A GRAVITY ANALYSIS OF VIETNAM TRADE FLOWS: DOES THE EXCHANGE RATE MATTER?

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Abstract

Over the past decades, Vietnam has increased trade volume and expanded its trade partners. It is often argued that the exchange rate policy should be revised to improve international trade. By applying the gravity model with international trade data between Vietnam and her world partners, this study shows that exchange rate devaluation may not help. More important is to have a more flexible exchange rate and to upgrade domestic production capacity as well as to implement structure reform.

Key words: *International trade, Exchange rate, Gravity model*

1. INTRODUCTION

After the 1986 "Doi Moi" policy, Vietnam economy becomes more open. Two main components of the comprehensive reform package are the outward-oriented policies in external economic relations and market-oriented policies in macroeconomic management. As a result, international trade has become one of major determinants of economic growth. As can be seen from Figure 1, both export and import value have been surging impressively since the 1990s.

Figure 1: Export and import value of Vietnam

Source: GSO

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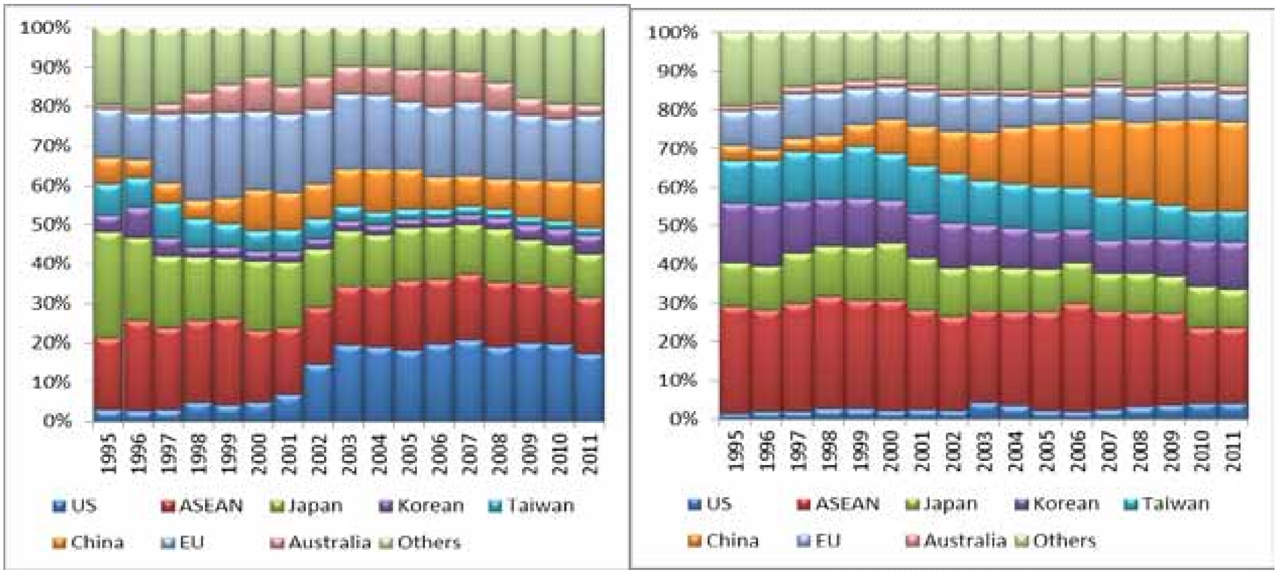
According to GSO, number of trading partners increased significantly from 43 in 1986 to 220 in 2011. There is also remarkable change in the structure of trading partners of Vietnam. During the period 1995-2001, exports to the United States increased from 3% to about 20%, while exports to ASEAN, Australia, and Japan went down. Nevertheless, EU, Japan and ASEAN have continued to be the important export markets. The most important trend in imports has been the increasing share of the Chinese market, which surged from 3% in 1995 to 23% in 2011. Imports from ASEAN still have an important weight although its share has decreased.

Figure 2: Export (LHS) and Import (RHS) Market Structure 1995 – 2011



Source: GSO

Nevertheless, Vietnamese export goods are mainly low value-added and import goods are predominantly of low and intermediate technology. Moreover, the trade balance of Vietnam has been continuously in deficit for 20 years. That does not only threaten the sustainability of the current account balance but also put high pressure on the internal balance. This issue has resulted in a serious debate among Vietnamese economists and policy-makers, separating them basically into two groups. The first group including Pham and Tran (2001), Thanh and Kalirajan (2005, 2006), Nguyen et. al. (2009) and Le (2009) highlights the importance of exchange rate policy on trade flows and supports the idea of a significant devaluation to improve the trade balance. The second group including Bui and Kobayashi (2011), Pham (2012) argues that the exchange rate is not a main determinant of Vietnam's trade flows so devaluation has little effect on improving the trade balance. This view results in the point of view that stabilizing the exchange rate is more important for promoting trade flows.

Participating in this debate, this paper analyzes the determinants of bilateral trade flows between Vietnam and her main trading partners by applying a gravity model. In particular, these following hypotheses will be tested:

Hypothesis 1: *There is a significantly positive relationship between the real exchange rate and exports*

Hypothesis 2: *There is significantly negative relationship between real exchange rate and imports*

Hypothesis 3: *Devaluation in the real exchange rate will definitely improve the trade balance*

Hypothesis 4: *The real exchange rate volatility depresses the trade flows*

Hypothesis 5: *Domestic production plays a crucial role in promoting trade flows*

Hypothesis 6: *The more similar in the level of development between Vietnam and her trading partners, the more they trade*

The next section of this paper provides literature review on the gravity model and the effects of exchange rate on trade flows. The third section discusses the estimation strategy and data. The fourth section presents the regression results. The fifth section contains conclusions and policy implication followed by the final section on some limitations of the study.

2. LITERATURE REVIEW

Gravity Model

The gravity model is inspired by Newton's law of universal gravitation: interaction between close clusters is stronger than between far ones and larger clusters interact to each other more strongly than smaller ones. Tinbergen (1962, p.286) is widely considered as the first economist who explicitly proposed a formal gravity equation for international trade. His equation $\ln E_{ij} = \alpha_1 \ln Y_i + \alpha_2; \ \ln Y_j + \ \alpha_3 \ln D_{ij} + \alpha_8 \ln G_i + \alpha'_0$ is mathematically equivalent to

$$E_{ij} = G \frac{Y_i^{\alpha_1} Y_j^{\alpha_2}}{D_{ij3}^{\alpha_3}}$$

which is an analogy of the Newton's gravity equation in physics.

The theory of the gravity model has, however, started to emerge since a study by Anderson (1979). Later contributions to the model include Bergstrand (1985), Bergstrand (1989), Deardorff (1998), and Anderson and Van Wincoop (2003).

The emergence of "economic geography" in 1970s-1980s started a new history for the gravity model when it jumped from lack of theoretical foundation to having too many (Baldwin and Taglioni 2006). As noted by Deardorff (1998) and Feenstra et al. (2001), a wide range of trade theories are proved to be consistent with gravity equations.

