A Study of the Iranian Economic Growth by Using the Balance of Payments Constrained Growth Model

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Abstract

This study is conducted aimed at investigating the Iranian economic growth based on the balance of payments constrained growth (BPCG) model. In contrast to the view of classical models that consider the economic growth to be related to supply-side in the economy, this model holds that the economic growth is dependent on demand-side in the economy, stating that the demand growth is inhibited by balance of payments deficit, and thus, it constrains achieving a higher economic growth rate. To investigate the model mentioned, the data on Iran's non-oil export growth and non-oil GDP growth over the period 1980–2017 are analyzed using the Granger causality test and Auto Regressive Distributed Lag (ARDL) method. Results indicated that there was a long-run relationship between the non-oil economic growth and the non-oil export growth, and that the economic growth increased by 0.54% with a 1% increase in the non-oil exports. So, based on the above model, the need to pay attention to the non-oil exports to achieve a sustainable economic growth is confirmed.

Keywords: Balance of Payments Constrained Growth Model, Economic Growth, Thirlwall's Law.

JEL Classification: *O11; O41; C22.*

1. Introduction

In contrast to neoclassical approaches, which consider the supply of factors of production and technical progress among the main growth factors, Keynesian economics focuses on the aggregate demand in the process of economic growth. The Post-Keynesian growth model considers the use of factors of production as the result of production, and states that demand is the main determinant of economic growth. In this regard, Thirlwall (1979), by developing a model, suggested that the demand growth is inhibited by balance of payments deficit, and thus, it constrains achieving a higher economic growth rate. According to this model, known as the Thirlwall's law and the "balance of payments constrained growth (BPCG) model", if long-run balance of payments equilibrium on current account is a requirement, and the real exchange rate stays relatively constant, then the long-run growth of a country can be approximated by the ratio of the growth of exports to the income elasticity of demand for imports. In this model, the economic growth is sustainable only if the growing demand for imports is financed by export earnings. So the economic growth is constrained to the balance of payments.

Given the dependence of the Iranian economy on trade, numerous studies have focused on the impact of trade, especially exports on economic growth, on the basis of supply-side factors and classical economic growth patterns, but no macroeconomic approach and demand-side economic research has been conducted. This paper is to investigate the economic growth of Iran from the demand side of the economy and to determine the effect of exports on economic growth based on the pattern of growth constrained by the balance of payments over the period 1980–2017. Understanding the extent of economic growth constraints by balancing payments provides an appropriate solution for economic planners and policymakers to achieve higher economic growth based on the demand-side components of the economy.

The remainder of this paper is organized as follows. Section 2 conceptualizes the theoretical foundations and hypotheses that support the study. Section 3 presents the literature review with an overview about different definitions and approaches for the subject matter. Section 4 discusses the model estimation and results, and finally, Section 5 concludes the paper, and gives some policy recommendations.

2. Theoretical Foundations

The BPCG model developed by Thirlwall (1979) is based on the Keynesian economics that emphasizes the role and importance of aggregate demand in the process of economic growth. In this model, exports are intended as one of the components of aggregate demand, and the income elasticity of demand for imports has an impact on the economic growth. In this way, the increase in the elasticity referred to reduces the effect of the increase in export coefficient. Therefore, assuming the export growth rate and the income elasticity of demand for imports, GDP growth is in consistent with the current balance of payments in the long-run. This model differs from supply-side growth models that consider the economic growth to be related to inputs such as savings, physical and human capital, population growth, and per capita GDP.

Thirlwall revived Harrod's balance of payments constrained model. The initial assessment of the model is based on dynamic Harrod foreign trade multiplier that determines the long-run economic growth. The basic model consists of three equations as follows:

$$X_t = \eta(p_{ft} + e_t - p_{dt}) + \varepsilon Z_t \quad (1)$$

Equation 1 is an export demand function, where:

X_t : Growth rate of real exports

e_t **:** Nominal exchange rate

Z_t : Global real income growth rate

η : Price elasticity of demand for export

p_{ft} : Growth rate of import prices

p_{dt} : Growth rate of domestic prices

$(p_{ft} + e_t - p_{dt})$: Real relative price change rate (term of trade)

