Are Current Account Deficits Sustainable? New Evidence from Iran Using Bounds Test Approach to Level Relationship

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ABSTRACT

This paper provides new evidence on the long-run relationship between exports and imports of the Iranian economy by employing bounds test approach to level relationship. In Iran, there has been many unusual policy changes and/or external shocks to the economy which resulted in the occurrence of multitude of structural breaks in macroeconomic variables. By taking these breaks into account, results of the present study reveal that there is long run equilibrium relationship between imports and exports over the sample period, 1960-2007. This result confirms the finding of Arize (2002) by employing bounds tests to level relationship and suggests that current account deficits in Iran are sustainable.

Keywords: Current Account; Bounds Test; Iran.
JEL classification: C22; F10; F32.

1. INTRODUCTION

One of the long-standing distinguished topics in macroeconomic has been the sustainability of current account (see, e.g., Husted, 1993; Bahmani-Oskooee, 1994; Gould and Ruffin, 1996; Fountas and Wu, 1999; Arize, 2002; Mann, 2002; Baharumshah, et al. 2003; Christopoulos and Leon-Ledesma, 2010; among others), which occurs when exports and imports converge to equilibrium in the long term period. In that case, significant changes in the macroeconomic policy are not necessary. An unsustainable disequilibrium occurs when exports and imports don’t converge in the long term period and leads to current account deficits. These deficits, in the long run, lead to an increase in interest payments, cause a large debt for future generations and thus a lower standard of living. Therefore, investigation of whether imports and exports are in long run equilibrium relationship is essential for the design and evaluation of current and future macroeconomic policies aimed at achieving trade balance (Arize, 2002).

Empirical investigation about the sustainability of current account deficits provides mixed results in the relevant literature. Some studies such as Husted (1993), Gould and Ruffin (1996) with US data, Bahmani-Oskooee (1994) with Australian data, Herzer and Nowak-Lehmannd (2005) with Chilean data, Cheong (2005) with Malaysian data, Kalyoncu (2005) with Turkish data, Hollauer and Mendonca (2006) with Brazilian data, Bineau (2007) with Bulgaria’s data, and Ramona and Razvan (2009) with Romanian data, found that exports and imports of these countries in their period of study converge in the long term period. Moreover, Wu et al. (2001) by applying panel cointegration tests support the sustainability of current account among major the G-7 countries. Founds and Wu (1999) with the US data, Cheong (2005) with Malaysian data, and Verma and

Perera, (2008) with Sri Lanka's data, on the other hand, have shown that the hypothesis of no long-run relationship between imports and exports cannot be rejected and conclude that the trade deficits of those countries are not sustainable. Baharamuhah et al. (2003) investigate the sustainability of current account deficits for four ASEAN countries (Indonesia, Malaysia, the Philippines, and Thailand) over the 1961-1991 period, and their results show that except Malaysia, the other countries were not on the long-run steady state in that period. Moreover, Erbaykal and Karaca (2008) examine the foreign deficit of Turkey and conclude that although exports and imports of Turkey are cointegrated, the slope coefficient of their regression is not statistically equal to one.

To investigate the long-run convergence between exports and imports in 50 countries over the period 1973:2 to 1998:1, Arize (2002) find evidence in favor of cointegration in 35 of the 50 countries by applying the Johansen (1988) and Johansen and Juselius (1990) techniques. In addition, he confirmed long-run relationship for all countries (except Mexico) using the Stock and Watson (1988) test. This is a vacuum of research as traditional approaches to cointegration such as Johansen's technique have some serious drawbacks.

For the Iranian case, Arize (2002) have shown that there is a long-run relationship between imports and exports and the sign on the estimated cointegrating coefficient is positive. This result reveals that the Iranian trade deficit is a short-run phenomenon during which its imports and exports may drift apart and converge toward equilibrium in the long-run.

