Does Exchange Rate Volatility Really Influence Foreign Trade? Evidence from Turkey

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Abstract

We investigated the influence of exchange rate volatility on foreign trade for an emerging economy, namely Turkey, by using monthly data spanning from 1990 to 2015. We employed the Johansen cointegration test, the vector error correction model, or VECM, and the VAR Granger causality test within the framework of the Toda-Yamamoto procedure in order to capture both the long-term and short-term effects of exchange rate volatility. We report that there is a long-term relationship between exchange rate volatility and Turkish exports. In addition, while exchange rate volatility has a positive effect on Turkish exports in the long-term, this relationship disappears in the short-term.

Keywords: exchange rate volatility, real effective exchange rate, foreign trade, export

1. Introduction

In the aftermath of the collapse of the Bretton Woods system in 1973, countries started to adopt floating exchange regimes one by one. According to the IMF, 97 percent of its member countries had pegged exchange rates as of 1970. That share had decreased to 39 percent as of 1980 and was only 11 percent in 1999 (Reinhart, 2000). In the post-Bretton Woods era, exchange rates have become highly volatile in both developed and developing countries. Numerous studies regarding the effect of exchange rates on foreign trade have been implemented. However, these studies have provided mixed empirical results. Because of the lack of consensus among economists, the debate pertaining to this relationship is still ongoing.

Most studies regarding this relation were conducted in developed countries. Developing countries, which now comprise the larger share of the world economy, were generally ignored. Among them, Turkey, which has a relatively large and vibrant economy, is an interesting case for investigating this relationship because of its unique cultural and institutional factors (see Jermias & Yigit, 2013), which may significantly influence the severity and even the direction of the relationship between exchange rate volatility and foreign trade. (For example, if exporters are not risk-averse, the influence of exchange rate volatility on them could be of little importance. However, if they are risk-averse, they will take into account volatility significantly. Nevertheless, if the domestic market does not demand the products of exporters, they will be obliged to sell in foreign markets, even though exchange rates are highly volatile.) Our study contributes to the literature by analysing this relationship in Turkey, an emerging country that has unique cultural and institutional factors.

2. Literature

Among others, Hooper and Kohlhagen (1978), De Grauwe (1988), Froot and Klemperer (1989) and Sercu (1992) constructed theoretical foundations for this relationship. On the one hand, Hooper and Kohlhagen (1978) and Sercu (1992) offered a negative relationship between volatility and export levels. On the other hand, De Grauwe (1988) and Froot and Klemperer (1989) asserted that there can be a positive relationship between these variables.

Hooper and Kohlhagen (1978) asserted that exchange rate volatility implies cost for risk-averse exporters and that this results in lower foreign trade, because although the price of the product is established when the contract is made, payment is realized only when delivery time comes. If the exchange rate is volatile and highly unpredictable, there will be an uncertainty about profits. Thus the benefits of foreign trade will be reduced. In addition, Sercu (1992) states that if there is no way to hedge or if hedging is too costly, rises in exchange rate

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volatility will inevitably lead to diminished trade, provided that traders are risk-averse.

On the other hand, De Grauwe (1988) argued that higher exchange rate volatility can mean higher profits if income effects reign over substitution effects, and that this will lead not to lower, but to higher, export levels. Moreover, Froot and Klemperer (1989) suggest that trade can be affected positively without the condition of risk obliviousness. Even under the circumstance that traders are risk-averse, trade can increase when the right conditions take place.

Numerous studies have concluded that there was a negative relationship between exchange rate volatility and the growth of foreign trade (e.g., Sercu, 1992; Arize, 1997; Chou, 2000). According to these studies, high currency volatility can intimidate both importers and exporters because of the increased risk. Thus the foreign trade volume of a country with relatively high currency volatility can shrink. The country can then suffer from low foreign trade volume.

Arize (1997) investigated the impact of exchange rate volatility on real exports in seven industrialized countries (Denmark, Germany, Italy, Japan, Switzerland, UK, US). He reported that exchange rate volatility had a negative impact on the export level of all the countries he analysed.

