Effects of Real Exchange Rate Volatility on Jordanian International Trade

Rania Abedllah Almohaisen
Department of Business, College of Business, Tafila Technical University, AMMAN-11942, P.O. Box 13720, Jordan

Abstract: This study tries to investigate the Exchange Rate volatility effects on Jordanian International Trade for the period (1997Q1-2013Q2). The variables include Real Exchange Rate (RER) volatility on Real Gross Domestic Product (RGDP), Exports (EX) and Imports (IMP). In order to estimate volatility, this study used the Autoregressive Conditional Heteroscedasticity (ARCH) model proposed by Engle (1982) and the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model proposed by Bollerslev (1986). The results show that there is negative effects of real exchange rate volatility on imports and exports of Jordanian economy and a positive effect on real GDP.

Keywords: ARCH, jordan, international trade, real exchange rate, volatility

INTRODUCTION

The Central Bank of Jordan (CBJ) plays a great role in stabilizing the Jordanian Dinar (JOD) exchange rate. The policy of stabilizing the exchange rate was conducted by CBJ since 1950, when the Jordanian Dinar linked with Sterling Pound (£) at nominal exchange rate equals JD1/£1. This price continued till November 1967 then the nominal exchange rate became 0.857 JD/£. In the year 1972 CB decided to link the JOD with two prices at the same time: 2.292 g of gold and US 2.8 per JOD 1. After that and in the year 1973 CBJ decided to link the JOD with only the US, with nominal exchange rate JOD 0.296/$1. In February 1975 CBJ decided to link the JOD with a Special Drawing Rights till 1987, then CBJ decided to conduct a policy of floating exchange rate, this policy led the country to the currency crises1989 and for deeper recession, this policy continued till February 1989 when the JOD linked again with US dollar at the rate of 0.709JD/$ 1 till now. (Abu-Al Sondos and Momani, 2012). Jordan economy is classified as a developing economy characterized by being open to the outside market- which makes it vulnerable to economic and political changes and upheavals at local and regional levels. During the 1970s and the early part of 1980s - according to the CBJ-Jordan has had an exceptional economic growth patterns enhanced by grants and loans from abroad. Economic performance was disturbed by the Gulf war. Jordan was forced to lose a major trading partner (Iraq) and there was an influx of hundreds of thousands of Jordanians who had been deported from the Gulf. The high unemployment rate and the conclusion of the post war construction boom were chiefly responsible for the economic slowdown. In 1996, the U.S. Congress approved Qualifying Industrial Zones (QIZ) to support the peace process. QIZ goods, which enter the United States tariff- and quota-free, have also driven economic growth. In 2000 Jordan entered World Trade Organization which also driven the economy growth (Al Muhaseen et al., 2013). Fixed exchange rate regime in which the central bank set the exchange rate value has a major effect on the microeconomic variables specially the trade balance variation, this study tries to model the exchange rate in suitable way to investigate the effects of this policy on Jordanian economy by investigate real exchange rate volatility effects on the real GDP, Exports and Imports. The objective of this study is to find the relationship between the real exchange rate volatility and the real GDP as well as Exports and Imports volatility, in order to find the effects of the volatility on the trade balance in Jordan.

LITERATURE REVIEW

There are many theoretical and empirical studies investigate the effect of real exchange rate volatility on international trade. Aghion et al. (2006) investigate the impact of real exchange rate volatility on long-term rate of productivity growth using data from 83 countries for the period 1960-2000, the study used the GMM dynamic panel data estimator, the main findings of this study that the countries of low levels of financial development, real exchange rate volatility reduces the growth and for financially advanced countries there is no significant effect. Panel regression method is used by Rahutami (2012), to study the effects of exchange rate volatility on international trade, and the study shows that there is no statistically significant of exchange rate volatility on the export and import of AMSs. Adeoye
and Akinwande (2009) used ARCH and GARCH models to analyze the severity of volatility in exchange rate of Nigerian currency (naira) against the United State Dollar using monthly time series data from 1986 to 2008. The study revealed the presence of overshooting volatility shocks. Umuru et al. (2013) investigate the impact of exchange rate volatility on export on Nigeria. The ARCH and GARCH results suggested that the exchange rate is volatile nevertheless export is found to be non-volatile. The study use annual data during the period 1970-2009.

**METHODOLOGY AND DATA**

This study investigates the effects of Real Exchange Rate (RER) volatility on Real Gross Domestic Product (RGDP), Exports (EX) and Imports (IMP), using quarterly data from the Central Bank of Jordan published statistics, starting from the first quarter 1997 till the second quarter 2013. The Purchasing Power Parity theory used to estimate RER. Following Bakhromov 2011), this study uses the following formula to compute RER:

$$RER = e \left( \frac{P^*}{P} \right)$$  \hspace{1cm} (1)

where,

- **RER**: Jordanian Real Exchange Rate
- **e**: Nominal exchange rate
- **P^***: Foreign Consumer Price Index (United States of America, Bureau of Labor Statistics)
- **P**: Jordanian Consumer Price Index (Home Country)

To investigate the effects of RER on IMP, EX and RGDP, this study considers the following functions:

$$IMP = \alpha_0 + \alpha_1 RER + \varepsilon$$ \hspace{1cm} (2)

$$EX = \beta_0 + \beta_1 RER + u$$ \hspace{1cm} (3)

$$RGDP = \gamma_0 + \gamma_1 RER + v$$ \hspace{1cm} (4)

where, \(\alpha_0, \alpha_1, \beta_0, \beta_1, \gamma_0\) and \(\gamma_1\) are parameters. \(\varepsilon, u\) and \(v\) are errors terms expected to be white noise errors with zero mean and constant variance.