According to the fact that Iran is an oil-exporting country and high oil prices in recent years led the Iranian economy to a positive balance, we may raise this question if current account balance is sustainable. Therefore, the purpose of the study is to answer this question that “Are the current account deficit sustainable in spite of various shocks such as oil prices, revolution, war and also some inappropriate currency polices?” To motivate this paper, we need to have a glimpse of the Iran’s economic situation. In Iran, after eight years war with Iraq, to create the appropriate conditions for improving productions and activating non-oil export sector, the government used a limited liberalization in foreign trade sector and exchange market. These reforms, however, were suspended. The high inflationary pressures and the volatility in the parallel exchange market, (under the conditions which foreign debt, especially, short-term loans had created a difficult situation in exchange market), lead to provide current account deficits. Specific problems such as financing budget deficit, inappropriate currency policies, high inflation, various monetary and fiscal shocks, and their impact on the current account deficits, makes this investigation in the central point of international trade studies. On the other hand, there are many methods for analyzing the current account sustainability; however, this paper applies the bounds test approach to level relationships as introduced by Pesaran et al. (2001). The paper differs from others in the following ways: 1) As standard unit root tests such as Augmented Dickey Fuller (ADF) and Philips and Perron (PP) tests are biased towards the null of a unit root in the presence of structural breaks, we use Perron (1990) and Lee and Strazicich (2004) tests to address this issue and test the null of unit root in the series. 2) Since the existence of structural breaks may cause the series to be integrated of different orders, to investigate a long-run relation between variables under consideration, this paper applies the bounds test for level relationship within the Autoregressive Distributed Lag (ARDL) modeling approach. This method was developed by

Pesaran et al (2001) and can be applied irrespective of whether the underlying regressors are I(1) or I(0) or fractionally integrated.

The paper proceeds as follows: section 2 provides a theoretical model for the intertemporal approach to current account determination. In section 3, the data and econometric methodology of the study are presented. Section 4 contains the empirical results and discussions and finally, section 5 concludes the paper.

2. THEORETICAL BACKGROUND

Following Arize (2002), this paper uses Husted (1993) framework that implies a long-run relationship between exports and imports. The theoretical basis of Husted (1993) model is an intertemporal balance model. He models the behavior of the stock of external debt to determine where a country's intertemporal budget constraint is verified. The individual current-period budget constraint at time t is:

$$C_t = Y_t + B_t - I_t - (1+r)B_{t-1} \tag{1}$$

Where C_t, Y_t, and I_t are consumption, output and investment respectively; r is a one-period interest rate; B_t describes international borrowing available to the consumer, which could be positive or negative.

Since this budget constraint must be satisfied for all periods, forward iterating equation (1), the intertemporal budget constraint is given by:

$$B_t = \sum_{i=1}^{\infty} \delta_{t+i}[Y_{t+i} - C_{t+i} - I_{t+i}] + \lim_{n \to \infty} \delta_n B_n \tag{2}$$

where $\delta_i = \prod_{j=1}^{i} \left(\frac{1}{1 + r_{t+j}} \right)$ is the product of the first i discount factors, and $Y_t - C_t - I_t = EX_t - IM_t = TB_t$.

Following Hakkio and Rush (1991), and Husted (1993), we assume a stationary world interest rate with mean r that is exogenous with respect to the economy’s choices. Equation (2) can be written as:

$$IM_t + rB_{t-1} = EX_t + \sum_{j=0}^{\infty} \frac{\Delta EX_{t+j} - \Delta Z_{t+j}}{(1+r)^{j-1}} + \lim_{j \to \infty} \frac{B_{t+j}}{(1+r)^{t+j}} \tag{3}$$

where $Z_t = IM_t + (r_t - r)B_{t-1}$

subtracting EX_t from both sides of this equation, we will have :

$$IM_t - EX_t + rB_{t-1} = \sum_{i=0}^{\infty} \frac{\Delta EX_{t+i} - \Delta Z_{t+i}}{(1+r)^{i-1}} + \lim_{i \to \infty} \frac{B_{t+i}}{(1+r)^{i-1}} \tag{4}$$

We assume that imports and exports are both non-stationary which can be written as follows:

constraint has been violated and the government needs to perform corrective policies. Since the coefficients in the last above equations can be changed over time due to structural changes, so the question is whether the changes in these coefficients, ultimately, affect on stability of the relationship between variables or not!

