1. Introduction

The debate on exchange rate volatility and exports is gaining attention after the collapse of the Bretton Woods exchange rate system (1973) in the last century. Also, in the early part of this century many countries switched from fixed to flexible exchange rate regime and adopted liberalized trade policy in their economies. These liberalizations of the exchange rate and trade policies intensify the capital flows and trade flows among the countries and appear to have amplified volatility of the exchange rate. That’s why increasing volatility of the exchange rate is a major concern of policymakers as well as academics. Though the volatility of exchange rates is a major concern of academics and policymakers, there is no common consensus about the impact of exchange rate volatility on exports either theoretically or empirically. Different empirical studies suggested that the effects of exchange rate volatility on exports differ noticeably across countries and regions for different sample periods and variables.

The common perception about the relationship between exchange rate volatility and exports is that exchange rate volatility has a negative effect on exports. The idea behind this consensus is the risk aversion of firms. If the firms are risk averse, then the volatility of the exchange rate creates uncertainty in the profitability of the firms which results in the reduction of output and exports (Clark, 1973). Clark (1973) first suggested that exchange rate volatility adversely affects exports. Later, Hooper and Kohlhagen (1978) established the basic model which explains the negative relationship between exchange rate volatility and exports. Some other empirical researchers also reported (Cushman, 1983; Arize et al., 2000; IMF, 2004; Thorbecke, 2008; Ozturk and Kalyoncu, 2009; Hayakawa and Kimura, 2009; Chit et al., 2010) the same conclusion. However, these conclusions rely on many theoretical assumptions, such as perfect competition, the absence of imported inputs, high aversion to risk, and the absence of financial instruments for hedging (Auboin & Ruta, 2011). Once these assumptions are relaxed, the relationship between exchange rate volatility and trade becomes more complicated and ambiguous.

On the other hand, De Grauwe (1988) established a positive relationship between exchange rate volatility and exports. The argument is that very risk-averse traders are exporting more to compensate for the expected risks.
fall in revenue per exported unit in response to increased volatility. As De Grauwe (1988) argued “exporters are universally made unhappy by the volatility of exchange rates, some may decide that they will be better off exporting more” (P. 67). In this case the income effect is more dominant than the substitution effect. Broll and Eckwert (1999) also confirmed the positive relationship between exchange rate volatility and exports. But this is only for those firms which can react flexibly due to exchange rate change and can reallocate their products among markets. Some other empirical studies (Assery and Peel, 1991; McKenzie and Brooks, 1997; Klein and Shambaugh, 2006; Rahman and Serletis, 2009) also confirmed the same specification.

Also, many other researchers could not find a significant relationship between exchange rate volatility and exports (Tenreyro, 2007; Hondroyiannis et al., 2008; Boug and Fagereng, 2010).

The relationship between exchange rate volatility and exports for Asian countries is also examined in many studies. Doganlar (2002) estimated the impact of exchange rate volatility on exports for five Asian countries (Turkey, South Korea, Malaysia, Indonesia and Pakistan) and found that exchange rate volatility reduces the real exports in these countries. Thorbecke (2008) found that exchange rate volatility decreases the flow of electronic components within East Asia. Hayakawa and Kimura (2009) found that intra-East Asian trade is discouraged by exchange rate volatility more seriously than the trade in other regions. Chit et al. (2010) investigated the relationship between exchange rate volatility and exports for emerging East Asian countries (China, Indonesia, Malaysia, Philippines and Thailand) and found that exchange rate volatility has a significant negative impact on the export flows to the world market. Pino et al. (2016) investigated the effects of exchange rate volatility on exports in six East Asian countries (Indonesia, Malaysia, South Korea, Singapore, Thailand and Philippines) and found that the effect of exchange rate volatility on exports flows is predominantly negative in the long run except for Singapore.

Though a large number of theoretical and empirical studies have examined the relationship between exchange rate volatility and exports since the collapse of the Bretton Woods exchange rate system to the recent period, there is no clear consensus on the topic. That’s why it is important to re-examine the relationship between exchange rate volatility and exports.