ε : Global income elasticity of demand for export

$$m_t = \psi(p_{dt} - p_{ft} - e_t) + \pi Y_t \quad (2)$$

Equation 2 is an import demand function, where:

m_t : Real import growth rate

ψ : Price elasticity of demand for import

p_{ft} : Rate of growth of import prices

Y_t : Growth rate of real domestic income

π : Income elasticity of demand for import

p_{dt} : Growth rate of domestic prices

$$p_{dt} + X_t = p_{ft} + m_t + e_t \quad (3)$$

Equation 3 indicates the balance of payments equilibrium condition. In addition, assuming the relative prices remain stationary in the long-run, i.e. $(p_{ft} + e_t - p_{dt}) = 0$, the role of prices in international competitiveness of the market is minimized. Given the above, and inserting Equations 1 and 2 into Equation 3, Equation 4 below is obtained:

$$Y_t = \frac{\varepsilon Z_t}{\pi} \Rightarrow Y_t = (\frac{1}{\pi})X_t \quad (4)$$

In Equation 4, Y_t indicates the long-run real economic growth rate, which is directly related to the growth rate of real exports (X_t), and is inversely related to the income elasticity of demand for imports (π).

Equation 4 is known as dynamic Harrod foreign trade multiplier, which is the basis for estimating the empirical work. Thus by increasing exports, the aggregate demand would also increase, which would lead to the increased domestic production and employment.

3. Literature Review

The empirical validity of the Thirlwall's model has been tested in different countries over the last three decades, and it has been confirmed in most studies. The methods used for the estimation of this model can be classified into four groups: cross-sectional method, traditional time series method, new time series method (cointegration), and Kalman Filter forecasting method (KFFM). Among the first group, the study by Bairam (1988) on 18 European and North American countries and the study by Bairam and Dempster (1991) on 11 Asian countries can be mentioned. Among the second group are the study by Thirlwall and Hussain (1982) on 20 developing countries, the study by Atesoglu (1994) on the United States, the study by Leon-Ledesma (1999) on Spain, and the study by Elitok and Campbell (2008) on Turkey, in which the ordinary least squares (OLS) and two-stage least squares (TSLS) methods were used to investigate the law referred to. Regarding the third group, namely the different ways of applying cointegration that began in the 1990s, the study by Bairam (1993) on five European countries, the study by Moreno-Brid (1999) on Mexico, the study by Joen (2009) on China, and the study by Gouvea and Lima (2010) on Latin American and South Asian countries can be noted. Concerning the fourth group, the use of the Kalman-Filter forecasting method, Alejandro and Fernandez (2008) on Cuba can be mentioned.

Using the Thirlwall's original balance of payments constrained growth (BPCG) model, Moreno-Brid and Caldenty (1999) analyzed Mexico's economic growth over the period 1950-1996. The long-run relationship between Mexico's real export growth and the real production in the above-mentioned period and the selected sub-periods was estimated using cointegration analysis. Results indicated that there is a positive significant cointegration between the two variables, and the BPCG model explains Mexico's long-run economic growth.

Razmi (2005) studied the Thirlwall's model in India by using the Johansen cointegration testing over the period 1950–1999. They predicted the average growth rates with various forms of the BPCG model hypothesis, and found that their values were close to the average real growth rate in the period, although they showed a significant deviation in some decades.

Elitok and Campbell (2008) studied the impact of the balance of the payments constraint on Turkey's long-run economic growth by using OLS method over the period 1960–2004. Findings verified the existence of the BPCG model in the period under study in Turkey.

Khasawaneh et al. (2012) studied the validity of the BPCG model for 16 Middle East and North African countries by using the cointegration technique. They tested the long-run relationship between the real economy growth rates and the real non-oil export rates with different starting points from 1950 and 1990 to 2010 for the countries under study. They stated that there was a long-run relationship between the real exports and the real economic growth in these countries (except Kuwait, Qatar, Saudi Arabia, and the United Arab Emirates, which are oil producers, and their economic growth rates are obtained through other factors such as capital inflows). In addition, the empirical results divided the countries into two groups based on the difference between the real economic growth rate and the projected balance of payments constrained growth rate. In Saudi Arabia, Syria, Tunisia, and the United Arab Emirates, real economic growth rate was higher than the projected balance of payments constrained growth rate, which meant a high income elasticity of demand for imports. The equilibrium exchange rate in Tunisia and Syria had an unexpected negative sign. Furthermore, in Algeria, Bahrain, Egypt, Iran, Jordan, Kuwait, Libya, Morocco, Oman, Qatar, and Yemen, the real economic growth rate was lower than the projected balance of payments constrained growth rate. This negative difference could mean a slower growth rate of capital inflows than the export growth rates and the relative price effect. The results of this study confirmed the BPCG model.