Anderson and Van Wincoop (2003) explicitly shows that bilateral trade does not only depend on bilateral variables but also on the position with respect to the rest of the world, namely the multilateral (price) resistance terms (MRTs) for exporting and importing countries. Without taking the MRTs into account, estimated gravity equations suffer from omitted variables bias. By assuming CES utility function of country *j*:

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1 Where $G = G_{i8}^{\alpha}.e^{\alpha'_0}$; E_{ij} is bilateral export flow; Y_i and Y_j is GNP of exporting and importing countries respectively; D_{ij} is distance between countries i and j, G_i is degree of one-sidedness (lack of diversification) of export product.As per the criticism by Leamer and Levinsohn (1995), while it has been one of the most successful empirical models in economics in terms of producing most robust empirical findings, the gravity model used to be ignored in all international economic textbooks in the 1990s due to the lack of a sound theoretical foundation.

$$U_j \equiv \left(\sum_i \left(\frac{c_{ij}}{\beta_i} \right)^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}$$

where c_{ij} is consumption by country *j* consumers of goods from country *i*, σ>1 is elasticity of substitution, the Anderson and Van Wincoop's result can be derived through six steps as Baldwin and Taglioni (2006) demonstrate to get the form as follows:

$$\frac{Y_i Y_j}{Y_W} \left(\frac{t_{ij}}{\Pi_i P_j} \right)^{1-\sigma}$$

where: M_{ij} are bilateral trade flows between country *i* and country *j*; Y_i, Y_j, Y_W are incomes of country *i*, country *j* and the world, respectively; t_{ij} are trade cost factors between country *i* and country *j* that translate mill price P_i in country *i* to price P_{ij} in market *j*:

$$P_j \equiv \left(\Sigma_i \left(\beta_i p_{ij} \right)^{1-\sigma} \right)^{\frac{1}{1-\sigma}}$$

Π_i are consumer price indices at country *j* given by ; Π_i are multilateral resistance terms, where .

$$Đ_i \equiv \left(\sum_j \left(\frac{t_{ij}}{P_j} \right)^{1-\sigma} \frac{Y_j}{Y_W} \right)^{\frac{1}{1-\sigma}}$$

The effect of exchange rate on trade flows

Relating to the effect of exchange rate on trade flows, there is no consensus. According to the elasticity approach or "imperfect substitute" model, which is contributed by Marshall and Lerner, if a country starts from a zero trade balance, the trade balance will tend to be improved if a condition, namely the Marshall-Lerner condition, $\eta_X+\eta_N>1$ (where η_X and η_N are respectively elasticity of export and import demand with respect to real exchange rate) holds. Nevertheless, as noted by Stern (2007, p.67), the Marshall-Lerner condition is *not a necessary condition* in the sense that it is possible that the devaluation may result in an improvement of the trade balance if the demand elasticities are small but the export and import supply elasticities are small enough. On the other hand, if trade is assumed to be in deficit, the Marshall-Lerner condition in terms of foreign currency can be written in a more general form:

$$\eta_X + \frac{V_{fM}}{V_{fX}} \eta_M > 1$$

where V_{fM} and V_{fX} are value of imports and exports, respectively, in terms of foreign currency (Stern 2007, p.130). Even when elasticities of demand for exports and imports are small, it is possible that devaluation can improve the trade balance in terms of foreign currency if the trade balance deficit is large enough. The Marshall-Lerner condition remains to be sufficient even if imports are used as inputs for domestic production. Sastre (2012) generalizes the Marshall-Lerner condition for an open economy in the long-run where there is no independence between GDP and exchange rate. According to his result, the Marshall-Lerner condition is revised as follows: $\eta_X (1+\varepsilon_{(X,M)}) + \eta_M(1+\varepsilon_{(M,X)}) > 1$ where $\varepsilon_{X,M}$ and $\varepsilon_{M,X}$ are elasticity of exports with respect to imports and elasticity of imports with respect to exports, respectively, or:

The second approach for investigating the effect of exchange rate on trade flows is based on the volatility approach. This approach is a border between opponents and proponents of floating exchange rate regimes. The opponents develop their argument from convention wisdom that while it is unpredictable, the volatility of exchange rate creates uncertainty that might negatively affect the profit of international transactions. The volatility of exchange rate works as transaction cost for firms because while the exchange rate is agreed when a contract is made, the payment is usually made later. Therefore, risk-adverse firms may trade more with countries that have a more predictable exchange rate (Dell' Ariccia 1999). This theoretical work provides a reason for many countries to follow a relatively fixed exchange rate system (Baron 1976).

The proponents of floating exchange rate regimes argue that there is positive relationship between exchange rate volatility and international trade. The theoretical argument provided by De Grauwe (1988), stated that while the exchange rate risk has a substitution effect due to reducing the attractiveness of international trade, it narrows the expected marginal utility of export revenue so that firms might respond by increasing exports to offset this negative effect. This response creates an income effect and if the income effect is larger than the substitution effect, the relationship between exchange-rate volatility and international trade becomes positive. According to this argument, the relationship between exchange rate volatility and international trade depends strongly upon the degree of risk aversion. Baron (1976) provides an imperfect capital market model to explain why the level of trade with a flexible exchange rate system and a fixed exchange rate system are the same. This implies that exchange rate volatility as an uncertainty has no effect on trade. Sercu and Uppal (2003) examine this relationship in a stochastic-endowment economy in general-equilibrium with imperfect international commodity market where the exchange rate was endogenous. The sign of the relationship between exchange rate volatility and trade flows was ambiguous, depending on the source of the volatility. For example, it is found that more volatility of the endowments and higher costs to international trade both boost exchange risk but the former increases the expected volume of trade, while the latter decreases trade. Klaassen (2004) based on an assumption that traders are forward-looking agents finds that export decisions are mostly affected by the probability distribution of the 12-months to come rate. Ozturk (2006) mentions the importance of sunk costs in international trade as an argument for an ambiguous relationship between exchange rate volatility and international trade. Hudson and Straathoof (2010) argue that the effect of exchange rate volatility disappeared after 1985 along with the development of the international finance market. Zhang et at. (2006) shows that the ambiguous results are due to the threshold effect. When the volatility is lower than a certain level, the impacts tend to be insignificant but exceeding this level the impacts become significant and positive in their study.

Coric and Pugh (2010) show that there are negative impacts of exchange rate variability on trade but the impacts are not robust. The authors conclude that this relationship is highly conditional. In order to obtain a general picture, the details of selected empirical studies between 1984 and 2012 are summarized in Appendix 3 based on Ozturk (2006) with our supplementation. There is no consensus among authors of these studies.

In conclusion, the empirical studies fail to provide a systematically significant link between exchange rate volatility and international trade (Caporale and Doroodian, 1994). Depending upon the sample periods, countries considered, model specification, econometric methods, and proxies for exchange rate volatility, the empirical results are mixed (Orturk, 2006).

3. ESTIMATION STRATEGY AND DATA

The gravity models for both the exports and the imports of Vietnam are formed based on the single country approach due to the asymmetric nature of the exports and the imports. To capture the impacts of the exchange rate within the gravity analysis of the trade flows, we follow Rose (2000) and Chit et al. (2010) to set up the traditional form with the GDP of Vietnam and her partners as the proxies for supplying capacity and purchasing power while the volatility and the real exchange rate level come into the models as explanatory variables. We follow Frankel and Wei (1998), Soloaga and Winters (2001)to use a proxy "economic remoteness" of the trading partners to measure the "economic distance" from each country to its "average trading partner" (or to the rest of the world) to capture the MRTs. As argued by Melitz (2007) "the same distance between a country pair will have different implications depending on whether they have many near-by neighbours or few".

Regarding econometric methods, the OLS method is used to estimate gravity equations in almost all cases (Cyrus, 2002). The omitted variable or misspecification problem is, however, very common in gravity analysis when the OLS method is applied. Frank (1995, p134) points out that estimating the gravity model by OLS method also suffers from an endogeneity problem. Therefore, some authors recommend the Instrumental Variable method as a better tool for empirical works. However, as shown by Cyrus (2002), while endogeneity exists in some cases, it plays little role in causing biased estimations. The gravity equations estimated by the Instrumental Variable method are not much different from ones estimated by the OLS method. The other problem with the OLS method is heterogeneous trading relationships among countries. With heterogeneity, a country would export different amounts to two countries even if other gravity variables are the same.

