

Heidari, Hassan; Katircioglu, Salih Turan; Davoudi, Narmin

**Working Paper**

## Are current account deficits sustainable? New evidence from Iran using bounds test approach to level relationship

Economics Discussion Papers, No. 2012-24

**Provided in Cooperation with:**

Kiel Institute for the World Economy – Leibniz Center for Research on Global Economic Challenges

*Suggested Citation:* Heidari, Hassan; Katircioglu, Salih Turan; Davoudi, Narmin (2012) : Are current account deficits sustainable? New evidence from Iran using bounds test approach to level relationship, Economics Discussion Papers, No. 2012-24, Kiel Institute for the World Economy (IfW), Kiel

This Version is available at:

<https://hdl.handle.net/10419/57774>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*



<http://creativecommons.org/licenses/by-nc/2.0/de/deed.en>

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

*Hassan Heidari*

*Urmia University*

*Salih Turan Katircioglu*

*Eastern Mediterranean University*

*Narmin Davoudi*

*Urmia University*

**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 have 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, the 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 (*Imports and Exports in 50 Countries: Tests of Cointegration and Structural Breaks*, 2002) by employing bounds tests to level relationship and suggests that current account deficits in Iran are sustainable.

**JEL** C22; F10; F32

**Keywords** Exports; imports; current account; bounds test; Iran

**Correspondence** Hassan Heidari, Department of Economics, Urmia University, P.O. Box, 165, Urmia, Iran, e-mail: [h.heidari@urmia.ac.ir](mailto:h.heidari@urmia.ac.ir).

Salih Turan Katircioglu, Department of Banking and Finance, Eastern Mediterranean University, P.O. Box 95, Famagusta, North Cyprus, Via Mersin 10, Turkey.

Narmin Davoudi, Department of Economics, Urmia University, P.O.Box, 165, Urmia, Iran.

## 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-Lehmannnd (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 policies?” 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:

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

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:

$$B_t = \sum_{i=1}^{\infty} \delta_i [Y_{t+i} - C_{t+i} - I_{t+i}] + \lim_{i \rightarrow \infty} \delta_i B_{t+i} \quad (2)$$

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:

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

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

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

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

The left hand side of equation (4) represents the current account of an economy. Moreover, we assume that the limit term is equal to zero and in order to test the hypothesis of current account sustainability, by several assumptions making by Husted (1993), the equation (4) can be written as follows:

$$EX = \alpha + MM_t + \varepsilon_t \quad \text{where} \quad MM_t = IM_t + r_t B_{t-1}$$

Following Arize (2002), the model to be estimated is given by:

$$IM_t = \alpha + bEX_t + \varepsilon_t \quad (5)$$

Where  $EX_t$  is the export of goods and services,  $IM_t$  is the import of goods and services, and  $\varepsilon_t$  is error term. For a sustainable current account deficit,  $\varepsilon_t$  should be stationary and  $b$  should be equal to one. This means that exports are cointegrated with imports and cointegrating coefficient,  $b$ , is one.

### 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.

#### *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 1973-75 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's Dmax test as well as SupFT(m) test of Andrews (1993). Additionally, 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. We present results of this test in Table (4). The results reveal that import is nonstationary, while export is stationary. It means that these two series are not integrated in the same order.

“Place Table 4 about here”

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 5 about here”

Table 5 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). The result is in line with Perron (1990) test, so we conclude that in the presence of structural break, these two series are not in the same order of integration. As most of the cointegration tests such as Engel-Granger (1987), and Johansen (1998) and Johansen-Juselius (1990) are confident when the series are in

the same order of integration, these tests would not be suitable for our study. Thus, we continue our study by using bounds test approach to level relationships, which can be applied to the variables with mixed order of integration. 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:

$$\Delta \ln Y_t = a_{0y} + \sum_{i=1}^n b_{iy} \Delta \ln Y_{t-i} + \sum_{i=0}^n c_{iy} \Delta \ln X_{t-i} + \sigma_{1y} \ln Y_{t-1} + \sigma_{2y} \ln X_{t-i} + \varepsilon_{1t} \quad (6)$$

In equation (6),  $\Delta$  is the difference operator,  $\ln Y_t$  is the log of dependent variable,  $\ln X_t$  is the log of independent variable and  $\varepsilon_{1t}$  is serially independent random error with mean zero and finite covariance matrix.

