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Exchange Rate and Trade Balance: Iran and its major Trading partners

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Abstract

The main objective of this paper is to evaluate the short and long run effects of exchange rate depreciation in Iran on the trade balance of each 5 major trading partners, including: Germany, United Arabic Emirates, Turkey, China and South Korea during 1980-2011. The equations are estimated by using ARDL approach and ECM, and the stability of trade balance in long term is evaluated by CUSUM and CUSUMSQ tests. The results of the short-term effects on trade balance indicate that J-Curve exists only for UAE and South Korea. Furthermore, a long run impact on trade balance of Iran with Germany, UAE and South Korea is recognized.

Keywords: Exchange Rate, Trade balance, Exchange rate, J-Curve, Auto-Regressive Distributed Lag approach, Error Correction Model.

Introduction

Currency depreciation is found to promote exports and restrict imports. According to economic theories, if the Marshall-Lerner condition holds, the trade balance will be improved. Nevertheless, a considerable number of empirical studies conclude that with the presence if this condition, trade balance deteriorates at the beginning, and in long run it may subsequently improve. J-curve illustrates that the exchange rate depreciation may induce some dynamic reactions in trade balance, and such reactions may occur over a period of time.

This paper contributes to the understanding of the relationship between the exchange rate and trade balance in Iran. In doing so, the trade relation between Iran and each of 5 major trade partners is examined by using Auto-Regressive Distributed Lag approach and Error Correction Model. The period that is explored covers 1980-2011, during which Iran has experienced international economic isolation and continuous currency depreciation.

The main findings of this paper can be summarized as follow. First, the analysis indicates that the J-curve effect of exchange rate volatility on trade balance is not always indicated. The second finding is that long run impact of currency depreciation and trade balance is not always recognized. These conclusions are similar to many empirical studies having to do with developed as well as developing countries and will be reviewed below.

A review of previous research

The relationship between exchange rate volatility and the trade balance has been studied for many countries. Some of these studies have reached different conclusions as follows:

Arora, Bahmani Oskooee and Goswami (2003) by using quarterly data from 1977 through 1998 and employing the ARDL procedure, demonstrated the existence of J-Curve effects between India and Australia, Germany, Italy, Japan.

Anafowora (2003) by using quarterly data from 1980 through 2001 and employing the VECM model, examined short-term and long-term effects of real exchange rate volatility on trade balance of three Asian countries (Malaysia, Indonesia and Thailand) with trade relations between America and Japan. The results indicate that Marshall-Lerner condition holds in long-run and for Indonesia and Malaysia in conjunction with America and Japan also Thailand with Japan the J-Curve phenomenon doesn't exist.

Yousefi and wirjanto (2003) by using data from 1970 through 1998 examined the American dollar fluctuations on trade balance of oil exporting countries included Iran, Saudi Arabia and Venezuela. The results indicate that the total price elasticity of demand for long-term import and export for Iran and Venezuela is more than 1 and for Saudi Arabia is less than 1.

Stucka (2004) by using ARDL procedure indicates that the J-Curve phenomenon presents for Croatia and also in short and long-run the positive effect of exchange rate depreciation on trade balance is invariant.

Moura and Dasilva (2005) tested the J-Curve phenomenon for trade balance of Brazil and its largest trading partners included 16 countries. Also by using monthly data from January 1990 through December 2003 examined the Marshall-Lerner condition for Brazil. The results indicate that the Marshall-Lerner holds in conjunction with Brazil's trade balance. But the J-Curve phenomenon doesn't exist in short-term.

- Bahmani Oskooee, Goswami and Talkudar (2005) by using quarterly data from 1973 through 2001 examined the short and long-term bilateral trade balance of Australia and its 23 trading partners in response to the exchange rate depreciation. The results indicate that the J-Curve effect doesn't exist.

- Beak (2006) by using quarterly data from 1980 through 2005 and employing ARDL procedure concluded that the J-Curve phenomenon doesn't present between forest products of America and Canada.

- Akhbari and Khoshbakht (2006) by employing ARDL procedure and ECM model examined the J-Curve effect on Iran's trade relations with Germany during the period of 1995-2004. The results indicate that the J-Curve phenomenon doesn't exist between trade balance and the real exchange rate during this period of time.

- Bahmani Oskooee and Ardalani (2007) examined the J-Curve effects on 66 industrial sections of USA and by using the monthly data from 1991 through 2002 and employing VAR procedure concluded that only in 6 sections the J-Curve phenomenon presents and devaluation of dollar has long-term effect on 22 sections.

- Bahmani Oskooee and Ratha (2007) examined the bilateral J-Curve effect for Swedish and its 17 trade partners. They used the quarterly data from 1980 through 2005 and by employing VAR procedure tested the short and long-term of trade balance in response to the exchange rate depreciation. The results indicate that in 14 countries the devaluation of Krone has short-term and significant effect on trade balance and the J-Curve phenomenon presents in 5 countries.

- Halicioglu (2007) by using annual data from 1985 through 2005 and employing ARDL procedure indicates that the J-Curve effect doesn't exist between Turkey and any of its 13 trading partners.

-Aftab and Khan (2008) by using quarterly data from 1980 through 2005 and employing ARDL procedure examined the short and long-term effects on Pakistan's trade balance in response to exchange rate depreciation against its 12 trading partners and concluded that the J-Curve effect doesn't present.

- Delavari and Kariminia (2008) explore the effects of fiscal policies (government's expenditure) on Iran's trade balance during 1959-2006. By employing some procedures such as ARDL and Philips-Hanson and Johanson they examined the government's expenditures and private investments and private consumption on Iran's trade balance. The results indicate that, first, by increasing in government's spending and private investment and private consumption, the current account deteriorated. Second, there is no long-run relationship between import constituent variables. Also they concluded that in short and long-term, government's expenditure as a fiscal policy has

positive effect on importing commodity. Also private investment and private consumption have positive effect on import.

- Hsing (2008) examined the J-Curve phenomenon for bilateral trade between America and 7 countries included Argentina, Chile, Colombia, Ecuador, Peru and Uruguay. The results indicate that only for Chile, Ecuador and Uruguay, the J-Curve exists. In other words, by exchange rate depreciation, the situation of trade balance has been deteriorated then has been improved.

