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## „The impact of exchange rate volatility on trade flows in large economies and developing countries"

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**OUTLINE**

## 0.  ABSTRACT

My thesis examines the effect of exchange rate volatility on bilateral trade between the trading country pairs for last four decades. The Gravity equation is the calculation method for measuring the effect of exchange rate volatility. Beside the volatility effect, Gravity equation also allows measuring other effective determinants on bilateral trade: membership of the WTO, the distance between the countries, regional trading agreements etcetera. The analyses in this thesis involve the multilateral resistance effect which is presented by van Wincoop (2003).

The exchange rate volatility has a weak negative effect on trade between the country pairs in the long run analysis. The results show that developed economies has better resistance against the volatility effect compared to emerging and developing country economies. As an alternative measurement technique, the short term analysis shows the similar effect with long run analysis. At the end, my data analyses show that the distance between the countries has a stronger effect on bilateral trade compared to the exchange rate volatility effect. My results show that exchange rate volatility has no strong negative effect on bilateral trade.

## 1. ABSTRAKT

Meine Arbeit untersucht die Auswirkungen von Wechselkurs-Volatilität auf den bilateralen Handel zwischen den Handelsländerpaare in den letzten vier Jahrzehnten. Das Gravitationsmodell ist die Berechnungsmethode, um die Auswirkungen von Wechselkurs-Volatilität zu messen. Das Gravitationsmodell erlaubt neben der Wechselkurs-Volatilität, auch das Bestimmen anderer wirksamer Faktoren des gegenseitigen Handels: Mitglieder der WTO, der Distanzen zwischen den Ländern, regionale Handelsabkommen und so weiter. Die Analyse in dieser Arbeit beinhalten den multilateralen Widerstandseffekt, der durch van Wincoop (2003) präsentiert wird. Bei Langzeitanalyse zeigt Wechselkurs-Volatilität eine schwache negative Auswirkungen auf den Handel zwischen den Länder. Die Ergebnisse zeigen, dass im Vergleich die Industrieländer eine bessere Stabilität bei Wechselkurs-Volatilität besitzen, als die Schwellen- und Entwicklungsländern. Die Kurzzeitanalyse zeigt als alternative Messtechnik, eine ähnliche Wirkung wie die Langzeitanalyse.

Meine analysierten Daten zeigen am Ende, dass der Abstand zwischen den Ländern eine stärkere Wirkung auf den bilateralen Handel hat, als die Wechselkurs-Volatilität im Vergleich.

Mein Ergebnis unterstützt somit nicht die Annahme, das Wechselkurs-Volatilität einige starke negative Wirkung auf den bilateralen Handel habe.

## 2. INTRODUCTION AND OVERVIEW

The increasing volatility of exchange rates became a very important subject after the fall of the Bretton Woods system. The bigger economies limited the effect of fluctuations of the US dollar exchange rate on their own exchange rates. Exchange rate fluctuations are an important determinant for investment plans for foreign investors. Especially for the big economies as the U.S. and some EU countries it is attractive to invest, as long as the exchange rate is low. Because then, the capital investments become cheaper during the depreciation of the exchange rate for the investors from those large economy countries. But if the depreciation happens because of a loss of confidence in the economy, then the big economies in question can be more doubtful to invest (Huchet-Bourdon and Korinek, 2011, p. 6-7)

In 1984 the IMF produced a study on General Agreement on Tariffs and Trade (GATT) about the impact of exchange rate volatility on Trade. GATT is an agreement dating from 1947 and established to regulate international trade. This agreement became an important factor to identify countries' trading conditions and evaluating the volatility regarding the trading tariff articles.

Rose (2003) provided contrary evidence on the effects of membership in GATT/WTO. It is unlikely that membership in GATT/WTO has such an impact on trade. Once the other gravity effects are removed, there remains not enough evidence to support the conclusions of the IMF study (Rose 2003, p. 22-23). Just like Rose, I included membership status of GATT/WTO for the countries in my data.

In the previous 40 years, capital flows have increased in large amounts in the scale of border transactions, and the magnitude of exchange rate movements have clearly increased following the liberalization of the capital.

Now considering the volatility effect, the first thing that springs to mind is that the exchange rate risk reduces the profit of international trade and is increasing the costs. Firms are entering the market and are facing start-up costs. We call these expenses 'Fixed start-up cost'. Fixed start-up costs involve observation in the market, collecting information about running business in the foreign market, generate a delivery system and introducing and placing the product in the foreign market. If the firm's local currency has depreciation, earnings and profit of the firm are increasing. This extra income can be used as a sunk cost for placing the firm's product in the new foreign markets. But in reality, the market system does not work like this. Imagine that in the case of the sudden currency appreciation, the firms will have a big loss and recovery of the loss will be very difficult, therefore, the firms do not prefer acting related to exchange rate movements. The firms will be even extra unwilling to export to markets which have high volatile exchange rates. (Hericourt and Poncet, 2013). The important point here is that the unknown exchange rate movements are increasing the costs of trade. Although, at macroeconomic level the effect of volatility on trade is not very clear and most of the times very small, emerging countries do anchor their currency to the big economies currencies. This suggests that volatility effect is still a considerable amount. Baccheta and van Wincoop (2000) did not find a relationship between those variables. They think that if the exporters regulate their prices in the local currency, the negative effect caused by the received income of their products, affected by nominal exchange rate movements, will be negligible. (Baccheta and van Wincoop 2000, p.2). Ozturk (2006) criticised and compared many studies regarding this subject

simultaneously. In the end, the general result of the studies assumed that exchange rate volatility has a negative effect on international trade. (Ozturk 2006, p.86-93)

Based on all of the above, I asked myself the following question:

Does exchange-rate risk dangerously increase transaction costs and reduce gains from international trade?

