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Exports, Government Size and Economic Growth (Evidence from Iran as a developing oil-export based economy)

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Abstract

In this study, I investigate the short run and long run effects of government size and exports on the economic growth of Iran as a developing oil export based economy for the period of 1974 to 2008. For this purpose I use the bounds testing approach to cointegration and error correction models, developed within an autoregressive distributed lag (ARDL) framework. A modified form of Ram's (1986) model has been applied to include both government size and exports as determinants of economic growth in addition to labor force and capital. I use total exports, oil exports and non-oil exports respectively in three different equations to assess their effects on economic growth. Moreover, according to Armey curve(1995) in each of the equations I test the existence of non-linear relationship between government size and economic growth. My findings show that in all of the equations both in long run and short run the Armey curve is valid for Iranian economy, indicating that both a very big size and a too small size of government are harmful for growth and Iranian government should adjust its size (to have smaller size, compared to the average size over the period of this study) for obtaining higher rates of growth. The results show that total exports, the amount of oil exports in terms of barrels and oil prices could affect the economic growth positively and significantly both in short run and long run. However because of the weaknesses of the Iranian non-oil sectors, the non-oil exports could not have significant effects on growth in the long run. As a result of this study in the short run, Iran should try to attract foreign technologies and investments to develop the capacity and ability of its oil production. In the short run this can be a reliable factor for having the stable economy in comparison with relying on uncertain oil prices. In the long run Iran should use the oil revenues to improve its economic structure and invest on some non-oil sectors to diversify its non-oil exports. This can create new resources for government revenues and will reduce the dependence of the economy on Oil exports.

Keywords

Iran, economic growth, oil exports, non-oil exports, government size, oil prices

JEL Classification: C 22; H 50; O 13; Q 38.

Exports, Government Size and Economic Growth [1] (Evidence from Iran as a developing oil-export based economy)

1 Introduction

Iran is an oil-based economy that adopts an export promotion policy as the fundamental strategy for economic growth. Oil revenues play strategic roles in the structure of the Iranian economy. Holding 10% of the world's total proven oil reserves and as the second largest producer (after Saudi Arabia) within the Organization of Petroleum Exporting Countries[2], Iran both affects the international oil market and is broadly affected by it. Iran's economy relies heavily on crude oil export revenues, representing about 80% of total export earnings and, on average, 60% of government revenues in annual budgets[3].

Iran has passed through periods of boom and bust as oil prices have risen and fallen on the volatile international markets. As the recipient of crude revenue, the state became, and remains, the dominant economic actor.

The development of the non-oil industrial sector has been undermined by a poorly functioning state-dominated banking system and the dominance of state or quasi-state actors. Moreover, due to the country's nuclear issues, current international pressure on Iran partly focuses on restricting oil exports and investment in the oil related projects of Iran.[4] Which it seems that to some extent they can influence the ability of Iranian economy to export the oil and consequently its economic growth.

The importance of increasing exports as an engine for economic growth has long been the subject of considerable debate in the economic development and growth literature. Economic growth is an important index for raising the standard of living and increasing the per capita GDP in a country. Export promotion can be considered as a strategy that enables an economy to grow.

Export promotion policy exposes domestic firms to foreign competition. Theoretically, domestic industry achieves better production technology and a higher quality of output. In addition, it should reduce its costs and increase its

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[1] This working paper was written as a visiting scholar to ISS (The author is a PhD candidate in economics at Tarbiat Modares University, Tehran, Iran). I thank ISS and in particular staff group 1 for hospitality and support. Special acknowledgment is due to Prof. Peter A.G. van Bergeijk (ISS) for detailed comments and helpful suggestions. Also I wish to thank Dr. Ebrahim Hosseini Nasab, Dr. Reza Najarzadeh and Dr. Abbas Asari (Tarbiat Modares University-Iran) for their encouragements and supports.

[2] OPEC, 2005

[3] Central Bank of Iran, 2008

[4] Financial Times reports the reduction of oil production in Iran to be about 300,000 barrels per day due to international sanctions. http://www.ft.com/cms/s/0/8a250ad6-6691-11df-aeb1-00144feab49a.html.

efficiency and credibility in the international market. This view suggests that an increase in productivity provides more efficient use of resources, increases specialization of export products, increases the level of skills in the export sector, and improves overall efficiency. In addition, increased productivity reallocates the economic resources from less productive sectors to more productive ones based on comparative advantage and increases the sales of export products in domestic and foreign markets. (Balassa, 1978; Feder, 1982; Ram, 1985, 1987; Darrat, 1987; Moschos, 1989; Riezman, 1996; Xu, 1996; Giles and Williams,2000; Abu-Qarn, 2004; AlKhuzaim, 2005).