- Hsing (2009) examined the J-Curve phenomenon for bilateral trade between America and 6 countries included Croatia, Czech Republic, Hungry, Poland, Slovakia and Slovenia. But J-Curve doesn't present in any of these 6 countries. So after a shock that caused exchange rate depreciation, the trade balance of Czech Republic improved, but for Poland, Hungry, Slovenia and Slovakia, the trade balance became worse. For Croatia, the trade balance improved at first then deteriorated.

- Tayyebnia and Fooladi (2009) examined the effects of rising world prices of agricultural, industrial and service commodities on Iran's trade balance by providing a general equilibrium model for Iran. The results indicate that rising prices of industrial goods, has the greatest impact on domestic price levels and rising prices of services has the minimal impact on domestic price levels. Also if the global prices rise, GDP will decline.

- Pirhadi (2012) by employing VAR and VECM procedures confirmed the relationship between inflation, money supply growth and exchange rates in short-term and long-term. But was not approved the impact of the exchange rate depreciation on increasing exports, improving trade balance and balance of payments.

These studies suggest a substantial impact on relative prices, in determining trade flows between countries. And exchange rate depreciation is used for correcting the imbalance of trade and improving economic growth. Based on the studies, it can be concluded that according to Iran's economic situation, in the short-term, exchange rate depreciation, can lead to an improvement in the trade balance, against some of trade parties. However, this improvement doesn't include all major trading partners.

Data description and their time series characteristics

In empirical analysis logarithms of trade balance (TB), real effective exchange rate (RER) and gross domestic product in Iran (GDPIR) and gross domestic product in major trading countries (GDPj) are used. These series are annually and run from 1980 to 2011.

The value in dollar terms of total exports (EX) and import (IM) of goods are used to obtain the trade balance, defined as ratio of export over import ($TB_j = \frac{EX_j}{IM_j}$).

Thus a decrease in the trade balance variable implies its improvement. The exchange rate is defined as foreign currency per unit of domestic one. Hence, its increase implies an appreciation of the domestic currency.

Real exchange rate for each country comes from multiplying the nominal exchange rate of that country (in dollar), in ratio of consumer price index of a foreign country, over consumer price index of Iran [RER = NEX*($\frac{\text{CPIj}}{\text{CPIir}}$)].

Real gross domestic product is available at WDI1, IFS2, Islamic republic of Iran's customs administration and Statistical yearbook of Iran.

Exchange rate and trade balance (long-run relationship)

[1] World Bank Development Indicators
[2] International Financial Statistics (IFS)

The trade balance is depend on the real exchange rate and on the main determinates of import and export. So the following model will be estimated:

$$TBj,t = \alpha0 + \alpha1GDPIR,t + \alpha2GDPj,t + \alpha3RERj,t + ut \quad (1)$$

All variables are expressed as logarithms. The main interest here is to explore the effect of the exchange rate (RER) on trade balance (TB), whether in the long-run, real depreciation of currency, will improve trade balance, and the other way round in case of appreciation.

The effect of domestic income should be controlled, in order to estimate the effect of exchange rate on trade balance, hence inclusion of gross domestic product (GDP) in relation (1). However the impact of GDP on TB is ambiguous. Namely an increase in domestic output raises imports but could also boost exports, and the net effect on the trade balance could either be an improvement or a worsening. It is now well understood that the supply driven output growth due to an increase in productivity, leads to an improvement of the trade balance3.

The presence of co-integration between the non-stationary I(1) variables above can be tested In order to explore the existence of a long-run relation for trade balance (1). While doing that, the autoregressive distributed lag (ARDL) will be respectively used.

Table (1). The results of short-term trade balance of Iran with each of its trading partners.

R2	c	Lnrer-2	Lnrer-1	lnrer	Lngdp-1	Lngdpi-1	lngdpi	Lngdpirn-2	Lngdpirn-1	lngdpirn	Lntb-2	Lntb-1		
0/85	40/05			-0/65		-30/67	32/21	4/27	0/74	-6/64	0/6	-0/025	coefficient	China
	0/15			0/002		0/00	0/00	0/08	0/88	0/05	0/001	0/84	probability	
0/88	16/6	-0/64	1/16	-0/49			0.61		3/41	-4/12		0/56	coefficient	Germany
	0/3	0/00	0/00	0/00			0/22		0/18	0/002		0/00	probability	
0/79	-147/08		1/02	-0/48			3/32			-3/61		0/27	Coefficient	South
	0/02		0/00	0/04			0/04			0/004		0/05	probability	Korea
0/52	81/32		0/65	-0/38	-5/08	9/99	-3/14			-5/12	-0/44	0/008	coefficient	UAE
	0/06		0/009	0/04	0/15	0/04	0/59			0/07	0/07	0/32	probability	
0/85	-9/6	-0/54	0/85	-0/25			0/79		-9/76	8/93		0/74	coefficient	Turkey
	0/36	0/015	0/006	0/29			0/78		0/006	0/06		0/00	probability	

Source: Authors` calculation

$$LnTB_{j,t} = \sum_{i=1}^{n} b_{1i} LnTB_{j,t-i} + \sum_{i=0}^{m} b_{2,i} LnGDP_{IR,t-i} + \sum_{i=0}^{l} b_{3,i} LnGDP_{j,t-i} + \sum_{i=0}^{k} b_{4,i} LnRER_{j,t-i} + \varepsilon_t \quad (1)$$

Pesaran, Shin and Smith (2001) have developed bounds of testing procedure, which incorporates the long-run trade balance equation (1) into an error correction model (ECM). This enables simultaneous evaluation of long and short-term coefficients, which represents one of the main advantages of this approach. Then an ARDL representation of equation (1) reads as follows:

This approach lends opportunity to the estimated long-run trade balance equation regardless of whether the exchange rate and/or gross domestic product are purely I(0), purely I(1), or mutually co-integrated. It is only required that the dependent variable, trade balance, be I(1) process.

For determination of the number of lags length selection, Akaike information criterion (AIC) and Schwars Baysian Criterian (SBC) can be used.

In this paper according to annually data, the SBC value in table (1) indicates that the optimal number of lags is 2, (p=2).

[3] Caves, Frankel, and Jones (2001), P.389.