In this paper, firstly, the OLS method is applied to estimate the exports and imports equations. After that, the model specification is decided based on multicollinearity and misspecification diagnostics. In particular, the variance inflation factor (VIF) diagnostic is applied to confirm that there is no multicollinearity in both models. In order to detect the misspecification problem, both the specification link test and the Ramsey RESET test are applied.

Because the most updated data of the bilateral trade between Vietnam and her partners are in 2009, we use yearly data from 2001 to 2009 for 75 main trading partners that cover about 90% - 95% of the exports and the imports of Vietnam.

The regression models have the forms as follows.

$$\begin{aligned}\mathbf{ln}\boldsymbol{X}_{it} = {} & \beta_0^X + \beta_1^X \ln Y_t^V + \beta_2^X Y_{it} + \beta_3^X \ln D_i + \beta_4^X \ln REMOTE_{it} + \beta_5^X \ln RER_{it} + \beta_6^X VOL_{it} + \\ & \beta_7^X DDev_{it} + \beta_8^X OPEN_{it} + \beta_9^X OIL_t + \beta_{10}^X TFI_{it} + \beta_{11}^X TCI_{it}^X + \beta_{12}^X APEC + \\ & \beta_{13}^X ASEAN + \beta_{14}^X ADJ + \beta_{15}^X LOCK + \varepsilon_{it}^X\end{aligned} \quad (1)$$

$$\begin{aligned}\mathbf{ln}\boldsymbol{M}_{it} = {} & \beta_0^M + \beta_1^M \ln Y_t^M + \beta_2^M Y_{it} + \beta_3^M \ln D_i + \beta_4^M \ln REMOTE_{it} + \beta_5^M \ln RER_{it} + \beta_6^M VOL_{it} + \\ & \beta_7^M DDev_{it} + \beta_8^M OPEN_{it} + \beta_9^M OIL_t + \beta_{10}^M FCI_{it} + \beta_{11}^X TCI_{it}^M + \beta_{12}^M APEC + \\ & \beta_{13}^M ASEAN + \beta_{14}^M ADJ + \beta_{15}^M LOCK + \varepsilon_{it}^M\end{aligned} \quad (2)$$

where RERit is CPI-based bilateral real exchange rate between Vietnam and country i in year t, calculated as.

$$\mathrm{RER}_{\mathrm{it}} = \mathrm{NER}_{\mathrm{it}} \cdot \frac{\mathrm{CPI}_{\mathrm{it}}}{\mathrm{CPI}_{\mathrm{i}}^{\mathrm{VN}}}$$

The exchange rate and CPI data are annual average data that are extracted from the IMF's International Financial Service database (IFS/IMF), except for the case of Taiwan where data are from National Statistics, Republic of China (Taiwan). All CPI data are reconverted so that 2005 is the base year (CPI2005=100). In the case a country participated in the EMU between 2001 and 2009, such as Slovakia, the exchange rate is recalculated based on the domestic currency and the exchange rate between the domestic currency and the Euro;

$\boldsymbol{Y_t^V, Y_{it}}$ are respectively real GDP of Vietnam and the country i in year t, calculated by deflating the nominal GDP by the GDP deflator. The GDP deflator index is then converted to be equal to 100 in 2005. All GDP and GDP deflator data are taken from the World Economic Outlook database (updated April 2012). Real GDP data are converted to the VND terms using the bilateral real exchange rate;

$\boldsymbol{X_{it}}$ and Mit are, respectively, Vietnam real exports to and real imports from the country i in year t. The export and import data in current price USD are taken from the UN COMTRADE database, except for the case of Taiwan where data is not available and in some cases where certain yearly data are missing (such as China's data in 2003). In this case, the official data from the General Statistics Office of Vietnam (GSO) are used. The nominal exports and the nominal imports are deflated by the GDP deflator of the United States to obtain real terms in USD and then converted to the real terms in VND using real bilateral exchange rate between Vietnam and the United States;

$\boldsymbol{D_i}$ is the geographic distance between the most populated city of Vietnam and the most populated city of the country i. The distance data is taken from the CEPII database;

$\boldsymbol{REMOTE_{it}}$ is the relative "economic remoteness" of country i to the world in year t. When we control the distance between Vietnam and her partner, the more remote her partner is from the rest of the world, the more she should trade with Vietnam, however, the importance of geographic distance should be reduced when the economic size of partner is taken into account. After the Anderson and van Wincoop's MRTs

$$\Pi_i \equiv \left(\Sigma_j \left(\frac{t_{ij}}{P_J} \right)^{1-\sigma} \frac{Y_j}{Y_W} \right)^{\frac{1}{1-\sigma}} \text{ where } (\sigma>1)$$

were derived, the remoteness proxy $\Sigma_J^N D_{ij} \cdot \left(\frac{Y_{jt}}{Y_{Wt}} \right)^{-1}$ was preferred. Although mathematical relation between this proxy and Π_i is weak[2], intuition of this formula is straightforward[3].

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2 $\Pi_i = \left(\sum_j \left(\frac{t_{ij}}{P_j} \right)^{1-\sigma} \frac{Y_j}{Y_W} \right)^{\frac{1}{1-\sigma}} \approx \sum_j \left(\frac{t_{ij}}{P_j} \right)^{\frac{1-\sigma}{1-\sigma}} \left(\frac{Y_j}{Y_W} \right)^{\frac{1}{1-\sigma}} \approx \sum_j \left(\frac{t_{ij}}{P_j} \right) \left(\frac{Y_j}{Y_W} \right)^{\frac{1}{1-\sigma}}$ After that set σ = 2 and use distance as a proxy for trade costs factor. A better but more complicated approximation can be seen in Baier and Bergstrand (2010)

3 Although Anderson and van Wincoop (2003) claimed that the theory did not provide any functional form of remoteness as used to be done in many empirical papers, Brun et.al. (2005) pointed out that their result with remoteness variable was quite close to the result derived by Anderson and van Wincoop (2003) and the gravity equation with remoteness was "closer to accepted theoretical foundations"

In particular, $\sum_{j=1, j\neq i}^{N} \frac{D_{ij}}{GDP_{jt}/GDP_{Wt}}$ where D_{ij} is the geographic distance between the country i and the country j, GDP_{jt} is nominal GDP of the country j in year t and GDP_{Wt} is the world nominal GDP in year t[4]. The world GDP data are also taken from the World Economic Outlook database. The remoteness is calculated based on the data of 178 countries whose the data are available in both the World Economic Outlook database (for GDP) and in the CEPII database (for distance).

$\boldsymbol{VOL_{it}}$ is the volatility of the real bilateral exchange rate between Vietnam and the country i in year t, which is calculated as the standard deviation of the first difference of the logarithm of monthly bilateral RER:

$$VOL_{it} = \sqrt{\frac{1}{11}.\sum_{t=1}^{12}\left(\Delta \ln RER_{it} - \Delta \ln RER_{it}\right)^2}$$

The monthly exchange rates are the average exchange rates of each month. In the case a country participated in the EMU between 2001 and 2008, such as Slovakia, the exchange rate is recalculated based on the domestic currency and the exchange rate between the domestic currency and the Euro. The monthly CPI data are sourced from IFS/IMF except for the case of Taiwan whose data are from National Statistics, Republic of China (Taiwan) and the case of China whose data are from the OECD. STAT database. The monthly exchange rates are the average exchange rates of each month and this data is mainly extracted from IFS/ IMF except for the case of Taiwan, whose data is from National Statistics, Republic of China (Taiwan). In the case a country participated in the EMU between 2001 and 2008, such as Slovakia, the exchange rate is recalculated based on the domestic currency and the exchange rate between the domestic currency and the Euro;

$\boldsymbol{TFI_{it}}$ and $\boldsymbol{FCI_{it}}$ are respectively the Trade Freedom Index (TFI) and the Freedom from Corruption Index (FCI) of the country i in year t. The TFI is marked from 0 to 100 points based on the formula:

$$TFI_{it} = \frac{\text{tariff}_{\text{max}} - \text{tariff}_{\text{i}}}{\text{tariff}_{\text{max}} - \text{tariff}_{\text{min}}} \times 100 - NTB_i$$

where $\text{tariff}_{\text{max}}$, $\text{tariff}_{\text{min}}$, tariff_{i} are relatively upper bound, lower bound and weighted average tariff rate of the country i. NTB_i is penalty score based on the existing of non-tariff barriers in the country i. This variable is important to Vietnam's exports but it does not matter to Vietnam's import because basically Vietnam has treated her trading partners equally on the basis of the Most Favoured Nations (MFN) to both WTO members and non-WTO members since 1990s[5]. The Heritage Foundation's FCI is basically a rescale version of the 10 point scale Corruption Perceptions Index announced by Transparency International, which is a proxy for effectiveness of government that may reduce trade cost.