"At the microeconomic level the benefits from trade may motivate public interest in trade and foreign investment as recent micro-data studies into the heterogeneity of firms uncover for many countries a positive correlation between productivity at the firm level and the extent of internationalization of the company. Firms that export, import, invest or have a head office in another country are more productive, larger, do more research and development, have a higher survival rate and pay better wages than firms that are only connected to local markets."[5]

The export-led growth (ELG) hypothesis has been commonly used to examine the impact of exports on economic growth. Numerous studies support this hypothesis and found evidence that exports have a significant positive relationship with economic growth. (e.g., Emery, 1967; Michalopoulos and Jay, 1973; Michaely, 1977; Balassa, 1978 and 1985; Bhagwati, 1978, Heller and Porter, 1978; Fajana, 1979; Tyler, 1981; Feder, 1982; Kavoussi, 1984, Krueger, 1985, Moschos, 1989; Grossman and Helpman, 1991; Giles and Williams, 2000, Abu-Qarn 2004).

In this paper I test the validity and powerfulness of the ELG hypothesis for a developing oil export based economy (Iran).

The developing oil-export based economies are the economies that rely heavily on exporting oil. The oil exports comprise the main part of the exports in these economies. The government owns all of the country's natural resources and it uses the oil revenue to finance its expenditures, so the government expenditures depend on oil revenues and the economy depends on the government expenditures. When oil prices or oil demand increases or decreases the entire economy will be affected.

It seems that because of the heavily reliance of government on oil exports revenues in such economies, the increases in oil exports will endogenously affect the size of the government, therefore an important point which I can add to this literature is that; it will be useful we include the government size as a determinant variable in our growth model when we want to investigate the ELG hypothesis in developing oil export based economies because the changes in government size can influence the process of economic growth in these economies as well.

Interestingly, the effects of government size on economic growth have been argued among the economists during the recent decades.

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[5] Bergeijk, 2009, p.74.

In theory the relationship between government expenditures and economic growth is ambiguous. "One point of view suggests that a larger government size is likely to be detrimental to efficiency and economic growth because, for example, (i) government operations are often conducted inefficiently, (ii) the regulatory process imposes excessive burdens and costs on the economic system, and (iii) many of government's fiscal and monetary policies tend to distort economic incentives and lower the productivity of the system. At the other extreme, one can identify some points of view that assign to the government a critical role in the process of economic development, and could argue that a larger government size is likely to be a more powerful engine of economic development. This can be because of the (i) role of the government in harmonizing conflicts between private and social interests, (ii) prevention of the country by foreigners, and (iii) securing an increase in productive investment and providing a socially optimal direction for growth and development."[6]

Unlike the 1980s, when economists studied whether government's expenditure has negative or' positive effect upon economic growth, nowadays they focus on issues like the optimum size for government and minimizing it. The turning point of such studies is the Curve presented by Richard Armey(1995). This curve contains a nonlinear relationship and the growth equation has a maximum point for the optimal size of government.
The Armey Curve shows that in a state of anarchy, output per capita is low. Similarly, where all input and output decisions are made by government, output per capita is likewise low. Where there is a mix of private and government decisions on the allocation of resources, however, output often is larger. Accordingly in this study also I focus on a nonlinear relationship between economic growth and government size.

The purpose of this research is to examine the impact of ELG and government size instruments on Iran's long-term and short-term economic growth. The paper modifies Ram's (1986) two sectors production model to include the export as a determinant factor for economic growth. Furthermore while most of the existing research on the relationship between export and economic consider only total exports, this study will employ GDP as the measure of output, and will investigate disaggregate exports (oil exports and non- oil exports) in addition to total exports. Also in the case of existence a significant and positive impact of oil exports on economic growth I want to identify if these effects are due to the increases in oil prices or because of the increases in the ability of Iranian economy in extracting and exporting more oil barrels. Moreover I will include the government size in a quadratic form in the growth model to test the validity of Armey curve in Iranian economy and find the optimal size of the government.

For the purpose of investigating the existence of long run and short run relationships among exports (both aggregate and disaggregate), government size and economic growth, the bounds testing approach to cointegration and error correction models, developed within an autoregressive distributed lag

[6] Ram, 1986.

(ARDL) framework is applied to Iranian annual data for the period of 1974 to 2008.

Section 2 includes a brief review over the previous studies on the relationship between growth and both exports and government size. Section 3 introduces the exports and government expenditures in Iran; Section 4 discuses about the models and methodologies that I have used in this research for economic growth; the empirical results and econometrics estimations have been included in section 5, and finally section 6 will discuss about the findings and recommendations.

2 Literature review

In this section I briefly review some studies on the relationship between economic growth and both exports and government size.

2.1 Literature on the relationship between exports and economic growth

In the late nineteenth and early twentieth centuries, exports were found as central to the development of a nation's economy and as the basic engine for economic growth. There are several facts that support the importance of exports in economic growth. First, an economy's specialization is improved by growth of exports, which leads to more efficient production. Second, the exports sector often generates positive externalities in other economic sectors, through improved production techniques. Third, if a country has export promotion, it uses more of the available factors of production, and uses these factors more efficiently. Fourth, an expansion of exports may increase the scope of the economy of scale in exporting firms and encourage allocative efficiency and dynamic competitiveness of these firms (Alkhuzaim, 2005, p.1).

Since exports are one of the GDP components, it is suggested that export growth contributes directly to GDP. The relationship between export and economic growth for various countries has been analyzed theoretically and empirically.

