International Journal of Economics, Finance and Management Sciences
2015; 3(3): 270-278
Published online May 22, 2015 (http://www.sciencepublishinggroup.com/j/ijefm)
doi: 10.11648/j.ijefm.20150303.23
ISSN: 2326-9553 (Print); ISSN: 2326-9561 (Online)

The J-Curve Effect on the Trade Balance in Armenia

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To cite this article:
Gevorg Grigoryan. The J-Curve Effect on the Trade Balance in Armenia. *International Journal of Economics, Finance and Management Sciences*. Vol. 3, No. 3, 2015, pp. 270-278. doi: 10.11648/j.ijefm.20150303.23

Abstract: Over the past years the Armenian Dram has appreciated against their major trading partners' currencies. Such appreciation has received mixed reactions. Some economists argue that the depreciation of currencies is a good stimulant for export growth, while others argue that the net benefits of depreciation cannot outweigh its ills on the economy. The purpose of this paper is to investigate the effects of depreciation on the trade balance of Armenia using vector error correction model (VECM) and to trace the response of the trade balance to the shocks in the exchange rate using Impulse response function. This study finds evidence of the J-curve on the Armenian trade balance and the existence of a long-run equilibrium relationship among the variables. This suggests that following a real depreciation the trade balance will initially deteriorate, but will improve in the long run.

Keywords: Armenia, J-Curve, Exchange Rate, Trade Balance, VECM

1. Introduction

Many economists and policy makers believe that currency devaluation gives advantages in international trade. When a country devaluates its currency, domestic export goods become cheaper relative to its trading partners resulting in an increase in quantity demanded. The devaluation policy is mainly aimed at improving the trade balance. However, there is a time lag before the trade balance improves followed by devaluation. The short run and long run effects of depreciation on the trade balance are different. Theoretically, the trade balance deteriorates initially after depreciation and some time along the way it starts to improve, until it reaches its long-run equilibrium. The time path through which the trade balance follows generates a J-curve. The time lag comes about, because of the time needed for recognition, decision, delivery, replacement and production (Junz and Rhomberg 1973). Following a real depreciation, traders take time to recognize the changes in market competitiveness, and this may take longer in international markets than in domestic markets, because of distance, language and cultural problems. Some time is spent on deciding on what business relationships to venture into and for the placement of new orders. Also, there is a delivery lag that explains the time taken before new payments are made for orders that were placed soon after the price shocks occurred. Procurement of new materials may be delayed to allow inventories of materials to be used up, which is called a replacement lag. Finally, there is a production lag before which producers become certain that the existing market condition will provide a profitable opportunity. One explanation for the J-curve phenomenon is that the prices of imports rise soon after real depreciation but quantities take time to adjust downward because current imports and exports are based on orders placed some time before (Yarbrough and Yarbrough 2002).

On the other hand, domestic exports become more attractive to foreign markets, but quantities do not adjust immediately for the same reason. An increase in value of imports against a constant or a small change in the value of exports results in a trade deficit in the short run. As time passes by, importers have enough time to adjust their import quantities with respect to the rise in prices, while quantity demanded for exports increases, which results in an improvement in the trade balance. The long-run improvement in the trade balance occurs when the Marshall-Lerner condition holds. In the long-run the volume effect dominates the price effect of a real depreciation. In order for the trade balance to improve the sum of imports and exports demand and supply elasticities must be greater than unity.

In this study we attempt to investigate the response of the trade ratio to shocks in the real effective exchange rate in Armenia. To my knowledge there is no previous study on this topic in Armenia. The quarterly data from 2000:1 to 2010:3 is used. The paper employs the cointegration methodology to estimate the long-run equilibrium relationship between the trade ratio and the real exchange rate. The impulse response analysis and the vector error correction models are used to investigate the short-run and feedback effects of the shocks in the exchange rate on the trade balance. The model sets trade balance as a function of real exchange rate, domestic income and foreign income. In this paper we define the trade balance as the ratio of imports to exports. This representation allows us to take the natural logarithm of the trade ratio, without worrying about negative values in case of trade deficits. The real effective exchange rate is used instead of the bilateral real exchange rate and weighted average of trading partners' real income is used as a proxy for foreign income.

The paper proceeds as follows, Section 2 provides the literature review. Section 3 develops theoretical framework and the empirical model. Section 4 provides the analysis of the empirical results. Section 5 concludes this paper.

2. Literature Review

During last few decades a large number of studies examined short run and long run relationship between exchange rate and trade balance. There are numerous empirical studies exploring both trade balance improvement after currency depreciation and the existence of J-curve pattern. These studies covered a very diverse set of economies such as developed countries (US, Canada and Japan), number of emerging European and Asian economies, as well as few developing African countries. The J-curve phenomenon was first advocated by Stephen P. Magee (1973) after the fact that the trade balance resembled the letter “J” in response to the currency depreciation.

The effects of devaluation of the exchange rate on the trade balance are related to the determinants of the demand and supply elasticities of exports and imports. Bahmani-Oskooee (2004) states, that in the short run, the elasticities are relatively smaller (inelastic demand and supply), than in the long run (elastic), hence the trade balance may deteriorate in the short run. Because of the currency contracts, initially, the trade balance worsens as a result of a real depreciation since prices and traded quantities cannot be changed.