$\boldsymbol{TCI_{it}^{X}}$ and $\boldsymbol{TCI_{it}^{M}}$ are Trade Complementarity Indices from Vietnam to her partner i and from her partner i to Vietnam, respectively, in year t, which is a proxy for the degree to which the export pattern of Vietnam matches the import pattern of trading partners and vice versaThe

[4] The remoteness of Vietnam is not included in both equations due to multicollinearity.

[5] Exceptions are regional trade agreements that are mostly controlled by two dummies ASEAN and APEC

TCIs are calculated based on the SITC Revision 3 for the tier 3-digit (group level) from UN COMTRADE database by the software World Integrated Trade Solution (WITS) designed by the World Bank, the UNCTAD, the WTO and the UN Statistics Division);

OILt is the crude petroleum price index in year t extracted from UNCTADStat (Free market commodity price indices database). This index is incorporated to capture the external shock from oil prices, which is important for both the exports and the imports of Vietnam. The expected sign of the coefficients is ambiguous;

OPENit is the openness of country i in year t[6], calculated as the percentage of total trade in goods and service in nominal GDP in year t. The data is extracted from the IFS/IMF database. In some cases where the data of total trade in goods and service is not available, the data of trade in goods is used alternatively;

DDe_{vit} is the relative difference of level of development between Vietnam and the country i, measured as

$$DDev_{it} = \left| \ln\left(\frac{Y_t^V}{P_t^V}\right) - \ln\left(\frac{Y_{it}}{P_{it}}\right) \right|$$

where PtV and Pit are relatively the population of Vietnam and the population of the country i. The population data is from the UN STATs database;

APEC, ASEAN, ADJ and LOCK are dummies for APEC membership, ASEAN membership, shared border with Vietnam and landlocked situation, respectively; and

ε_{it}^X and ε_{it}^M are error terms.

While both equations pass the linktest, the Ramsey RESET test rejects the null hypothesis of no omitted variable in the import model. Therefore, the augmented component plus residual plots are examined and the relationship between LnM and DDev is found to be non-linear. This finding suggests that a power of DDev should be included into the import equation. Because DDev2, the quadratic power of DDev, causes multicollinearity as detected by the VIF diagnostic[7], the cubic power of DDev, namely DDev3, is added into the import equation. The result of regression shows that the coefficient of the DDev3 variable is small and negative but statistically significant at the 5% level.[8]

The visual diagnostic of residual-versus-fitted plot also suggests that both models (1) and (2) have a problem of heteroskedasticity[9]. The Breusch-Pagan/Cook-Weisberg test for heteroskedasticity rejects the hypothesis of homoskedasticity. In the case of many countries data, the heteroskedasticity is reasonably assumed to be a groupwise in the sense that the variance of the error terms is constant within each country but it might be different between countries[10].

The visual diagnostic of leverage-versus-squared-residual plot also presents the problem of outliers.[11] Some observations

[6] The openness of Vietnam is not included due to multicollinearity
[7] The VIF value of DDev2 is greater than 10, the cut-off level by rule of thumbs
[8] See Appendix 4
[9] Indeed, Levene's robust test statistic and Brown and Forsythe's alternative test statistic for the equality of variances between
[10] Indeed, Levene's robust test statistic and Brown and Forsythe's alternative test statistic for the equality of variances between the groups firmly reject the null hypothesis of equal variance in our data (while they cannot reject for the case of years)
[11] See Appendix 4

that have extremely strong influence in the regression may affect the slope and the intercept of the regression line so significantly that this may cause a systematic problem for statistical inference. Indeed, in the OLS, the vector of parameters are estimated, or in other words, are based on minizing the sum of the squared residuals , so it might be very sensitive to the existings of outliers because one could see "the sum of squared error terms as weighted average of the absolute values of the errors, where the weights are their own values" (Kennedy, 2008, p.347). Hence, if outliers exist the OLS method will inflate the error terms significantly.

An idea which could be used to handle this problem is that instead of using We should set the weight to 1, so estimated parameters; or in other words, instead of minimizing the sum of the squared residuals, we should minimize the sum of absolute valude of residuals to reduce the influence of outliers. This work could be done by so-called quantile regression. In another method, we perform a robust regression (rreg command in Stata). The basic idea of the robust regressoin is that each observation should be weighted and a better behaviour should be weighted higher than the worst one, so outliers are weighted less than other observations. In fact the observations with Cook's distance greater than 1 are weighted zero in Stata's robust regression[12].

4. REGRESSION RESULTS

The empirical results for the export equation and import equation are presented in Table 1 and Table 2, respectively. In Model 1 (X1/M1), Huber-White sandwich estimators are applied to adjust the standard error in the OLS method to ensure the valid of the t-statistics and other statistics. In Model 2 (X2/M2), the heteroskedasticity is assumed to be born due to the cluster of countries which have their own variance. So the cluster-robust-VCE estimators are applied to adjust the standard error. The coefficients in Model 1 (X1/M1) and Model 2(X2/M2) are similar (and similar with the coefficients of the OLS). In Model 3 (X3/M3), the weighted least squares estimation is applied based on the conditional variance estimated from modelling the heteroskedasticity, while in Model 4 (X4/M4) weighted least squares estimation is done based on the estimated variance of each country. Model 5 (X5/M5) and Model 6 (X6/M6) are robust regression and quantile regression, respectively. Appendix 1 and Appendix 2 also provide 5 more model estimations: MM-estimators with an efficiency of 70% and an efficiency of 95%, non-parametric regression bootstrapping method (with 2000 bootstrap replications) for the OLS estimation and the quantile regression, as well as the seemingly unrelated regression model (SURE)[13] to ensure significant statistics.

In Table 1, all models present statistically significant positive relationships between the exports and the GDP of Vietnam and the GDP of her trading partners. Interestingly, all models fail to find a significant relationship between the real exchange rate level and exports. That is due to not only small t-statistics but also the point estimation being very inconsistent. While

[12] Stata weights observations by computing M-estimator using iterative algorithm. More details can be seen in Verardi and Croux(2009). Verardi and Croux (2009) also provide a more robust algorithm based on the S-estimator and MM-estimator and are incorporated into a user-written Stata command: mmregress. The result based on this algorithm is also reported as a reference in Appendix 1 and Appendix 2.

[13] This model is applied to deal with potential correlation between the export equation and the import equation.

