Exports, Imports, and Economic Growth Nexus in Iran: Bounds test approach to Cointegration

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Abstract

This paper examines the long-run relationship between exports, imports and economic growth in Iranian economy using annual data over the period of 1960-2007. As Iran is an oil-exporting country, and oil-export boom has a direct impact on the import demand function, and it leads to higher levels of consumption that impact on growth, we emphasize the role of the imports variable in this investigation. Moreover, following recent studies about importance of human capital in endogenous growth models, we extend Feder's model (1982) by entering a proxy for human capital. As Iranian economy has been subject to numerous shocks and regime shifts, we apply Bai and Perron (2003) test to detect any possible endogenous structural breaks. Hence, investigating data properties by concerning structural breaks shows that our variables are not in the same order of integration. This property convince us to use Bounds Test approach to cointegration developed by pesaran et, al. (2001) where it can be applied irrespective of order of integration of the variables. Finally, being sure about existence a long-run relationship between variables, ARDL approach and ECM employed to argue about short-run and long-run coefficient. The results reveal that while there is significant positive relationship between exports and economic growth, the effect of imports is insignificant and also human capital has a negative effect on growth both in short and long run.

JEL classification: C22; F14

1 Introduction

Discussion about relationship between export and economic growth can be traced to about over two centuries, but arguments over this issue still continue, and results are still varied in different countries.

It was common using time series for investigating ELG hypothesis in individual countries. The results of time series studies was not consisted with previous researches on ELG hypothesis, for example, Ahmad and Kwan (1991) rejected the relationship between exports and growth hypothesis for 41 African countries. Also Ahmad and Harnihirum (1996) found no link between exports and growth for all of ASEAN countries. Al-Yousif (1997) in the study for Arab gulf countries using time series found evidence that supports the hypothesis in the short run, but it fails to find any long run relationship. Chang et al (2000) found no support for ELG hypothesis for Taiwan during the fast growth. Furthermore, Ahmad et al (2000) estimated the relationship between exports, growth and foreign debt for Bangladesh, India, Pakistan, Sri lanka and East Asian countries, and reject hypothesis for all countries except Bangladesh. Panayiotis et al (2005) reject the ELG hypothesis for 22 African and Asian countries, using panel cointegration. Vis-à-vis, some time series studies support the ELG hypothesis, like Sengupta (1991) for south –east Asia, Ghartey (1993)'s investigation for Taiwan, USA and Japan, using bootsrap approach, Al-Yousif (1997) for Malaysia, Emiliu (2001) for Costarica, Vohra (2001) for countries like Pakistan, India, Philipin, Malaysia, and Tayland, Hatami (2002) for Japan, Al-mavali (2004) for Egypt, Awokuse and Christopoulos (2009) for Canada, Italy, Japan, UK, and US. Our paper is different from others in following way:
Some researches like Edwards (1993) and Chang et al (2000) imply that most early studies didn't take into account important factors on growth, and it may leads biased results. Most of previous studies neglected the role of imports in ELG hypothesis. Since Iran is a petroleum-exporting country, we add imports to the model under examination, because, according to

Holder and Williams (1997) an oil-export boom has a direct impact on the import demand function. Higher oil price leads to improved trade, and increased level of consumption which are satisfied through higher levels of imports. Moreover, endogenous growth models also emphasize the role of imports in the model. They argue that knowledge from advanced economies spills another countries through imports. In turn, this knowledge spillover enables the economy to achieve increasing returns. (sengupta, 1993)

In this paper, we investigate ELG hypothesis for Iranian economy by concerning role of imports and using bounds test approach to cointegration introduced by Pesaran et al (2001).

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 & Strazicich (2004) tests to address this issue and test the null of unit root in the series. Since existence of structural breaks may cause the series to be integration of different orders, so, to investigate a long-run relation between variables under consideration, this paper applies the bounds test for cointegration within the Autoregressive Distributed Lag (ARDL) modeling approach. This method was developed by Pesaran et al (2001) and can be applied irrespective of the order of integration of the variables.

The paper proceeds as follows: In section II the data and econometric methodology of the paper is presented. Section III, contains the empirical results and discussions and finally, section IV concludes that paper.

2 Data and econometric methodology

2.1 Data

The study employs real GDP, real exports, real imports, gross capital formation for K, and the average of human capital as a proxy of labor force covering the period 1966-2007 gathered form central bank of Iran and International financial statistics (IFS).