Short-run effect of exchange rate on trade balance: J-Curve effect

As explained before, in short-run, currency depreciation might first worsen the trade balance before subsequently improving it, hence creating J-Curve effect empirical evidence for a number of countries does support the presence of this effect. The results of short-term trade balance of Iran with each of its trading partners in table (1), indicate that for UAE and South Korea, the J-Curve effect presents. But for others doesn't exist. The J-Curve effect corresponds should be examined in order to the long-run trade balance equation above, and by calculating the impulse response of the trade balance, following a shock from real exchange rate. After short-term estimation, long-term relationship should be examined based on the calculated value of the test statistic (t-ratios) and compare them with the Banerjee critical values. Table (2) indicates the results:

Table (2). The results of long-term relationship

country	The test statistic	Banerjee critical value	result
China	-1/61	-3/57	No long-run relations
Germany	-3/67	-3/57	Long-run relationship
South Korea	-5/78	-3/57	Long-run relationship
Turkey	-2/45	-3/57	No long-run relations
UAE	-3/72	-3/57	Long-run relationship

Source: Authors' calculations.

The results of table (2) indicate that there is long-run relationship for variables in Iran with South Korea and Germany and UAE during this period of time. While doesn't establish the co-integration relationship between Iran and China and Turkey. So according to the long-run relationship between Iran and Germany, Iran and South Korea, Iran and UAE, long-term coefficients should be examined as follows:

Table (3). The estimated coefficients of the long-term pattern

result	LnRERi	LnGDPi	LnGDPIRN		
Not confirmed the J-Curve effect	0/08	1/39	-1/63	coefficient	Germany
	0/76	0/12	0/12	probability	
Confirmed the J-Curve effect	0/74	4/52	-4/92	coefficient	South Korea
	0/008	0/03	0/03	probability	
Confirmed the J-Curve effect	0/18	1/24	-3/57	coefficient	UAE
	0/01	0/32	0/002	probability	

Source: Authors' calculations.

The results indicate that in the equation between Iran and Germany, the coefficient of logarithm of gross domestic product (LNGDP), is negative but it doesn't have a significant effect on Iran's trade balance with Germany. Indeed, the Iran's trade balance with Germany, relative to Iran's GDP is inelastic. Also it is true for other variables in the model, scilicet logarithm of the Germany's GDP and logarithm of the exchange rate. In addition, the results of the table (3), indicate that in long-term, the J-Curve effect presents for Iran-South Korea and Iran-UAE, but doesn't exist for Iran-Germany.

Error correction model

The estimates of the co-integration trade balance equation above is used to get corresponding ECMs. The result of the estimated error correction coefficients of the different patterns are shown in the following tables:

Table (4). The estimated coefficients of the Error Correction model, Germany.

t-statistic	Standard deviation	coefficient	variables
1/26	0/48	0/61	dLnGDPDEU
-3/55	1/16	-4/13	dLnGDPIRN
-4/78	0/10	-0/49	dLnRER
4/36	0/15	0/64	dLnRER(-1)
-3/64	0/12	-0/44	ECM(-1)

R2 = 0/89 F-State = 41/4 (0/00)

Source: Authors' calculations.

The estimated of ECM(-1) is equal to -0/44 that it is significant and expected. It indicates that in each period of time, about 0/44 of trade imbalance of Iran and Germany is adjusted and approach its long-term trend. Also the coefficient of determination is 0/89 that indicates the high explanatory power of the model.

Table (5). The estimated coefficients of the Error Correction model, South Korea.

t-statistic	Standard deviation	coefficient	variable
2/11	1/57	3/32	dLnGDPKOR
-2/17	1/66	-3/61	dLnGDPIRN
-2/18	0/22	-0/48	dLnRER
-5/77	0/12	-0/73	ECM(-1)

R2 = 0/67 F-State = 14/42

Source: Authors' calculations.

The estimated of ECM(-1) is equal to -0/73 that is relatively high and significant and expected. It indicates that, in each period of time about 0/73 of trade imbalance of Iran and South Korea is adjusted and approach its long-term trend. Also the coefficient of determination is equal to 0/67.

The estimated of ECM(-1) is equal to -1/43, that is significant and expected.

Although the amount of this coefficient is less than -1 but still the model converge towards its long-term equilibrium. Indeed when the coefficient is less than -1 and higher than -2 the model is oscillatory convergent. This coefficient indicates that in each period of time, 1/43 of trade imbalance of Iran and UAE is adjusted and approach its long-term trend. This imbalance will eventually converge to its long-term amount. Also the coefficient of determination is equal to 0/78

Table (6). The estimated coefficients of the Error Correction model, United Arabic Emirates.

variable	coefficient	Standard deviation	t-statistic
DLnTBUAE(-1)	0/44	0/18	2/48
dLnGDPUAE	-3/14	3/48	-0/90
dLnGDPUAE(-1)	5/08	3/18	1/6
dLnGDPIRN	-5/12	1/88	2/72
dLnRER	-0/38	0/19	-2/05
C	81/3	30/9	2/63
ECM(-1)	-1/43	0/26	-5/42