Table 1: Determinants of exports

	Model X1	Model X2	Model X3	Model X4	Model X5	Model X6
	OLS, Robust	**OLS, Cluster**	**WLS**	**WLS groupwise**	**Robust Regression**	**Quantile Regression**
LnYi	0.624***	0.624***	0.653***	0.600***	0.613***	0.582***
	(20.68)	(7.86)	(19.77)	(17.10)	(21.49)	(16.10)
LnYv	0.523**	0.523*	0.482***	0.378**	0.541***	0.681**
	(3.07)	(2.44)	(3.46)	(2.83)	(3.48)	(3.21)
LnRER	-0.0175	-0.0175	0.0273	0.00237	0.0000725	0.00596
	(-0.87)	(-0.33)	(1.57)	(0.13)	(0.00)	(0.26)
VOL	9.876*	9.876	8.194**	-3.315	7.156+	6.804
	(2.56)	(1.43)	(2.59)	(-0.90)	(1.89)	(1.29)
LnDi	-0.336***	-0.336	-0.354***	-0.104	-0.455***	-0.540***
	(-3.57)	(-1.30)	(-4.61)	(-1.17)	(-5.28)	(-4.10)
LnREMOTE	-0.440	-0.440	-1.165*	-0.361	-0.544	0.108
	(-0.63)	(-0.25)	(-2.03)	(-0.59)	(-0.91)	(0.11)
DDev	0.438***	0.438***	0.327***	0.421***	0.460***	0.498***
	(10.35)	(4.28)	(7.83)	(9.27)	(11.39)	(10.29)
OIL	0.00291***	0.00291***	0.00154**	0.00281***	0.00249***	0.00210**
	(3.86)	(4.51)	(2.85)	(4.71)	(3.34)	(2.78)
OPEN	0.00166+	0.00166	0.00172*	0.00369***	0.00196*	0.00164
	(1.81)	(0.68)	(2.56)	(4.69)	(2.15)	(1.23)
TCIx	0.00111	0.00111	0.0134+	0.0187**	0.00469	0.00335
	(0.12)	(0.05)	(1.96)	(2.62)	(0.63)	(0.26)
TFI	0.0144***	0.0144	0.0176***	0.0144***	0.0134***	0.0191***
	(3.71)	(1.58)	(6.21)	(4.26)	(3.38)	(3.99)
APEC	0.839***	0.839+	0.698***	1.013***	0.666***	0.699***
	(5.43)	(1.99)	(6.16)	(8.38)	(4.88)	(4.17)
ASEAN	1.667***	1.667***	1.701***	1.868***	1.638***	1.700***
	(12.20)	(4.64)	(16.13)	(12.21)	(8.47)	(11.04)
ADJ	0.991***	0.991+	1.252***	1.554***	0.857***	1.064***
	(5.13)	(1.99)	(8.42)	(6.06)	(3.32)	(3.52)
LOCK	0.0624	0.0624	-0.0458	-0.0856	0.00712	0.0692
	(0.50)	(0.22)	(-0.36)	(-0.51)	(0.05)	(0.48)
Constant	-7.349+	-7.349	-4.558	-7.958*	-5.996+	-9.810+
	(-1.90)	(-0.87)	(-1.47)	(-2.43)	(-1.74)	(-1.90)
N	675	675	675	675	675	675
Note: t statistics in parentheses; + p<0.10 * p<0.05 ** p<0.01 *** p<0.001						

in the robust regression the point estimation is positive but close to zero, in the robust standard error method it is a small negative coefficient. As a result, it is reasonable to assume that the elasticity of export demand with respect to the exchange rate is zero: $\eta_X=0$.

All models also find no evidence that the volatility of the exchange rate depresses trade. While three models fail to find any statistically significant relationship between the volatility and the exports, the remaining three models support the view that the more the volatility, the more Vietnam exports is[14]. It is perhaps because the income effect exceeds the substitution effect as the exporting firms might try to increase export to maximize profit in domestic currency terms when the volatility increases.

The negative and statistically significant coefficients of the distance are consistent with the theory that Vietnam does export more to countries that are located closer geographically. Surprisingly, only the quantile regression model presents the coefficient of remoteness with the expected sign, although it is statistically insignificant. The five remaining models estimate negative signs but only one model finds it statistically significant. It is, thus, reasonable to reject the Linder hypothesis. In other words, the results show that Vietnamese exports are mainly based on the H-O theory of comparative advantage.

Regarding the oil price, all models show minimal but significantly positive coefficients, suggesting that when the oil price increases Vietnamese exports will increase due to the fact that crude oil is one of major exporting goods of Vietnam. The openness of trading partners also has a positive relationship with the export flows of Vietnam. One surprising result is that only two models show statistical evidence that the match of Vietnam's export and her partner's import structures increases exports of Vietnam. When the problem of outliers is taken into account, it seems that the trade complementarity index has no role. Both the robust regression and the quantile regression show that the coefficient is statistically insignificant. Regional economic integration, indicating by joining ASEAN and APEC, has important roles in the growth of Vietnam exports. Nevertheless, all of the models fail to find any significant effect of the landlocked situation.

Table 2 presents the estimated results from the six models for the import equation. All of the models show statistically significant positive relationships between the import flows and the incomes of Vietnam as well as of that of her partners. The negative relationship between the import flows and the geographic distance in the theory of the gravity model is also confirmed.

All of the models consistently show small impact of the exchange rate level on imports. The elasticity of import demand with respect to the exchange rate is estimated at about 0.08 ($\eta_M=0.08$). Although all of the models estimate a negative relationship between exchange rate volatility and the imports, only two of the models find this relationship statistically significant, one at the significance level of 5% and one at the significance level of 10%[15].

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[14] This result is statistically significant at the level of 10%, 5% and 1% depending upon each model. Moreover, as can be seen in the Appendix 1, the statistical significance of the positive relationship is also confirmed by 2000 times non-parametric bootstrapping.

[15] All MM-regressions with efficiency 70%, MM-regression with efficiency 95% as well as nonparametric bootstrapping find this relationship statistically insignificant.

Table 2: Determinants of imports

	Model M1	Model M2	Model M3	Model M4	Model M5	Model M6
	OLS, Robust	**OLS, Cluster**	**WLS**	**WLS groupwise**	**Robust Regression**	**Quantile Regression**
LnYi	0.624***	0.624***	0.673***	0.604***	0.665***	0.620***
	(15.09)	(6.27)	(17.95)	(17.03)	(19.34)	(16.86)
LnYv	0.576*	0.576*	0.423+	0.579***	0.407*	0.496**
	(2.36)	(2.15)	(1.89)	(4.37)	(2.48)	(2.65)
LnRER	-0.0647*	-0.0647	-0.0717***	-0.0796***	-0.0819***	-0.0743***
	(-2.50)	(-1.06)	(-3.83)	(-4.54)	(-4.33)	(-3.60)
VOL	-5.024	-5.024	-9.627*	-6.047+	-3.922	-3.569
	(-1.02)	(-0.73)	(-2.24)	(-1.81)	(-0.98)	(-0.75)
LnDi	-1.160***	-1.160***	-1.238***	-1.108***	-1.067***	-1.101***
	(-8.75)	(-3.85)	(-11.78)	(-13.94)	(-11.72)	(-6.93)
LnREMOTE	1.729*	1.729	2.672***	2.574***	2.375***	2.169**
	(2.08)	(0.97)	(4.12)	(4.48)	(3.81)	(2.62)
DDev	0.306***	0.306+	0.376***	0.381***	0.272***	0.269***
	(3.85)	(1.71)	(4.95)	(6.13)	(4.18)	(3.89)
OIL	0.00365***	0.00365***	0.00380***	0.00298***	0.00279***	0.00211*
	(3.75)	(4.44)	(4.42)	(5.29)	(3.61)	(2.40)
OPEN	0.000206	0.000206	-0.00301***	-0.00143*	-0.000840	0.000735
	(0.18)	(0.08)	(-3.49)	(-2.07)	(-0.85)	(0.49)
TCIm	0.0183***	0.0183	0.0269***	0.0284***	0.0150***	0.0206***
	(3.34)	(1.46)	(6.24)	(7.89)	(3.68)	(3.84)
FCI	0.0150***	0.0150*	0.0150***	0.0118***	0.0144***	0.0124***
	(5.10)	(2.17)	(6.45)	(6.72)	(6.23)	(4.87)
APEC	1.727***	1.727***	1.777***	1.867***	1.798***	1.901***
	(10.97)	(4.61)	(13.72)	(16.01)	(12.28)	(13.78)
ASEAN	0.621***	0.621	0.720***	0.625***	0.635**	0.559*
	(3.82)	(1.51)	(4.88)	(5.32)	(3.15)	(2.06)
ADJ	0.750***	0.750+	0.740***	0.728***	0.918***	0.945***
	(4.40)	(1.90)	(5.53)	(5.16)	(3.40)	(5.17)
LOCK	0.154	0.154	-0.0203	-0.335*	-0.0519	-0.402**
	(0.92)	(0.36)	(-0.12)	(-2.28)	(-0.32)	(-2.74)
DDev3	-0.00865**	-0.00865	-0.0170***	-0.0128***	-0.0106***	-0.0104***
	(-3.11)	(-1.38)	(-6.04)	(-5.93)	(-3.64)	(-4.23)
Constant	-9.497+	-9.497	-11.20**	-12.82***	-10.51**	-10.11*
	(-1.94)	(-1.07)	(-2.87)	(-4.07)	(-2.91)	(-2.20)
N	675	675	675	675	675	675
*Note: t statistics in parentheses; + p<0.10 * p<0.05 ** p<0.01 *** p<0.001*						