As this situation assumes that exports are invoiced in domestic currency and imports in foreign currency, Hsing (1999) proposed, that the degree of foreign and domestic producer’s price pass-through to consumers and the scale of supply and demand elasticities of exports and imports, determine the value of the effect. The J-curve effect can be explained by both a perfect pass-through and a zero pass-through. Under a perfect pass-through domestic import prices increase, while domestic export price remains unchanged. This results in deterioration in the trade balance. In zero pass-through situation, domestic export prices increase and domestic import prices remain constant hence the real trade balance improves following devaluation. Most studies on the J-curve effect have come up with mixed results. Some results are consistent with the J-curve phenomenon, while others show nonexistence or new evolution of the J-curve effect.

Gupta-Kapoor and Ramakrishnan (1999) used the error correction model and the impulse response function to determine the J-curve effect in Japan using quarterly data from 1975:1 -1996:4. Their analysis showed the existence of the J-curve on the Japanese trade balance.

Tihomir Stucka (2004) found evidence of J-curve on trade balance of Croatia. His study employed a reduced form model to estimate the impact of a permanent shock on the merchandise trade balance. It was found that 1 percent depreciation in the exchange rate improves the equilibrium trade balance by the range from 0.94 to 1.3 percent, moreover it took 2.5 years for equilibrium to be established.

Koch and Rosensweig (1990) studied the dynamics between the dollar and components of U. S. trade. They employed time series-specification tests and Granger causality test to identify the J-curve phenomenon. Two of the four components portrayed dynamic relationships that are weaker and more delayed than the standard J-curve. The conventional J-curve theory asserts a strong and rapid dependency of imports prices on the currency.

Carter and Pick (1989) found empirical evidence indicating the existence of the J-curve using the U.S. Agricultural trade balance. The results exhibited deterioration in the trade balance that lasted for about 9 months following 10 percent depreciation in the U.S. dollar.

Hsing (2003) used the generalized impulse response function from the vector error correction model to examine the existence of J-curve in Japan, Korea and Taiwan. He finds that Japan’s aggregate trade provided evidence of the phenomenon, while Korea and Taiwan did not show any presence of the J-curve effect. He argues that this might be attributed to a small open economy effect. In small open economies like Korea and Taiwan, both imports and exports are invoiced in foreign currency as a result the short run effect of real devaluation is hedged and the trade balance remains unaffected.

Scott Hacker and Abdulansser Hatemi-J (2004) used bilateral trade data to estimate the short and long-run effect of exchange rate changes on the trade balance in the transitional Central European economies of Czech Republic, Hungary and Poland against their trade with Germany. Their findings suggest that in all the three cases, there were some evidence of the J-curve effect after real depreciation of the currencies in question. They also investigated the J-curve effect replacing the real exchange rate with the nominal exchange rate and the relative German price level. The argument for introducing these variables is that real exchange rate changes are either a result of shocks in the nominal exchange rate or general domestic price changes. In some case it’s a combination of both variables. Nominal exchange rate changes are much more observable than real exchange rate changes. Besides, it is easily controlled by authorities. They found weak forms of the J-curve effect.

Paresh Narayan (2004) investigates the J-curve effect of on the trade balance for New Zealand. He finds no cointegrating relationship between the trade balance and real effective exchange rate, domestic income and the foreign income during the period of 1970-2000. However, the New Zealand trade balance exhibited a J-curve pattern. Following a real depreciation of the New Zealand dollar, the trade balance worsens for the first three years and improves thereafter. Similar study by Wilson and Kua (2000) investigated the Singapore's trade relations with the U.S. and found no significant impact of the Singapore's real exchange rate on the trade balance and little evidence of the J-curve hypothesis. This study used the partial reduced form model of Rose and Yellen (1989) derived from two-country imperfect substitute model.

Bahmani-Oskooee et al. (2003) conducted another study on India's trade balance and did not find any significant results. As researchers have long been argued that the problem could probably be the use of aggregated data, they used disaggregated data to investigate the J-curve hypothesis against India's trading partners. The empirical results of the study did not support the J-curve pattern, but the long-run real depreciation of India's Rupee had significant effect on the improvement of the trade balance. This clearly suggests that in studying the J-curve phenomenon, it is crucial to separate and identify both the short and long-run implication of devaluation on the trade balance. In estimating the J-curve, researchers either use aggregated or bilateral trade data. Rose and Yellen (1989) argue that the use of bilateral data is useful because a proxy for the world income variable is not required as in the aggregate analysis, which reduces aggregation bias.

3. Methodology

3.1. Theoretical Framework

In this work we follow the model introduced by Rose and Yellen (1989), where the country's trade balance is a reduced form function of real exchange rate, real domestic and foreign incomes.

We start with a standard model specifying export and import demand functions

$$X_t = \left(\frac{P}{P^{*}\cdot E}\right)_t^{\eta} \cdot (Y_t^{*})^{\varepsilon} \quad (1)$$

$$M_t = \left(\frac{P^{*}\cdot E}{P}\right)_t^{\gamma} \cdot (Y_t)^{\pi} \quad (2)$$

where X_t and M_t are the volume of exports and imports at time t , E is the nominal exchange rate, P and P^{*} are the domestic and foreign prices, Y and Y^{*} are domestic and foreign incomes. η and γ are the real exchange rate elasticities for exports and imports and ε and π are the income elasticities of exports and imports.