Related to all previous different conclusions, the ultimate relationship between exchange rate volatility and the export volume can be categorized into three types as follows:

**Type 1:** The exchange rate volatility affects exports negatively (significant or not significant)

**Type 2:** The exchange rate volatility affects exports positively (significant or not significant)

**Type 3:** There are no relationships between these variables.

In my study, I focused on the impact of effective volatility of the real, short- and long-run exchange rate on aggregate trade. Currently, it is uncertain whether the big economical changes in the world during the last forty years increased or decreased the volatility effect on trade. As a realistic result, the big economies have better endurance compared to emerging economies. Since the 1980's, currency crises occurred more often in emerging markets because of their considerably larger exchange rate volatility. The anxiety for these currency crises creates different reactions against the volatility fluctuations between developed countries and emerging economies.

Given the number of countries I included in the data set, it is possible to estimate the degree to which volatility has a differential effect, depending on whether the country is

advanced or developing. In addition there is no certain result about relationship between low exchange rate volatility and growth in trade level. (Clark, Tamirsa, Wei, Sadikov and Zeng 2004, p.11)

# 3. EMPIRICAL LITERATURE AND THEORETICAL REVIEW

Last four decades several studies dwelled on the exchange rate volatility effect. Much empirical work on the effect of exchange rate variability and trade surveys in the past did not find a consistent result. Clark, Tamirsa, Wei, Sadikov and Zeng (2004) have examined exchange rate variability in the years 1975 to 2000 for 108 countries, and they have used state-of-the-art statistical techniques for testing hypothesis that trade volume between countries decreasing because of the exchange rate volatility (Clark, Tamirsa, Wei, Sadikov and Zeng 2004, p.48-54). The study reports some evidence that is consistent with a negative effect of volatility on trade. Rose and van Wincoop (2001) examined the volume of trade flows by the use of the American dollar or the use of currency unions. The currency unions enable a low trade barrier between the member countries. Both countries of a country pair are having benefit and their trading level increases. (Rose and van Wincoop 2001, p.8). On the other side, some studies have found a significant positive impact of exchange rate volatility on export volumes. The results of Kasman and Kasman (2005) indicate that exchange rate volatility has a significant positive effect on export volume in the long run. This conclusion may indicate that firms operating in small economies, like Turkey, have little options to deal with increased exchange rate risk (Adnan Kasman and Saadet Kasman 2005, p.44-54). Baak, Mamood and Vixathep (2007) found that exchange rate volatility between the Yen and the currencies of East Asian countries had a negative impact on the exports of these countries to Japan in the short and long run (Baak, Mamood and Vixathep 2007, p.947-958)

My analysis includes some of these countries with short and long run dimensions. Nishimura and Hirayama (2013) used an ARCH. They found no significant effect of exchange rate volatility on bilateral trade between Japan and China.

In my study, my stata outputs show a weak negative relationship between exchange-rate volatility and trade.

## 4. RELATIONSHIP BETWEEN EXCHANGE RATE VOLATILITY AND TRADE

Some of the results from my data and analyses show that exchange rate volatility gives a small negative effect on trading flows. With regard to the relationship between exchange rate volatility and trade, consider an example of a developing exporting firm to illustrate the impact of exchange rate volatility on the level of firm's exports. Consider a small scale firm that is producing only one kind of product and selling it always in the same foreign market. This firm does not import any inputs needed for production, using local sources as intermediate inputs. During trading, the firm gets payments in a foreign currency. So it means that the firm has to exchange this payment by the local currency which is fluctuating freely. Since it is a small company we can assume that the firm has no hedging possibilities and that there is no improved future market system. Under those conditions, the firm makes the decisions for production based on the previous years and the current time exchange rate levels. Because of the advance production decision the firm cannot change the output amount based on negative or positive exchange rate level. The production has to continue as planned in advance. In this case, the firms gain increases or decreases depending on the exchange rate fluctuations. That means they are facing a risky situation (Clark, Tamirsa, Wei, Sadikov and Zeng 2004, p.13-14). This basic example shows the clear negative relationship between exchange rate volatility and the level of trade, while a hedging system was not taken into account.

Big economies' forward markets are very well working so that transactions can be hedged easily. It means that the unexpected exchange rate movements' effects are minimised. The main issue here is that most of the developing countries have not such a forward market.

Actually, there is an important reason why trade can be negatively affected by exchange rate volatility. This is because the firm cannot adjust factor inputs based on the movements of the currencies. If this assumption is not there and firms can arrange their factors of production based on the movements of exchange rates, then this increased variability can give profitable opportunities for the firm. If the firm can set the inputs to both high and low prices caused by the higher exchange rate volatility, it's expected or average profits will be larger as it will sell more when the price is high or vice versa. In other words, if the firm is risk averse, the higher variance of profits has a negative effect on the firm and constitutes a disincentive to produce and to export. If the firm is less risk averse, the positive effect of greater price variability on expected profits outweighs the negative impact of the higher variability of profits and the firm will raise the average capital stock and the level of output and exports.