More importantly, almost all existing exchange rate and trade literature rely on the conventional approach of gross measuring of trade flows data. But due to the emergence of the global supply chain, the rise in the production network and the multi-country production chains, gross trade data is increasingly very different than how much value-added is exchanged between countries (Johnson, 2014). That’s why gross trade may no longer be accurate in measuring “real” bilateral trade positions. This is because traded intermediate goods and services used as inputs for export may be counted several times (when they cross borders) in the trade statistics. That means, large exports need not reflect large amounts of domestic value added (Ceglowski, 2017). For example, to produce an exported good may require a significant amount of inputs and that may have been imported from abroad. That’s why much of the revenue, from selling the exported good may have to be spent on purchasing intermediate imports used in production, yielding only marginal benefits in the exporting economy. As Dedrick et al. (2009) showed, of the $144 (Chinese) factory-gate price of an iPod less than 10% contributed to Chinese value-added, with the substantial amount of components (about $100) being imported from Japan and rest of them from the US and Korea. Many other studies also showed similar evidence. That’s why Johnson (2014) points out that gross trade data can overestimate or underestimate bilateral trade relations and foreign exposure
as intermediate trade dominates two-thirds of world trade.

In recent times, economists have thus put the emphasis on value-added content of exports rather than gross exports. Increasing use of imported components and offshoring parts of the production process means that a final export may contain a high percentage of foreign value-added and a correspondingly small percentage of value added by the exporting country (Ceglowski, 2017). Value-added exports help better quantify the strength of demand spillovers, the consequences of relative price movements for competitiveness (Johnson, 2014). Moreover, it is value-added in final exports that really matters for job creation, value generation, and wealth accumulation (Yizhe, 2016). By extension, a country’s export competitiveness measured by the domestic value-added contained in its exports could look quite different from one measured by gross exports. So, exchange rate movements are likely to have different impacts on trade, particularly in magnitude between gross trade data and trade in value-added. Therefore, it is necessary and critical to re-examine the impact of exchange rates on trade using value-added trade data and compare the findings with the results using gross trade data.

Though it is important to quantify the magnitude of exchange rate volatility on value-added exports, very few studies exist on this topic. To the best knowledge of this author, only Duval et al. (2016) and Yizhe (2016) have done the research on this topic. But their studies are not focused on Asian countries. That’s why this study attempts to examine the impact of exchange rate volatility on gross exports and value-added exports for 11 Asian countries and intends to contribute the existing empirical literature by providing new estimation results for value-added exports.

The paper is organized as follows. Section 2 presents the empirical strategy which includes: the definition of the variables and data sources; methodology; theoretical considerations; model specification and calculating exchange rate volatility. Section 3 reports and discusses estimation results. Section 4 performs some robustness checks and section 5 concludes.

2. Empirical Strategy

a) The definition of the variables and data sources

This paper used annual data for all variables for 11 Asian countries from 2001 to 2016 except the value-added exports variable to estimate the empirical model. The value-added exports variable is from 2001 to 2012 due to the unavailability of this data. The variables used in this study are; gross exports, value-added exports, trade-weighted income of importing countries, exchange rate volatility and a relative price measure. All variables are in natural logarithm except exchange rate volatility. By deflating gross exports and value-added exports with CPI this paper computed the real exports and real value-added exports. For calculating importer’s countries income this paper covered up to 90 percent of exports of a country to its export destination countries. Exchange rate volatility is calculated annually from the monthly nominal exchange rate by using the standard deviation formula. This paper used monthly exchange rate data rather than quarterly because the monthly data reflect the real fact of the exchange rate situation.

Nominal exchange rate and CPI data are collected from IMF’s International Financial Statistics. Gross exports and GDP are in USD and collected from World Development Indicators. Value-added exports are also in USD and was collected from the UNCTAD-Eora GVC database.