Rewriting equations (1) and (2) in logarithmic form,

$$\ln X_t = \eta[\ln P_t - \ln P_t^{*} - \ln E_t] + \varepsilon \ln Y_t^{*} \quad (3)$$

$$\ln M_t = \gamma[\ln P_t^{*} + \ln E_t - \ln P_t] + \pi \ln Y_t \quad (4)$$

where $\ln e_t = [\ln P_t^{*} + \ln E_t - \ln P_t]$ is the natural logarithm of real exchange rate. Let TB_t be the trade balance and is defined as the ratio between exports and imports

$$\ln TB_t = \pi \ln Y_t + \varepsilon \ln Y_t^{*} + \vartheta \ln e_t \quad (5)$$

where $\vartheta = -(\eta + \gamma)$. The coefficient of $\ln e_t$ indicates whether Marshall-Lerner condition fulfilled or not. Note that η and γ are assumed to have negative sign and ε and π positive. Marshall-Lerner condition holds whenever ϑ has a positive sign, indicating that higher real exchange rate, or in other words the depreciation, improves the trade balance.

3.2. The Model

As we mentioned in the previous section we use partial reduced form model of Rose and Yellen (1989), which is as follows:

$$ME_t = f(REER, FY, DY) \quad (6)$$

Instead of using trade balance as the dependent variable, we use the ratio of imports and exports (ME_t). The use of imports to exports ratio as a dependent variable has its advantages over the trade balance, so that we can take natural logarithms without worrying for the possible negative values of the trade balance in case of trade deficit as in Hsing (2003). The empirical model for trade balance of Armenia

$$\ln ME_t = \alpha_0 + \beta_1 \ln REER_t + \beta_2 \ln FY_t + \beta_3 \ln DY_t + \varepsilon_t \quad (7)$$

Where $\ln ME_t$ is the logarithm of real imports to real exports ratio, $REER_t$ is the logarithm of trade weighted real effective exchange rate, defined as the amount of domestic currency per unit of foreign currency, $\ln FY_t$ is the logarithm of weighted average of trade partners' real income and $\ln DY_t$ is the logarithm of domestic real income (GDP). α_0 is the regression constant, $\beta_1, \beta_2, \beta_3$ are the parameters to be estimated and ε_t is the error term. All the variables are in logarithmic form, so that the parameter estimates could be interpreted as elasticities.

According to the J-curve hypothesis, an increase in the real effective exchange rate initially reduces the demand for the home country's exports and increases its demand for imports, hence this initially leads to deterioration of the trade balance. So here we expect the coefficient β_1 to be negatively related to ME_t, that is $\beta_1 < 0$. Furthermore, we expect the trade ratio to be positively related to the domestic real income and negatively related to foreign income. However, for instance, an increase in economic activity of a trading partner not only boosts its demand for imports from Armenia but also its exports to Armenia.

We use the Johansen procedure (Johansen (1995)) to test for the existence of long-run relationship between the trade ratio and the real effective exchange rate. Since it only accounts for the long run cointegration between the variables, in order to capture the short run effects as well, we use the vector error correction (VEC) model. For VEC model to be applicable all variables should be stationary. Therefore, we run an Augmented Dickey-Fuller (ADF) test and Phillip-Peron (PP) test to check for existence of unit roots. If the variables do not contain unit roots we can express the equation (7) as a vector error correction model.

$$\Delta \ln ME_t = \delta_0 + \sum_{j=1}^{p} \theta_j \Delta \ln ME_{t-j} + \sum_{j=1}^{p} \gamma_j \Delta \ln REER_{t-j} + \sum_{j=1}^{p} \varphi_j \Delta \ln FY_{t-j} + \sum_{j=1}^{p} \phi_j \Delta \ln DY_{t-j} + \lambda(\ln ME_{t-1} - \beta_1 \ln REER_{t-1} - \beta_2 \ln FY_{t-1} - \beta_3 \ln DY_{t-1}) + \varepsilon_t \quad (8)$$

Where the Δ denotes the first difference operator, λ provides information about the speed of adjustment coefficient, ε_t is a pure white noise term.

We then apply impulse response function derived from the VEC model to estimate the J-curve effect. The impulse response function shows the response of current and future trade ratio to one standard deviation change in the real effective exchange rate.

3.3. Variables and Data Discription

In this part we present detailed description of the variables and the data. As mentioned previously the variables used in the empirical model are the imports and exports ratio, real effective exchange rate, domestic real income and Armenia's trade partners' real income. The data set covers the period from 2000 to 2010 in quarterly frequencies. To be consistent in the interpretation of the estimates, all the variables must to be in the same currency except for the real effective exchange rate, since it is only an index. Fortunately the provided data set was in the same currency, specifically in US dollars, so we had no need to convert it. The small sample size is associated with the Republic of Armenia being a rather young country. The main data source used in this study was provided by the Central Bank of Republic of Armenia[1] and National Statistic Service of the Republic of Armenia. Next we describe the variables more detailed.

3.3.1. Imports and Exports Ratio (ME)

To calculate the imports to exports ratio we are using the values of Armenia's imports and export expressed in U.S dollars.

$$ME_t = \frac{Imports_t}{Exports_t} \quad (9)$$

the data for both variables was provided by the Central Bank of Armenia.

We can easily notice that the trade balance of Armenia is suffering from deficit starting form 1996. Armenia's export volume increased between 2001 and 2008 followed by a significant fall starting at the beginning of the financial crisis in 2008. Since then, export volume has started a modest recovery. In late 2008, exports and overall external trade volumes started to decrease. In the same period imports had a dramatic increase till 2008. The deepest decline in exports and imports were recorded in May 2009 declining by 48% and 30% respectively. Starting from the second half of the year, recovery trends became visible.