When running the volatility analysis in several theoretical models, the nominal exchange rate volatility is giving opposite signals compared to the real exchange rate. But although these two are different conceptually; they are not significantly different in reality. In my analysis, I used the nominal exchange rates for checking the robustness of my results. For this reason, I will not explain the separate effect of nominal exchange rate volatility. To get a complete picture of the relationship between exchange rate variability and trade, it is important to take the interaction of all the major macroeconomic variables into account in a general equilibrium framework, In the concept of theory and framework, when all major macroeconomic variables take place and are explained in the model, there will be a clearer structure of the relationship between exchange rate variability and trade.

## 5. METHODOLOGY

Some of the previous works on this topic illustrates that the gravity model has found some important findings of a negative relationship between exchange rate variability and trade (Wei 1999). Wei concludes that in case the hedging possibility does not exist between the country pairs, volatility has a negative effect on the trade between the pairs. The volatility elasticity of trade is negative. The gravity equation is a very successful and often used method for describing the trade flows in studies and work. In its basic form, the gravity model explains bilateral trade flows between countries depending positively on the product of their GDP's and negatively on their geographical distance from each other. When the distance is representing the transportation costs, which is a very important factor for trade, the developed countries tend to do more trading than the developing countries. The gravity model uses several dummy variables to consider mutual characteristics of the countries for understanding the propensity of bilateral trading. These dummies are; common language, common border, common colonies, membership of monetary unions and others that will be explained in the data description part.

In one of my main reference studies, Rose (2000) applied the gravity model. His main aim is explaining the effect of currency unions on the unions' members' trade, and in addition, he used this model to measure the effect of exchange rate volatility on trade. Rose's data set includes 186 countries for the years; 1970, 1975, 1980, 1985, and 1990. Rose's volatility measuring method '*standard deviation of the first difference of the monthly logarithm of the bilateral nominal exchange rate*' (Andrew Rose 2000 p.815) presents every five years output in the long run.

Another assertive study and influential reference is the study by Silvia Tenreyro (2007). She used the gravity equation on a large sample of countries between 1990 and 1997. She

addressed some doubt on the robustness of these results and also focused on several estimation problems with endogeneity. During her estimations, she discovered that if endogeneity is considered through the use of instruments, then volatility has an insignificant effect on trade flows. Tenreyro calculated the volatility by the same method as Rose. The only difference in this calculation is that the standard deviation of the log change in monthly exchange rates is measured only over the current year.

## 6. GRAVITY EQUATION

This study uses the classical gravity equation. Total trade between two countries is represented as a function of economic mass and the distance between those countries. The gravity model has useful findings. The gravity model is involving the differences between the countries as; Economical power, technology using level and geographical position, beside these properties the model is controlling: cultural similarities, historical links and trading agreements to find the effective factors on trade between the country pairs. For example: Transaction cost is one of the main factors which are effective on the trade. Therefore, the geographical position is quite important. Also historical link and cultural similarities can be the priority reason for the countries to choose their trading factor. There are some more factors which are affecting trade in a positive way; For instance, the level of economic development is included in the model, as more developed countries have more propensities to trading (Clark, Tamirsa, Wei, Sadikov and Zeng 2004, 63-66). All of these right-hand side variables in the gravity equation focus on which variables are effective on the transection cost and the level of bilateral trading between the country pairs in the data. I applied country-specific fixed effects in the model to control for the 'multilateral resistance' by Anderson and Van Wincoop (2003); this index takes the characteristic properties of the countries into account. These characteristic properties are unobservable. The trading barriers between the country pairs are specifying the price indices of the equilibrium. The interpretation of the gravity equation with the existence of multilateral resistance, the trade barrier between the two countries and the barriers between the trading partners, decreases the price of the product when causes increase of the trade. In my study, I used the time fixed effect and country specific fixed effect for observing the time-specific changes and multilateral resistance. Additionally, I experiment

by including time-varying country fixed effects, which are more general than including time dummies and country fixed effects separately. For example; if one country changes the monetary policy and suddenly increases the money supply, this would cause the changes in the exchange rate level among the other countries and depresses the trading between this country and its trading partners. (Clark, Tamirsa, Wei, Sadikov and Zeng 2004, p.42-63)

## 7. AGGREGATE TRADE DATA

Aggregate trade estimation is possible with a bilateral total trade data set, total trade incomes, the distance between trading partners, and characteristic, cultural, and historical information. I am presenting bilateral trade data from 23 countries with their important trading partners and involving every fifth year from 1985 to 2010. I have a variation of the country types according to their economic situation which is suitable for the gravity frame. The following tables provide summary statistics and correlation coefficients for the main variables:

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| ltrade | 2927 | 12.02938 | 3.308378 | -6.060803 | 20.88973 |
| vol_sor5 | 2904 | .0320747 | .0288759 | .0017038 | .2046167 |
| vol_lor | 2931 | .0395736 | .0248521 | .0028349 | .1784665 |
| lgdppc_edss | 2882 | 16.49694 | 1.960363 | 10.49007 | 20.84343 |
| lgdp_edss | 2882 | 49.15271 | 3.038892 | 37.11742 | 58.34918 |

| | ltrade | vol_lon | vol_lor | vol_sor5 | vol_son5 | lgdppc~s | lgdp_e~s |
|---|---|---|---|---|---|---|---|
| ltrade | 1.0000 | | | | | | |
| vol_lon | -0.0740 | 1.0000 | | | | | |
| vol_lor | -0.1102 | 0.9834 | 1.0000 | | | | |
| vol_sor5 | -0.0142 | 0.4103 | 0.4350 | 1.0000 | | | |
| vol_son5 | 0.0264 | 0.4065 | 0.4164 | 0.9770 | 1.0000 | | |
| lgdppc_edss | 0.4755 | -0.1497 | -0.1970 | -0.0643 | 0.0046 | 1.0000 | |
| lgdp_edss | 0.8453 | -0.0129 | -0.0576 | 0.0415 | 0.0950 | 0.4778 | 1.0000 |

The correlation table shows a negative correlation between bilateral trade, long run real volatility and long run nominal volatility. One other important finding is the high correlation between real and nominal volatilities in long and short terms.