The effects of both the export sector and the non-export sector on economic growth for a sample of 31 semi-industrialized countries were examined by Feder(1982). He uses data from 1964 to 1973, and he divides the whole economy into two main sectors.The first sector produces export goods for international market, while the second sector produces non-export goods for domestic market. Feder finds that the marginal factor productivity in the export sector is higher than in the non-export sector due to international competition and foreign investment. Therefore, shifts the economic resources from the less productive to the more productive sector lead to higher economic growth.

Ram (1985), investigates the effect of exports on economic growth using the production function model and considers the exports as the productive input. He looked at data from 73 less developed countries (LDC) between the periods 1960-1970 and 1970-1977. He divided the data into two time periods in order to judge whether the importance of exports for economic growth increased during 1970s. He worked under the hypothesis that in the 1970s, the burden of petroleum imports may have made exports more important for economic growth than earlier. Also, in order to see if the impact of exports on growth differed from one group to another over 1960s and 1970s, the study focused on two groups; low-income LDC and middle-income LDC. The results of this study indicated that export growth is important for economic growth, both for low-income LDC and middle-income LDC. In addition the study concluded that while the importance of exports for economic growth increased everywhere during the 1970s, during the 1960s the impact of exports on growth was smaller in low income LDC than in the middle income LDC.

In a subsequent study, Ram(1987) tested the relationship between exports and economic growth for 88 LDCs using both time series and cross-sectional data for two different time periods 1962-1972 and 1973-1982. For the cross sectional study, he sorted the countries by income into a low income group and a middle income group, and then added government size (expenditure) as an explanatory variable.

One of the chief advantages of Ram's method was his use of the time series for a large sample size in order to estimate the export-growth linkage in each country. A positive relationship was found to exist between exports and economic growth in both the time series model and the cross-sectional one; additionally, this study showed the important influence of the government on economic growth.

Abu-Qarn and Abu-Bader (2004) examine the relationship between export growth and economic growth for nine Middle East and North Africa (MENA) countries using time series techniques. They used the following time periods: 1963-1999 for Algeria, Egypt, Israel, and Morocco; 1976-1999 for Iran; 1976-1998 for Jordan; 1960-1991 for Sudan; 1963-1998 for Tunisia; and 1966-1996 for Turkey. When they consider total exports, the unidirectional causality runs from exports to GDP only in the case of Iran. Yet when they consider manufactured exports, the results support the ELG hypothesis. The results show that not all exports contribute equally to the GDP. However, the results also support the importance of promoting manufactured exports to boost economic growth in the MENA countries.

Alkhuzaim (2005), examines the export-led growth (ELG) hypothesis for the Gulf Cooperation Council (GCC) countries using two models for the time period 1970-2001.The first model is based on Ram's 1985 model, while the second model is based on Feder's 1982 model. The results of cointegration test show that, with the exception of Saudi Arabia, there is a long run relationship between economic growth and both aggregate and disaggregate exports in the GCC countries. The results of causality test provide support for the ELG hypothesis in the long run only in the case of Oman, where aggregate exports Granger cause real GDP. The results obtained from investigating disaggregate exports showed that in regard to oil exports, a unidirectional causality from real GDP growth to oil exports was indicated in Kuwait, Saudi Arabia, and the United Arab Emirates while the reverse result was found in Oman. With regard to non-oil exports, the causality tests clearly indicate that causality runs from GDP growth to non-oil exports in the UAE, and reverse causality is found for Oman. Bidirectional causality was found in the long run in Saudi Arabia and Kuwait.

Merza (2007), investigates the relationship of two components of exports (oil exports and non-oil exports) with economic growth by examining the ELG hypothesis using annual time series data for the Kuwait economy over the period 1970-2004. The results of the cointegration test confirm the existence of the long run relationship among the three variables. The Granger test shows bidirectional causality between oil exports and economic growth, and a unidirectional causality from non-oil exports to economic growth. The causality results are consistent with the results reported by the ECM. He argues that, diversification of production and more focus on non-oil exports products may help the economy to benefit from comparative advantage.

According to the previous studies, I can conclude that for making appropriate policies to improve the economic growth in developing oil export based economies like Iran it is helpful and important to know about the effects of both oil exports and non-oil exports on economic growth in these economies. Therefore in this study I disaggregate total exports to oil exports and non-oil exports to investigate their separated effects on Iranian economic growth.

2.2 Literature on the relationship between government size and economic growth

There are some debates on the relationship between government size and economic growth. Some economists like, Landau (1983), Engen and Skinner (1991), F¨olster and Henrekson (2001), and Dar and AmirKhalkhali (2002) have found a negative relationship between government size and economic growth. According to them, expansion of government size can decrease the return of government expenditure and over-expanding government size will cause a crowding out effect to private investment. When government expenditure is expanding, the government will need more taxes to support these expenditures, but increases in taxes can damage the economy. Moreover, government expenditures can turn into inefficient expenditures which will cause an inappropriate allocation of the resources.

Another group of economists, like Ram (1986) and Kormendi and Meguire (1986) find a positive relationship between government size and economic growth. They indicate that government expenditure often provide the investment of public goods that will make better the investment environment. Moreover, expanding government size provides an insurance function to private property, and public expenditure can encourage private investment which will cause economic growth.