Again in equation (6), the F-test is used for investigating a level (long-run) relationship. In the case of a long-run relationship, the F-test indicates which variable should be normalized. In Equation (6), when Y is the dependent variable, the null hypothesis of no level relationship is  $H_0: \sigma_{1Y} = \sigma_{2Y} = 0$  and the alternative hypothesis of a level relationship is  $H_1: \sigma_{1Y} \neq \sigma_{2Y} \neq 0$ .

#### **4. EMPIRICAL RESULTS OF LEVEL RELATIONSHIP**

Results in Table 4 suggest that the application of the bounds *F-test* using the ARDL modeling approach 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).

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.

#### **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.

## REFERENCES

- Andrews, D. W. K. (1993), Tests for Parameter Instability and Structural Change with Unknown Change Point, *Econometrica*, Econometric Society, vol. 61(4), pages 821-56.
- Arize, A. (2002). Imports and exports in 50 countries: tests of cointegration and structural breaks. *International Review of Economics and Finance*. Vol. 11, pp.101-115.
- Bahmani-Oskooee, M. (1994), Are imports and exports of Australia cointegrated? *Journal of Economic integration*, Vol. 9, pp.525-533.
- Bahramushah, A., Lau, E. and Fountas, S. (2003). On the sustainability of current account deficits: evidence from four ASEAN countries. *Journal of Asian Economics*. Vol. 14, pp.465-487.
- Bai, J., Perron, P. (2003). Computation and analysis of multiple structural change models. *Journal of Applied Econometrics*. Vol. 18(1), pp.1-22.
- Bai, J. and Perron, P. (1998), Estimating and Testing Linear Models with Multiple Structural Changes, *Econometrica*, vol. 66(1), pages 47-78.
- Bineau, Y. (2007). Are imports and exports cointegrated: the case of Bulgaria between 1967 and 2004. *South East European Journal of Economics and Business*. Vol. 2(2), pp.53-56.
- Cheong, T. (2005). Are Malaysian exports and imports cointegrated? A comment. *Sunway Academic Journal*. Vol. 2, pp. 101-107.
- Christopoulos, D. and Leon-Ledesma, M. (2010). Current account sustainability in the US: What did we really know about it? *Journal of International Money and Finance*, Vol. 29, pp. 442-459.
- Dickey, D. and Fuller, W.A. (1981). Likelihood ratio statistics for autoregressive time series with a unit root. *Econometrica*, 49, 1057-1072.
- Enders, W. (2005). *Applied Econometric Time Series*, Wiley Series in Probability and Statistics, Second edition.
- Engle, R. F. and Granger, C. W. J. (1987) Co-integration and error correction: Representation, estimation and testing, *Econometrica*, 55, 251-76.
- Erbaykal E, Karaca O (2008). "Is Turkey's Foreign Deficit Sustainable? Cointegration Relationship Between Exports and Imports. *International Research Journal of Finance and Economics*, 14, 177-181.
- Fountas, S., Wu, J. L. (1999). Are the US current account deficits very sustainable?, *International Economic Journal*, Vol. 13, pp. 51-58.

Gould, D. M., and Ruffin, R. J. (1996), Trade Deficits: Causes and Consequences. Federal Reserve Bank of Dallas Economic Review 10--20 (fourth quarter).

Hakkio, C. and Rush, M. (1991). Is the budget deficit too large? *Economic Inquiry*, 29, 429-445.  
Herzer, D. and Nowak-Lehmann, F. (2005). Are exports and imports of Chile cointegrated?, *Working Paper*, Ibero-America Institute for Economic Research, No. 11.

