Fiscal Policy and Economic Growth
A Case Study of IRAN

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Abstract

The paper analyses and estimates the impact of fiscal policy on Iran's economic growth during the period 1974-2007. Using co-integration techniques and a vector error correction model, it shows that there exists a unique long-run relationship between economic growth and its major determinants including public investment and private investment, human capital stock and labor force. Also, the short-term error correction dynamics analysis shows that, aside from private investment and human capital accumulation, public investment has a significant role in dynamic of growth.
Keywords: Fiscal Policy, Economic Growth, Co-integration, Error Correction Model.
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1- Introduction

Over the last decade, the growth impact of fiscal policy has generated large volume of both theoretical and empirical literature. The effects of fiscal policy on the long-run rate of growth have been extensively researched within endogenous growth theory. Among the different components of fiscal policy, the impact of government expenditure on growth and welfare has been investigated in several studies (see, among others, Barro ,1990). However, most of these studies paid more attention to developed economies and the inclusion of developing countries in case of cross-country studies were mainly to generate enough degrees of freedom in the course of statistical analysis (Aregbeyen, 2007). There is a popular assertion in the empirical literature that public spending is negatively correlated with economic growth due to inefficiency of the public sector especially in the developing countries where large proportion of public spending is attributed to non-development expenditure like defence and interest payments on debt (Husnain et.al 2011). However, current trends in fiscal administration has introduced various ways in view to reducing such expenditure that contributes little to the development goals of national economy.

This study presents an empirical analysis of fiscal policy and economic growth relationship and is organized as Section 2presents theoretical foundations as well as some empirical studies. Section 3models an aggregate production function for Iranian economy. Section 4presents empirical results. Finally, the paper closes with concluding remarks in Section 5.Conclusion is stated in the Section 5In the end references and tables are attached.

2.Theoretical Foundation and Empirical Controversies

The impact of fiscal policy on growth has generated large volume of empirical studies with mixed findings using cross sectional, time series and panel data. Some of these studies are country-specific while others are cross-country. Fuente (1997) examined the impact of public expenditures and taxation on economic growth of 21 OECD[1] countries from 1965 to 1995. The results of the study could not provide evidence in support of fiscal policy-led growth. Specifically, public expenditures tend to crow-out private investment leading to reduction in disposable income and the incentive to save.

Ghali and Al-Shamsi (1997) examined the causal links between fiscal policy (government expenditure) and economic growth (GDP)[2] from 1973 to 1995 in U.A.E[3] using a cointegration and error-correction framework. The results provided evidence in support of existence of cointegration between government expenditure and GDP. The results of the causality tests showed that causation runs from government expenditure to GDP. Mansouri (2008) studied the relationship between fiscal policy and economic growth in Egypt, Morocco and Tunisia from 1970 to 2002. The empirical results showed that 1 percent increase in public spending raised the real GDP by 1.26 percent in Morocco, 1.15 percent in Tunisia and 0.56 percent in Egypt. The results also indicated existence of long-run relationships for all the three countries. Enache (2009) investigated the connection between fiscal policy and economic growth in Romania using Forecasted time series data which covered periods between 1992 and 2013. The empirical results indicated weak evidence for the positive impact of fiscal policy on economic growth. The study concluded that government authorities could use fiscal policy to affect economic growth in an indirect manner.

Karimi and Khosravi (2010) investigated the impact of monetary and fiscal policies on economic growth in Iran using autoregressive distributed approach to cointegration between 1960 and 2006. The empirical results indicated existence of long-run relationship between economic growth, monetary policy and fiscal policy. The results further revealed a negative impact of exchange rate and inflation (as proxies for monetary policy), but a positive and significant impact of

[1] OECD:Organization for Economic Cooperation and Development.
[2] GDP:Gross Domestis Product
[3] UAE: United Arab Emirates

government expenditure on growth. Babalola and Aminu (2011) have indicate that productive expenditure positively impacted on Nigeria's Economic growth during the period of coverage and a long-run relationship exists between them as confirmed by the cointegration test.