Bilateral trading data between trading partners are from the IMF's Direction of Trade Statistics category. The U.S. dollar is the unit of measurement for the bilateral import and export. Bilateral trade data is obtained from Fenstra (WTA) bilateral trade data. Real GDP and population data are obtained from the World Bank's World Development Indicators (WDI). I obtained data with different time frequencies; I obtained the real and nominal exchange rates based on the monthly consumer price index data but all the other data are yearly data. That is why I decided to calculate volatilities before constructing the whole data for my gravity analyses. Rose (2000) and Tenreyro (2007) use similar data, and their volatility calculation method is the standard deviation of the first difference of the monthly logarithm of the bilateral nominal exchange rate. Tenreyro has one difference in the volatility measurement; her standard deviation of the log change in monthly exchange rates is measured only over the current year, because her data is not time series data. I chose the same method for volatility measurement instead of GARCH. I found this method more practical because it provides me with more available resources. To calculate the volatilities I need to calculate the bilateral exchange rate. Therefore I obtained all nominal and real exchange rates belonging to the last 4 decades from IFS. The next step is the long-run measure of IFS-based real exchange rate volatility calculated as the *standard deviation of the first-difference of the monthly natural logarithm of the bilateral real exchange rate'* (Andrew Rose 2000) in the five years preceding year t. Real exchange rates are constructed

by using consumer prices index from IFS. I construct my gravity equation to use ordinary least squares with robust standard error and applied the log-linear transformation;

$$ltrade_{ijt} = B_0 + B_1 lrgdp_{ijt} + B_2 lrgdppc_{ijt} + B_3 lareap_{ijt} + B_4 ldist_{ijt} + B_5 lreal_{ijt} + B_6 custric_{ijt} +$$

$$B_7 comlang_{ijt} + B_8 island_{ijt} + B_9 landl_{ijt} + B_{10} border_{ijt} + B_{11} comcol_{ijt} + B_{12} curcol_{ijt} + B_{13} colony_{ijt} +$$

$$B_{14} comctry_{ijt} + B_{15} fta_{ijt} + B_{16} gsp_{ijt} + B_{17} onein_{ijt} + B_{18} bothin_{ijt} + fe + te + E_{ijt}$$

All the variables here are belong to country $i$ and country $j$ at time $t$. The name of the variables explanations; $ltrade_{ijt}$ is representing the real value of aggregate bilateral trade; $lrgdp_{ijt}$ is the logarithm of the product of real GDP; $lrgdppc_{ijt}$ is the logarithm of the product of real GDP per capita; $lareap_{ijt}$ is the logarithm of the product of the land areas; $ldist_{ijt}$ is the logarithm of distance between $I$ and $j$; $lreal_{ijt}$ is the long-run real IFS-based measure of volatility in the bilateral exchange rate; and $custrict_{ijt}$ is a dummy variable taking the value of 1 if countries $i$ and $j$ share a common currency at time $t$, and zero otherwise. The coefficients of interest are those on the measure of exchange rate volatility, $lreal_{ijt}$, and the currency union dummy, $custrict_{ijt}$. Other variables control for various cultural, geographical, and historical factors: $comlang_{ijt}$ is a dummy taking the value of 1 if $i$ and $j$ have a common language; $island_{ijt}$ is the number of islands and $landl_{ijt}$ is the number of landlocked countries in the country pair; $border_{ijt}$ is a dummy taking a value of 1 if $i$ and $j$ share a common border; $comcol_{ijt}$ is a dummy taking a value of 1 if after 1945 $i$ and $j$ were colonies with the same colonizer; $curcol_{ijt}$ is a dummy taking the value of 1 if $i$ was a colony of $j$ at time $t$, or vice versa; $colony_{ijt}$ is a dummy taking a value of 1 if $i$ ever colonized $j$, or vice versa; and $comctry_{ijt}$ is a dummy taking a value of 1 if $i$ and $j$ belong to the same origin.