Hollauer, G. and Mendonca, M. (2006), Testing Brazilians' Imports and Exports cointegration with monthly data for 1996-2005, Instituto de Pesquisa Economica Aplicada, *Discussion Paper*, No. 1154.

Husted, S. (1993). The emerging US current account deficit in the 80s: a cointegration analysis, *The Review of Economics and Statistics*, Vol. 74, 159-66

IFS (2011), International Financial Statistics, <http://www.imfstatistics.org/imf/>.

Johansen, S. (1988) Statistical analysis of co-integrating vectors, *Journal of Economic Dynamics and Control*, 12, 231-54.

Johansen, S. and Juselius, K. (1990) Maximum likelihood estimation and inference on co-integration with application to the demand for money, *Oxford Bulletin of Economics and Statistics*, 52, 169-221.

Kalyoncu, H. (2005). Sustainability of current account for Turkey: Intertemporal solvency approach, *MPRA Paper*, no.1220, pp.1-10.

Katircioglu, S. (2009), Revisiting the Tourism-led Growth Hypothesis for Turkey Using the Bounds Test and Johansen Approach for Cointegration, *Tourism Management*, 30, 1, 17-20.

Kwiatkowski, D., Philips, P. C. B., Schmidt, P., Shin, Y. (1992). Testing the null hypothesis of stationary against the alternative of a unit root, how sure are we that economic time series have a unit root? *Journal of Econometrics*, Vol. 54, pp. 159-178.

Lee, J. and Strazicich, M. (2003), Minimum Lagrange Multiplier unit root test with two structural breaks, *The Review of Economics and Statistics*, Vol. 85(4), pp. 1082-1089.

Lumsdaine, R. L. and Papell, D. H. (1997). Multiple trend breaks and the unit root hypothesis, *The Review of Economics and statistics*, Vol. 79, pp. 212-218.

Mackinnon, J.G. (1991). Critical values for cointegration tests, in long-run Economic relationships, (Engle, R. F and Granger, C. W. J, eds.), pp. 267-276, Oxford university press, Oxford.

Mackinnon, J.G. (1996). Numeral distribution functions for unit root and cointegration test, *Journal of Applied Econometrics*, Vol. 11, pp. 602-18.

- Mann, C. L. (2002). Perspective on the US current account deficit and sustainability. *Journal of Economic Perspectives*, Vol. 16, pp. 131-152.
- Narayan, P.K. (2005). The saving and investment nexus for china: evidence from cointegration tests, *Applied Economics*, Vol. 37, pp.1979-90.
- Ng, S. and Perron .P. (1995). Unit root tests in ARMA models with Data-Dependent methods for the selection of the truncation lag, *Journal of the American Statistical Association*, Vol. 90, pp. 268-281.
- Ng, S. and Perron .P. (2001). Lag length selection and the construction of unit root tests with good size and power, *Econometrica*, vol. 69(6), pp.1519-1554.
- Perron, P. (1997). Further evidence on breaking trend function in macroeconomic variables, *Journal of Economics*, Vol. 80, pp.355-385.
- Perron, P. (1990). Testing for a unit root in a time series with a changing mean, *Journal of Business and Economic Statistics*, Vol. 8, pp. 153-62.
- Perron, P. and Vogelsang, J. (1992). Testing for a unit root in a time series with a changing mean: corrections and extensions, *Journal of Business and Economic Statistics*, Vol. 10, pp. 467-70.
- Pesaran, M. H., Shin, Y., and Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships, *Journal of Applied Econometrics*, Vol. 16, 289-326.
- Pesaran, M. H. and Shin, Y. (1999). An autoregressive distributed lag modelling approach to cointegration analysis. Chapter 11 in *Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium*, Strom S (ed.). Cambridge University Press: Cambridge.
- Phillips, P. C. B. and Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika*, 75, 335-346.
- Pindyck, R. S. and D. L. Rubinfeld, (1991) *Models and Economic Forecasts*, McGraw-Hill Inc.
- Ramona, D. and Razvan, S. (2009). Analysis of the Romanian current account sustainability. *Annals of faculty of Economics*, Vol. 1(1). Pp. 163-168.
- Stock, J. H. and Watson, M. W. (1988), A Probability Model of The Coincident Economic Indicators, NBER Working Papers 2772, National Bureau of Economic Research, Inc.
- Verma, R. and Perera, N, (2008). An empirical analysis of sustainability of trade deficit: evidence from Sri Lanka, *International Journal of Applied Econometrics and Quantitative Studies*, Vol. 5(1), pp. 71-92.