Chou (2000) analysed China, which is the largest developing economy, over the period from 1981 to 1996 in terms of exchange rate volatility. He reported that exchange rate volatility had a negative impact on exports in the long run. Chou (2000) argued that foreign traders avoided or tried to minimize the uncertainty by hedging. However, if the forward markets are not sufficiently developed, higher exchange rate volatility will result in lower foreign trade. Arize, Osang, and Slottje (2000) examined 13 less developed countries in terms of the effect of exchange rate volatility on export flows over the period from 1973 to 1996. They reported that exchange rate volatility had a negative impact on export demand in the short and long terms.

Doganlar (2002) investigated the impact of exchange rate volatility on the export levels of five developing countries, namely Turkey, Malaysia, Pakistan, Indonesia and Korea. He reported that exchange rate volatility reduced export levels for all five of these countries. He asserted that in the event of an increase in exchange rate volatility, the exporters turn their faces to domestic markets, away from international markets. Acaravcı and Öztürk (2002) investigated the impact on exports of exchange rates in Turkey between 1989 and 2002. They reported that higher volatility and uncertainty over exchange rates led to less export demand.

However, there are some studies that suggest a positive relation (e.g., Froot & Klemperer, 1989), Arize and Malindretos (1998), Arize et al. (2000). Arize and Malindretos (1998) examined the short- and long-term influence of exchange rate volatility on trade volume in Australia and New Zealand for the period 1973-1992. They found that there was a long-term relationship between exchange rate volatility and export levels and that export levels were influenced by exchange rate volatility in the short-term.

Arize et al. (2000) noted that under volatile conditions, how export levels will be influenced by volatility is ambiguous, since it is up to the risk perception of economic agents. If agents are fairly normal risk takers, they can see a volatile currency as a way of making profits when they perceive good prospects for the future of the economy. In that situation, instead of declining, export levels increase.

Finally, some empirical studies suggested that there is no relationship between exchange rate volatility and foreign trade (e.g., Bacchetta & Van Wincoop, 2000; Aristotelous, 2001). Bacchetta and Van Wincoop (2000) reported that exchange rate stability is not necessarily associated with more trade. They suggested that export levels could increase under exchange rate stability and volatility. Short-term exchange rate stability is just one factor among numerous factors that influence foreign trade. In another empirical study, Aristotelous (2001) investigated 110 years of data on British exports to the US, over the period of 1889-1999. He reported that exchange rate volatility did not have an impact on British export levels.

3. Empirical Analysis

Our model is based on the traditional long-term aggregate export demand function plus exchange rate volatility. In addition, we added to the model Turkish income level, proxied by the industrial production index, because Turkish exports are heavily dependent on imports; and imports, in turn, are dependent on income levels.

So our model takes the following form:

$$ln\, X_t = \beta_0 + \beta_1 ln\, W_t + \beta_2 ln\, T_t + \beta_3 ln\, P_t + \beta_4 V_t + \varepsilon_t \qquad (1)$$

where $ln X_t$ denotes the natural logarithm of real exports (nominal export/export price index) of Turkey; $ln W_t$ is the natural logarithm of income levels of the world, proxied by the industrial production index of advanced economies; $ln T_t$ is the natural logarithm of Turkish income levels, proxied by the industrial production index of

Turkey; lnP_t corresponds to the natural logarithm of relative prices (export price index of Turkey/export price index of developed countries), and V_t denotes volatility.

Although there are numerous studies on exchange rate volatility, there is no consensus in the literature on how to measure it (Clark & Zeng, 2004). In this study, we used one of the most extensively used volatility measures, namely, the moving average standard deviation, or *MASD:*

$$V_t = [\left(\frac{1}{m}\right)\sum_{i=1}^{i=m}(ln\,REER_{t+i-1} - ln\,REER_{t+i-2})]^{1/2} \qquad (2)$$

where *lnREER* is the natural logarithm of the real effective exchange rate of Turkey and *m* denotes the order of the moving average. We specified *m* as 24, because two years for the standard deviation is a plausible time span and is also a standard in the literature.