Begnay et al. (2013) investigated the long-run relationship between the economic growth and current account equilibrium based on the BPCG model in Vietnam over the period 1985–2010. Results showed that Vietnam's economic growth was lower than the projected growth rates, and the neutral relative price effect made the value effects play a dominant role in determining the balance of payments constraint.

Kavand (2017) studied the BPCG model in Iran over the period 1978–2014. Using the ARDL method, he estimated the long-run income elasticity of demand for import. Then, he calculated the balance of payments constrained average growth rate, the average real growth rates, the average growth rates of real non-oil exports, and the average growth rates of real oil exports over the ten-year periods that overlap. Results suggested that if the period was divided into two parts, in the first period, the average balance of payments constrained growth rates would be higher than the average real growth rates, which could be due to the higher average growth rates of the non-oil exports than the average growth rates of the real oil exports. In the second period, the average balance of payments constrained growth rates and the average real growth rates declined and became negative in some decades, which could be due to the lower average growth rates of the non-oil exports than the average growth rates of the real oil exports.

Capote Lellis et al. (2017) investigated the export and import demand functions in Brazil over the period 1995–2013, by using vector error correction model (VECM) and structural space-place model. Results indicated that the balance of payments was a constraint to economic growth in Brazil.

Igbinuba (2017) estimated Nigeria's economic growth components within the framework of the growth model by Thirlwall and Hussain (1982). For this purpose, the Johansen cointegration test on time series data was used to estimate the long-run relationship between GDP and the real exports. According to the results, the Thirlwall's balance of payments constrained growth (BPCG) model was an appropriate structure to explain long-run growth in Nigeria.

Conteras Aloras (2017) analyzed the economic growth in Mexico over the period 1993–2016, by using the BPCG model, the vector autocorrelation (VAR) method, and the cointegration test. Results indicated that there was a positive long-run relationship between exports and economic growth in Mexico.

Ehsani and Taheri Bazkhaneh (2018) first studied the long–run cointegration relationship of import and export demand functions in Iran during the period of 1984–2013, by using ARDL model. Then, regarding the importance of the elasticities of above functions on the results of the study and for considering the structural instability of the model coefficients, time–varying parameter (TVP), and Kalman–filter were used to estimate the elasticities. Finally, the validity of Thirlwall's law was not confirmed by applying Wald Test.

Fasania and Olayemi (2018) studied the balance of payments constrained growth in Nigeria and the application of the Thirlwall's hypothesis from 1980 to 2012 by using the autocorrelation distributed lag (ARDL) method. The above test indicated that there was a long-run relationship between the variables. The empirical findings indicated that imports were added to relative prices and incomes, and that the equilibrium growth rates were equal to the real growth rates. So, according to Thirlwall's law, the real growth rate was equal to the growth rate predicted by the current account balance.

4. Model Estimation

According to the model presented in Equation 4 described in Section 3 and Moreno–Brid (1999), Equation 5 is defined to estimate the Iranian economic growth based on the BPCG model:

$GGDPNO_t = a_0 + aGEXNOt + u_t$ (5)

Where:

$GGDPNO_t$: Non-oil GDP growth

$GEXNO_t$: Non-oil export growth

$a=1/\pi$: Reverse the income elasticity of demand for imports

The statistical data is of the base year 2004. To estimate Equation 5, the autoregressive distributed lag (ARDL) method is used with the help of Eviwes. Cointegration test is applied by using the ARDL bound testing approach to as proposed by Pesaran et al. (2001). Compared to other time series methods (i.e., Engel-Granger, 1987; Johansen and Julius, 1990; Philip and Hansen, 1990), this method is more efficient in small samples, where the number of explanatory variables is low. Banerjee and Inder (1993) suggested that the estimation bias in small samples may be significant.

Also the unrestricted ECM in ARDL bound test seems to take satisfactory lags that captures the data generating process in a general–to–specific framework of specification (Laurenceson and Chia, 2003). Traditional cointegration method may also suffer from the problems of endogeneity, while the ARDL method can distinguish between dependent and explanatory variables. Thus, estimates obtained from the ARDL method of cointegration analysis are unbiased and efficient, for they avoid the problems that may arise in the presence of serial correlation and endogeneity.