Wu, J., Chen, S., and Lee, H. (2001). Are current account deficits sustainable? Evidence from panel cointegration, *Economics Letters*, Vol. 72, 219-224.

Zivot, E., Andrews, D. W. K. (1992). Further evidence on the great crash, the oil-price shock, and the unit root hypothesis, *Journal of Business and Economic statistics*, Vol. 10, pp. 251-270.

**Table 1. Unit root tests results**

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

Note:  $\tau_T$  represents the most general model with a drift and trend;  $\tau_\mu$  is the model with a drift and without trend;  $\tau$  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. Perron unit root test (level):**

Series	Model	Break point	dummy variable	test statistic	critical value5%	result
IMt	(1)	1975	DU55, D(TB)55	-0.001	-3.76	I(1)
IMt	(2)	1975	DT55	-1.768085	-3.87	I(1)
EXt	(1)	1979	Du57, D(TB)57	-3.966263	-3.72	I(0)
EXt	(2)	1979	DT57	-5.094001	-3.94	I(0)
First difference						
$\Delta$ IMt	(4)		DU57, D56	-6.1698	-3.76	I(0)

Notes: Models (1) and (2) refer to the models specified in Perron (1990).

The dummy variables are specified as follows: D (TB) 55 and D (TB) 57 are impulse dummy variables with zeros everywhere except for a one in 1976, 1979. DU55 and DU57 are 1 from 1976, 1979 onwards and 0 otherwise. DT55, and DT57 are 0 before 1976, 1979 and t-TB otherwise. Critical values for the levels are provided by Perron (1997). Critical values for the first differences are from MacKinnon (1996). For the first differences only impulse dummy variables were included in the regression. Impulse dummy variables, that are those with no long-run effect, do not affect the distribution of the MacKinnon (1996) test statistics.

**Table 5. 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, -5.286 and -4.989, respectively (Lee & Strazicich, 2002, p.22). 2)\* indicates that the corresponding null is rejected at the 1% level.

**Table 6. Critical Values for the ARDL Modeling Approach**

k = 1	0.10		0.05		0.01	
	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 Pesaran et. al (2001) for t-ratios.

NOTES: (1) k is the number of regressors for dependent variable in ARDL models,  $F_{IV}$  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. (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 7. The Bounds Test for Level Relationship**

Variables	With Deterministic Trends			Without Deterministic Trend		Conclusion
	F <sub>IV</sub>	F <sub>V</sub>	t <sub>V</sub>	F <sub>III</sub>	t <sub>III</sub>	
(1) F <sub>IMP</sub> (lnIMP / lnEXP)						H <sub>0</sub>
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<sub>IV</sub> represents the F statistic of the model with unrestricted intercept and restricted trend, F<sub>V</sub> represents the F statistic of the model with unrestricted intercept and trend, and F<sub>III</sub> represents the F statistic of the model with unrestricted intercept and no trend. t<sub>V</sub> and t<sub>III</sub> are the t ratios for testing  $\sigma_{1Y} = 0$  in Equation (6) with and without deterministic linear trend. <sup>a</sup> indicates that the statistic lies below the lower bound, <sup>b</sup> that it falls within the lower and upper bounds, and <sup>c</sup> that it lies above the upper bound.*

Please note:

You are most sincerely encouraged to participate in the open assessment of this discussion paper. You can do so by either recommending the paper or by posting your comments.

Please go to:

<http://www.economics-ejournal.org/economics/discussionpapers/2012-24>

The Editor