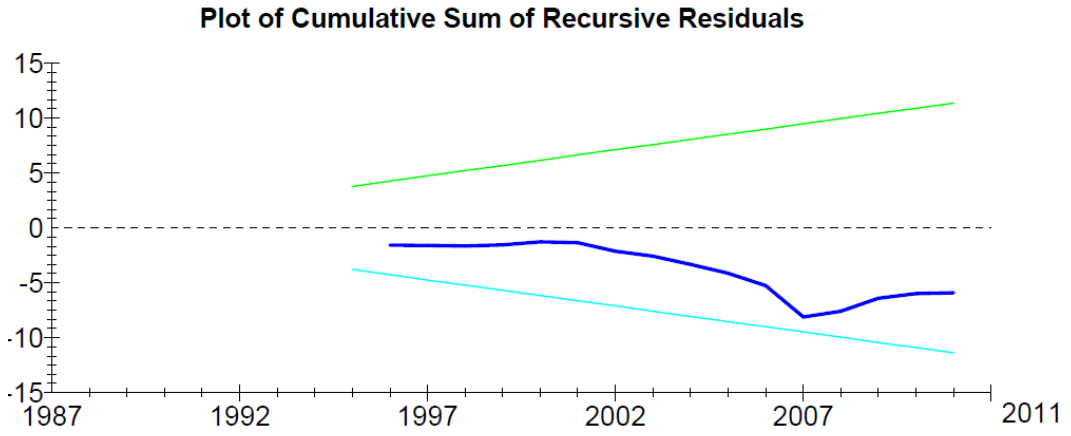
R2 = 0/78 F-State = 11/1

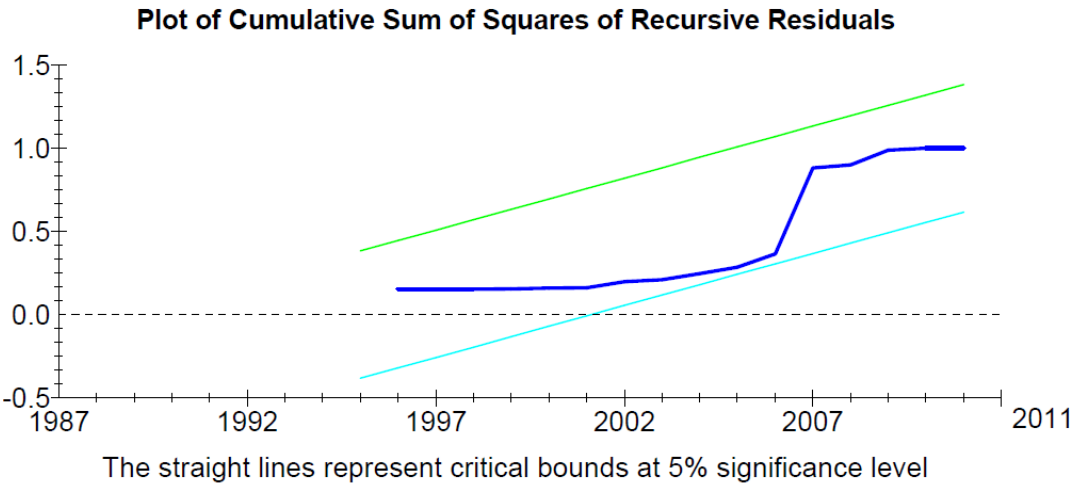
Source: Authors' calculations.

Then in order to verify the stability of the estimated long-run coefficients, the CUSUM and CUSUMSQ tests should be used. In these tests, the stability of parameters at the 5% significance level should be examined. Confidence interval in this case is two straight lines that show the 95% confidence level. If the cumulative residual plots and cumulative squared residual is within the confidence interval, the null hypothesis that there was no structural failure is accepted.

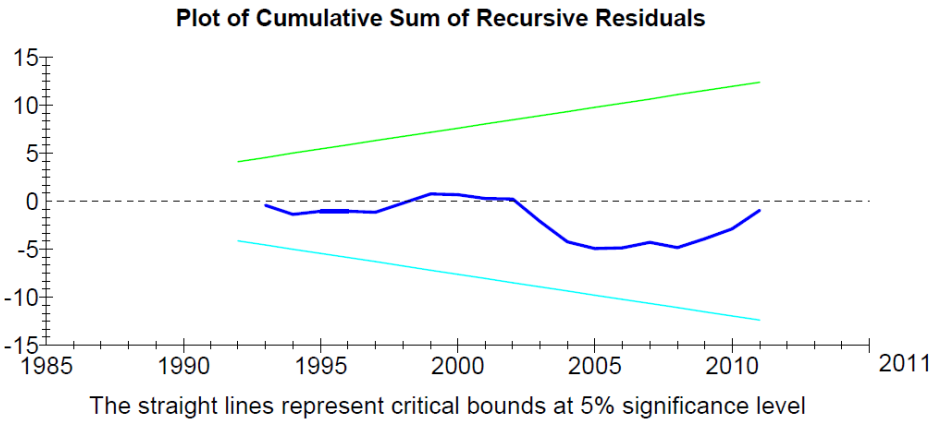
The results of the tests are presented in the following charts:

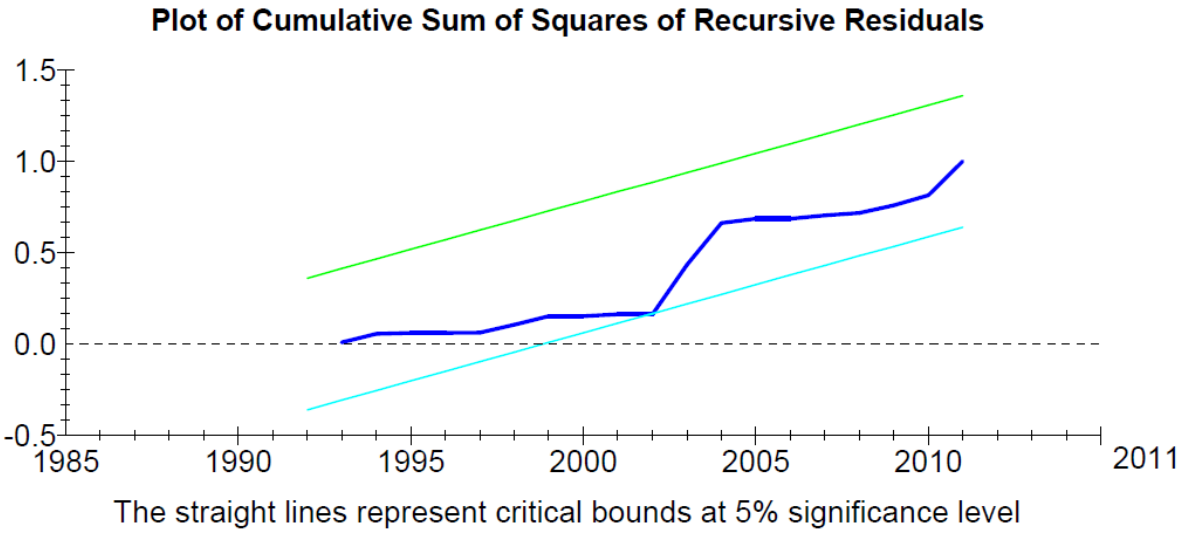
China:



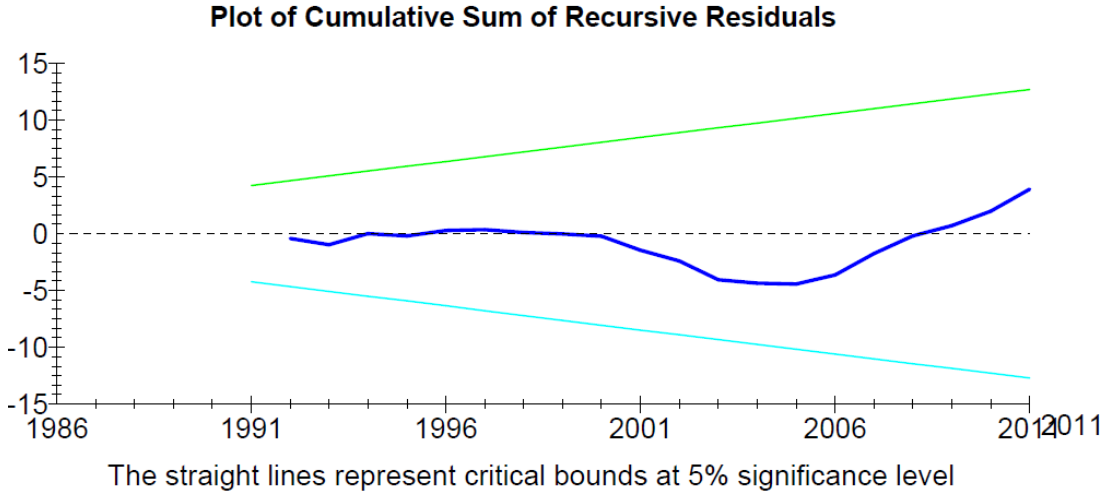


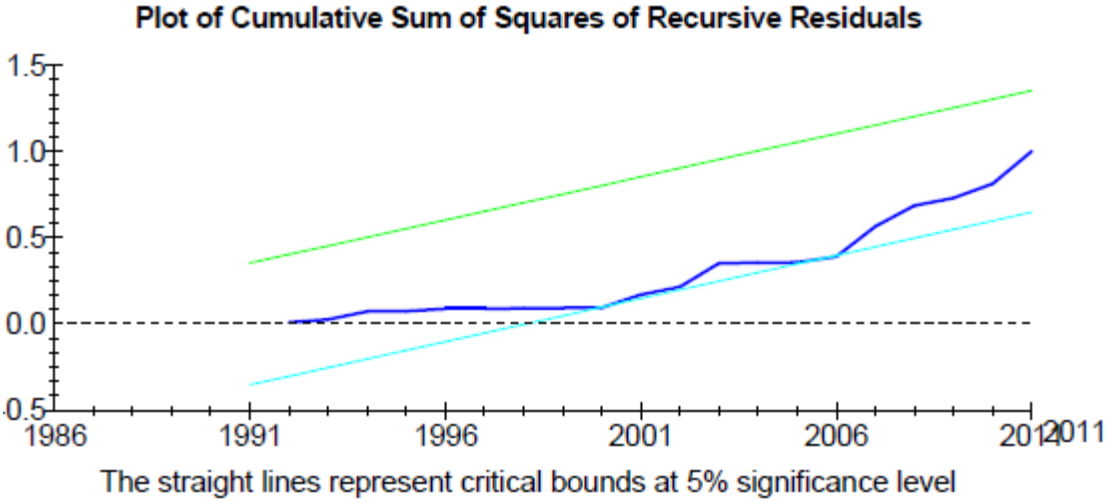
Germany:



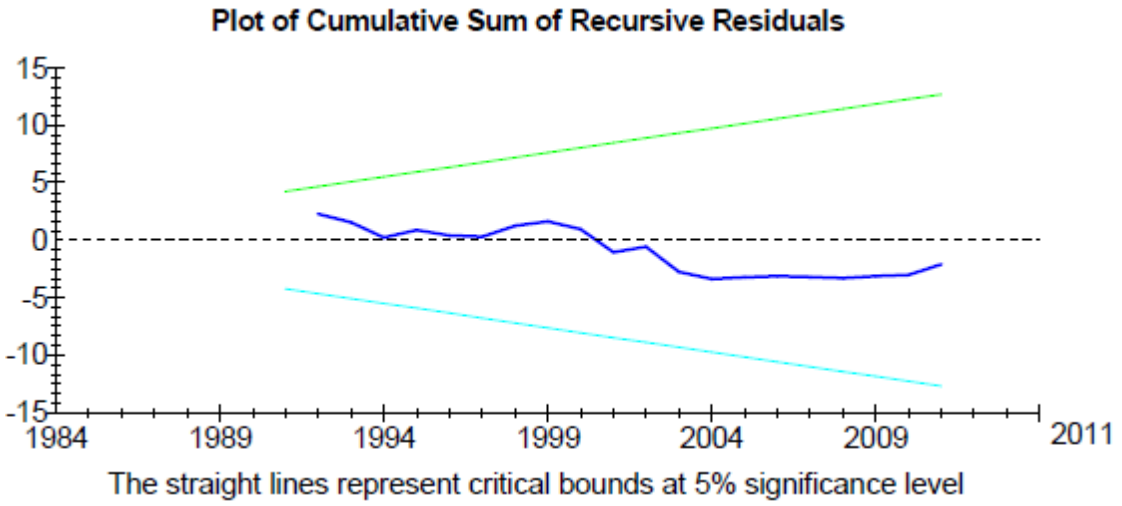


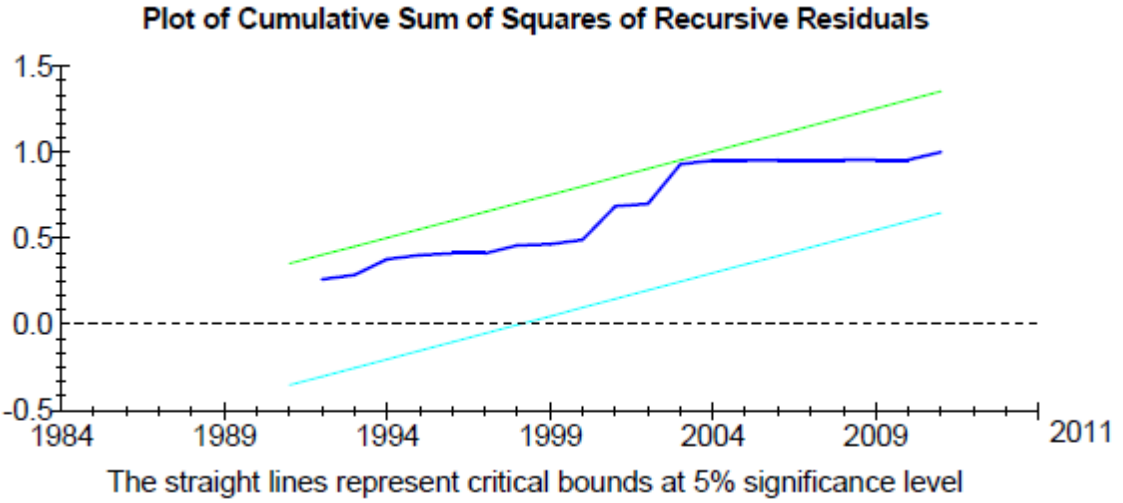
South Korea:



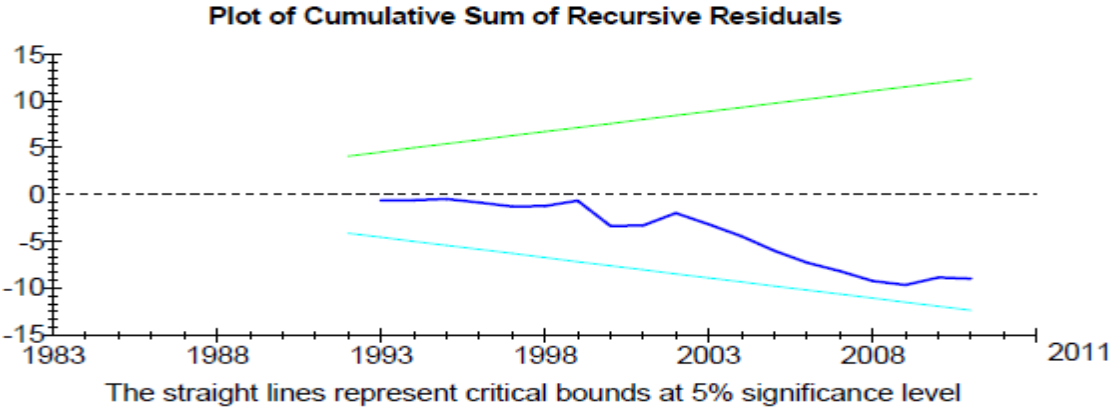


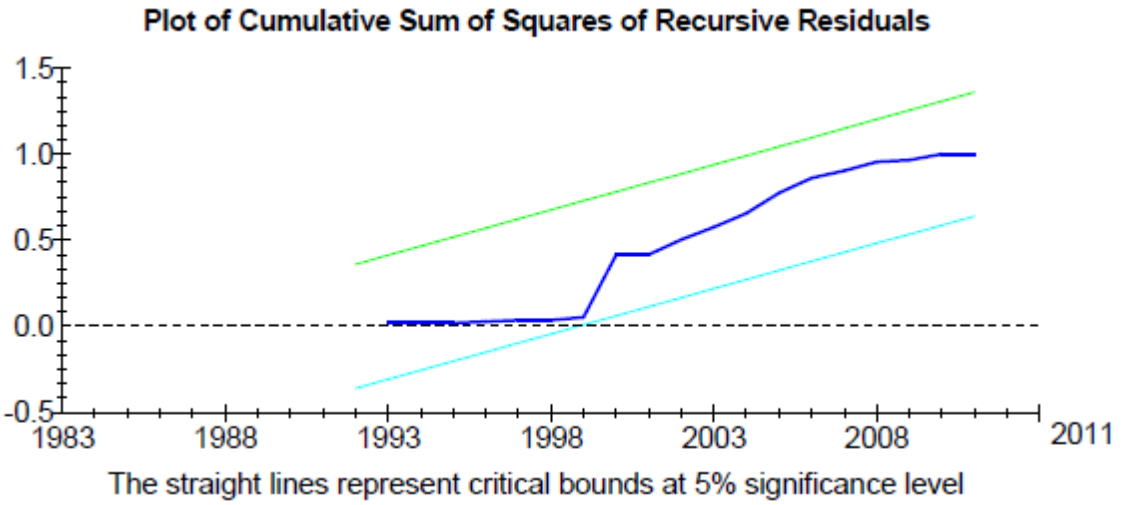
Turkey:





United Arabic Emirates:





Conclusions

The main findings of the paper are that real exchange rate depreciation has a positive significant long-run impact on Iran's trade balance, and that in the short-term trade balance first deteriorates before it later improves. Also indicate the existence of the J-Curve effect in short-term only for UAE and South Korea.

Then according to the long-term co-integration relationship between Iran and Germany, Iran and UAE, Iran and South Korea, the long-term coefficients is estimated and indicates, also in long-run, the J-Curve effect exists only for Iran-UAE and Iran-South Korea. But it doesn't exist for Germany in long-run.

The estimates of the J-Curve, based on ECM, indicates that, how much time does it take for trade balance in Iran and its trading partners to adjust and approach to their long-term trend.

The results indicate that in conjunction with three countries included Germany, UAE and South Korea in each period of time some of the trade imbalance is adjusted and approached their long-term trend. In other words this imbalance eventually will converge to its long-term amount.

It is worth noting that the results of this paper don't ignore the impact of other factors on the status of the trade balance. Even factors such as, productivity volatility, increase in competitive strength in production, changes in business strategy or even non-economic factors, creating changes in the status of Iran's trade balance. But indeed this paper is about evaluation of national currency on trade balance it is obvious that in separate research, the other factor's effect can be examined.

References

Aftab , Z. and S. Khan (2008). Bilateral J-Curves between Pakistan and her Trading Partners, PIDE Working Paper, No. 45, Islamabad.

Akhbari, Mohammad., Khoshbakht, Ameneh., (2006). Trade dynamics: Investigation of J-Curve in Iranian trade relations with Germany, Economic research, 74

Arora, S., Bahmani Oskooee, M. and Goswami, G. G.(2003). Bilateral J-Curves between India and Trading Partners, Applied Economics, 35, 1037-41

Bahmani-Oskooee, M. and A. Ratha (2007). The Bilateral J-Curve: Sweden Versus Her 17 Major Trading Partners, International Journal of Applied Economics, 4, 1 - 13.