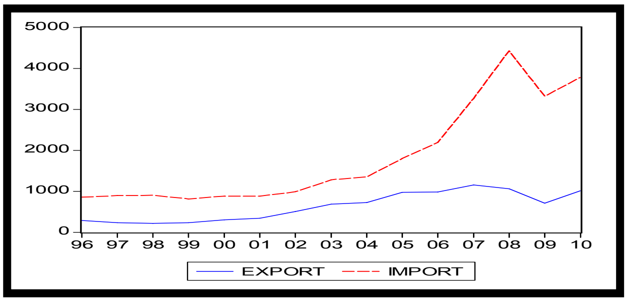

Figure 1. *Armenia's Exports and Imports in USD, annual basis (1996-2010).*

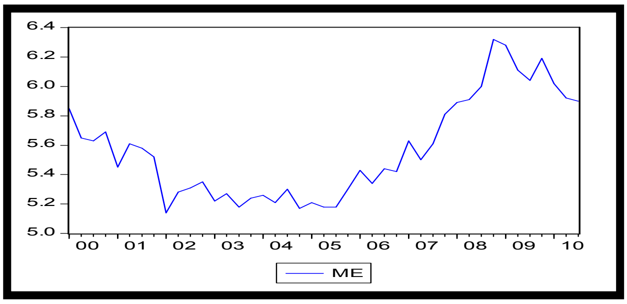

Figure 2. *Trade ratio (ME), quarterly basis (2000Q1-2010Q3).*

3.3.2. Real Effective Exchange Rate (REER)

The real effective exchange rate for Armenian Dram is based on consumer price index. There was no specific reason for choosing the CPI based REER other than convenience in the availability of the data.

$$REER = NEER \frac{P}{\prod_{i=1}^{n} (P_i^*)^{w_i}} \quad (10)$$

Where NEER the nominal effective exchange rate of Armenian Dram, P is is the price level in Armenia, P_i^* is the price level in country i , w_i is the proportionally calculated weight, based on the ratio of foreign trade between trading partner i and home country to the total amount of home country's foreign trade. The increase in the real effective exchange rate indicates appreciation of the currency.

Despite the volatilities, Armenian Dram has been appreciating throughout time, specifically, starting from the 3rd quarter of 2003.

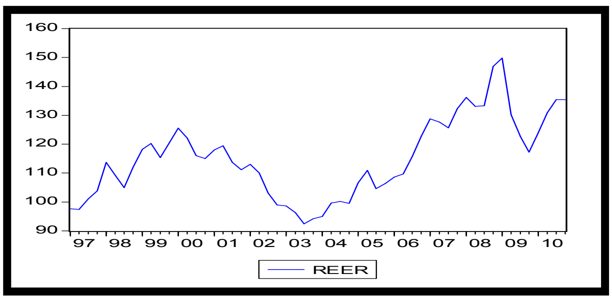

Figure 3. *Armenian dram real effective exchange rate (REER), quarterly basis (2000Q1-2010Q3).*

1 http://www.cba.am/EN/SitePages/statdatabank.aspx

3.3.3. Trading Partners' Real Income (FY)

FY is calculated in following way. First of all, we obtain the data on gross export and import among Armenia and its 10 main trade partners, such as Russian Federation, Germany, USA, China, Turkey, Bulgaria, Georgia and so on. Using the official statistics we compute the average value for the gross imports and exports. Taking these computed values as weights, we calculate FY as a weighted average that is we multiply the weights for each country by its real GDP growth rate. On the final step we add all of this multiplied figures and as a result we get DY as a weighted average values. It is obvious from the graph that data is not stationary, that is it contains a time trend and will need to be differenced.

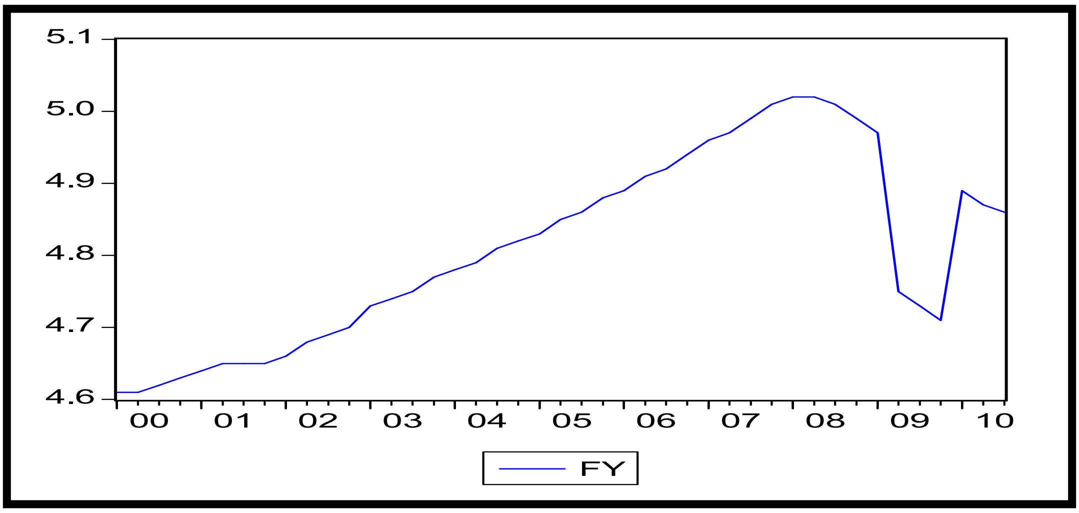

Figure 4. *Weighted average of trading partners' real income, quarterly basis (2000Q1-2010Q3).*