Table (1) shows the findings of some studies on the relationship between government size and economic growth.

TABLE 1
Summary of some studies on the relationship between government size and economic growth

Authors	Sign of the relationship	Econometric method	Countries
Ram (1986)	Positive	OLS	115 countries
Kormendi and Meguire (1986)	Positive	OLS	47 countries
Launda (1983)	Negative	OLS	96 developed countries
Engen and Skinner (1991)	Negative	2SLS	107 countries
Fölster and Henrekson (2001)	Negative	OLS	23 OECD countries and 7 developing countries
Dar and AmirKhalili (2002)	Negative	Random effect model	19 OECD countries

Vedder and Gallaway (1998) and Sheehey (1993) indicate that the existent inconsistency about the relationship between government size and economic growth is because of the nonlinear relationship between government size and economic growth.[7] The existence of a non-linear relationship between government expenditure and economic growth, has been first verified in endogenous growth models. Barro(1990), argues that different sizes of government can create two different effects on economic growth. In particular, an increase in taxes reduces growth rate through disincentive effects, but an increase in government spending raises marginal productivity of capital, which raises growth rate. He indicates that the second force is stronger when the government is small, and the first force becomes stronger when the government is large. Barro, claims that the size of government consumption relative to national output is optimal when its marginal product equals one(so-called Barro rule). Furthermore, based on empirical findings Barro discussed about an inverse U-shape curve showing the relationship between growth rate and government expenditure ratio.

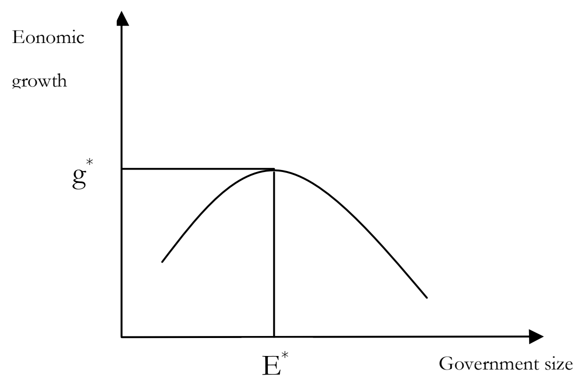
Heitger (2001) views increases in government size arising from increased consumption as constraints on growth, while increases in size that arise from government investment should be positive in their effect on growth. His central hypothesis is that government expenditures on core public goods (such as on the rule of law, internal and external security, etc.) have a positive impact on economic growth, but this positive impact of government tends to decline or even reverse if government further increases expenditures in a way that it also provides private goods. He indicates that there are two important reasons for a negative impact of excessive government spending on economic growth

[7] Sheehey (1993) uses data of cross countries and finds that while government size (government consumption expenditure/GDP) is smaller than 15%, government size and economic growth have a positive relationship, but when government size is larger than 15%, the relationship is negative. Giavazzi, Jappelli,&Pagano (2000) indicate the possibility that fiscal policy may have non-linear effects.

one is the fact that the necessary taxes reduce the incentives to work, to invest and to innovate, and the other fact is that government crowds out more efficient private suppliers.

Armey (1995) implements the Laffer curve to present the relationship between government size and economic growth. Armey argues that without government, a state of anarchy and low levels of output per capita will exist, because there is no rule of law, and no protection of property rights. Therefore, there is little incentive to save and invest, because the threat of expropriation exists. On the other hand, where all input and output decisions are made by government, output per capita is also low.[8] However, where there is a mix of private and government decisions on the allocation of resources, output should be larger. Accordingly, the output-enhancing features of government should be stronger when government is very small, and expansions in governmental size should be associated with expansions in output. Nevertheless, at some point growth-enhancing features of government should diminish and further expansion of government should no longer lead to output expansion. Armey infers that government size and economic growth have an inverse U shape as Fig. 1 shows.

FIGURE 1
The Armey Curve



Source: Armey, 1995.

Because of the inverse U shape, one can find the optimum government size that promotes the greatest economic growth rates (point E*).

Chao and Grubel (1998), indicates several reasons for the existence of the mentioned inverted U shape curve. First the law of diminishing returns to additional government expenditure exists and the additional withdrawal of

[8] As Vedder and Gallaway (1998) stress, the monopolisation of the allocation of resources and other economic decisions by government usually does not lead to sustained economic prosperity, as too much government stifles the spirit of enterprise and consequently lowers economic growth. In this context, the revealing should be the experience of former socialist and communist countries in Europe.

resources from the private sector more and more occurs at the cost of projects with ever-higher returns. Second, in order to finance the government expenditure, taxes should be increased, which reduce the private sector's incentives to work, save, invest, and take risks. Third, some of the spending programmes can also make disincentive effects if they lower the risk of economic life.[9] These effects change economic behavior of individuals, which decrease the effective supply of labor and entrepreneurship. As Chao and Grubel argue, all these forces reduce economic growth.