The summary statistics of the variables used in this study are presented in Table 1.
b) Methodology

Panel data regression analysis is used to examine the impact of exchange rate volatility on gross exports and value-added exports for the case of 11 Asian countries (Bangladesh, India, Indonesia, Malaysia, Pakistan, Philippines, South Korea, Sri Lanka, Vietnam, Thailand and Turkey). Panel data are better suited to study economic dynamics and minimize the bias that occurs due to omitted, unobserved characteristics and has the flexibility to focus on individual country-specific effects (Gujrati, 2009). Also, according to the literature, panel data methods are more suitable for this analysis to account for the addressing heterogeneity of different countries. Moreover, panel data methods have a large number of data points which increases efficiency and reduces the multicollinearity problem.

The literature suggests two types of estimation technique for panel data method namely: fixed-effects and random-effects. The fixed-effects model assumes that the effects of omitted country-specific variables are fixed over time, and that they are correlated with the regressors in the model (Sauer & Bohara, 2001). The random-effects model, on the other hand, treats the country-specific effects as random variables, which are independent of the other regressors (Sauer & Bohara, 2001). To choose between fixed-effects and random-effects, the Hausman test is often used. The Hausman test tests the null hypothesis that the coefficient estimated by the efficient random-effects estimator is the same as the one estimated by the coefficient fixed-effects estimator. That’s why for the estimation technique, first, this study carried out the Hausman test (Hausman, 1978) to select the appropriate model between the random-effects model estimation or fixed-effects model estimation. Then, according to the result of the Hausman test, fixed-effects or random-effects model is estimated finally. To check robustness, this study also carried out a Seemingly Unrelated Regression (SUR).

c) Theoretical Considerations

According to the existing literature, some theoretical studies (Clark, 1973; Hooper and Kohlhagen, 1978) posit that the relationship between exchange rate volatility and exports are negative. The view is that when traders are risk averse, then the exchange rate volatility adversely affects international trade because increasing volatility unexpectedly can increase the costs. This is because the exchange rate is agreed on at the time of the trade contract, but payment is not made until the future delivery actually takes place (Arize et al., 2000). If payment is not made until delivery, then unpredictable changes in the exchange rate between the time of the contract and delivery can increase uncertainty for the expected profits from exports (Doganlar, 2002).
On the other hand, other theoretical studies (De Grauwe, 1988; Broll and Eckwert, 1999) suggested that the relationship between exchange rate volatility and exports is positive. The argument is that very risk-averse traders are exporting more to compensate for the expected fall in revenue per exported unit in response to increased volatility (Auboin & Ruta, 2011). As De Grauwe (1988) argued that “exporters are universally made unhappy by the volatility of exchange rates, some may decide that they will be better off exporting more” (P. 67). In this case, due to the uncertainty of exchange rate some traders may decide to export more and the income effects are greater than the substitution effects.

d) Model Specification

To analyze the impact of exchange rate volatility on exports, various papers (e.g., Asseery and Peel, 1991; Chowdhury, 1993 and Arize et al., 2000) used the following export functions:

\[
\ln rex_{it} = \beta_0 + \beta_1 \text{exvol}_{it} + \beta_2 \ln \text{income}_{it} + \beta_3 \ln p_{it} + \alpha_{it} + \mu_{it} \tag{1}
\]

\[
\ln rexval_{it} = \beta_0 + \beta_1 \text{exvol}_{it} + \beta_2 \ln \text{income}_{it} + \beta_3 \ln p_{it} + \alpha_{it} + \mu_{it} \tag{2}
\]

Where,

\( \ln rex \) = Natural logarithm of Real Exports (deflated gross exports by CPI)

\( \ln rexval \) = Natural logarithm of Real Value-Added exports (deflated gross value-added exports by CPI)

\( \ln \text{income} \) = Natural logarithm of the trade-weighted Income of importing countries (which covered 90% of exports)

\( \text{exvol} \) = Exchange Rate Volatility (calculated from monthly nominal exchange rate)

\( \ln p \) = Natural logarithm of relative price and is measured by the ratio of that country’s unit export price in U.S. dollars to the world unit exports price in U.S. dollars

\( \alpha_{it} \) = Unobserved or heterogeneity effect and

\( \mu_{it} \) = Error term.