There are also several controls for trade policy factors: $fta_{ijt}$ is a dummy variable if $i$ and $j$ are members in the same regional trading arrangement; $gsp_{ijt}$ is a dummy taking the value of 1 if $i$ was a Generalized System of Preferences beneficiary of $j$ or vice versa at time $t$; and $onein_{ijt}$ and $bothin_{ijt}$ are dummies taking a value of 1 if either $i$ or $j$, or both were members of GATT/WTO at time $t$, respectively. Finally, the vectors $fe$ and $te$ represents country- year specific dummies. $E_{ijt}$ is the error term. (Clark, Tamirsa, Wei, Sadikov and Zeng 2004, p. 66-67)

## 8. NUMERICAL RESULTS AND CRITICISM

In this part I performed gravity approach on my data. In Table 1 I ran the analyses for the whole sample of my data set. Table 2 presents the results for emerging and developing economies, and Table 3 those for advance economies. One of the important findings from the entire table is: The coefficient of distance is negative and statistically significant in all the analyses. The other variables show changes depending on regression and country type, but because of the transfer costs distance is a very effective variable on trade volume. The distance coefficient is ranging around -1.5 and it is significant (Table 1). In column one (country FE + time FE) other control variables are mostly significant, for example, common language, GSP preferences, FTA membership, colonization by the same country. All these have a positive and statistically significant relationship on trade, being the member of WTO has a trade-enhancing and significant but not very high-level effect. For all the countries in the data set, under the country and time fixed effect, the long run real exchange rate volatility has a negative significant impact on trade. This impact can be computed as the effect of increasing volatility by one standard deviation around its mean, which implies a reduction in trade flows of almost 10%. I computed this impact as the estimated coefficient in the regression equation multiplied by one standard deviation of the volatility measure, multiplied by 100 to convert to percent. In the case of time-varying country fixed effect for the whole sample (column 2), the control variables are still mostly significant and as it is shown in the table, long run real exchange rate volatility has still negative significant effect, which implies a reduction in trade flows around 12%. When I consider country-pair fixed effect during the regressing variables, I have less significant results according to other regressions but still distance between the countries, whereas membership of FTA, GDP and

GDP per capita still appear significant. Moreover, the F-test indicates that the estimated

coefficients for the country-pair fixed effects are jointly significant.

## 9.    COMPARING DEVELOPING AND DEVELOPED COUNTRIES

In table 2 the emerging and developing economies are presented. The first column is including country and time fixed effect. Real exchange rate volatility has a significantly negative impact on trade. In table 3 are the result of the advance economies shown. The country and time fixed effect column shows that there is a significant level of real exchange rate volatility as well. In Tables 2 and 3, individual country fixed effect are replaced with country-pair fixed effect in the second columns. The main advantage of this approach is that it allows controlling for unobserved variables, such as historical, geographical and others which are specific to a given pair of countries, and these estimated coefficients are jointly significant. In the advance economies, long run exchange rate volatility is insignificant on trade, also, membership of FTA turns into insignificant effect on trade as well. For the emerging and developing economies' long run real exchange rate volatility and membership of FTA has still significant effect on trade volume.

 When I allow time variation on country fixed effects, then this is more suitable with the theoretical concept of 'multilateral resistance' by Anderson and van Wincoop (2003). Multilateral resistance indices are likely to vary over time. But my data does not support this approach. What may account for the difference in the results? One possible explanation given by Anderson and van Wincoop (2003) runs as follows: '*Time-varying country fixed effects in principle control all unidentified country-specific time-varying factors, including the effective, i.e., overall exchange rate volatility for e each of the trading partners in question.*' (Anderson and Wincoop 2003)

Intrinsically, if I include the effective volatility measurement in time-invariant country effects, bilateral exchange rate volatility is negative (only for advance economies it is

positive but in the insignificant level), while the measure of effective volatility is also negative and statistically significant and in the model with time-varying fixed effects it is still negative. Based on the multilateral approach, in the model with time-invariant country effect, the effective volatility is statistically significant and its coefficient is negative while the bilateral exchange rate volatility is positive. It means that the bilateral volatility's negative effect on trade is not robust for exchange rate volatility and multilateral resistance. But this approach does not hold for my data because my results are not significantly changing when I allow the time variance in my regressions. (Clark, Tamirsa, Wei, Sadikov and Zeng 2004, p.75-78)

# 10. ALTERNATIVE TECHNIQUES FOR MEASURING IMPACT OF VOLATILITY

I estimated the impact of an alternative measure of volatility on trade with using time and individual country fixed effects as shown in table 4. I used short run real exchange rate volatility as an alternative measurement technique. For the whole sample, the short run volatility calculations gives negative significant effect on trade flows. In the advance economies dimension, my results show that short-run real exchange rate volatility has a negative significant effect on the trade volume as well as on the whole sample. I can calculate this impact as the effect of increasing volatility by one standard deviation around its mean, which implies a decreasing in trade flows of almost 10% for advance economies and 6% for the whole sample. I computed this impact as the estimated coefficient in the regression equation multiplied by one standard deviation of the volatility measure, multiplied by 100 to convert to percent. This result is consistent with emerging and developing economies as well. As it is shown in table 4, short run real effective volatility has significant negative effect on trade volume. During my analysis in the long run case, I could not find a very clear effect about WTO membership on trade, but in the short run case, WTO membership has a clearly insignificant effect on short-term trade flows. The other controlling variables have a significant effect which is not so different compared to the long run case.

## 11. CONCLUSION

The most important finding of my work is that exchange rate volatility has a weak negative effect on trade flows between the country pairs in my data. Transportation cost, in other words; distance between the countries pairs, is a more significant factor on trade compared to exchange rate volatility.

One other important conclusion of my work is that emerging and developing economies have more negative effect compared to well-developed economies. Because well developed economies are more capable to deal with volatility negative effect.

The last finding of this study is that exchange rate volatility has a more negative effect for emerging and developing economies in the long run but in the short run case exchange rate volatility has a negative effect on all country categories in my data.