3-Modeling an Aggregate Production Function for Iran

Using an aggregate production function, we try first to model the link between fiscal policy and economic growth in Iran. Following Barro (1990), the following production function is specified:

$$Y = f\,(L, Iprv, Ipub, Tax, H) \quad (1)$$

where *Y* is the real domestic product as a function of *L, Iprv, Ipub, H* and *Tax* which represent respectively labor, private investment, public investment, tax income and human capital. Based on the availability of time-series data and the characteristics of Iranian economy, we use two measures of public investment (Ipub): current payments (Ic) and development payments (Id).

Following Otani and Villanueva (1990) we have used government expenditures in human capital as a proxy for human capital. These include expenditures in education, health, culture, art, nutrition, research, sport, and technical and vocational training. These expenditures are expected to increase efficiency of workforce, leading to higher productivity and economic growth.

The log linear model has been specified to scrutinize impact of government expenditures on growth as this form is better than the linear form theoretically and empirically (Ehrlich (1977) and Layson (1983)). Also, using Box-Cox transformation test, we specify a log-linear production function[1] as follows (with an error term, u_t):

$$\mathrm{Ln}(\mathrm{GDP}_t) = \alpha_0 + \alpha_1 \mathrm{Ln}(\mathrm{L}_t) + \alpha_2 \mathrm{Ln}(\mathrm{Iprv}_t) + \alpha_3 \mathrm{Ln}(\mathrm{Ic}_t) + \alpha_4 \mathrm{Ln}(\mathrm{Id}_t) + \alpha_5 \mathrm{Ln}(\mathrm{Tax}_t) + \alpha_6 \mathrm{Ln}(\mathrm{EDU}_t) \quad (2)$$

[1] In the log-linear models, The problem of Heteroskedasticity becomes,less likely.

here:
GDP = Gross Domestic Product (at constant prices)
L = Total Labor Force
Iprv = Private Investment (at constant prices)
Ic = Current Payments (at constant prices)
Id = Development Payments (at constant prices)
Tax= Tax Income
EDU = Government Expenditures in Human Capital

Equation (2) captures the long-run relationship between output and its determinants. We expect the following signs for the estimated long-run elasticities $(\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5) > 0$, and $\alpha_5 < 0$.

To capture the shorts-run dynamic effects, an error correction model (ECM) of the following form is estimated:

$$\Delta \mathrm{Ln}(\mathrm{GDP_t}) = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \Delta \mathrm{Ln}(\mathrm{GDP})_{t-i} + \sum_{i=0}^{n} \beta_{2i} \Delta \mathrm{Ln}(\mathrm{L})_{t-i} + \sum_{i=0}^{n} \beta_{3i} \Delta \mathrm{Ln}(\mathrm{Iprv})_{t-i} + \sum_{i=0}^{n} \beta_{4i} \Delta \mathrm{Ln}(\mathrm{Ic})_{t-i} + \sum_{i=0}^{n} \beta_{5i} \Delta \mathrm{Ln}(\mathrm{Id})_{t-i} + \sum_{i=0}^{n} \beta_{6i} \Delta \mathrm{Ln}(\mathrm{Tax})_{t-i} + \sum_{i=0}^{n} \beta_{7i} \Delta \mathrm{Ln}(\mathrm{EDU})_{t-i} + \gamma \mathrm{EC}_{t-1} + \varepsilon_t \tag{3}$$

where EC_{t-1} = error-correction term lagged one period and ε_t is white noise error term. Equation (3) captures the short-run dynamics, showing the relationship between short-run movements in output and the variability of other variables. The error correction term (EC_{t-1}) shows how quickly the short-run deviation of variables from their long-run cointegrating relationship is corrected over time.Using annual times series data[1] for the period 1972-2007, we have first tested for

[1] Data was obtained from Iran’s central Bank.

unit roots and then estimated the long-run elasticities as well as short-run dynamics.