All the data used in this study was obtained from the Turkish Statistical Institute and the Central Bank of The Republic of Turkey. Monthly data over the period from January 1990 to March 2015 was used for the model.

We expected a positive relationship between Turkey's real exports and the income levels of the world. In addition, because of the special case of Turkey being an emerging country with a special emphasis on exporting from the 1980's onwards and also being heavily dependent on imports for exports, we expected a positive relationship between Turkish exports and Turkish income levels. On the other hand, relative prices should affect Turkish exports negatively, since any increase in the relative price results in a decline of the competitiveness levels of the Turkish exporters. Lastly, the effect of volatility on export levels is indefinite –that is primarily what we intend to investigate in this study.

4. Results

The Augmented Dickey-Fuller, or ADF, test reveals that all the variables have a unit root in their levels and are stationary in their first difference at the 1% significance level.

Table 1. ADF unit root tests

Variable	I (0)		I (1)	
	t-statistic	Probability	t-statistic	Probability
Export ($ln\,X_t$)	- 1.31	0.6259	- 4.63	0.0001
World income ($ln\,W_t$)	- 1.25	0.6535	- 5.29	0.0000
Turkish income ($ln\,T_t$)	- 0.60	0.8679	- 4.61	0.0002
Relative price ($ln\,P_t$)	- 2.00	0.2853	- 18.75	0.0000
Volatility (V_t)	- 2.47	0.1229	- 12.70	0.0000

Accordingly, we applied the Johansen Cointegration test in order to understand whether these series have a long-run relationship among themselves. As can be seen in Table 2, there is a long-run relationship between the series at the 5% significance level.

Table 2. Johansen cointegration test

Trace		
Trace Statistic	0.05 Critical Value	Probability
71.16	69.82	0.0389
Maximum Eigenvalue		
Trace Statistic	0.05 Critical Value	Probability
34.15	33.88	0.0464

Finally, we constructed a *Vector Error Correction Model*, or VECM. The lag length of the variables was set at 13 based on the *Akaike information criterion*, or AIC, which is highly plausible given that monthly data was employed for the model. The main empirical result, namely the cointegrating equation, is reported in Equation 3. The numbers in the round brackets refer to the standard errors of the coefficients; the numbers in the square brackets denote the t-statistics.

$$ln\,X_t = -13.34 + 2.00ln\,W_t + 1.81ln\,T_t - 0.66ln\,P_t + 9.7V_t \qquad (3)$$

$$(0.345) \quad (0.197) \quad\quad (0.731) \quad\quad (1.333)$$

$$[-5.794] \quad [-9.200] \quad\quad [0.903] \quad\quad [-7.288]$$

In the VECM, all the variables have the expected sign: while world income levels positively affect the exports of Turkey, relative price levels have a negative impact on them. In addition, Turkish income levels, as we expected, positively affect export levels. Lastly, volatility seems to have a positive impact on Turkish export levels. All the coefficients are significant at the 5% level. In addition, as a support to a cointegration relationship between the variables, the error correction term of the model has the correct negative sign and is statistically significant.

The impulse-response functions in Figure 1 illustrate the dynamic responses of real exports to one standard deviation change in world income level, Turkish income level, relative price and volatility. In line with the model, a positive shock in world income level, Turkish income level and volatility culminate in an increase in real export level, while a positive shock in relative price has a negative impact on it.