## 12. TABLES

**Table 1: Role of Long Run Real Exchange Rate Volatility on Trade Results Table for Full Sample**

| Variable | Country FE + Time FE | Country pair FE +Time FE | Time Varying Country Effect |
|---|---|---|---|
| **Long run volatility of real exchange rate** | Coef : -3.65 (1.18)<br>Pvalue: 0.002 | Coef :-1.5 (0.93)<br>Pvalue:0.104 | Coef :-5.1 (1.12)<br>Pvalue:0.00 |
| **Log of GDP** | Coef :1.04 (0.09)<br>Pvalue:0.00 | Coef :1.59 (0.22)<br>Pvalue:0.00 | Coef :0.033 (0.03)<br>Pvalue:0.387 |
| **Log of per capita GDP** | Coef :0.11 (0.03)<br>Pvalue:0.004 | Coef :-.037 (0.21)<br>Pvalue:0.079 | Coef : 1.07 (0.023)<br>Pvalue:0.000 |
| **Log of Distance** | Coef :-1.5 (0.04)<br>Pvalue:0.00 | Coef :-1.83 (0.57)<br>Pvalue:0.001 | Coef :-1.5 (0.04)<br>Pvalue:0.00 |
| **Common Language Dummy** | Coef :0.71 (0.07)<br>Pvalue:0.00 | Coef :-0.40 (0.82)<br>Pvalue:0.622 | Coef :0.55 (0.08)<br>Pvalue:0.00 |
| **Common Border Dummy** | Coef : 0.152(0.23)<br>Pvalue:0.517 | Coef :-1.5 (2.05)<br>Pvalue:0.451 | Coef :-0.15 (0.23)<br>Pvalue:0.519 |
| **Number of Landlocked countries in the Country pair** | Coef :-0.37 (0.09)<br>Pvalue:0.00 | Coef :-1.5 (1.04)<br>Pvalue:0.132 | Coef :-.32 (0.09)<br>Pvalue:0.001 |
| **Number of Island Countries in the Country Pair** | Coef :-0.07 (0.07)<br>Pvalue:0.324 | Coef :1.78 (0.99)<br>Pvalue:0.074 | Coef :-0.017 (0.07)<br>Pvalue:0.817 |
| **Log of Area Product** | Coef :-0.08 (0.01)<br>Pvalue:0.00 | Coef :-0.5 (0.14)<br>Pvalue:0.00 | Coef :-0.06 (0.017)<br>Pvalue:0.001 |
| **Dummy for common Nation** | Coef : -0.5 (0.53)<br>Pvalue: 0.307 | Coef :1.47 (0.95)<br>Pvalue:0.123 | |
| **Dummy for Being Colonizer and Colony to Each Other** | Coef :0.49(0.13)<br>Pvalue:0.00 | Coef :-1.82 (1.6)<br>Pvalue:0.277 | Coef :0.7 (0.15)<br>Pvalue:0.00 |
| **Dummy for common FTA Membership** | Coef :0.69(0.18)<br>Pvalue:0.00 | Coef :0.41 (0.17)<br>Pvalue:0.018 | Coef :0.38 (0.18)<br>Pvalue:0.038 |
| **Dummy for one in WTO** | Coef :0.12(0.16)<br>Pvalue:0.45 | Coef :0.22 (0.16)<br>Pvalue:0.173 | Coef :-0.015 (0.16)<br>Pvalue:0.929 |
| **Dummy for Both in WTO** | Coef :0.11 (0.18)<br>Pvalue:0.00 | Coef :0.21 (0.18)<br>Pvalue:0.230 | Coef :-0.507 (0.17)<br>Pvalue:0.005 |
| **Dummy for GSP** | Coef :0.44(0.07)<br>Pvalue:0.529 | Coef :0.08 (0.2)<br>Pvalue:0.685 | Coef :0.685 (0.075)<br>Pvalue:0.00 |
| **Number of Obs** | **2878** | **2878** | **2878** |
| **Prob > F** | **0.00** | **0.00** | **0.00** |
| **R-squered** | **0.8515** | **0.9475** | **0.8484** |