4- Empirical Results

4-1- Unit-Root Tests

To avoid spurious regressions, any empirical work on times series data requires testing for existence of unit roots. In this section, we perform unit root tests for stationarity on the levels and the first differences of all five variables (Ln(GDP), Ln(L), Ln(Ic), Ln(Id), Ln(Tax) and Ln(EDU)). This study employs a number of popular techniques like ADF (1981), Phillips-Perron(PP),(1988), DF-GLS (1996), and Ng-Perron (2001), to test unit roots of concerned series. Our results clearly show that all variables have unit roots at level (they are I(1)), but their first differences are stationary under both tests. Hence we have concluded that these variables are integrated of order 1[1].

4-2- Cointegration Analysis

Having found that variables are integrated of order one in the model, our next step is to determine whether any combinations of the variables are cointegrated or not. Before that, we must first specify the relevant order of lags (*p*) in the vector autoregressive (VAR) model. The four information criteria, Sequential modified likelihood ratio (LR), Final Prediction Error (FPE), Akaike (AIC), Schwarz (SC) and Hannan-Quinn, are used. Using the Schwarz criteria test for model reductions, we have selected one lag for the order of the VAR[2]. The cointegration results obtained by application of the Johansen-Juselius (JJ) method are presented in Table 1. The maximal eigenvalue test suggests that the number of cointegrating vector is one (r = 1), while the trace statistic supports two cointegrating vectors (r = 3). Using the Monte Carlo method, Haug (1996) looked for efficiency of alternative tests for cointegration and found that Johansen and Juselius maximum

[1] The result are available on request (not reported).
[2] The result are available on request (not reported).

eigenvalue test has the overall least size distortions over the trace test. For this reason, we have chosen one cointegrating vector (r = 1). Therefore, our annual data from 1974 to 2007 appear to support the hypothesis that there exists a unique long-run statistical relationship between level of gross domestic product and its determinants including labor force, private investment,current investment, development investment, tax income and real expenditures in human capital. Estimates of long-run normalized elasticities are given in the last row of Table 1. All elasticities are statistically significant with expected signs.The results show that in the long run, labor force, private investment, human capital, current and development payments have positive effects on real income, while the tax income has a negative effect, implying that fiscal policy in terms of tax reduction or increase of public investment are welfare improving. Our results imply that Iran's high average tax rates during the last three decades have caused deterioration of real income and welfare for Iranian people.

Table 1: Johansen-Juselius Maximum Likelihood Cointegration Tests and Estimates of Long-Run Cointegrating Vector

Trace Test Maximal Eigenvalue Test				**Maximal Eigenvalue Test**			
NULL	**Alternative**	**Statistic**	**0.001 Critical Value**	**NULL**	**Alternative**	**Statistic**	**0.001 Critical Value**
r = c_a	r ≥ 1	196.96*	133.66	r = ۰	r = 1	59.92*	56.13
r ≤ 1	r ≥ 2	137.04*	103.398	r ≤ 1	r = 2	42.09	49.39
r ≤ 2	r ≥ 3	94.82*	76.94	r ≤ 2	r = 3	31.37	42.52
r ≤ 3	r ≥ 4	52.63	54.57	r ≤ 3	r = 4	29.32	35.44
r ≤ 4	r ≥ 5	34.33	36.23	r ≤ 4	r = 5	16.27	28.13
r ≤ 5	r ≥ 6	17.95	21.79	r ≤ 5	r = 6	11.45	20.32
r ≤ 6	r ≥ 7	6.51	11.13	r ≤ 6	r = 7	6.51	11.13

Estimates of long-run cointegrating vector

	Ln(GDP)	Ln(L)	Ln(Iprv)	Ln(Ic)	Ln(Id)	Ln(Tax)	Ln(EDU)
Normalized Vector:	1	0.09	0.70	0.37	0.04	0.44	0.22
Standard Errors:		(0.31)	(0.12)	(0.26)	(0.15)	(0.14)	(0.06)

Note: i- r stands for the number of cointegrating vectors.

ii- * denotes rejection of null hypothesis of no cointegration at 1 percent significance level.