3.3.4. Domestic Real Income (DY)

We use the gross domestic product (GDP) of Armenia expressed in US dollars. We can see from the graph that starting form year 2000 the domestic income has shown a steady improvement, on average showing 10% growth annually. The global financial and economic crisis heavily affected the Armenian economy. After continuing high growth rates for the past 16 years, Armenia experienced economic decline in 2009.Specifically, the decline started in late 2008, with further deepening in the beginning of 2009 and came to end by the end of the year. As a consequence, Armenia recorded 6.9% growth rate in 2008 in contrast to expected much higher rate, while in 2009, the economy declined by 14.2%. Again there is an obvious trend in the series, which indicates existence of unit root in the series. The data was provided by the National Statistical Service of the Republic of Armenia (NSSA)

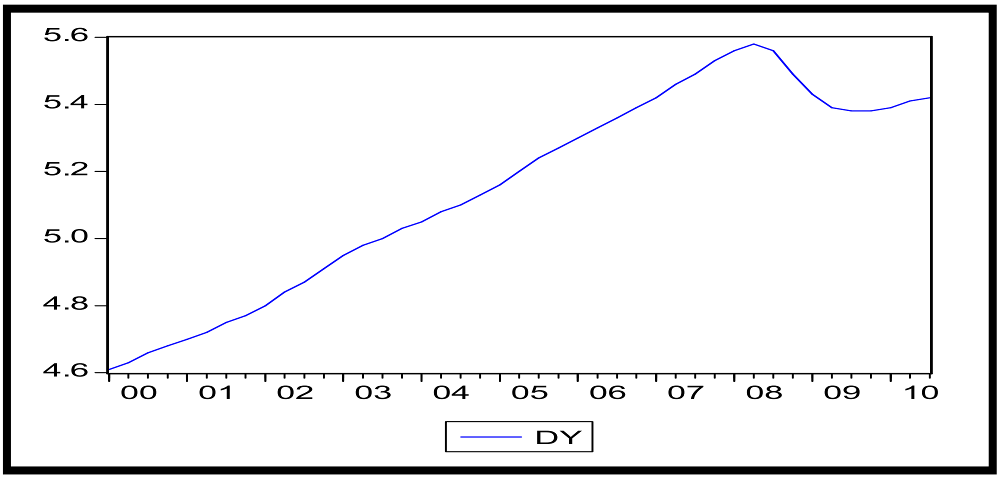

Figure 5. *Domestic income (DY), quarterly basis (2000Q1-2010Q3).*

4. Empirical Analysis and Results

4.1. Unit Root Test

To test for unit root of the variables the Augmented Dickey-Fuller (ADF) test procedure and Phillips-Peron test are employed as described by Enders (1995). The ADF test compared to the ordinary Dickey-Fuller unit root test, allows the inclusion of lagged dependent variable terms in order to correct for serially correlated residuals. The regression model of ADF test is as follows

$$\Delta z_t = a_0 + \gamma z_{t-1} + \sum_{i=2}^{p} \beta_i \Delta z_{t-i+1} + \varepsilon_t \quad (11)$$

Where a_0, γ and β_i are parameter estimates and ε_t is the error term. The number of augmented lags is denoted by p. The null hypothesis of the ADF in this specification is that $\gamma = 0$ (the data needs to be differenced to make it stationary) and the alternative hypothesis is that $\gamma < 0$ (the data is stationary and doesn't need to be differenced). Plots of variables for Armenia exhibit a presence of a trend in the series. As a result, the unit root tests for these variables must include a constant and a time trend, as equation (12) applies. Thus, the following equation is used

$$\Delta z_t = a_0 + \gamma z_{t-1} + a_2 t + \sum_{i=1}^{p} \beta_i \Delta z_{t-i} + \varepsilon_t \quad (12)$$

where t is time trend and a_2 is a parameter estimate. The null hypothesis is $\gamma = 0$ (the data needs to be differenced to make it stationary) and the alternative hypothesis is $\gamma < 0$ (the data is trend stationary).

Phillips and Perron (1988) developed a number of unit root tests that have become popular in the analysis of financial time series. The main difference between Phillips-Perron (PP) unit root tests and the ADF tests is how they deal with serial correlation and heteroskedasticity in the errors. The PP tests ignore serial correlation in the test regression, but the error term may be heterosedastic. The test regression for the PP tests is

$$z_t = \alpha + \pi z_{t-1} + u_t \quad (13)$$

The results for the test are provided in the following tables. Table 1 reports the for the unit root test at level

Table 1. *Unit root test at level: ADF and PP.*

Variables	ADF stat.	LL	PP stat.	BW
ln (ME)	-2.45	0	-2.43	4
ln(REER)	-2.33	1	-2.11	3
ln(FY)	0.80	3	-1.58	4
ln(DY)	-0.83	2	-0.27	4

Notes: LL is the lag length selected using the Schwartz Information Criterion and BW is the bandwidth based on the Newey West Bandwidth. *, **and *** reflect the significance level at 1%, 5% and 10%

As we see from table 4-1 all variables appear to be statistically not significant, therefore all variables are non-stationary at the level form. Further, we run unit root tests again after differencing all variables at the first level. For all variables test statistics exceed the critical values, except DY, though its critical value is very close to the 10% significance level. The results for the tests are depicted in Table 2. The unit root characteristics of the variables have important implication when testing for cointegration of the variables in a specified empirical model. It is often, wrongly assumed that all variables in the error correction model (ECM) need to be of order one. However, a necessary condition to finding a cointegrating relationship among non-stationary variables is that only two of the variables have to be integrated of the order one (Hansen and Juselius, 1995). According to Gupta-Kapoor and Ramakrishnan (1999) economic relevance should be a key determinant of the system of the variables in the VECM and not the time series properties of the data.

