2.93)a	0.008 (2.09)b
ΔP_{jt-1}	-	-	-	-	0.155 (1.79)b
ΔP_{jt-2}	0.962 (2.60)b	-	0.013 (0.08)	0.262 (1.36)	-
ΔP_{jt-3}	-	0.246 (1.13)	-	-	-
ΔP_{jt-4}	0.753 (2.06)b	-	-	-	-
ΔP_{jt-5}	-	-	-	0.544 (2.48)b	-0.316 (-2.27)b
ΔP_{jt-6}	0.544 (1.45)	0.506 (2.32)b	-0.01 (-0.07)	-0.256 (-1.29)	-
ΔP_{jt-7}	0.839 (2.18)b	-	-	-	-
ΔP_{jt-8}	-	-	-	-	-
ΔP_{jt-9}	-	0.49 (2.418)b	-	-	-
ΔP_{jt-10}	0.429 (1.13)	-	0.214 (1.41)	-	-
ΔP_{jt-11}	-	-	-	0.240 (1.23)	-0.174 (-2.16)b
ΔP_{jt-12}	-	-	-	-	-
$\Delta \sigma_{ijt-1}$	-	-	-	-	0.148 (1.17)
$\Delta \sigma_{ijt-2}$	-	-	0.620 (2.52)b	-	0.007 (0.063)
$\Delta \sigma_{ijt-3}$	-	0.986 (1.43)	0.291 (0.89)	-	-
$\Delta \sigma_{ijt-4}$	-	-	-	-2.02 (-3.13)a	0.500 (2.499)b
$\Delta \sigma_{ijt-5}$	-	-1.215 (-1.65)c	-	-	-
$\Delta \sigma_{ijt-6}$	-2.09 (-1.15)	-	-	-0.818 (-1.39)	-
$\Delta \sigma_{ijt-7}$	-4.23 (-2.26)b	-1.135 (-1.460)	0.103 (0.45)	-1.189 (-2.08)b	-

Table 7...*cont*

$\Delta\sigma_{ijt-8}$	-	-0.737 (-0.97)	-	-	-
$\Delta\sigma_{ijt-9}$	-	-	-	-	-
$\Delta\sigma_{ijt-10}$	-	-	-0.086 (-0.24)	-1.672 (-2.67)a	-
$\Delta\sigma_{ijt-11}$	-	-	-	-	-
$\Delta\sigma_{ijt-12}$	-	1.118 (1.93)c	-	-	-
ΔCD_{ijt-1}	-	-0.028 (1.65)	-	-	-
ΔCD_{ijt-2}	-	0.111 (2.62)a	0.134 (3.16)a	0.105 (2.37)b	0.153 (2.69)a
ΔCD_{ijt-3}	-	-0.066 (-1.54)	-	-0.093 (-2.09)b	-
ΔCD_{ijt-4}	-0.126 (-2.24)b	-0.104 (-2.43)b	-0.037 (-0.91)	-	-0.072 (-1.28)
ΔCD_{ijt-5}	-0.094 (-1.67)c	-0.058 (-1.309)	-	-0.034 (-0.74)	-
ΔCD_{ijt-6}	-0.082 (-1.45)	-	-	-	-
ΔCD_{ijt-7}	-0.122 (-2.12)b	-	-0.006 (-0.14)	-0.094 (-1.98)b	-0.102 (-1.65)c
ΔCD_{ijt-8}	-	-	-	-0.059 (-1.258)	-
ΔCD_{ijt-9}	-	-	-	-	-
ΔCD_{ijt-10}	-	-	-	-	-
ΔCD_{ijt-11}	-	-	0.075 (1.44)	-	-0.094 (-1.46)
ΔCD_{ijt-12}	-	0.106 (2.25)b	0.004 (0.10)	-	-
DW	2.0213	2.0680	1.9032	2.0800	2.0822
B-G	**F=1.5[lag4/0.34]**	**F=1.9[lag12/0.35]**	**F=1.2[lag2/0.31]**	**F=1.1[lag2/0.22]**	**F=1.5[lag2/0.25]**
B-P-G	**F=2.25[0.1887]**	**F=2.3[0.2432]**	**F=1.69[0.2938]**	**F=2.03[0.2180]**	**F=1.12[0.3180]**
R^2	**0.6343**	**0.5384**	**0.6816**	**0.6306**	**0.5746**
Ads. R^2	**0.5868**	**0.4759**	**0.6296**	**0.5744**	**0.5171**
F-stat	**13.3624**	**8.6229**	**13.1045**	**11.2332**	**9.9880**
Prob. (F-Stat)	**(0.0000)**	**(0.0000)**	**(0.0000)**	**(0.0000)**	**(0.0000)**
5% Critical values					

Note that figure in parentheses are the absolute t-statistic.

CONCLUSION

This paper offers some new results for the exchange rate volatility from ASEAN countries to the United States over the monthly period from January, 1990 to December, 2012. In order to capture for the short and long-run relationship between the variables under estimation, this study performed the Johansen Juselius (1990) tests and Granger causality in the vector error correction framework in order to distinguish for the short and long-run relationship between the variables in the systems. In general, the real bilateral exchange rate volatility has a significant impact on exports at least for all the countries considered in our sample, and the impact overall is negative except for Indonesia.

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