4-3- Short-Run Dynamics: Estimation of a Vector Error Correction Model

Using the Granger representation theorem, we have estimated a vector error correction model (VECM) which describes the short-run dynamics and convergence of the non-stationary variables to their long-run cointegrating relationships. The advantage of VECM lies in its strength of capturing the short-run dynamics as well as long-run equilibrium. Durr (1993) argues that an error correction model is appropriate when short run changes in the dependent variable are significantly related to short run changes in the independent variables. The empirical results, shown in Table 2, show that the growth rate of gross domestic product in Iran is significantly related to changes in private investment, human capital, current and development payments and tax income. In addition, the negative coefficient of the error correction term (-0.63) is statistically significant at the 5 per cent level, indicating rapid rate of convergence of the whole system to the long-run equilibrium. The diagnostic test statistics clearly shows that our estimated VECM is very robust, rejecting existence of any econometrics problem such as model misspecification, serial correlation, heteroscedasticity and non-normality of the residuals.

Table 2 : Estimated Error-Correction Model

Dependent Variable = $\Delta \mathrm{Ln(GDP)}$			
Regressor	**Parameter Estimate**	**t-Ratio**	**P-Values**
Intercept	0.004	0.13	0.895
$\Delta \mathrm{Ln(L)}$	0.49	0.82	0.417
$\Delta \mathrm{Ln(Iprv)}$	0.22	5.11	0.000
$\Delta \mathrm{Ln(Ic)}$	0.23	3.15	0.003
$\Delta \mathrm{Ln(Id)}$	0.10	2.09	0.045
$\Delta \mathrm{Ln(Tax)}$	-0.21	-2.58	0.015
$\Delta \mathrm{Ln(EDU)}$	0.32	2.91	0.006
$\mathrm{EC}(-1)$	-0.63	-3.39	0.002
Adj R^2 = 0.60 D.W.=2.08 Serial Correlation LM Test= 2.12(0.34) White Heteroskedasticity Test=36.94(0.37) Normality=3.63(0.16) RESET=3.56(0.62)			

Note: Figures in bracket indicate p-values.

The estimated vector error correction model also determines short-run and long-term Granger causality between explanatory variables[1] and economic growth ($\Delta\text{Ln}(\text{GDP})$) as the dependent variable. The Wald tests reported for each of explanatory variables in Table 3 clearly show that all variables have Granger-caused economic growth. The significant coefficient of the error term (EC(-1)) also indicates the long-run Granger causality, supporting existence of cointegration among the long-run stochastic trends of the above variables.

Table 3: Granger causality in gross domestic product error correction model

Dependent Variable	Explain Variables	Null Hypothesis	Wald Statistic(P_Value)	Conclusion
$\Delta\text{Ln}(\text{GDP})$	$\Delta\text{Ln}(\text{L})$	$\beta_2 = 0$	0.67(0.410)	Non-Causality
	$\Delta\text{Ln}(\text{Iprv})$	$\beta_3 = 0$	26.10(0.000)	Causality
	$\Delta\text{Ln}(\text{Ic})$	$\beta_4 = 0$	9.91(0.005)	Causality
	$\Delta\text{Ln}(\text{Id})$	$\beta_5 = 0$	4.37(0.036)	Causality
	$\Delta\text{Ln}(\text{Tax})$	$\beta_6 = 0$	6.65(0.009)	Causality
	$\Delta\text{Ln}(\text{EDU})$	$\beta_7 = 0$	8.47(0.003)	Causality

Note: Figures in bracket indicate p-values.

4-4- Variance Decompositions and Impulse Responses Functions

It is informative, based on the estimated VAR model, to do a little bit more dynamic analysis by computing the variance decompositions (VDCs) and impulse response functions (IRFs). The decomposition of variance allows us to break down the variance of the forecast error for our dependent variable into components that can be attributed to its own variability and variability of each of explanatory variables. The information contained in the decomposition of variance can be equivalently represented by impulse response functions. Both are obtained from the moving average representation of the original VAR model. Impulse response functions essentially map out the dynamic response path of each variable due to a one standard deviation

[1] ($\Delta\text{Ln}(\text{L}), \Delta\text{Ln}(\text{Iprv}), \Delta\text{Ln}(\text{Ic}), \Delta\text{Ln}(\text{Id})$and $\Delta\text{Ln}(\text{Tax})$

structural shock. The impulse response functions are normalized such that zero represents the steady-state value of the response variable.