3 Overview of Iran economy

Holding 10% of the world's total proven oil reserves, Iran has the world's third largest petroleum reserves after Saudi Arabia and Canada, and the second largest gas reserves, following Russia. Iran also has the Middle East and North Africa region's second largest economy, after Saudi Arabia, and the second largest population, after Egypt. Nonetheless, Iran faces some important internal and external challenges. Internal challenges include the large dependence of government spending on oil export revenues and vulnerability to oil price fluctuations; high inflation and unemployment levels, reliance on gasoline imports to meet domestic energy needs, domestic economic mismanagement; and extensive economic inefficiency. The external problems are U.S. and U.N. sanctions against the Iranian nuclear program, which to some extent they have damaged the Iranian oil industry and consequently the Iran's ability to export the oil.

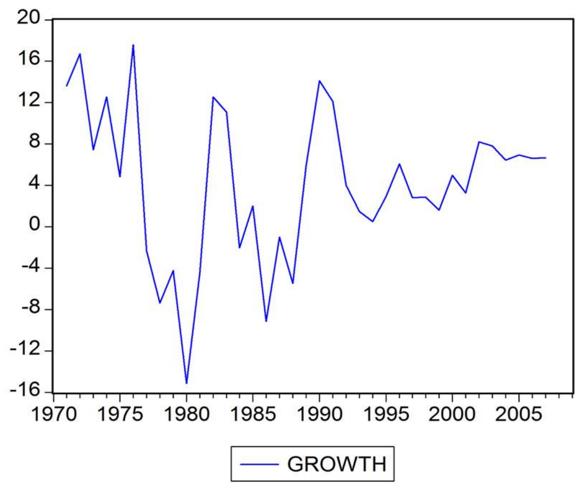
Iran-Iraq war (1980-1988) caused negative rates of real economic growth, decline in oil production and revenue, and high levels of inflation, while in 1960s and 1970s, Iran's economy had experienced real economic growth rates about 10%, one of the world's highest, along with growth in per capita income.

During the 1990s, Iranian government attempted to rebuild war-torn local production, attract international investment, enhance foreign relations, liberalize trade, and, more recently, redistribute wealth under a series of five-year economic plans. Because of these and also due to recovery in oil output, economic growth improved in the earlier part of 1990s, but the country faced a serious economic downturn in the latter part of the decade due to a drop in international oil prices.

Since 2000, Iran has experienced broad-based economic growth. However, despite high international oil prices in recent years, the contribution of the oil and gas sector to economic growth has been more modest. Iran's oil economy has been faced with high levels of inflation and unemployment, low levels of production and inadequate investment.

[9] For instance, social security programmes protecting workers from unemployment, illness, and retirement often cause them to change their behavior and reduce work-effort and savings as they are insured.

FIGURE 2
Plot of real GDP growth rate[10]



Source: CBI(2011) and author calculations

The unemployment rate remains high, reaching an estimated 11.8% in 2008. Iran has a young population and each year, about 750,000 Iranians enter the labor market for the first time, making pressure on the government to create new jobs.[11] Foreign direct investment (FDI) in Iran historically has been low relative to other countries in Middle East region due to a combination of political and structural factors. A stringent domestic regulatory environment and government inflexibility to allow foreign investment have led to low levels of FDI.

3.1 Exports

Iran's economy relies heavily on crude oil export revenues, representing about 80% of total export earnings. In 2008, Iran exported 2.5 million barrels of oil per day. Iran's net revenues from oil exports totaled $73 billion in that year. Iran exports primarily to Asian countries and European countries that are a part of the OECD. Top export markets for Iran are Japan, China, India, South Korea, and Italy.

While oil export revenues have grown in past years due to increases in oil prices, Iran's crude oil output has remained essentially flat. Iran faces with some problems for expanding its oil production. The oil industry faces a high rate of natural decline of mature oil fields and low oil recovery rates. It is believed that millions of barrels of oil are lost annually because of damage to

[10] Which is equal to annual percentage change in real GDP compared with previous year's real GDP.
[11] The emigration of young skilled and educated people continues to pose a problem for Iran. The IMF reported that Iran has the highest "brain drain" rate in the world.

reservoirs and these natural declines. Iran also has been plagued by aging infrastructure and old technology. Structural upgrades and access to new technologies, such as natural gas injections and other enhanced oil recovery efforts, have been limited by a lack of investment partly due to U.S. sanctions.[12] Despite its vast gas resources, Iran was a net importer of natural gas as late as 2005.

During the 1990s non-oil exports peaked in 1994/95, but, at US$4.5bn, they still amounted to only 30% of the value of oil revenue. The imposition of the overvalued "export rate" in 1995 undermined the competitive position of nonoil exporters, whose productive capacity was also damaged by tight controls on imports. As a result, non-oil export earnings fell over the following years, reaching a low of just US$2.9bn in 1997/98. Earnings have since picked up as the exchange-rate regime has been reformed, reaching US$6.8bn in 2003/04. The sector is expected to show further steady growth, particularly as petrochemicals and other industrial exports grow, displacing traditional goods, such as carpets, as the main non-oil revenue earners. This will add some stability to overall export earnings, although crude oil revenue will remain the key component, and therefore volatility will remain a feature of Iran's export profile.[13]

TABLE 2
Main composition of exports (% of total exports)

Year	2003	2004	2005	2006	2007
Exports fob					
Oil & gas	80.74	82.86	83.38	82.23	83.94
Petrochemicals	4.08	3.95	4.24	3.76	3.03
Carpets	1.58	1.11	0.72	0.54	0.44
Fresh & dried fruits	2.44	1.63	1.86	2.06	2.13
Others	11.40	10.48	9.83	11.38	10.44

Source: Central Bank of Iran and author calculations.