Five out of the six models confirm the statistical importance of the remoteness of the trading partners regarding Vietnamese imports, indicating that the further geographical distance the Vietnam trading partners are from the rest of the world, the more they export to Vietnam. All of the models also confirm a positive relationship between imports and the difference in the level of development, indicating that Vietnam imports increase together with the increase in the level of development, which can be explained by the H-O theory of factor endowments. However, when the difference between the levels of development reaches a certain threshold, this relationship turns negative.

One of the surprising results is the relationship between imports and the openness of the trading partners of Vietnam. The coefficient of the openness variable is negative in three out of six models, of which two models find this relation is statistically significant. This result might be due to the outliers, especially the existence of a very open economy like Hong Kong in the data. When we exclude Hong Kong from the data, the signs in this coefficient are all positive and four of them are statistically significant. The regression models also show that the more the import structure of Vietnam matches the export structure of her trading partners, the more Vietnam trades with them. Interestingly, all of the models provide evidence that Vietnam tends to import more from less corrupt countries. Although an interpretation of this index is not straightforward because the FCI index is built based on a perception survey, the intuition is very clear because corruption places a burden on trade cost that negatively affect the flows of trade. As expected from the theory of gravity analysis, all of APEC membership, ASEAN membership and sharing border are important factors for the import flows.

5. CONCLUSIONS AND POLICY IMPLICATION

In this study, the gravity model is used to analyse the impact of the exchange rate policy on trade flows in terms of both exchange rate level and exchange rate volatility. The study shows that both the exchange rate elasticity of export demand and import demand are minimal (η_X=0 and η_M=0.08).

In the case of exports, the relationship between exports and the exchange rate is statistically insignificant while in the case of imports, the relationship is statistical significant and negative. Contrary to the conventional wisdom, our result shows that the Marshall-Lerner condition and generalized versions (taking into account the current high deficit position and the correlation between exports and imports) do not hold in the case of Vietnam. As a result, it is impossible to improve the trade balance by devaluation unless there is a significant reform in the economic structure.

In terms of exchange rate volatility, it is found that the volatility does not depress the trade flows. As a result, if keeping exchange rate stable is too costly for the economy, such policy should be reconsidered. A more effective policy in this case is a more flexible exchange rate policy with a larger band for the transaction exchange rate as this policy does not need to be accompanied by devaluating the domestic currency. A recommendation is that the exchange rate can be widened.

In the mean time, domestic production is crucial for improving international trade, indicating that upgrading production capacity is as an important target within the framework of external economic policy. Furthermore, the Linder hypothesis is rejected, suggesting that Vietnam should pay more attention to restructure the pattern of exports, which consists mainly of resource and unskilled-labour intensive goods. Also, the result of no correlation between export volume and the matching index (TCI) suggests that in the long-run, there should be better match of foreign demand and Vietnamese supply in international markets with high competition. Vietnam should build a more careful strategy for exports and imports instead of encouraging international trade by all means as has been done so far.

In conclusion, in spite of some limitations, this study shows that various factors affect international trade of Vietnam. It is not exchange rate that is important but domestic production and better policy to match Vienamese exports and the world demand.

6. LIMITATIONS AND FURTHER RESEARCH

In this study, the single country approach was applied for estimating the gravity equations for exports and imports of Vietnam. Although a lot of econometric problems are taken into account or proved to not significant affect the estimated result, some potential issues are still ambiguous.

Firstly, the study does not deal with the serial correlation problem by assuming that the OLS result explains the long-run relationship. This argument is reasonable somehow, but it is better to work on the serial correlation problem to understand the trade pattern in the short-run, and more important, to test this assumption. In this case, one should consider a fixed effect model as a more appropreate alternative.

Secondly, the study skips the problem of zero trade flows by selecting 75 main trading partners based on their availalability of bilateral trade flows with Vietnam in every year between 2001 and 2009. It is not clear if a zero trade flow is simply missing, unrecorded or in fact it does not happen. Obviously, existence of zero-trade flow implies certain information and when this is not taken into account in the regression model, the emprical results are potentially biased. However, when a zero-trade flow is taken into account, the log-log functional form is impossible to apply because the logarithm of 0 is undefined. A solution is that instead of using zero value, one could use a very small positive zero, such as 0.000001, but in this case the OLS regression should be replaced by a Tobit regression.

Thirdly, the high correlation between export equations and import equations should be worked on more seriously. Although it is shown in Appendix 1 and Appendix 2 that the estimations from SURE (Seemingly Unrelated Regression Estimators) are consistent with all other models, it is important to note that SURE is more efficient if T (the number of years in the data) is large. However, this is not the case in our data where T=9.

Fourthly, although many papers estimate the gravity equation in real terms in order to test the Marshall-Lerner condition, there are no clear explanations as to why real terms are more appropriate than nominal terms. It would be more appropriate if the estimation is also implemented in nominal terms in order to compare the result in a sensitivity analysis.

Finally, although trade potential estimation provides useful information for discussion, it is basically based on point estimation from the gravity equation. Egger (2002) criticizied such estimation intensively because it depends upon mispecification problem. If the gravity equation have problem of mispecification, residuals do not reflect trade potential correctly. Although there is no evidence of mispecification in our gravity equations, it is important to work more on this problem.