Table 4 shows the results of VDCs. Two observations from this table are worth mentioning. The first one relates to the persistence of the shocks to real GDP over time. Even in the long run more than 50 percent of real GDP movements are attributed to its own movement, indicating the essence of unit root and permanent effects of shocks in the time series characteristics of this variable. The second observation relates to the important role of current payments in the medium and long term. The percentage of real GDP forecast variance that can be attributed to movements in current payments is 3.52 per cent which is quite high in comparison with that of development payments(0.97 per cent). Next in importance to development payments is the contribution of fiscal policy embodied here in reductions in tax income and increases in development payments. These shares in the long run are 0.66 per cent and 49.31 per cent respectively.

Table 4: Variance decompositions of gross domestic product

Period	Ln(GDP)	Ln(L)	Ln(Iprv)	Ln(Ic)	Ln(Id)	Ln(Tax)	Ln(EDU)
1	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	93.52619	0.972995	1.776964	3.524059	0.154058	0.034902	0.010831
3	84.88176	1.764166	2.101290	10.22105	0.509675	0.302717	0.219346
4	76.46100	2.738767	1.793849	17.01397	0.868772	0.475099	0.648538
5	68.97094	3.858429	1.634615	22.67476	1.221319	0.488866	1.151069
6	62.58030	4.892601	1.642363	27.23539	1.593612	0.448344	1.607395
7	57.23244	5.697660	1.719973	30.99571	1.981205	0.407072	1.965940
8	52.79005	6.260355	1.830764	34.16674	2.358935	0.375326	2.217830
9	49.11023	6.626534	1.969053	36.86392	2.704378	0.352703	2.373177
10	46.06396	6.847216	2.132742	39.16166	3.007347	0.338062	2.449020
20	33.01662	6.252860	4.250565	49.63606	4.286356	0.445936	2.111607
30	29.90529	6.087844	5.866868	49.31524	4.180550	0.669364	3.974846

Figures 1 show the response of real GDP to shocks in current and development payments as well as tax income. In each figure, the point estimates are plotted with a solid line, whereas the dotted lines represent a two standard deviation band around the point estimates. The dynamics of adjustment of real GDP to shocks in these variables have the expected sign and confirm the relative importance of the different shocks.

Figure 1 shows the response of real GDP to a one-standard deviation shock in current payments. The initial effect of the shock on real GDP is 5.9 per cent above baseline in the first year, and but gradually decrease over time and eventually reach the steady state. Figure 2 shows response of real GDP to a one-standard-deviation shock in the development payments. The initial effect of the shock on real GDP is 6.9 per cent above the baseline in the first year, and reaches the_maximum value of 3.7 per cent in the ninth year. Finally, Figure 3 shows the response of real GDP to a one-standard-deviation shock in the tax income. The initial effects of the shock on real GDP are about 3.2 per cent above baseline in the first year, but gradually decrease over time and eventually reach the steady state.