During the past years Iran's trading relations have shifted from western countries to the developing world as western countries have supported some sanctions against the Iranian nuclear program.

[12] EIA, "Country Analysis Briefs: Iran," updated January 2010.
[13] Economist Intelligence Unit, 2008, country profile.

TABLE 3
Major export markets for Iran, 2009 (% of total)

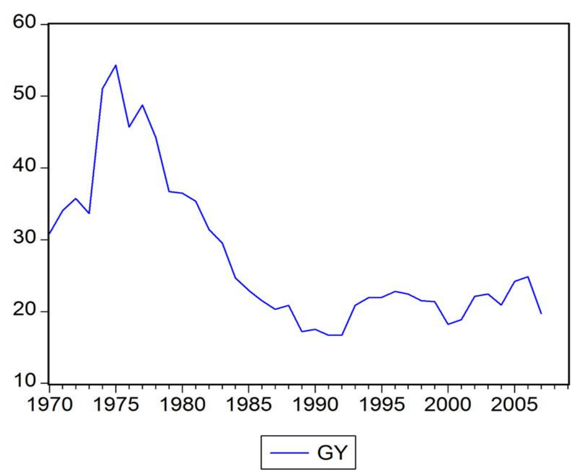
Country	Total Trade (%)	Exports (%)	Country	Total Trade (%)	Exports (%)
Argentina	0.85	0.008	Japan	13.41	19.42
Brazil	0.90	0.019	Korea	8.79	8.75
China	19.13	20.84	Russia	2.89	0.42
Taiwan	3.73	5.36	Singapore	1.38	1.69
France	4.35	3.70	Spain	3.46	4.76
Germany	5.02	0.82	South Africa	2.56	3.97
India	10.01	14.12	Turkey	6.95	8.73
Italy	6.30	6.17	UAE	10.18	1.14

Source: IMF, Direction of Trade Statistics and author calculations.

3.2 Government expenditures

The petrodollars are the main source of financing government expenditures and imports of products. Overambitious development plans following the price explosion of 1973 served to concentrate yet more power in the hands of the public sector, and the nationalisation of many large firms in the aftermath of the revolution, and restructuring for the war effort in the 1980s, compounded the process.

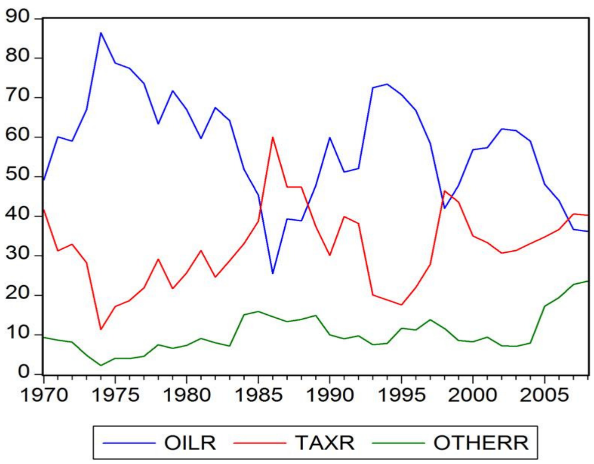
FIGURE 3
Plot of government size (G/Y)
(defined as the ratio of government total expenditures to GDP)



Source: Central Bank of Iran and author calculations.

Oil revenue provides some 80-85% of export earnings and anywhere between40% and 80% of government revenue. Figure 4 shows the proportions of government revenues from oil, taxes and other resources with respect to total government revenue.

FIGURE 4
Proportions of government revenues from oil (OILR), taxes (TAXR) and other resources (OTHERR)



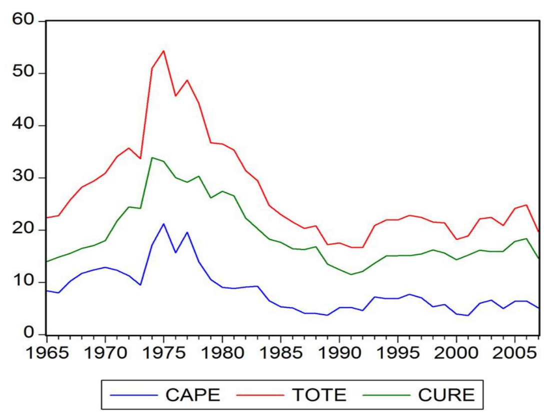
Source: CBI (2011) and author calculations

The Iranian government spending can be divided into current and capital expenditures. The current expenditures are for maintaining the current capacities of government administration while the capital expenditures aim to expand the current capacities of the government. The current expenditures themselves are divided into: expenditures on goods and services such as wage bills of government employees, employer contribution including social security and pensions, interest payment, subsidies and all other payments which relate to the management of government functions in military, health, education, cultural, and social activities.