Table 2. *Unit root test at 1st level: ADF and PP.*

Variables	ADF stat.	LL	PP stat.	BW
Δ ln ME	-7.64*	0	-7.66	4
Δln REER	-5.56*	1	-4.47	9
ΔlnFY	-6.01*	2	-6.28	13
ΔDY	-2.92	1	-2.13	0

Notes: LL is the lag length selected using the Schwartz Information Criterion and BW is the bandwidth based on the Newey West Bandwidth. *, **and *** reflect the significance level at 1%, 5% and 10%

4.2. Cointegration Test

The Johansen procedure can estimate multiple cointegrating vectors. This approach works with the estimation of Vector of Autoregression (VAR) of the form

$$\Delta X_t = \alpha + \sum_{i=1}^{\rho-1} \Pi_i \Delta X_{t-1} + \Pi X_{t-\rho} + \Pi u_t$$

Where X_t is a column of vector of n endogenous variables, Π_i and Π are $n \times n$ matrices of unknown parameters, u_t is the error term. All long-run information about the relationship between variables is contained in the impact matrix Π . When the matrix Π has full column rank, it implies that all variables in X are stationary. When the matrix Π has zero rank, the system is a traditional first-differenced VAR involving no long-run elements. However, when the rank of Π is intermediate or $0 <$ rank $(\Pi) = r < n$, there exist r cointegrating vectors that make the linear combinations of X_t become stationary or cointegrated.

The one of the most important stage of the analysis is the selection of lag length. Lag lengths have significant influence on the outcome of the results. There is always a tradeoff between using too many lags and too few lags. Too many lags tend to make the model less parsimonious and reduce the degrees of freedom while using very few lags leads to correlation of the residuals. The Likelihood ratio, Akaike Information Criterion (AIC) and Schwartz Bayesian Criterion (SBC) indicated the optimal lag length be one.

We applied the Johansen procedure to test for cointegration of the variables. The Johansen method uses the maximum eigenvalue statistics and the trace statistics to determine the rank of the cointegrating vectors. The results of the Johansen cointegration rank test are presented in Table 3 and Table 4.

Table 3. *Unrestricted Cointegration Rank Test (Trace).*

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.623619	80.98260	63.87610	0.0010
At most 1	0.416019	40.91933	42.91525	0.0781
At most 2	0.278274	18.86598	25.87211	0.2888
At most 3	0.125442	5.495501	12.51798	0.5269

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level. * denotes rejection of the hypothesis at the 0.05 level

Table 4. *Unrestricted Rank test (Maximum Eigenvalues).*

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.623619	40.06327	32.11832	0.0043
At most 1	0.416019	22.05335	25.82321	0.1457
At most 2	0.278274	13.37048	19.38704	0.2991
At most 3	0.125442	5.495501	12.51798	0.5269

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

As we see from the tables there is only one cointegration equation existing, since both Trace and Maximum Eigenvalue statistics exceed its' critical values, so the null hypothesis of no cointegration against alternative hypothesis of existence of cointegration is strongly rejected at 5% significance level for both test.

The existence of one cointegrating vectors implies that the long-run relationship is unique. The results for long run relationship between the variables are presented in table5.

Table 5. *Estimated cointegration vector for Armenia (Long run).*

Variables	ME	REER	FY	DY	C
Coeficients	1.000000	-2.979856	24.41515	-15.28627	-34.51286
Standard error		(0.90730)	(3.69334)	(3.21760)	
t-statistics		[-3.28430]	[6.61058]	[-4.75083]	

The long run cointegration equation can be written in following way,

$$\mathrm{ME_t} = -34.51286 - 2.979856\mathrm{REER_t} + 24.41515\mathrm{FY_t} - 15.28627\mathrm{DY_t}$$

The overall performance of variables is fairly good, that is all the variables are statistically significant. In Armenia, the long run model predicts negative relationship between trade ratio and real effective exchange rate, which is consistent with the theory that real depreciation improves the trade balance in the long run. However, the coefficients on domestic and foreign income have inconsistent signs to those predicted by economic theory. In our results domestic and foreign incomes are negatively and positively related to the trade ratio.

The coefficient of the real effective exchange rate (REER) has a correct sign and it is statistically significant at 1% significance level. The implication of this relationship is that the appreciation of the real effective exchange rate by one point will have a negative impact on the by 2.979856. Since it is imports to exports ratio the trade balance will improve in the long run as the fraction will decrease.

The positive sign of FY states that the increase of Armenia's main trade partner countries' income has a negative impact on the trade balance. The t-statistics shows significance at 1% level. Similarly, because of the negative sign, an increase in domestic income will be followed by the improvement in the trade ratio, since, the exports will increase.

Further, to estimate the relationship between the trade ratio and its determinants in the short run, we run the regression using the vector error correction model VECM (table 6).