Figure 1: Response of Ln(GDP) to Generalized One S.D. Ln(Ic)Innovation

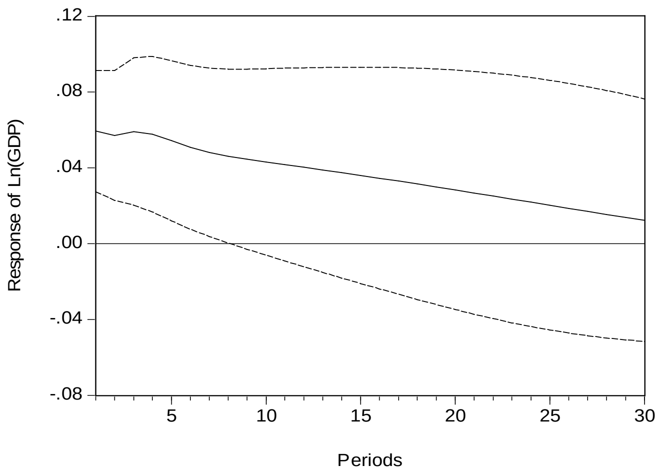


Figure 2: Response of Ln(GDP) to Generalized One S.D. LOG(Id)Innovation

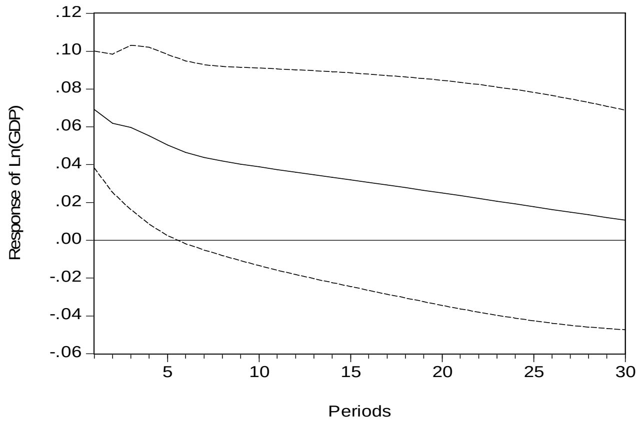
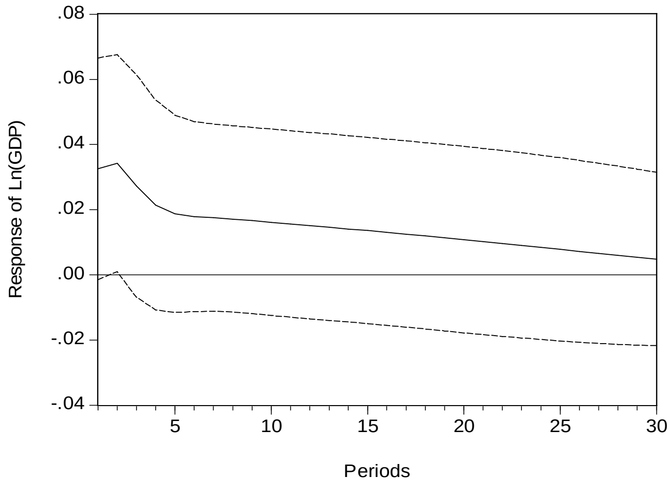


Figure 3: Response of Ln(GDP) to Generalized One S.D. Ln(Tax)Innovation



5- Conclusions

In the spirit of endogenous growth models and using cointegration techniques this paper has analyzed the long-run relationship between economic growth and its determinants with particular attention to role of fiscal policy. It showed that a unique cointegrating relationship exists among these variables, consistent with the implications of endogenous growth models. The empirical analysis clearly shows that the Iranian economy in the long run is driven not only by its labor force and physical and human capital, but also by fiscal policy, such as tax reduction and promotion of current and development payments. The paper also used a vector error correction model to analyse the short run dynamics of Iran's economic growth as well as the relative importance of its main determinants. It showed that human capital has emerged as a significant determinant of real GDP. In addition, fiscal policy proved to be important for short run movements in real GDP.

The paper has some simple but very important policy implications. Stylized facts about the Iranian economy show that, unlike many developing countries, it is rich in resources and well-endowed with both physical and human capital. However, due to three decades of inappropriate policies in areas of macroeconomic discipline and economic integration with the global economy, Iran's real GDP growth has, on average, been low, very volatile and unsustainable. According to the World Bank figures, Iran's real GDP in 2005 has reached to its 1974 level, showing no growth during three decades. Comparing with the performances of many other developing countries such as China, India, Turkey and South East Asian countries, this performance has been very unsatisfactory for the Iranian people.

The Iranian government has recently realized the importance of sound microeconomic incentives for long run economic growth and removed inefficient and chronically distortionary subsidies in 2011. That is not enough. To have long-run, positive effects on economic growth, the removal of subsidies must be complemented by macroeconomic discipline in general and appropriate exchange rate policies in particular. In addition, integration with the world economy and reducing tensions with the major players in the world economy are necessary ingredients of economic development and growth. Unfortunately, no sign of any movement toward these latter policies is currently being seen from policy makers.

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