Cointegrarion analysis based on ARDL bound testing implies that unit root testing is not necessary. But ARDL approach becomes nonsignificant in the face of I(2) variables, and we should make sure that none of the cointegrated variables are order two, I(2). Therefore, there is need to test for presence of unit root (non stationary). The unit root test of variables was evaluated by using the augmented Dickey-Fuller (ADF). Results are presented in Table 1.

Table 1: Unit Root Test of Variables

Variable	ADF test statistic	Prob	Result
GEXNO	-9.631027	0.0000	stationarity
GGDPNO	-4.317019	0.0017	stationarity

Source: Research findings

As shown in Table 1, according to the ADF, the two variables of the non-oil export growth and the non-oil GDP are stationarity at level, and there is no unit root problem in the above time series.

At the next stage, the Granger causality test was applied to determine the direction of the relationship between the two variables of export growth and GDP growth. As can be seen in the first row of Table 2, at a confidence level of 98%, the non-oil export growth led to the non-oil GDP growth. However, the opposite was not confirmed, and the non-oil GDP growth was not a cause for non-oil export growth. Therefore, Equation 5, in which non-oil GDP growth was referred to as a dependent variable, was used to study the economic growth.

Table 2: Granger Causality Test

Null Hypothesis	F-Statistic	Prob	Result
GEXNO does not Granger Cause GGDPNO	5.92854	0.0207	Reject the null hypthesis
GGDPNO does not	0.00528	0.9425	Accept the null hypothesis

Granger Cause GEXNO			

Source: Research findings

At this stage, the study model is estimated by using the ARDL method. In this method, three criteria including Akaike information criterion (AIC), Schwarz's Bayesian criterion (SBC), and Hannan-Quinn criterion (HQC) are used to determine the optimal lags. In samples with a size less than 100, the SBC is used, which provides less lags than the other two ones, and loses less degrees of freedom. In this study, this criterion is also used to determine the optimal lags.

Results of the estimation of the short-run model are given in Table 3. In addition to the variables of Equation 5, the Dummy variable (DUM) of war, which is related to the years 1980–2017, is also included in the model.

Table 3: Estimation of Dynamic Short-Run Patterns with Autoregressive Distributed Lag

Variable	Coefficient	Std. Error	T-statistic	Prob
GGDPNO(-1)	-0.33	0.108	-3.06	0.00
GEXNO	-0.07	0.153	-0.44	0.67
GEXNO(-1)	0.78	0.153	5.11	0.00
DUM	-0.22	0.108	-2.02	0.05
C	0.12	0.079	1.51	0.14

Source: Research findings

As can be seen in Table 3, the non-oil export growth with one lag has a positive significant effect on the non-oil GDP growth, and 1% growth in the non-oil export lead to a 0.8% increase in the non-oil economic growth. Also as expected, the war had a negative significant effect on the economic growth.

Diagnostic tests are used to investigate the absence of autocorrelation and heteroscedasticity, the results of which are presented in Table 4. It can be seen in Table 4 that using the LM test, the probability obtained for the relevant coefficient is more than 0.05, and there is no autocorrelation. Additionally, since the probability obtained using the ARCH test is more than 0.05, it is concluded that there is no heteroscedasticity in the residuals.

Table 4: Residual Tests

Test statistics	LM Version	F Version
Autocorrelation	CHSQ=4.182831 Prob.0.1235	F(2,29)=1.906237 Prob.(0.1668)
Heteroscedasticity	CHSQ(1)=10.24588 Prob.(0.0686)	F(2,29)=2.468396 Prob.(0.0599)

Source: Research findings

F-bounds test is used to determine the long-run equilibrium relationship. In Table 5, the F-statistic value is 68.88. Since this value is above the upper and lower bound critical values in the test, the null hypothesis, the lack of long-rum relationship, is rejected, and there is a long-run equilibrium relationship at a confidence level of 99%.