Bahmani-Oskooee, M. and T.J. Brooks (1999), Bilateral J-Curve Between U.S. and her trading partners, Weltwirtschaftliches Archive, 135(1), 156-165.

Bahmani-Oskooee, M. and Z. Ardalani (2007). Is there a J-Curve at the Industry Level, Economics Bulletin, 6(26), 1 - 12.

Bahmani-Oskooee, M., G.G. Goswami and B.K. Talukdar (2005), "The Bilateral J-curve: Australia Versus her 23 Trading Partners", Australian Economic Papers, 44, 110 - 120.
Beak, J. (2006), The J-Curve Effect and the US – Canada Forest Products Trade, Journal of Forest Economics, 13, 245-258
Economic reports and balance sheets of central Bank of Islamic Republic of Iran, different years
Delavari, Majid., Kariminia, Asma (2008). Investigation of fiscal policy of Iran's trade balance with an emphesis on government's expenditure, Economic research, 85
Dicky, D.A. & W.A. Fuller (1981), Likelyhood Ratio Statistics for Autoregressive Time Series With a Unit Root, Econometrica, 49(4), 1057-1072.
Halicioglu, F. (2007). The Bilateral J-Curve: Turkey versus her 13 Trading Partners, Department of Economics, Yeditepe University, MRPA Paper No. 3564, November.
Halicioglu, Ferda (2007), The J-Curve Dynamics of Turkish Bilateral Trade: a Co Integration Approach, Journal of Economic Studies, 34(2), 103-119.
Hsing, Yu (2008). A Study of the J-Curve for Seven Selected Latin American Countries, Global Economy Journal, 8(4).
Hsing, Yu (2009), Test of the J-Curve for Six Selected New Eu Countries, International Journal of Economic Policy in Emerging Economies, 2(1), 76-85.
Junz H. B., Rhomberg R. R. (1973). Price Competitiveness in Export Trade Among Industrial Countries, American Economic Review, 63, 412-418.
Khan, Mohsin, 1974, Import and Export Demand in Developing Countries, IMF Staff Papers, 21.
Magee, S.P. (1973), Currency Contracts, Pass Through and Devaluation,
Brooking Papers on Economic Activity, 1, 303 - 325. Memarian, Erfan., Jalali Naeeni, Ahmadreza., (2010), The short-term and long-term fluctuations of exchange rate's effect on trade balance (examine J-Curve phenomenon by employing VECM model), economic bulletin.
Moura, G. and S. Da Silva (2005), Is there a Brazilian J-curve, Economic Bulletin, 6, 1 - 17.
Onafowora, Olugbenga (2003). Exchange Rate and Trade Balance in East Asia: Is there a J-Curve, Economics Bulletin, 5(18), 1-13.
Pirhadi Tavandashti, Nargeskhatoon (2012), Short-term and long-term effects of exchange rate on Iran's balance of payments, Master's thesis, Islamic Azad University, South Tehran branch.
Rose A. K. (1990). Exchange Rates and The Trade Balance: Some evidence from developing countries, Ecomomics letters, 34, 271-5
Rose A. K., Yellen J. L., (1989). Is there a J-Curve?., Journal of Monetary Economics. 24, 53-68.
Stucka, T. 2004, The Effect of Exchange Rate Change on the Trade Balance in Croatia, Interational Monetary Fund, IMF WORKING PAPER, WP/04/65.
Tayyebnia, Ali., Fooladi, Masoomeh., (2009). Investigation of rising world's prices level, trade balance and exchange rate, by using a computable general equilibrium model, Economic research, 44
Yousefi, Ayoub & Wirjanto, Tony (2003). Exchange Rate of the US Dollar and the J curve: the case of Oil Exporting Countries. Energy Economics, 25.
World Bank Development Indicators_ WDI CD Ram 2008.

Appendix: Results of the model estimation error

China
Error Correction Representation for the Selected ARDL Model
ARDL(2,1,2,0) selected based on Schwarz Bayesian Criterion
****
Dependent variable is dLNTB2CHN

25 observations used for estimation from 1987 to 2011
****
Regressor Coefficient Standard Error T-Ratio[Prob]
dLNTB2CHN1 -.60585 .14463 -4.1890[.000]
dLNGDPCHN 32.2122 4.8775 6.6043[.000]
dLNGDPIRN -6.6367 3.1957 -2.0768[.052]
dLNGDPIRN1 -4.2653 2.3323 -1.8288[.083]
dLNRERCHN -.64804 .17959 -3.6085[.002]
ecm(-1) -.41942 .17868 -2.3474[.030]
****
List of additional temporary variables created:
dLNTB2CHN = LNTB2CHN-LNTB2CHN(-1)
dLNTB2CHN1 = LNTB2CHN(-1)-LNTB2CHN(-2)
dLNGDPCHN = LNGDPCHN-LNGDPCHN(-1)
dLNGDPIRN = LNGDPIRN-LNGDPIRN(-1)
dLNGDPIRN1 = LNGDPIRN(-1)-LNGDPIRN(-2)
dLNRERCHN = LNRERCHN-LNRERCHN(-1)
ecm = LNTB2CHN -3.6612*LNGDPCHN + 3.8792*LNGDPIRN + 1.5451*LNRERCHN
****
R-Squared .89053 R-Bar-Squared .84546
S.E. of Regression .40764 F-stat. F(5, 19) 27.6601[.000]
Mean of Dependent Variable .15752 S.D. of Dependent Variable 1.0369
Residual Sum of Squares 2.8248 Equation Log-likelihood -8.2181
Akaike Info. Criterion -16.2181 Schwarz Bayesian Criterion -21.0936
DW-statistic 1.8102
****