APPENDIX 1. MM-estimators, Bootstraps and SURE for Export Equation

	Model X1	Model X5					
	OLS Robust	**Robust Regression**	**MM 70**	**MM 95**	**Bootstrap OLS**	**Qreg Bootstrap**	**SURE**
LnYi	0.624***	0.613***	0.603***	0.614***	0.624***	0.582***	0.622***
	(20.68)	(21.49)	(14.72)	(17.22)	(20.01)	(13.52)	(21.65)
LnYv	0.523**	0.541***	0.787**	0.545**	0.523**	0.681***	0.531***
	(3.07)	(3.48)	(3.17)	(2.85)	(3.08)	(5.05)	(3.39)
LnRER	-0.0175	0.0000725	-0.0181	0.00592	-0.0175	0.00596	-0.0217
	(-0.87)	(0.00)	(-0.54)	(0.26)	(-0.86)	(0.23)	(-1.19)
VOL	9.876*	7.156+	1.192	6.210	9.876**	6.804	9.955**
	(2.56)	(1.89)	(0.15)	(1.43)	(2.59)	(1.54)	(2.62)
LnDi	-0.336***	-0.455***	-0.918***	-0.499***	-0.336***	-0.540***	-0.339***
	(-3.57)	(-5.28)	(-6.63)	(-4.12)	(-3.51)	(-5.42)	(-3.91)
LnREMOTE	-0.440	-0.544	2.146	-0.590	-0.440	0.108	-0.368
	(-0.63)	(-0.91)	(1.47)	(-0.59)	(-0.62)	(0.15)	(-0.61)
DDev	0.438***	0.460***	0.463***	0.468***	0.438***	0.498***	0.443***
	(10.35)	(11.39)	(7.27)	(9.66)	(10.45)	(10.30)	(10.92)
OIL	0.003***	0.003***	0.002**	0.002**	0.003***	0.002***	0.003***
	(3.86)	(3.34)	(2.79)	(3.17)	(4.06)	(4.79)	(3.97)
OPEN	0.002+	0.002*	-0.001	0.002+	0.002+	0.002+	0.002+
	(1.81)	(2.15)	(-0.32)	(1.82)	(1.79)	(1.73)	(1.73)
TCIx	0.001	0.005	0.018	0.007	0.001	0.003	-0.005
	(0.12)	(0.63)	(0.70)	(0.56)	(0.12)	(0.41)	(-0.65)
TFI	0.014***	0.013***	0.017+	0.013**	0.014***	0.019***	0.016***
	(3.71)	(3.38)	(1.92)	(2.68)	(3.65)	(3.50)	(4.17)
APEC	0.839***	0.666***	0.724**	0.588***	0.839***	0.699***	0.839***
	(5.43)	(4.88)	(3.12)	(3.47)	(5.42)	(4.58)	(6.09)
ASEAN	1.667***	1.638***	1.551***	1.652***	1.667***	1.700***	1.652***
	(12.20)	(8.47)	(10.03)	(12.31)	(11.68)	(10.93)	(8.48)
ADJ	0.991***	0.857***	1.145***	0.823***	0.991***	1.064***	1.003***
	(5.13)	(3.32)	(5.84)	(4.17)	(4.82)	(3.60)	(3.85)
LOCK	0.062	0.007	0.331**	0.012	0.062	0.069	0.039
	(0.50)	(0.05)	(2.86)	(0.09)	(0.49)	(0.50)	(0.25)
Constant	-7.349+	-5.996+	-16.31*	-5.522	-7.349+	-9.810**	-7.605*
	(-1.90)	(-1.74)	(-2.41)	(-1.09)	(-1.88)	(-2.77)	(-2.19)
*Note: t statistics in parentheses; + p<0.10 * p<0.05 ** p<0.01 *** p<0.001*							

APPENDIX 2. MM-estimators, Bootstraps and SURE for Import Equation

	Model M1	Model M5					
	OLS Robust	**Robust Regression**	**MM 70**	**MM 95**	**OLS Bootstrap**	**qreg Bootstrap**	**SURE**
LnYi	0.624***	0.665***	0.635***	0.667***	0.624***	0.620***	0.646***
	(15.09)	(19.34)	(18.69)	(19.09)	(14.93)	(12.97)	(15.12)
LnYv	0.576*	0.407*	0.383*	0.397*	0.576*	0.496*	0.632**
	(2.36)	(2.48)	(2.57)	(2.23)	(2.32)	(2.29)	(3.08)
LnRER	-0.065*	-0.082***	-0.077***	-0.083***	-0.065*	-0.074*	-0.065**
	(-2.50)	(-4.33)	(-4.25)	(-4.09)	(-2.51)	(-2.40)	(-2.76)
VOL	-5.024	-3.922	-3.960	-4.028	-5.024	-3.569	-3.442
	(-1.02)	(-0.98)	(-1.12)	(-0.96)	(-1.00)	(-0.69)	(-0.69)
LnDi	-1.160***	-1.067***	-0.904***	-1.042***	-1.160***	-1.101***	-1.191***
	(-8.75)	(-11.72)	(-8.85)	(-7.61)	(-8.74)	(-7.91)	(-10.45)
LnREMOTE	1.729*	2.375***	2.054**	2.359**	1.729*	2.169***	1.829*
	(2.08)	(3.81)	(3.22)	(3.08)	(2.06)	(3.61)	(2.35)
DDev	0.306***	0.272***	0.277***	0.278***	0.306***	0.269***	0.297***
	(3.85)	(4.18)	(4.53)	(4.22)	(3.81)	(4.76)	(3.74)
OIL	0.004***	0.003***	0.002***	0.003***	0.004***	0.002*	0.004***
	(3.75)	(3.61)	(3.41)	(3.50)	(3.70)	(1.97)	(3.69)
OPEN	0.002	-0.008	0.001	-0.007	0.002	0.007	0.003
	(0.18)	(-0.85)	(0.08)	(-0.77)	(0.18)	(0.52)	(0.29)
TCIm	0.018***	0.015***	0.024***	0.015**	0.018***	0.020**	0.001+
	(3.34)	(3.68)	(4.50)	(3.30)	(3.33)	(3.11)	(1.91)
FCI	0.015***	0.014***	0.009***	0.014***	0.015***	0.012***	0.016***
	(5.10)	(6.23)	(4.03)	(5.06)	(5.12)	(3.86)	(5.90)
APEC	1.727***	1.798***	1.803***	1.804***	1.727***	1.901***	1.688***
	(10.97)	(12.28)	(16.11)	(14.10)	(10.86)	(12.51)	(9.21)
ASEAN	0.621***	0.635**	0.640***	0.641***	0.621***	0.559+	0.617*
	(3.82)	(3.15)	(4.40)	(4.30)	(3.62)	(1.87)	(2.44)
ADJ	0.750***	0.918***	1.089***	0.934***	0.750***	0.945***	0.684*
	(4.40)	(3.40)	(7.28)	(6.36)	(4.16)	(5.62)	(2.02)
LOCK	0.154	-0.0519	-0.476***	-0.0814	0.154	-0.402*	0.194
	(0.92)	(-0.32)	(-3.77)	(-0.51)	(0.91)	(-2.14)	(0.95)
DDev3	-0.009**	-0.011***	-0.012***	-0.011***	-0.009**	-0.010***	-0.007*
	(-3.11)	(-3.64)	(-5.30)	(-4.65)	(-2.91)	(-4.24)	(-2.05)
Constant	-9.497+	-10.51**	-9.838**	-10.52**	-9.497+	-10.11*	-10.45*
	(-1.94)	(-2.91)	(-2.90)	(-2.62)	(-1.92)	(-2.46)	(-2.31)