Table 5: ARDL Bounds Test

F-statistic	Lower Bound (1%)	Upper Bound (1%)
68.87795	5.763	6.48

Source: Research findings

The long-run coefficients are presented in Table 6. The model error correction coefficient is presented in the last row is -1.3, which is statistically significant. Since the coefficient value is between -1 and -2, it could be seen that the gap between the short- and long-run models is sinusoidally eliminated. That is in each period, 1.3% of the gap is eliminated, and the short-run model is cointegrated to the long-run model.

Table 6: ARDL Long-Run Form and Error Correction Coefficient

Variable	Coefficient	Std. Error	T-statistic	Prob.
C	0.089968	0.059286	1.517535	0.1393
GEXNO	0.536527	0.216466	2.478569	0.0188
CointEq(-1)*	-1.330171	0.089687	-14.83122	0.0000

Source: Research findings

The long-run equilibrium relationship is as follows:

GGDPNO = 0.09 + 0.54*GEXNO (6)

Based on Equation 6, the non-oil export growth coefficient is 0.54. It indicates that the economic growth increase by 0.54%, with a 1% increase in the non-oil export growth. This coefficient is lower by studies based on classical economic growth models, which is about 0.2 (Shoraka and Safari, 1998). In other words, according to the present study, the large income elasticity of demand in the country do not reduce the impact of exports on the economic growth, and do not restrict it.

The cumulative sum of recursive residuals (CUSUM) test is used to investigate the stationarity of the parameters and the model variance (Brown et al., 1975).

As shown in Figure 1, the hypothesis of parameter stationarity is rejected at a confidence level of 95% as the path of recursive residuals do not fall out of the range of the two lines. So the long-run permanent stationarity is acceptable for the model parameters studied, and no structural failure is observed in the model.

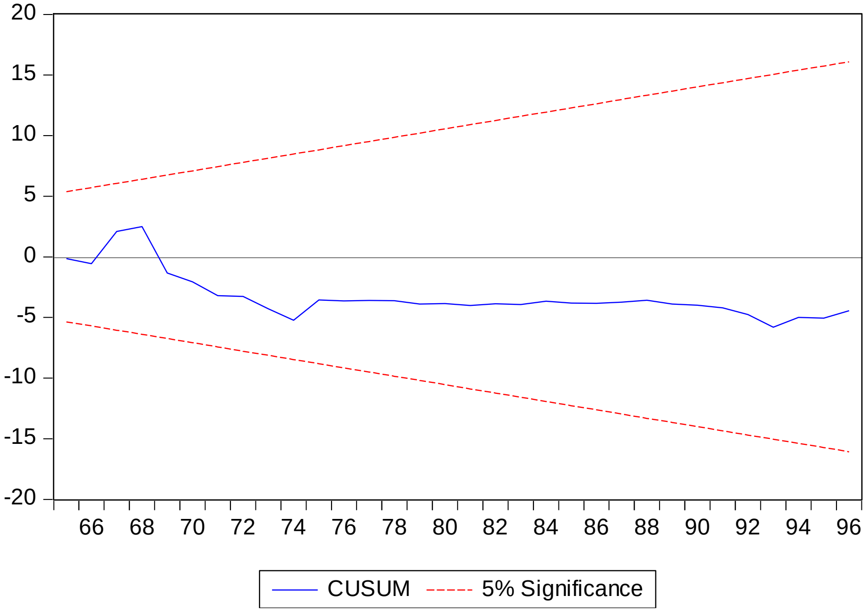

Fig. 1: Cumulative Sum of Recursive Residuals (CUSUM) Test

5. Conclusion and Recommendations

In order to study the Iranian economic growth based on the BPCG model, the relationship between the non-oil export growth and the non-oil GDP growth was first investigated by applying Granger causality test, and it was found that there was a unilateral relationship from the non-oil export growth to the economic growth. Then, using the autoregressive distributed lag (ARDL) method, a long-run relationship between the two variables over the period 1980–2017 is confirmed. According to the above relationship, the non-oil export growth coefficient is 0.54, indicating that economic growth increase by 0.54% with a 1% increase in the non-oil export growth.

It is also observed that the gap between the short- and long-run models was sinusoidally eliminated. In each period, 1.3% of the gap is eliminated and the short-run model cointegrated to the long-run model. So, the BPCG model explains the long-run economic growth of Iran. This may be because the Iranian economy relies heavily on foreign trade. A Sustainable growth can be achieved by creating competitive exports through the macroeconomic stability and reducing the problems of external sector, among other factors affecting growth.

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