2.2 The econometric methodology

We employ different unit root tests to investigate stationarity properties of the series, both with concerning structural breaks and without. There are several unit root tests such as ADF, PP, KPSS, ng-perron, which ignore the structural breaks of the data. In other words, their results are biased in favor of identifying data as integrated. We present results of these tests in table 1. As we see in this table, results are not the same and are therefore, uncertain. In fact, the general conclusion about the order of integration of data through these approaches is very difficult and the non-confidence is high. One of the reasons of these mixed results can be existence of some structural breaks in time series. According to Perron (1990), ignoring the effects of structural breaks can lead to spurious unit root results and improper policy implications.

	ADF	*PP*	*KPSS*	*Ng-Perron*
GDP	I(1)	I(1)	I(1)	I(1)
K	I(1)	I(1)	I(0)	I(0)
HU	I(1)	I(1)	I(1)	I(1)
EXP	I(1)	I(1)	I(0)	I(1)
IMP	I(1)	I(1)	I(0)	I(1)

Table 1. Results of common unit root tests

2.3 About Iranian data

The Iranian economy has been experienced numerous shocks and regime shifts such as the 1973-75 oil shock, Islamic revolutions in 1979, the destructive eight-year (1980-1988) war

with Iraq, the freezing of the country's foreign assets, in march 1993 the Iranian government embarked upon the exchange rate unification policy with consultation of the International monetary fund.

Many of these events and policies during the fundamental review leads to structural breaks occurred in several macroeconomic variables.

2.4 Structural break tests

One of our purposes must be determine the appropriate structural breaks in data under investigation. Bai and Perron (1998-2003) developed two tests of null hypothesis of no structural break against an unknown number of breaks given from upper bounds. These tests are called double maximum tests ($D_{\max}$): the first is an equal weighted labeled by $UD_{\max}$. The second test, $WD_{\max}$, applies weights to the individual tests such that the marginal P-value are 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.

More of related tests confirmed at least one structural break for Iranian data. The joint time that has been considered from most tests is 1979 Islamic revolution. Also in addition to this dummy variable, another dummy variable related to 1973-74 oil shock has been added to the model.

2.5 Unit root test with structural breaks

To decrease uncertainty of result reported in Table1, that caused by ignoring structural breaks, we continue our investigation by using unit root test with presence of two endogenous structural breaks developed by Lee and Strazicich (2002) which we report the results in Table 2 .

The results, shows that by concerning two possible structural breaks, GDP, human capital and total exports will be stationary.

Although the results of performed tests, don't lead us to make a general and reliable conclusion, but all set of results suggests that, in general, these series are not in the same order. Therefore, investigation of long run relationship using approaches like Engle and Grenger (1987) and Johansen (1991, 1995)-which assumed that underlying variables need to be integrated of order 1 or I(1)-will be difficult. So, to solve this issue, we use bounds test approach introduced by Pesaran et al (2001) which is applicable irrespective of the order of integration of regressors.

Variable	t-statistics	K	TB1	TB2	result
GDP	-7.0820*	7	1352	1364	I(0)
Hu	-7.4917*	7	1365	1369	I(0)
K	-4.7352	1	1355	1362	I(1)
Texp	-8.3775*	8	1357	1367	I(0)
Imp	-5.3827	6	1361	1379	I(1)

Table 2. Lee and Strazicich unit root test with two breaks

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 all levels.

2.6 Bounds test approach

Pesaran et al (2001), proposed a new approach to testing for the existence of a long-run relationship which is applicable irrespective of whether the underlying regressors are I(0), I(1) or mutually co integrated. They provide two asymptotic critical value bounds for the F-test for large samples, both in the case where all the regressors are I(1), and when one or more of the

regressors are individually I(0). If the computed F-statistics falls outside the critical value bounds, a conclusive inference can be drawn, without needing to know about order of integration of regressors. However, if the F-static falls inside the critical value's band, inference would be inconclusive, and in such case according Bahmani-Oskoaee and Nasir (2004) an efficient way of establishing co integration is by applying the ECM version of the ARDL model. The error correction representation of ARDL model for our modified Feder's model introduced by Pesaran , Shim, and Smith(2000), is given by the following equation:

$$\Delta Lny_t = \alpha_0 + \beta_1 \ln y_{t-1} + \beta_2 \ln k_{t-1} + \beta_3 \ln hu_{t-1} + \beta_4 \ln t\exp_{t-1} + \beta_5 \ln imp_{t-1} +$$
$$\sum_{j=1}^{n} b_j \Delta \ln y_{t-j} + \sum_{j=0}^{n} c_j \Delta \ln k_{t-j} + \sum_{j=0}^{n} d_j \Delta \ln hu_{t-j} + \sum_{j=0}^{n} e_j \ln t\exp_{t-j} + \sum_{j=0}^{n} f_j \ln imp_{t-j}$$
$$+ \delta DU_{57} + \gamma D_{52} + \varepsilon_t$$

Where β_i , i = 1, … , 5 is the coefficient of long-run parameters, and b_j, c_j, d_j, e_j, f_j, are the short-run dynamic coefficient of the underlying ARDL.