On the other hand, while effects of Turkish income level and relative price on real exports gradually fade away, world income level and volatility have an enduring effect on real exports.
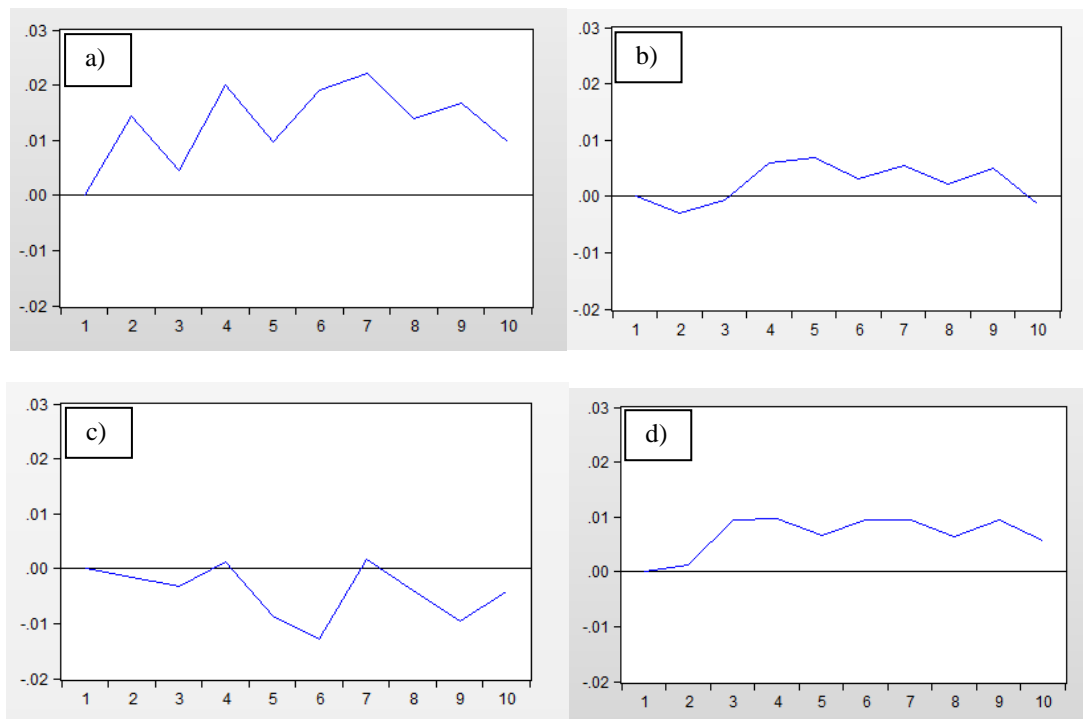

Figure 1. VEC impulse response functions

Note. Response of real export to one standard deviation change in a) world income level, b) Turkish income level, c) relative price, d) volatility.

Lastly, we applied a VAR Granger causality test within the framework of the Toda and Yamamoto (1995) procedure in order to elicit the short-term dynamics among the variables. The empirical results are reported in Table 3. As expected, world income levels, Turkish income levels and relative prices have an effect on the real export levels of Turkey at the 5% significance level. However, volatility seems not to affect real exports in the short-run.

Table 3. VAR granger causality test

Dependent variable: Export ($ln\,X_t$)			
Excluded	Chi-sq	df	Probability
World income ($ln\,W_t$)	63.23720	13	0.0000
Turkish income ($ln\,T_t$)	27.41966	13	0.0109
Relative price ($ln\,P_t$)	23.64903	13	0.0345
Volatility (V_t)	13.65431	13	0.3986
All	160.7051	52	0.0000

5. Discussion and Conclusion

In this paper, we examined the impact of volatility on Turkish export levels. We report that there is a long-term relationship between real exports, world income levels, Turkish income levels and exchange rate volatility.

In addition, we find that there is a positive relationship between exchange rate volatility and real exports in the long run. This may show that Turkish exporters are not risk averse; oppositely, they may be seeing volatility as an opportunity to make a profit, particularly when they anticipate that the economy will grow faster in the future. Moreover, Turkish exporters are used to volatility, since Turkey experienced high-inflation from the 1970s to the 2000s, and moderate inflation, such as 7-8%, in the last decade. On the other hand, we find volatility has no impact on exports in the short-run, as the VAR Granger causality test indicates. This may be due to slow adaptation of the exporters to the newly emerging situation.

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