Table 6. *Vector error correction estimation (first difference, short run).*

Variables	D(ME)	D(REER)	D(FY)	D(DY)
Coefficient	0.077296	0.002960	-0.055901	-0.014180
Standard error	(0.05248)	(0.01796)	(0.01353)	(0.00514)
t-statistics	[1.47283]	[0.16483]	[-4.13181]	[-2.75615]

In the short run real effective exchange rate has positive impact on the trade balance, where D(REEX) denotes the first difference of the variable. However, it is not significant. Both the foreign income D(FY) and domestic D(DY) income have negative signs and are statistically significant at 1% significance level.

4.3. Variance Decomposition

The essence of a variance decomposition analysis is its ability to provide information about the relative importance of the random innovations. Specifically, it provides information on the percentage of variation in the forecast error of a variable explained by its own innovation and the proportion explained by innovations in other variables. Table 7 summarizes the results of the variance decomposition on the effects of trade balance, real effective exchange rates, foreign income and domestic income on the trade balance.

Table 7. *Variance decomposition.*

Period	ME	REER	FY	DY
1	100.0000	0.000000	0.000000	0.000000
2	99.40684	0.023184	0.250842	0.319137
3	97.83992	0.313943	0.960888	0.885249
4	95.99598	0.5m93894	1.336518	2.073603
5	93.86878	0.839328	1.476812	3.815082
6	91.58268	1.017577	1.441694	5.958048
7	89.24415	1.125938	1.322816	8.307096
8	86.97810	1.177717	1.190390	10.65380
9	84.89346	1.189552	1.081629	12.83536
10	83.06513	1.176918	1.006798	14.75115

The variance decomposition suggests that the significant part of the variability in the forecast error for trade balance is explained by its own innovations, which accounts for about 92% and declines over time. The results demonstrate that current performance of trade balance relays largely on past performance. Only 5.95% and 1.5% of the variability in forecast error for trade balance is explained by domestic and foreign income, respectively. Furthermore, the empirical results suggest that only a small proportion of variability in trade balance could be attributed to innovations in the real effective exchange rates.

4.4. Impulse Response

Recent studies suggest that the best way of deriving evidence of the j-curve is to use impulse response function. An impulse response function measures the time profile of the effect of shocks at a given point of time on the expected (future) values of variables in a dynamic system. The best way to describe an impulse response is to view it as the outcome of a conceptual experiment in which the time profile of the effect of a hypothetical $k \times 1$ vector of shocks of size $\delta = (\delta_1, \ldots, \delta_m)'$, say, hitting the economy at time t is compared with a baseline profile at time $t + n$, given the economy's history. After giving a residual shock by one unit we obtain the following figure.

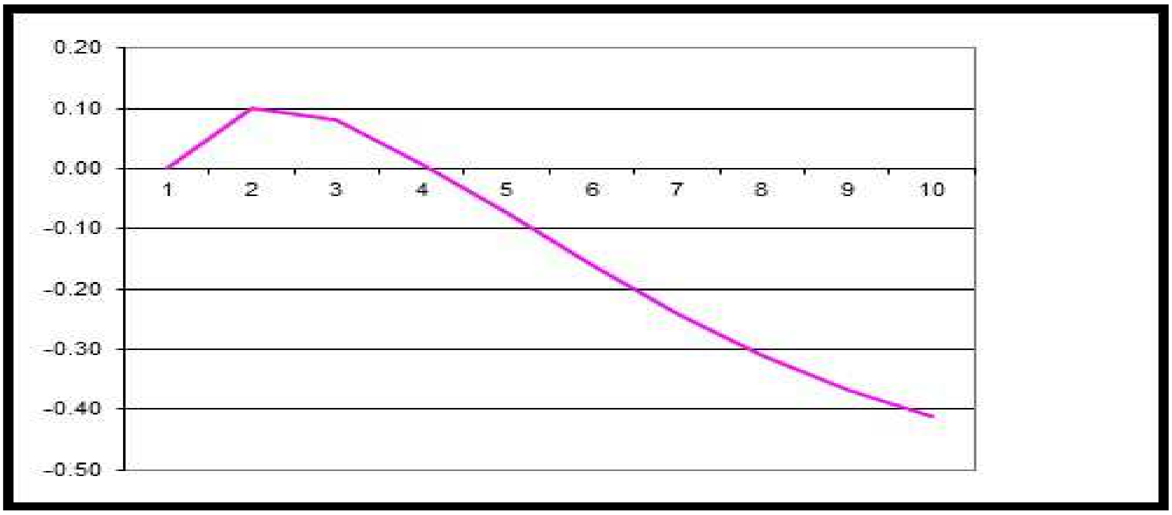

Figure 6. *Impulse response of Armenian trade ratio to residual one unit shock of REER.*

Figure 6 shows a clear path of inverse J-curve, it is inversed because of the definition of trade balance. The figure shows that in short run Armenia's trade ratio initially deteriorates by about 10% due to a 1% real depreciation in Armenian currency.The deterioration of the trade ratio is due to price effect which implies that the unit value of imports has increased resulting in an increase in total value of imports against a constant or an insignificant change in the value of exports. About four quarters after the initial shock, the trade ratio starts to improve. The improvement in the trade balance is due to volume effect, as both supply and demand elasticities increase in absolute values.

Much as we find evidence of the J-curve hypothesis in Armenia, this does not provide enough information to prescribe a devaluationary policy in Armenia. It is important to assess the effect of such policy on the economy as a whole and not just the trade balance. It is possible to observe the trade balance improvement as a result of real depreciation at the same time register a decline in gross national product. The net effect could be zero as the improvement in the trade balance would be offset by the decline in the gross national product. We should consider the behavior of other macroeconomic variables such as interest rate, inflation rate and so on under the devaluationary policies. One needs to keep in mind that devaluation has its own contractionary effects on the economy. Devaluation raises the cost of imported intermediate inputs and this affects supply side of the economy. In situations where devaluation is accompanied by inflation in the domestic market, it erodes purchasing power of money resulting in a decline in the aggregate demand.