The current expenditures are inflexible and sticky downward, because they are needed to manage and maintain new investments which are financed by capital expenditures. In the case of positive oil markets, the current expenditures also go up because of the larger size of government. When oil prices go down, however, the government is not able reduce the size of its activities immediately, leading to a significant budget deficit. By contrast, capital or development expenditures are sensitive to fluctuation of oil revenues. The Iranian government in development plans wanted to reduce the dependence of current expenditures to oil revenues by financing these costs through nonoil sources such as taxes. But because of the windfall oil revenues, there were not sufficient incentives for doing that. Government cannot adjust its current spending easily in the case of a negative oil market. This makes budget deficits a critical issue for the government. It is then important to consider a reform of the tax system more seriously.(Farzanegan, 2011).

Figure 5 shows total, current and capital expenditures of the Iranian government divided by GDP.

FIGURE 5
Ratios of total (TOTE), current (CURE) and capital (CAPE) expenditures with respect to GDP



Source: CBI (2011) and author calculations

4 Methodology and Modeling

4.1 Specification of models

According to Ram (1986) we assume that the economy consists of two broad sectors, the government sector(G) and the nongovernment sector(C). Moreover according to another study from Ram (1985) we take the most popular model of the time and apply it to the relationship between exports and economic growth. Like him we treat exports as a type of indirect input.

If output in each sector of the economy depends on the inputs of labor(L), capital(K), and exports(X) and if, in addition, output ("size") of the government sector exercises an "externality" effect on output in the other sector(C), production functions for these two sectors can be written as

$$C = C(L_c, K_c, X_c, G), \quad (1)$$

$$G = G(L_g, K_g, X_g), \quad (2)$$

Where subscripts denote sectoral inputs. If the total inputs are given,

$$L_c + L_g = L, \quad (3a)$$

$$K_c + K_g = K, \quad (3b)$$

$X_c+X_g=X.$ (3c)

The total output (Y) is just the sum of outputs in the two sectors, and thus

$C+G=Y.$ (3d)

Following Ram(1986), we assume that the relative factor productivity in the two sectors differ; in particular,

$G_L/C_L = G_K/C_K = G_X/C_X=(1+\delta),$ (4)

Where uppercase subscripts denote partial derivatives of the functions with respect to subscripted input. The sign of δ shows which sector has higher marginal factor productivity, and a positive δ implies higher input productivity in the government sector. By manipulating the production functions, and using (3) and (4), the following approximation for an aggregate growth equation can be derived:

$$\dot{Y} = \alpha\dot{L} + \beta\dot{K} + \gamma\dot{X} + [(\delta/(1+\delta)) - \theta]\dot{G}(G/Y) + \theta\dot{G}, \qquad (5)$$

or, writing δ' for δ/(1 + δ),

$$\dot{Y} = \alpha\dot{L} + \beta\dot{K} + \gamma\dot{X} + (\delta' - \theta)\dot{G}(G/Y) + \theta\dot{G}, \qquad (5')$$

Where a dot over the variable indicates its rate of growth. In this case, α is the elasticity of nongovernment output C with respect to L; β is the elasticity of nongovernment output C with respect to K, γ is the elasticity of nongovernment output C with respect to X; and θ equals $C_G(G/C)$, and is the elasticity of nongovernment output with respect to G.[14]

If θ is believed to be a constant parameter across the sample observations, equation (5) provides an econometric specification that can easily yield estimates of δ and θ. According to Ram(1986) and regarding to the purpose of this study, I suppose in a special case δ'=θ, so (5) changes to

$$\dot{Y} = \alpha\dot{L} + \beta\dot{K} + \gamma\dot{X} + \theta\dot{G} \qquad (6)$$

In (6), as in (5), θ gives only the externality effect of government size, and not the total effect. However, since (6) is premised on δ'=θ, estimate of θ also yields an estimate of δ' (and of δ), and therefore of the total effect, provided the constraint δ'=θ is valid. An important point to note is that collinearity between G and $\dot{G}(G/Y)$ might lower precision in the estimation of (5), so it is important that (6) does not have that drawback.[15]

Moreover, as the studies by Rubinson (1977) and Landau (1983) indicate, specifications that include a regressor like G/ Y seem to be widely used for

[14] More details about the derivations, and the interpretation of the models and the parameters, are in Feder (pp. 61-67).
[15] More details about this discussion, and the interpretation of the models and the parameters, are in Ram(1986).

assessing the impact of government size on economic growth or development. Therefore, we can use the following equation

$$\dot{Y} = \alpha\dot{L} + \beta\dot{K} + \gamma\dot{X} + \lambda(G/Y) \quad (7)$$

Or writing (g) for (G/Y);

$$\dot{Y} = \alpha\dot{L} + \beta\dot{K} + \gamma\dot{X} + \lambda g \quad (7')$$

As discussed in the literature review, recent studies have empirically verified and reformulated a complex and nonlinear relationship between government spending and growth.
In this study we will include the government size (g=G/Y) inside the equation (7) in a quadratic form (as suggested by Armey (1995) and others). So, we can use the following equation instead of equation $(7')$:

$$\dot{Y} = \alpha_0 + \alpha_1\dot{L} + \alpha_2\dot{K} + \alpha_3\dot{X} + \alpha_4 g + \alpha_5 g^2 \quad (8)$$

Where α_0 is the intercept; (g=G/Y) is the relative size of government defined as the ratio of government expenditures to gross domestic product, and (g^2) is the square of g.