**Table 2: Role of Long Run Exchange Rate Volatility in Trade Results for Emerging and Developing Economies**

| Variable | Country FE + Time FE | Country pair FE +Time FE | Time Varying Country Effect |
|---|---|---|---|
| **Long run volatility of real exchange rate** | Coef :-3.15 (1.3) <br> Pvalue:0.016 | Coef :-1.04 (1.01) <br> Pvalue:0.301 | Coef :-4.69 (1.2) <br> Pvalue:0.00 |
| **Log of GDP** | Coef :1.05 (0.02) <br> Pvalue:0.00 | Coef :2.37 (0.29) <br> Pvalue:0.00 | Coef :1.03 (0.02) <br> Pvalue:0.00 |
| **Log of per capita GDP** | Coef :0.05 (0.04) <br> Pvalue:0.239 | Coef :0.87 (0.27) <br> Pvalue:0.001 | Coef :-0.009 (0.04) <br> Pvalue:0.83 |
| **Log of Distance** | Coef :-1.59 (0.05) <br> Pvalue:0.00 | Coef : -3.66 (0.56) <br> Pvalue: 0.00 | Coef :-1.62 (0.05) <br> Pvalue:0.00 |
| **Common Language Dummy** | Coef :0.66 (0.1) <br> Pvalue:0.00 | Coef :-3.47 (1.3) <br> Pvalue:0.008 | Coef :0.63 (0.1) <br> Pvalue:0.00 |
| **Common Border Dummy** | Coef :-0.27 (0.29) <br> Pvalue:0.34 | Coef :-5.6 (1.7) <br> Pvalue:0.001 | Coef :-0.35 (0.29) <br> Pvalue:0.23 |
| **Number of Landlocked countries in the Country pair** | Coef :-0.31 (0.11) <br> Pvalue:0.005 | Coef :-0.66 (1.11) <br> Pvalue:0.55 | Coef :-0.3 (0.11) <br> Pvalue:0.007 |
| **Number of Island Countries in the Country Pair** | Coef :-0.08 (0.08) <br> Pvalue:0.33 | Coef :6.08 (1.4) <br> Pvalue:0.00 | Coef :-0.6 (0.08) <br> Pvalue:0.45 |
| **Log of Area Product** | Coef :-0.09 (0.029 <br> Pvalue:0.00 | Coef :-0.61 (0.13) <br> Pvalue:0.00 | Coef :-0.08 (0.02) <br> Pvalue:0.00 |
| **Dummy for common Nation** | Coef :0.49 (0.15) <br> Pvalue:0.002 | Coef :3.02 (1.3) <br> Pvalue:0.027 | Coef :0.48 (0.15) <br> Pvalue:0.002 |
| **Dummy for Being Colonizer and Colony to Each Other** | Coef :0.48 (0.19) <br> Pvalue:0.011 | Coef :4.2 (1.3) <br> Pvalue:0.002 | Coef :0.61 (0.19) <br> Pvalue:0.001 |
| **Dummy for common FTA Membership** | Coef :0.7 (0.23) <br> Pvalue:0.003 | Coef :0.67 (0.23) <br> Pvalue:0.003 | Coef :0.36 (0.23) <br> Pvalue:0.112 |
| **Dummy for one in WTO** | Coef :0.14 (0.17) <br> Pvalue:0.42 | Coef :0.17 (0.17) <br> Pvalue:0.327 | Coef :0.04 (0.18) <br> Pvalue:0.81 |
| **Dummy for Both in WTO** | Coef :-0.1 (0.19) <br> Pvalue:0.59 | Coef :0.31 (0.19) <br> Pvalue:0.1 | Coef :-0.47 (0.19) <br> Pvalue:0.014 |
| **Dummy for GSP** | Coef :0.55 (0.99) <br> Pvalue:0.00 | Coef :0.09 (0.23) <br> Pvalue:0.686 | Coef :0.75 (0.09) <br> Pvalue:0.00 |
| **Number of Obs** | **2261** | **2261** | **2261** |
| **Prob > F** | **0.00** | **0.00** | **0.00** |
| **R-squered** | **0.817** | **0.93** | **0.81** |

**Table 3: Role of Long Run Real Exchange Rate Volatility in Trade Results for Advance Economies**

| Variable | Country FE + Time FE | Country pair FE +Time FE | Time Varying Country Effect |
|---|---|---|---|
| **Long run volatility of real exchange rate** | Coef :-8.98 (3.2)<br>Pvalue:0.007 | Coef :1.5 (3.0)<br>Pvalue:0.623 | Coef :-14.93 (3.12)<br>Pvalue:0.00 |
| **Log of GDP** | Coef :0.9 (0.03)<br>Pvalue:0.00 | Coef :1.19 (0.57)<br>Pvalue:0.34 | Coef :0.87 (0.038)<br>Pvalue:0.00 |
| **Log of per capita GDP** | Coef :0.37 (0.06)<br>Pvalue:0.00 | Coef :-0.07 (0.55)<br>Pvalue:0.217 | Coef :0.12 (0.064)<br>Pvalue:0.046 |
| **Log of Distance** | Coef :-1.18 (0.07)<br>Pvalue:0.00 | Coef : -2.34 (0.97)<br>Pvalue: 0.016 | Coef :-1.28 (0.08)<br>Pvalue:0.000 |
| **Common Language Dummy** | Coef :0.25 (0.12)<br>Pvalue:0.039 | Coef :1.63 (0.47)<br>Pvalue:0.001 | Coef :0.237 (0.13)<br>Pvalue:0.07 |
| **Common Border Dummy** | Coef :0.45 (0.32)<br>Pvalue:0.159 | Coef :-1.38 (3.55)<br>Pvalue:0.639 | Coef :0.26 (0.34)<br>Pvalue:0.43 |
| **Number of Landlocked countries in the Country pair** | Coef :-0.53 (0.12)<br>Pvalue:0.00 | Coef :-0.23 (2.3)<br>Pvalue:0.92 | Coef :-0.36 (0.13)<br>Pvalue:0.007 |
| **Number of Island Countries in the Country Pair** | Coef :0.4 (0.14)<br>Pvalue:0.00 | Coef :1.54 (0.52)<br>Pvalue:0.004 | Coef :0.5 (0.14)<br>Pvalue:0.001 |
| **Log of Area Product** | Coef :-0.03 (0.2)<br>Pvalue:0.282 | Coef :-0.205 (0.36)<br>Pvalue:0.569 | Coef :0.011 (0.02)<br>Pvalue:0.701 |
| **Dummy for common Nation** | Coef :0.001 (0.2)<br>Pvalue:0.99 | Coef :-3.5 (1.19)<br>Pvalue:0.003) | Coef :-0.06 (0.25)<br>Pvalue:0.804 |
| **Dummy for Being Colonizer and Colony to Each Other** | Coef :1.3 (0.24)<br>Pvalue:0.00 | Coef :0.17 (2.4)<br>Pvalue:0.94 | Coef :1.35 (0.21)<br>Pvalue:0.00 |
| **Dummy for common FTA Membership** | Coef :0.73 (0.25)<br>Pvalue:0.004 | Coef :0.09 (0.23)<br>Pvalue:0.68 | Coef :0.318 (0.26)<br>Pvalue:0.223 |
| **Dummy for one in WTO** | Coef :0.21 (0.2)<br>Pvalue:0.306 | Coef :1.4 (0.3)<br>Pvalue:0.00 | Coef :0.21 (0.22)<br>Pvalue:0.34 |
| **Dummy for Both in WTO** | Coef : -<br>Pvalue: | Coef :<br>Pvalue: - | Coef : -<br>Pvalue: |
| **Dummy for GSP** | Coef :0.22 (0.11)<br>Pvalue:0.041 | Coef :0.16 (0.39)<br>Pvalue:0.67 | Coef :0.3 (0.11)<br>Pvalue:0.012 |
| **Number of Obs** | **617** | **617** | **617** |
| **Prob > F** | **0.00** | **0.00** | **0.00** |
| **R-squered** | **0.94** | **0.97** | **0.93** |