Here, exports (gross or value added) is a function of exchange rate volatility, the income of export destinations countries and relative price. By setting up the above equations (equation 1 and 2) this paper will determine the impact of exchange rate volatility on gross exports and value added-exports.

e) Calculating Exchange Rate Volatility

According to the standard literature, there are two well-known approaches to measure exchange rate volatility. The first approach is to use the historical standard deviation of the time series of exchange rates. The second one is to employ the volatility model to generate conditional volatility series (by using the ARCH and GARCH model). This paper used the first approach, and collected the monthly exchange rate data for 11 Asian countries and then used the following standard deviation formula:
This study calculated the annual standard deviation of the monthly exchange rate for every year and every country. This paper uses monthly exchange rate data rather than quarterly because the monthly data more accurately reflect the exchange rate situation.

3. Estimation Results and Discussion

In our model the value of Hausman test is Prob>chi2 = 0.0000 which is less than 0.05 that means p-value is significant, therefore we should use the fixed-effects model.

The main results of the fixed-effects and random-effects regressions for the period from 2001 to 2016 for gross exports are presented in Table 2.

All estimation results confirm that the impact of exchange rate volatility on gross exports is negative in both the fixed-effects and random-effects regression, but not significant, which implies that the volatility of exchange rate has no impact on gross exports in these Asian countries. All other variables which also affect the gross exports are the trade-weighted income of importing countries and the relative price of exports. The other previous findings for gross exports (Doganlar, 2002; Thorbecke, 2008; Hayakawa and Kimura, 2009; Chit et al., 2010; Pino et al., 2016) for Asian countries found that the impact of exchange rate volatility on gross exports is negative and significant. But in this study, we found that though the impact of exchange rate volatility on gross exports is negative, but not significant at all.

The main results of the fixed-effects and random-effects regression for the period from 2001 to 2012 for value-added exports are presented in Table 3.
All independent variables which affect the value-added trade are statistically significant (except relative price) for both fixed and random-effect specifications. In the case of value-added exports to determine the appropriate model, this study also conducted the Hausman test.

The most important finding of this study is that the coefficient of exchange rate volatility in the case of value-added exports is significant as contrasted with that of gross exports for 11 Asian countries. This implies that value-added exports are more sensitive in response to exchange rate volatility compared to gross exports. The trade-weighted income of importers countries is also more responsive in the case of value-added exports than gross exports. The relative price is no longer significant in the case of value-added exports. The results are as expected and provide evidence that the relationship between exchange rate volatility and valued-added exports are negative and significant compared to gross exports. This is because, valued-added exports directly affects the price level of capital inputs and labor inputs by removing the indirect foreign inputs (Yizhe, 2016). The findings of this study are also consistent with Duval et al. (2016) findings. By using a gravity model for 41 countries and for the period of 1995-2013, Duval et al. (2016) also found that the relationship between exchange rate volatility and value-added exports was negative.

### 4. Robustness Check

This paper estimated an export function by using two dependent variables, namely gross exports and value-added exports. According to the calculation viewpoint value added exports is a part of gross exports. That's why there has a possibility that the regressions may be related because the errors associated with the dependent variables are correlated. To check up the robustness of the regressions, it is necessary to estimate the models by using the Seemingly Unrelated Regression (SUR) because accounting for country time-invariant characteristics is important in signifying the estimation results for the fixed-effects model.

SUR results for both models are shown in Table 4 and Table 5. SUR results also confirm the same results.
which were found in the fixed-effects model.

5. Conclusion

This study investigated the impact of exchange rate volatility on gross exports and value-added exports for 11 Asian countries. By using the fixed-effects model, this study found that exchange rate volatility does not affect the gross exports but affects the value-added exports negatively and significantly. This implies that value-added exports are more sensitive to exchange rate volatility compared to gross exports. As value-added exports are more important for a country’s job creation, value generation and wealth accumulation, these findings can act as an important guideline for the policymakers.

Policymakers should pay more attention to exchange rate volatility due to the significance of its effect on
value-added exports. Countries should support the development of financial markets and hedging products to help firms reduce their exposure to exchange rate volatility from the perspective of the producer or exporter.

References