3 Empirical results

Since the application of the unit root tests to the underlying variables-as we argued in previous section- yields mixed results, following the methodology developed in Pesaran et al (2001), we test the existence of a long run real GDP equation involving for variables without worrying about order of integration of them. Moreover, the lag length (p) for this test is based on Schwarz Bayessian (SBC) and Akike information criteria (AIC). The best choice of lag order is one. Table 4 Gives the values of F-statistics for bounds test under 3 different cases depending on whether the model contains a linear trend or not and whether the trend coefficients are restricted. Intercept in these cases are all unrestricted. (See Pesaran et al, 2001, pp. 7-9).

These statistics need to be compared with the critical value bounds provided by Narayan (2005) for small samples. As we see in table3, F_{IV} lies outside the lower bound at all levels, while at 90% critical value bounds, F_{III} and F_v are inconclusive. It means that the test outcome is mixed, and we need to estimate ECM version of ARDL model to decide about existing long run equation. (Bahmani-oskooee and Nasir, 2004)

K=4	1%		5%		10%	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
F_{IV}	4.763	6.20	3.512	4.587	2.985	3.862
F_V	5.376	7.092	3.958	5.226	3.334	4.438
F_{III}	4.428	6.250	3.202	4.54	2.660	3.838

Table 3. Critical value for bounds test

Notes:1) Critical values are from Narayan (2005, pp.1987:1990)

2) 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.

Variables	with deterministic trend		without deterministic trend
	F_{IV}	F_V	F_{III}
FGDP(GDp|hu, K,imp,exp,du57,du72)	2.68524 a*	4.4371b*	3.02339b **

Table 4. Bounds test for cointegration

Note: H_0: no existence long run.

a* indicates that the statistic falls outside the lower bound at all levels.

b* indicates that the statistic falls inside the bands at 5% level.

b** indicates that the statistic falls inside the bands at 10% level.

3.1 ARDL and ECM

To estimate the long run relations, we use ARDL approach discussed in Pesaran and Shin (1999). The optimal order of lags in the model selected based on Schwarz-Bayessian information criteria as suggested by Pesaran et al (2001) will be ARDL (1,1,0,0,1). Results reveal in table 5.

variable	*Coefficient*	*t-statistic*
Lhu	-3.70096	-0.9655
Lk	0.33623	0.4962
Limp	0.32913	0.72142
Ltexp	0.82648	1.17317
Constant	-1.7876	-0.1941

Table 5. long run coefficients of ARDL model

Regressors	*Coefficient*	*t-Ratio*
dLhu	-0.26467	-0.86543
dLk	0.15218	3.4095
dLimp	-0.01871	-0.4115
dLtexp	0.20828	10.1970
dDu57	0.07616	1.9626
dD52	-0.00304	-0.1316
Constant	0.00593	0.4655
ECMT(-1)	-0.10461	-6.3575

Table 6. ECM-ARDL

Results find no significant long run coefficient except export. Also we see surprisingly the negative sign of human capital that is not theoretically correct. We also report the short run coefficient estimates obtained from the ECM version of the ARDL model in table 6. As we can see, the error term (EC_{t-1}) in the short run is statistically significant with a correct negative sign, which confirms that a long run equilibrium relationship exists between the variables, but the error correction coefficient is 0.1046 which means that convergence to equilibrium is very slow with only 10 percent of the adjustment occurring in the first year. The short run coefficient of physical capital and export is significant, implies that just these two parameters among other underlying variables effects on GDP.

4 Conclusion

We investigated augmented Feder's model for Iranian data, and following endogenous growth theory, imports added to model, and also instead of labor's force, we use human capital as a proxy of labor's force according endogenous growth theory. The results imply that the speed of adjustment of equation is too slow, and the sign of human capital is theoretically incorrect. It means that human capital have negative effect on GDP. There are some reasons for getting this result: human capital is a quality related to labor force, and so in many studies it is

used by measuring the number of educated people, but there is not enough quality of education in Iran to enter the labor market and basically, graduated labor force don't have enough productivity. Moreover, imports doesn't have any effect on GDP neither in short run or long run. The lack of sufficient professional labor force to make imported technologies indigenous, through imports of industrial goods, is one of the reasons for long term and short term coefficients of imports to be insignificant in the underlying model, but total export has strong and significant impact on GDP.

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