**Table 4: Role of Short Run Real Exchange Rate Volatility on Trade Results Table**

| Variable | Full Sample | Emerging and Developing Economies | Advance Economies |
|---|---|---|---|
| **Long run volatility of real exchange rate** | Coef :-3.03 (0.9) <br> Pvalue:0.002 | Coef :-3.2 (1.08) <br> Pvalue:0.003 | Coef :-5.2 (2.1) <br> Pvalue:0.015 |
| **Log of GDP** | Coef :0.9 (0.1) <br> Pvalue:0.00 | Coef :1.03 (0.02) <br> Pvalue:0.00 | Coef :0.73 (0.02) <br> Pvalue:0.00 |
| **Log of per capita GDP** | Coef :0.111 (0.02) <br> Pvalue:0.00 | Coef :-0.13 (0.02) <br> Pvalue:0.00 | Coef :0.46 (0.07) <br> Pvalue:0.000 |
| **Log of Distance** | Coef : -1.1(0.04) <br> Pvalue:0.00 | Coef : -1.35(0.05) <br> Pvalue: 0.00 | Coef :-1.05(0.06) <br> Pvalue:0.000 |
| **Common Language Dummy** | Coef :0.7(0.08) <br> Pvalue:0.00 | Coef :0.58(0.1) <br> Pvalue:0.000 | Coef :0.034 (0.12) <br> Pvalue:0.06 |
| **Common Border Dummy** | Coef :0.6 (0.25) <br> Pvalue:0.015 | Coef :0.56(0.3) <br> Pvalue:0.066 | Coef :0.48 (0.33) <br> Pvalue:0.152 |
| **Number of Landlocked countries in the Country pair** | Coef :-0.3(0.09) <br> Pvalue:0.001 | Coef :-0.29 (0.11) <br> Pvalue:0.011 | Coef :-0.51(0.13) <br> Pvalue:0.000 |
| **Number of Island Countries in the Country Pair** | Coef :0.06 (0.05) <br> Pvalue:0.265 | Coef :0.12(0.07) <br> Pvalue:0.108 | Coef :0.61 (0.1) <br> Pvalue:0.00 |
| **Log of Area Product** | Coef :-0.06 (0.01) <br> Pvalue:0.000 | Coef :-0.107 (0.17) <br> Pvalue:0.000 | Coef :0.07 (0.02) <br> Pvalue:0.001 |
| **Dummy for common Nation** | Coef :0.14 (0.13) <br> Pvalue:0.289 | Coef :0.09 (0.15) <br> Pvalue:0.548 | Coef :-0.23(0.22) <br> Pvalue:0.296 |
| **Dummy for Being Colonizer and Colony to Each Other** | Coef :0.61 (0.15) <br> Pvalue:0.00 | Coef :0.62 (0.19) <br> Pvalue:0.02 | Coef :1.4(0.2) <br> Pvalue:0.00 |
| **Dummy for common FTA Membership** | Coef :0.83 (0.19) <br> Pvalue:0.000 | Coef :0.76 (0.25) <br> Pvalue:0.02 | Coef :0.77(0.25) <br> Pvalue:0.223 |
| **Dummy for one in WTO** | Coef :-0.03(0.17) <br> Pvalue:0.862 | Coef :0.11(0.19) <br> Pvalue:0.546 | Coef :-0.13 (0.21) <br> Pvalue:0.524 |
| **Dummy for Both in WTO** | Coef :-0.14 (0.18) <br> Pvalue:0.414 | Coef :0.01 (0.19) <br> Pvalue: 0.00 | Coef : - <br> Pvalue: |
| **Dummy for GSP** | Coef :0.38 (0.05) <br> Pvalue:0.00 | Coef :0.290(0.07) <br> Pvalue:0.00 | Coef :0.36 (0.11) <br> Pvalue:0.002 |
| **Number of Obs** | **2851** | **2237** | **614** |
| **Prob > F** | **0.00** | **0.00** | **0.00** |
| **R-squered** | **0.85** | **0.78** | **0.93** |

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