3. DATA, ECONOMETRIC METHODOLOGY, AND INITIAL RESULTS

Data

This paper uses annual data of the Iranian economy covering the period 1960-2007. All the data are gathered from the Central Bank of Iran and International Financial Statistics (IFS, 2011). Following Arize (2002), the data for export variable includes exports of goods and services, and the data for import variable includes imports of goods and services. Since there were multiple breaks in the exports and imports of Iran apart from 1955, deterministic trend dummies from this year were also added to the estimations in the present study. The time series plot is presented in Figure 1. As it is clear from the Figure 1, both series have experienced various breaks due to various events such as Islamic Revolution, 8-years war with Iraq, sanctions and so on. For example the oil income in 1963 was $555 million; it approaches to $956 million in 1969 and also to 5 billion dollars in 1974 and surprisingly quadrupled to 20 billion dollars in1976. Explosive income from oil revenues at that time, leads to explosive increase in imports between the years 1974 to 1979 which causes current account to be surplus continuously. The effect of fluctuations in world oil prices in these years was followed by increasing tendency for consumption and inflation in Iran. In the 1979, due to the strike of oil industry's workers, exports declined sharply.

All of these events cause structural breaks which make it essential to consider them in econometric approaches.

"Place Figure 1 about here"

Unit Root Tests

In order to determine stationarity properties of the series, we employ several tests such as Augmented Dickey and Fuller (ADF), Phillips and Perron (PP), (Dickey and Fuller 1981; Phillips and Perron 1988), Kwiatkowski, Phillips, Schmidt, and Shin's test (KPSS) (1992), and Ng-Perron (2001). ADF unit root test is a low power and weak test and biased toward nonrejection of unit root hypothesis. As an alternative, the PP procedure computes a residual variance that is robust to auto-correlation. These two tests are known to suffer potentially severe finite sample power and size problems. Ng and Perron (2001) suggested useful modifications to the PP test to deal with these problems. On the other hand, the KPSS test uses a null hypothesis that the series is trend stationary.

Table 1 presents the results of these tests. These results reveal that both exports and imports series are nonstationary at their levels, but stationary at first differences. However, KPSS test result shows that we can't reject the null of stationary at the 5% for both series.

"Place Table 1 about here"

Structural Breaks of the Series

One of the most important problems in applying aforementioned unit root tests is that their results are biased in favor of identifying data as integrated in the presence of structural breaks. The Iranian economy has been subject to numerous shocks and regime shifts such as the 1973-76 oil shock, the upheavals consequential to the 1979 Islamic Revolution, the destructive eight-year (1980-1988) war with Iraq. These had frozen the country's foreign assets, lead to volatility international oil markets, domestic economic sanctions, and international economic isolation. In March 1993 the Iranian government embarked upon the exchange rate unification policy with consultation of the International Monetary Fund. According to Perron (1990), ignoring the effects of structural breaks can lead to spurious unit root test results.

To carry out a test of no structural break against an unknown number of breaks in the Iranian exports and imports series, we apply the endogenously determined multiple breaks tests developed by Bai and Perron (1998, 2003). Bai and Perron (1998) introduced two tests of the null hypothesis of no structural break against an unknown number of breaks given from upper bounds. The first test is called Double Maximum test (Dmax); where breaks are equally weighted and it is labeled by UDmax. The second test, WDmax, applies weights to the individual tests such that the marginal P-value is equal across the value of breaks. In both of these tests, break points are estimated by using the global minimization of the sum of squared residuals. Table (2) and (3) presents the results of Bai and Perron'sDmax test as well as SupFT(m) test of Andrews (1993). Addionally, SupFT(m) test is also employed in the study. These results lead us to conclude that there is at least one structural break in each series. These results are strongly supported by CUSUM and Chow tests.

Testing various dates in Chow type of tests and the endogenously determined multiple break tests of Bai and Perron (2003), we accept one break in 1979 for exports which coincided with the Islamic revolution of 1979, and one break in 1976 for imports related to oil boom in Iran which led to a sharp increase in imports of goods and services.

"Place Table 2 about here"

"Place Table 3 about here"

Unit Root Test with Endogenous Structural Breaks

To carry out unit root test with presence of any structural break, Perron (1990) and Perron and Vogelsang (1992) suggests a modified Dicky-fuller unit root test that includes dummy variables to account for one known, or exogenous structural break. Subsequent papers modified the test to allow for one or two unknown break point that is determined endogenously from the data like Zivot and Andrews (1992) for one endogenous break and Lumsdaine and Papell (1997) for two endogenous breaks.