5. Conclusion

This paper employed cointegration analysis and vector error correction model to investigate the J-curve effect on the trade balance in the Republic of Armenia. Negative relation between trade ratio and the real effective exchange rate was found from the long-run equilibrium model for Armenia. From theoretical point of view this implies that real currency depreciation will lead to a long-run improvement in the trade ratio. It states that exports increases more than imports and the trade balance is expected to be positive. The empirical results of the impulse response function from the vector error correction model suggest that Armenia support the J-curve hypothesis that soon after a real depreciation, the trade balance deteriorates as a result of price effects. The unit value of imports increases relative to exports but as time passes by, the volume effect takes over and the trade balance starts to improve. One limitation of this study is the short time series data. Finally, we will be very careful to prescribing devaluationary policy in the Republic of Armenia. Countries planning to implement policies targeted at the exchange rate need to do that with caution because of varying macroeconomic environments and different responses to currency depreciation.

References

[1] Al Shehabi, O. and Ding, Sh. (2008). Estimating Equilibrium Exchange Rates for Armenia and Georgia, IMF Working Paper, 110.

[2] Armenia economic report (2010). The necessity of economic diversification and export expansion, Ministry of Economy of the Republic of Armenia.

[3] Bahmani-Oskooee, M. (2004). The J-Curve: A Literature Review. Journal of Applied Economics, 36, 1377-1398.

[4] Bahmani-Oskooee, M. and Jehanzeb, Ch. (2009). Short run and long-run effects of currency depreciation on the bilateral trade balance between Pakistan and her major trading partners. Journal of economic development,34.

[5] Bahmani-Oskooee, M. and Swarnjit, A. (2003). Bilateral J-Curve Between India and her Trading Partners. Journal of Applied Economics, 35, 1037-1041.

[6] Bahmani-Oskooee, Mohsen, and Ali M. Kutan (2007). The J-Curve in the Emerging Economies of Eastern Europe. The International Trade Journal, 19,165–178.

[7] Bredin, D.,Fountas, S. and Murphy E.(2003). International Review of Applied Economics, 17, 2.

[8] De Silva, D. G., and Zhu, Z. (2004). Sri Lanka's Experiment with Devaluation: VAR and ECM Analysis of Exchange Rate Effects on Trade Balance and GDP. The International Trade Journal, 18 (4), 269-301.

[9] Dickey, D. A. and Fuller, W. A. (1979) Distributions of the estimators for autoregressive time series with a unit root, jounal of the American Statistical Association, 74, 427.

[10] Enders, E. (2004). Applied Econometric Time Series (2nd edition) New Jersey: John Wiley & Sons.

[11] Grigoryan, V. and Dallakyan, A. (2003). Equilibrium real exchange rate model of Armenia, Working paper of Central bank of Armenia.

[12] Gupta-Kapoor, A. and Ramakrishna, U. (1999). Is There a J-curve? A New Estimation for Japan. International Economic Journal,13 (4), 71-19.

[13] Hacker, R. Scott, and Abudlnasser, Hatemi-J. (2004). The Effect of Exchange Rate Changes on the Trade Balance in the Short and Long Run: Evidence from German Trade and Transitional Central European Economies. Journal of Economics of Transition, 12(4), 777-799

[14] Hsing, Han-Min (2005). Re-examination of J-Curve Effect for Japan, Korea and Taiwan. Japan and the World economy, 2 (17), 43-58.

[15] Johansen, S. (1995). Likelihood–Based Inference in Cointegrated Vector Autoregressive Models. Oxford: Oxford University Press.

[16] M. Abimbola Oyinlola, Oluwatosin Adeniyi and Olusegun Omisakin (2010). Responsiveness of Trade Flows to Changes in Exchange rate and Relative prices: Evidence from Nigeria. International Journal of Economic Sciences and Applied Research 3 (2): 123-141

[17] Narayan Paresh (2004). New Zealand's Trade Balance: Evidence of the J-Curve and Granger Causality. Applied Economics Letters, 11, 351-354.

[18] Narayan, Paresh. K., and Narayan, Seema (2004). The J-Curve: Evidence from Fiji. International Review of Applied Economics, 18 (3), 369-380.

[19] Pesaran, M. H. Y. Shin and Smith, R. J. (2iJ01) Bounds testing approaches to the analysis of level relationships, journal of Applied Econometrics. 16, 289-326.

[20] Petrovic, P. and Grigoric, M. (2010). Exchange Rate and Trade Balance: J-curve Effect, Panaeconomicus,1, 23-41.

[21] Rabeya, Kh. and Rahman M. M. (2009). Assessing the Existence of the J-Curve Effect in Bangladesh, The Bangladesh Development Studies,32 , 2.

[22] Rose, A. K. (1990) Exchange rates and the trade balance: some evidence from developing countries economic letters, 3, 271-275.

[23] Rose, Andrew, and Janet Yellen (1989). Is There a J-Curve. Journal of Monetary Economics, 24, 53-68.

[24] Tarlok Singh (2004). Testing J-Curve Hypothesis and Analyzing the Effect of Exchange Rate Volatility on the Balance of Trade in India. Empirical Economics, 29, 227-245.