Germany
Error Correction Representation for the Selected ARDL Model
ARDL(1,0,1,2) selected based on Schwarz Bayesian Criterion
****
Dependent variable is dLNTB2DEU
27 observations used for estimation from 1985 to 2011
****
Regressor Coefficient Standard Error T-Ratio[Prob]
dLNGDPDEU .60796 .48105 1.2638[.220]
dLNGDPIRN -4.1296 1.1649 -3.5451[.002]
dLNRERDEU -.49307 .10303 -4.7859[.000]
dLNRERDEU1 .63749 .14623 4.3595[.000]
ecm(-1) -.43740 .12010 -3.6421[.001]
****
List of additional temporary variables created:
dLNTB2DEU = LNTB2DEU-LNTB2DEU(-1)
dLNGDPDEU = LNGDPDEU-LNGDPDEU(-1)
dLNGDPIRN = LNGDPIRN-LNGDPIRN(-1)
dLNRERDEU = LNRERDEU-LNRERDEU(-1)
dLNRERDEU1 = LNRERDEU(-1)-LNRERDEU(-2)

ecm = LNTB2DEU -1.3899*LNGDPDEU + 1.6362*LNGDPIRN -.084040*LNRERDEU
****
R-Squared .89231 R-Bar-Squared .86000
S.E. of Regression .27514 F-stat. F(4, 22) 41.4276[.000]
Mean of Dependent Variable .058147 S.D. of Dependent Variable .73533
Residual Sum of Squares 1.5140 Equation Log-likelihood .58294
Akaike Info. Criterion -6.4171 Schwarz Bayesian Criterion -10.9525
DW-statistic 1.1386
****

South Korea
Error Correction Representation for the Selected ARDL Model
ARDL(1,0,0,1) selected based on Schwarz Bayesian Criterion
****
Dependent variable is dLNTB2KOR
26 observations used for estimation from 1986 to 2011
****
Regressor Coefficient Standard Error T-Ratio[Prob]
dLNGDPKOR 3.3195 1.5719 2.1117[.046]
dLNGDPIRN -3.6071 1.6608 -2.1719[.041]
dLNRERKOR -.47646 .21843 -2.1813[.040]
ecm(-1) -.73371 .12715 -5.7706[.000]
****
List of additional temporary variables created:
dLNTB2KOR = LNTB2KOR-LNTB2KOR(-1)
dLNGDPKOR = LNGDPKOR-LNGDPKOR(-1)
dLNGDPIRN = LNGDPIRN-LNGDPIRN(-1)
dLNRERKOR = LNRERKOR-LNRERKOR(-1)
ecm = LNTB2KOR -4.5243*LNGDPKOR + 4.9163*LNGDPIRN -.73745*LNRERKOR
****
R-Squared .67319 R-Bar-Squared .61094
S.E. of Regression .61002 F-stat. F(3, 22) 14.4192[.000]
Mean of Dependent Variable .12079 S.D. of Dependent Variable .97799
Residual Sum of Squares 7.8146 Equation Log-likelihood -21.2651
Akaike Info. Criterion -26.2651 Schwarz Bayesian Criterion -29.4104
DW-statistic 1.3028
****

Turkey
Error Correction Representation for the Selected ARDL Model
ARDL(1,0,1,2) selected based on Schwarz Bayesian Criterion
****
Dependent variable is dLNTB2TUR
28 observations used for estimation from 1984 to 2011
****
Regressor Coefficient Standard Error T-Ratio[Prob]
dLNGDPTUR .78938 2.7644 .28556[.778]
dLNGDPIRN 8.9260 4.5617 1.9567[.063]

dLNRERTUR -.25075 .22934 -1.0933[.286]
dLNRERTUR1 .53626 .20224 2.6516[.014]
ecm(-1) -.26211 .11775 -2.2260[.036]
****
List of additional temporary variables created:
dLNTB2TUR = LNTB2TUR-LNTB2TUR(-1)
dLNGDPTUR = LNGDPTUR-LNGDPTUR(-1)
dLNGDPIRN = LNGDPIRN-LNGDPIRN(-1)
dLNRERTUR = LNRERTUR-LNRERTUR(-1)
dLNRERTUR1 = LNRERTUR(-1)-LNRERTUR(-2)
ecm = LNTB2TUR -3.0116*LNGDPTUR + 3.1720*LNGDPIRN -.22258*LNRERTUR
****
R-Squared .59701 R-Bar-Squared .48188
S.E. of Regression .67645 F-stat. F(4, 23) 7.7777[.000]
Mean of Dependent Variable .18727 S.D. of Dependent Variable .93976
Residual Sum of Squares 9.6092 Equation Log-likelihood -24.7575
Akaike Info. Criterion -31.7575 Schwarz Bayesian Criterion -36.4202
DW-statistic 2.2928

United Arabic Emirates

Error Correction Representation for the Selected ARDL Model
ARDL(2,2,0,2) selected based on Akaike Information Criterion
****
Dependent variable is dLNTB2UAE
29 observations used for estimation from 1983 to 2011
****
Regressor Coefficient Standard Error T-Ratio[Prob]
dLNTB2UAE1 .32388 .17029 1.9019[.070]
dLNGDPUAE -1.9747 3.5369 -.55830[.582]
dLNGDPUAE1 4.8169 3.2484 1.4828[.152]
dLNGDPIRN -3.5121 1.8320 -1.9171[.068]
dLNRERUAE -.44544 .19911 -2.2372[.036]
dLNRERUAE1 .42211 .21089 2.0016[.058]
ecm(-1) -1.1055 .27975 -3.9516[.001]
****
List of additional temporary variables created:
dLNTB2UAE = LNTB2UAE-LNTB2UAE(-1)
dLNTB2UAE1 = LNTB2UAE(-1)-LNTB2UAE(-2)
dLNGDPUAE = LNGDPUAE-LNGDPUAE(-1)
dLNGDPUAE1 = LNGDPUAE(-1)-LNGDPUAE(-2)
dLNGDPIRN = LNGDPIRN-LNGDPIRN(-1)
dLNRERUAE = LNRERUAE-LNRERUAE(-1)
dLNRERUAE1 = LNRERUAE(-1)-LNRERUAE(-2)
ecm = LNTB2UAE -3.0134*LNGDPUAE + 3.1771*LNGDPIRN -.020019*LNRERUAE
****
R-Squared .74301 R-Bar-Squared .64021
S.E. of Regression .63897 F-stat. F(6, 22) 9.6373[.000]

Mean of Dependent Variable .016671 S.D. of Dependent Variable 1.0653
Residual Sum of Squares 8.1657 Equation Log-likelihood -22.7727
Akaike Info. Criterion -31.7727 Schwarz Bayesian Criterion -37.9255
DW-statistic 1.9399
****