Lee and Strazicich (2003) extended Lumsdaine and Papell (1997) endogenous two breaks for unit root tests and introduced a new procedure to capture two structural breaks. They proposed two breaks unit root test in which the alternative hypothesis unambiguously implies trend stationarity. Their testing methodology is based on the Lagrange Multiplier (LM) unit root test.

In this method, the optimal lag length is determined based on the general to specific approach suggested by Ng and Perron (1995).

"Place Table 4 about here"

Table 4 presents the result of Lee and Strazicich (2004) unit root test. This result reveals that in the level of 1% critical value, exports are stationary at level; while imports are non-stationary at level (we can't reject the null hypothesis of unit root for imports), so we conclude that in the presence of two structural breaks, these two series are not in the same order of integration. As regards, the last structural break tests using here, estimates more than 1 break for both series, some of them even estimate more than 3 breaks. (See Tables 2 and 3), and in contrast, the latest unit root tests can consider only up to 2 breaks. This can lead us to uncertainty about the order of integration and strong reason for rejection the use of some standard cointegration approaches such as Engel-Granger (1987), Johansen (1998) and Johansen-Juselius (1990) which are confident when the series are in the same order of integration. Therefore, we continue our study by using Bounds test approach to level relationships. This procedure is the strong one in order to test for the existence of long run relationship even if we do not have accurate information about the order of integration of the series. However, Pesaran et al. (2001) suggest that dependent variable need to be integrated of order one.

Bounds Test Approach to Level Relationship

Pesaran and Shin (1999) and Pesaran et al. (2001) introduced the bounds test for level relationships that can be employed within an ARDL specification. This method has several advantages in comparison to other cointegration procedures: Firstly, this approach yields consistent estimates of the long run coefficients that are asymptotically normal irrespective of whether the underlying regressors are I(1) or I(0) or fractionally integrated. Thus, the bounds test eliminates the uncertainty associated with pre-testing the order of integration. Secondly, this technique generally provides unbiased estimates of the long run model and valid t-statistics even when some of the regressors are endogenous. Thirdly, it can be used in small sample sizes, whereas the Engle–Granger (1987) and the Johansen (1988) and Johansen-Juselius (1990) procedures are not reliable for relatively small samples.

Bounds tests can be applied irrespective of the order of integration of the variables (irrespective of whether regressors are purely I (0), purely I (1) or mutually co-integrated) as mentioned before. The ARDL modeling approach involves estimating the following error correction models:

4. EMPIRICAL RESULTS OF LEVEL RELATIONSHIP

Results in Table 6 suggest that the application of the bounds *F-test* using the ARDL modeling approach and suggest level relationship in the model where imports are dependent and exports are independent variable. This is because the null hypothesis of H_0: $\sigma_{1Y} = \sigma_{2Y} = 0$ in equation (6) can be rejected for this model in various lags other than optimum lag level one. Pindyck and Rubinfeld (1991) point out that it would be best to run the test for a few different lag structures and make sure that the results were not sensitive to the choice of lag length. Since the lag levels other than the optimum one have allowed the null hypothesis to be rejected, we conclude that a long run relationship exists between exports and imports when imports are dependent variable (See also Katircioglu, 2009). The results from the application of the bounds *t-test* in each ARDL model generally allow for the imposition of the trend restrictions in the models since they are found statistically significant at some lag levels (See Pesaran, et al., 2001).

"Place Table 5 about here"

"Place Table 6 about here"

"Place Table 7 about here"

Based on the above results, the major finding of the present study is that there is a long run equilibrium relationship between exports and imports in Iran, they converge in the long term period; thus, current account deficits in the case of Iran are sustainable. Long run estimation can also be seen in Table 7. This result suggests that in the long run, an increase of export by one percent leads to an increase of import by 1.6477.