*Note: t statistics in parentheses; + p<0.10 * p<0.05 ** p<0.01 *** p<0.001*

APPENDIX 3. Exchange Rate Volatility and Trade: A Literature Survey

Study	Period	Estimation technique	Main results
Akhtar and Hilton (1984)	1974-1981Q	OLS	Negative effect
Gotur (1985)	1974-1982Q	OLS	Little to no effect
Bailey et.al. (1986)	1973-1984Q	OLS	Not significant, mixed effects
Bailey et.al. (1987)	1962-1985Q	OLS	Little to no effect
Brada and Mendez (1988)	1973-1977A	Cross-section	Positive effect
Pere and Steinherr (1989)	1960-1985A	OLS	Negative effect
Lastrapes and Koray (1990)	1975-1987Q	VAR	Weak relationship
Medhora (1990)	1976-1982A	OLS	Not significant and positive
Bini-Smaghi (1991)	1976-1984Q	OLS	Significant and negative
Feenstra and Kendall (1991)	1975-1988Q	GARCH	Negative effect
Savvides (1992)	1973-1986A	Cross-section	Negative effect
Chowdhury (1993)	1973-1990Q	VAR	Significant negative effect
Caporale and Dorodian (1994)	1974-1992M	Joint estimation	Significant negative effect
McKenzie and Brooks (1997)	1973-1992Y	OLS	Positive effect
McKenzie (1998)	1969-1995Q	ARCH	Generally positive effect
Hook and Boon (2000)	1985-1997Q	VAR	Negative effect on exports
Aristotelous (2001)	1989-1999A	Gravity model	No effect on exports
Abbot et.al. (2001)	1973-1990Q	ARDL	No effect on exports
Vergil (2002)	1990-2000Q	Standard deviation	Negative effect on exports
Das (2003)	1980-2001Q	Cointegration ECM	Significant negative effect on exports
Arize (2003)	1973-1998Q	Cointegration ECM	Negative effect on exports in short-run and long-run
Don Bredin et.al. (2003)	1978-1998Q	Cointegration ECM	No in short-run, negative in long-run
Baak (2004)	1980-2002A	OLS	Significant negative effect on exports
Kasman and Kasman (2005)	1982-2001Q	Cointegration ECM	Significant positive effect on exports
Arize et al. (2005)	1973-2004Q	Cointegration ECM	Significant negative effect on exports
Chit (2008)	1982-2005Q	Panel cointegration	Significant negative effect on exports
Hondroyiannis et.al. (2008)	1977-2003Q	Panel estimation	Significant negative effect on trade
Rahman (2009a)	1973-2007M	GARCH-M VAR	Significant negative effect on exports
Hudson and Straathoof (2010)	1961-2006A	Gravity model	Significant negative before 1985, no effect after 1985
Chit et.al. (2010)	1982-2006Q	Gravity model	Negative impact on exports

Chit and Judge (2011)	1990-2006Q	Gravity model	Negative, non-linear effect on exports
Hsu and Chiang (2011)	1973-2004Q	Threshold regression model	Negative on exports with high income partner, positive with low income partner
Verheyen (2012)	1995-2010M	ARDL	Small negative effect on exports

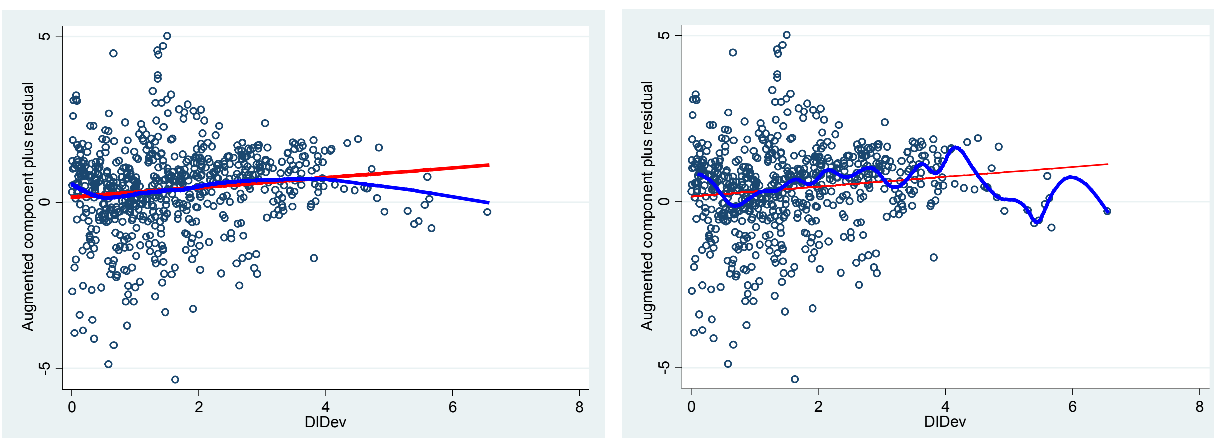
Note: A = Annual; Q=Quarterly; M=Monthly

Source: Ozturk (2006) and our supplementation

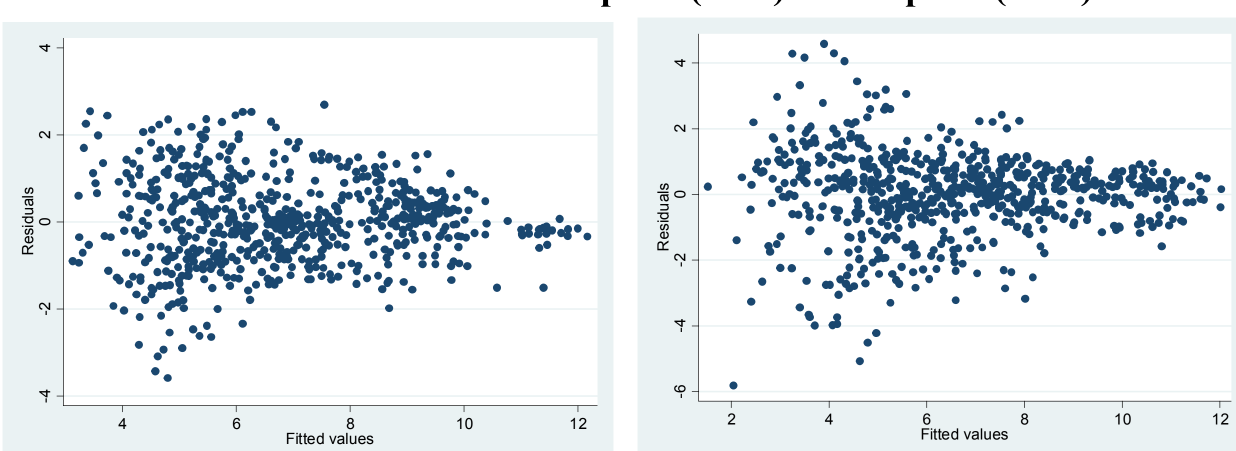
APPENDIX 4. Misspecification Tests

	LnX	**LnM**	**LnM** with DDev3		**LnX**	**LnM**	**LnM** with DDev3
Linktest				*Ramsey RESET test*			
_hatsq	-0.0077	-0.00066	0.004723	F-statistic	2.01	2.38	1.37
P-value	0.408	0.939	0.591	P-value	0.1118	0.0682	0.2497

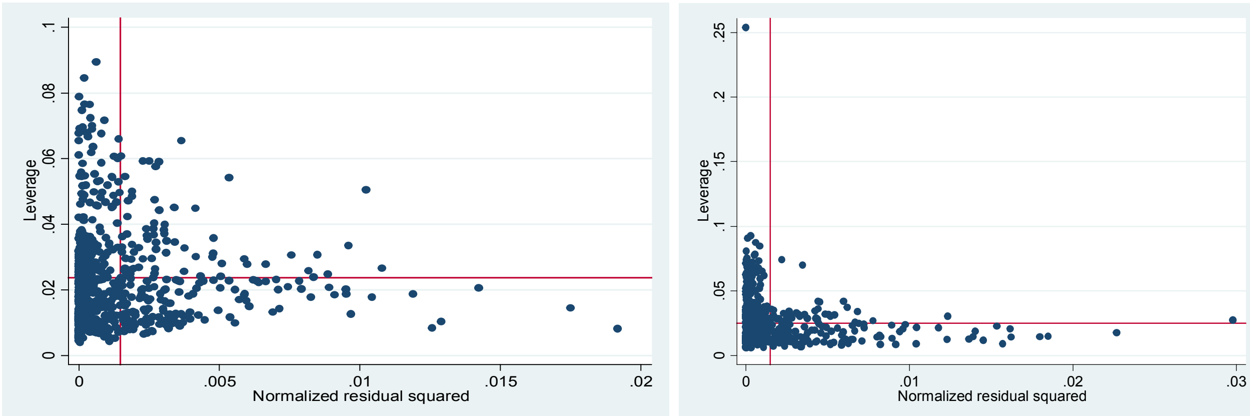
Detect non-linear relationship



Residual-versus-fitted of Exports (LHS) and Imports (RHS)



Leverage-versus-squared-residual of Exports (RHS) and Imports (LHS)



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