In order to estimate volatility, this study will use the Autoregressive Conditional Heteroscedasticity (ARCH) model proposed by Engle (1982) and the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model proposed by Bollerslev (1986). The GARCH\(_{(p,q)}\) process is specified by:

$$h_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^{q} \beta_j h_{t-j}$$ \hspace{1cm} (5)

The GARCH\(_{(1,1)}\) is the simplest form and can expressed as follow:

$$h_t = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 h_{t-1}$$ \hspace{1cm} (6)

where, \(\alpha_0 \geq 0, \alpha_1 \geq 0\) and \(\beta_1 \geq 0\) and \(h_t\) is the conditional variance \(\sigma_t^2\). If \(\beta_1 = 0\), then Eq. (5) became ARCH\(_{(1)}\).

**Empirical analysis:** The starting point is to estimate Eq. (2), (3) and 4 by using the Ordinary Least Squares (OLS) method. The estimation revealed the following results:

$$IMP = 13702106.5053 - 17414016.1035 RER \hspace{0.5cm} (15.028) \hspace{0.5cm} (-13.026)$$ \hspace{1cm} (7)

$$EX = 4556489.87935 - 5721577.7295 RER \hspace{0.5cm} (14.912) \hspace{0.5cm} (-12.771)$$ \hspace{1cm} (8)

$$RGDP = 6014.8936 - 6479.86521 RER \hspace{0.5cm} (14.869) \hspace{0.5cm} (-10.925)$$ \hspace{1cm} (9)

To test for Heteroskedasticity, Table 1 illustrates the result of Lagrange Multipli er (LM) test for Autoregressive Conditional Heteroskedasticity (ARCH).

The null hypothesis that there is no ARCH up to order q. The test results revealed that the ARCH problem exists, for models 1, 2 and 3. The presence of the Heteroskedasticity problem in the estimated models gives the reason to use the ARCH and GARCH models. This study in order to select the suitable model to estimate the volatility use the Akaike Information Criteria (AIC) and Schwarz Criterion (SC), the model with the smallest information criterion will be selected.

The GARCH\(_{(1, 2)}\) is the best model to estimate volatility for model (1) and the result of the estimation is as follow:

$$IMP = 13702110.5132 - 17414013.0592 RER \hspace{0.5cm} (97.636) \hspace{0.5cm} (-188.94)$$

$$h_t = 200826161645 + 1.179 \varepsilon_{t-1}^2 + 0.027 h_{t-1} - 0.347 h_{t-2}$$

<table>
<thead>
<tr>
<th>Table 1: ARCH LM test</th>
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<tr>
<td><strong>Model (1)</strong></td>
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<td>F-statistics</td>
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<tr>
<td>Prob.</td>
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<td>Obs*R²</td>
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<tr>
<td>Prob.</td>
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For model (2), GARCH(1, 2), is also the best model to estimate volatility, the result as follow:

\[
\begin{align*}
EX &= 4557055.9379 - 5721186.36124\text{RER} \\
& (14.293) (-11.975) \\
\h_t &= 22554856575.5 + 0.812\epsilon_{t-1} - 0.0861\h_{t-1} + 0.222\h_{t-2}
\end{align*}
\]

Model (3) is different from models 1 and 2, the estimation revealed that GARCH(1, 0) is the appropriate model to estimate volatility and as above mentioned if \(\beta_1 = 0\), then Eq. (5) became ARCH(1). The result is as follow:

\[
\begin{align*}
\text{RGDP} &= 5785.44939447 - 6026.0754804\text{RER} \\
& (23.67) (-16.292) \\
\text{GARCH} &= 9440.835 + 0.749\epsilon_{t-1}^2
\end{align*}
\]

The results denote a negative relationship between import volume and real exchange rate as it appear first on OLS estimation and on volatility estimation, this result is similar to the theory relations, the change in the foreign prices will decrease the volume of imports. The GARCH model according to the sum of ARCH coefficient (\(\alpha\)) and the GARCH coefficients (\(\beta_1\) and \(\beta_2\)) which is less than 1, confirm that the imports is not volatile and the effect of real exchange rate volatility on imports is negative.

The second result from the estimation of model (2) reveal a negative relationship between exports and real exchange rate and this result is theoretically acceptable because the increase of the domestic price will decrease the exports and also the analysis of GARCH model show that the export is not volatile and the effect of real exchange rate volatility on exports is negative.

Finally the estimation of OLS for model (3) show negative relationship between real GDP and real exchange rate, this mean a decrease in domestic prices or an increase in foreign prices will increase the real GDP, given the fact that the nominal exchange rate is fixed and does not affect the real GDP and also this result is acceptable. Moving to volatility estimation, from the previous results the real exchange rate volatility affect real GDP positively.

**CONCLUSION**

This study tries to model the real exchange rate volatility and to show the effects of the real exchange rate volatility on imports and exports of Jordanian economy and a positive effect on real GDP. The fixed exchange rate regime adapted by the central bank of Jordan that links the Jordanian Dinar with U.S Dollar, makes the change in relative prices the sole source of the change on the real exchange rate, so any change in foreign and domestic prices will affect the real exchange rate. On the other hand the central bank of Jordan adapted a floating exchange rate regime against other currencies and given the fact that the United State is not the only trade partner of Jordan, that may be change the results in this study and give a space to extend the analysis to estimate the real exchange rate volatility on import, exports and real GDP in more accurate way.

**REFERENCES**


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