5. CONCLUSIONS

This paper provides new evidence on the Iranian current account sustainability using bounds test approach to level relationship. Unit root tests reveal that exports are integrated of order one (this series is non-stationary at level) while imports are integrated of order zero (this series is stationary at level). Bounds test results suggest that exports in Iran are in level relationship with imports when imports are dependent variable; therefore, exports and imports converge in the long term period. This proves that current account deficits in Iran are statistically sustainable and the finding of Arize (2002) is also supported by bounds tests for this country.

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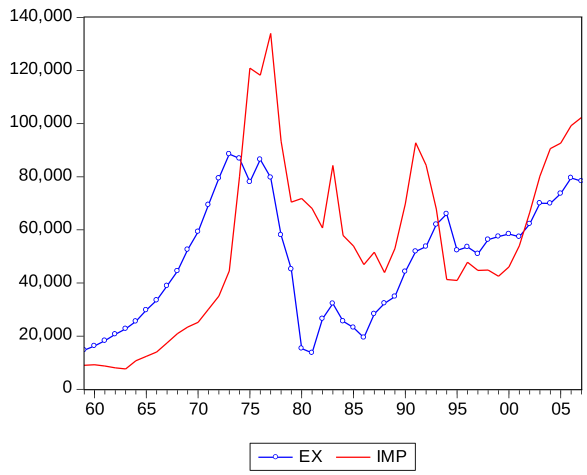
Figure 1


140,000
120,000
100,000
80,000
60,000
40,000
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0
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65
70
75
80
85
90
95
00
05
EX
IMP

Table 1. Unit root tests results

Statistics (Level)	Export	Import
τ_T (ADF)	-2.190197	-2.428383
τ_μ (ADF)	-2.157996	-2.248327
τ (ADF)	-0.229776	-0.044257
τ_T (PP)	-1.903687	-1.983620
τ_μ (PP)	-1.880811	-1.811980
τ (PP)	-0.080817	-0.044257
τ_μ(KPSS)	0.143170	0.31043
τ_T(KPSS)	0.08632	0.131094
$Mz_{a\mu}$(np)	-6.475	-6.7915
$Mz_{t\mu}$(np)	-1.6533	-1.6880
Mz_{at}(np)	-9.2646	-11.486
Mz_{tT}(np)	-2.1434	-2.3894
First difference	ΔEX	ΔIM
τ_T (ADF)	-4.132542	-4.889208
τ_μ((ADF)	-4.185137	-4.949369
τ_μ(PP)	4.189873	-4.9830
τ_T(PP)	4.1375	-4.1375
τ_μ(KPSS)	0.09725	0.0973
τ_T(KPSS)	0.09588	0.09496
$Mz_{a\mu}$(np)	-18.27	-20.42
$Mz_{t\mu}$(np)	-3.815	-3.195
Mz_{at}(np)	-3.017	-3.19
Mz_{tT}(np)	-18.30	-20.44

Note: τ_T represents the most general model with a drift and trend; τ_μ is the model with a drift and without trend; τ is the most restricted model without a drift and trend. Both in ADF and PP tests, unit root tests were performed from the most general to the least specific model by eliminating trend and intercept across the models (See Enders, 2005: 181-199). The critical values are obtained from Mackinnon (1991) for the ADF and PP test and from Kwiatkowski et al. (1992) and Ng-Perron(2001) for the KPSS and Ng-Perron tests, respectively.

Table 2. Structural Break Tests for Exports

export	value of test	Critical value10%	Critical value5%	Critical value2.5%	Critical value1%
supfT(1)	0.3242	7.0400	8.5800	10.1800	12.2900
supFT (2)	1.3947	6.2800	7.2200	8.1400	9.3600
supF T (3)	20.0591	5.2100	5.9600	6.7200	7.6000
supF T (4)	20.9182	4.4100	4.9900	5.5100	6.1900
supF T (5)	19.7047	3.4700	3.9100	4.3400	4.9100
UD max	20.9182	7.4600	8.8800	10.3900	12.3700
WDmax	–	39.9772 (8.2000)	43.2394 (9.9100)	46.2197 (11.6700)	49.3219 (138300)
supF(2|1)	0.6284	7.0400	8.5800	10.1800	12.2900
supF(3|2)	15.3162	8.5100	10.1300	11.8600	13.8900
supF(4|3)	0.9236	9.4100	11.1400	12.6600	14.8000
supF(5|4)	0.9236	10.5800	12.2500	13.8900	15.7600

Table 3. Structural Break Tests for Imports

import	value of test	Critical value10%	Critical value5%	Critical value2.5%	Critical value1%
supfT(1)	4.3737	7.0400	8.5800	10.1800	12.2900
supF(2)	6.3697	6.2800	7.2200	8.1400	9.3600
supF (3)	9.0645	5.2100	5.9600	6.7200	7.6000
supF (4)	5.9963	4.4100	4.9900	5.5100	6.1900
supF (5)	6.3468	3.4700	3.9100	4.3400	4.9100
UD max	9.0645	7.4600	8.8800	10.3900	12.3700
WDmax	–	39.9772 (8.2000)	43.2394 (9.9100)	46.2197 (11.6700)	49.3219 (138300)
supF(2|1)	3.6407	7.0400	8.5800	10.1800	12.2900
supF(3|2)	0.1455	8.5100	10.1300	11.8600	13.8900
supF(4|3)	0.1455	9.4100	11.1400	12.6600	14.8000
supF(5|4)	0.2283	10.5800	12.2500	13.8900	15.7600

Table 4. Lee and Strazicich Unit Root Test with Two Endogenous Breaks

t-statistic	K	TB2	TB1	Variable
-8.3775*	8	1988	1979	EX
-5.6459	8	1995	1975	IM

Note: 1) The critical values at 1, 5, and 10% are-5.823, -5.286and -4.989, respectively (Lee &Strazicich, 2002, p.22). 2)*indicates that the corresponding null is rejected at the 1% level.

Table 5. Critical Values for the ARDL Modeling Approach

	0.10		0.05		0.01	
k = 1	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
F_{IV}	4.230	4.740	5.043	5.607	7.017	7.727
F_V	5.780	6.540	6.985	7.860	9.895	10.965
F_{III}	4.190	4.940	5.220	6.070	7.560	8.685
t_V	-3.130	-3.400	-3.410	-3.690	-3.960	-4.260
t_{III}	-2.570	-2.910	-2.860	-3.220	-3.430	-3.820

Source: Narayan (2005) for F-statistics and Pesaranet. al (2001) for t-ratios.
NOTES: (1) k is the number of regressors for dependent variable in ARDL models, FIV represents the F statistic of the model with unrestricted intercept and restricted trend, F_V represents the F statistic of the model with unrestricted intercept and trend, and F_{III} represents the F statistic of the model with unrestricted intercept and no trend. (2) t_V and t_{III} are the t ratios for testing $\sigma_{IY} = 0$ in Equation (6) with and without deterministic linear trend.

Table 6. The Bounds Test for Level Relationship

	With Deterministic Trends			Without Deterministic Trend		
Variables	F_{IV}	F_V	t_V	F_{III}	t_{III}	Conclusion
						H_0
(1) F_{IMP} (lnIMP / lnEXP)						
P = 1*	4.344b	6.449b	-2.860a	3.871a	-2.055a	Rejected
2	4.699b	6.856c	-3.525c	2.592a	-2.128a	
3	5.203c	7.284c	-3.625c	3.007a	-2.312a	
4	5.200c	6.734c	-3.256b	4.151a	-2.611b	

*Note: Akaike Information Criterion (AIC) and Schwartz Criteria (SC) were used to select the number of lags required in the bounds test. p shows lag levels and * denotes optimum lag selection in each model as suggested by both AIC and SC. F_{IV} represents the F statistic of the model with unrestricted intercept and restricted trend, F_V represents the F statistic of the model with unrestricted intercept and trend, and F_{III} represents the F statistic of the model with unrestricted intercept and no trend. t_V and t_{III} are the t ratios for testing $\sigma_{IY} = 0$ in Equation (6) with and without deterministic linear trend. [a] indicates that the statistic lies below the lower bound, b that it falls within the lower and upper bounds, and c that it lies above the upper bound.*

Table 7: Long run estimation

Level Equation with Constant

Method: ARDL

Dependent Variable: L1MPORT

Sample: 1339 1384

Included observations: 46

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LEXPORT	1.647744	0.789267	2.087689	0.0426
C	-6.328557	8.137335	-0.777719	0.4409