The positive sign on the linear term, g, is for displaying the beneficial effects of government spending on output, while the negative sign for the squared term indicates that the variable measures any adverse effects which is caused by increases in government size. Since the squared term increases in value faster than the linear term, the presence of negative effects from government spending eventually will exceed the positive effect, producing the downward-sloping portion of Figure 1.

Both aggregate export and disaggregate export will be examined in this study. Iranian economy is an oil- export based economy; thus it is important to closely examine the relationship between oil exports and GDP. Therefore we will analyze the effect of disaggregate exports on the GDP by dividing exports into two categories: oil and non-oil exports. The following equations will be used:

$$\dot{Y} = \beta_0 + \beta_1\dot{L} + \beta_2\dot{K} + \beta_3\dot{OX} + \beta_4 g + \beta_5 g^2 \quad (9)$$

$$\dot{Y} = \gamma_0 + \gamma_1\dot{L} + \gamma_2\dot{K} + \gamma_3\dot{NX} + \gamma_4 g + \gamma_5 g^2 \quad (10)$$

Where (OX) represents the export of oil products and (NX) represents the export of non-oil products.

Oil export growth rate $(\dot{OX})$ is a function of the oil price growth rate $(\dot{OP})$ and the growth rate of the amount of oil exports in terms of barrels $(\dot{BOX})$. Therefore:

$$\dot{OX} = B\dot{OX} + \dot{OP} \qquad (11)$$

With substituting equation (11) in equation (10), we have the following equation:

$$\dot{Y} = \lambda_0 + \lambda_1 \dot{L} + \lambda_2 \dot{K} + \lambda_3 B\dot{OX} + \lambda_4 \dot{OP} + \lambda_5 g + \lambda_6 g^2 \qquad (12)$$

4.2 The ARDL Cointegration Approach

In this study the autoregressive distributed lag (ARDL) method developed by Pesaran, Shin, and mith (2001) will be used to establish cointegration relationships among the variables using the Microfit 4.0 for Windows software (Pesaran & Pesaran, 1997).

The autoregressive distributed lag (ARDL) approach is a more statistically significant approach for determining cointegrating relationships in small samples, while the Johansen cointegration techniques require larger samples for the results to be valid (Ghatak and Siddiki, 2001). A further advantage of the ARDL is that while other cointegration techniques require all of the regressors to be integrated of the same order; the ARDL can be applied irrespective of their order of integration. It thus avoids the pre-testing problems associated with standard cointegration tests (Pesaran et al., 2001). Moreover, while the conventional cointegration method estimates the long run relationships within a context of a system of equations, the ARDL method employs only a single reduced form equation (Pesaran and Shin, 1995). Furthermore, the ARDL method avoids the large number of specification to be made in the standard cointegration test. These include decisions regarding the number of endogenous and exogenous variables (if any) to be included, the treatment of deterministic elements, as well as the optimal number of lags to be specified. With the ARDL, it is possible that different variables have different optimal lags, which is impossible with the standard cointegration test.

The ARDL method involves two steps. First, the existence of a long-run relationship among the variables in the model is determined. At this stage, the calculated F-statistic is compared with the critical value tabulated by Pesaran et al. (2001). The null hypothesis of no cointegration will be rejected if the calculated F-statistic is greater than the upper bound. If the computed F-statistic falls below the lower bound, then the null hypothesis of no cointegration cannot be rejected. Finally, the result is inconclusive if it is between the lower and the upper bound.

Next we estimate the long-run coefficients of the ARDL model. One of the more important issues in applying ARDL is choosing the order of the distributed lag function. Pesaran and Smith (1998) argue that the SBC should be used in preference to other model specification criteria because it often has more parsimonious specifications: our small data sample in the current study further supports this point.

The determination of an appropriate and correctly specified ARDL model is based on test criteria such as the Schwarz–Bayesian criterion (SBC), adjusted

R^2 and various diagnostic tests for econometric problems. The unrestricted error correction model is directly derived from the ARDL model. The ARDL model is a vector autoregressive (VAR) model. Hence, the unrestricted error correction model is a re-parameterisation of theVAR model (Lewis & MacDonald, 2002; Pesaran et al., 2001).

In addition, in this study I will use the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of the recursive residuals (CUSUMQ) tests to consider the stability of the models.

4.3 Data, Models and Hypotheses tested

In this study I will use data from 1973 to 2008. The data has been collected from the Central Bank of Iran (CBI), and the Energy Information Administration (EIA). In this study, instead of a growth rate of the variables, the logs of level of the variables have been used. The regression coefficient on a logarithmic variable can be interpreted as an elasticity, that is, as the rate of the percentage change in the dependent variable for each one percent change in the independent variable. For investigating the long-run relation between our variables we will use the ARDL approach to estimate the following equations separately (L represents the Log):

Model (I):

$$LY = \alpha_0 + \alpha_1 LL + \alpha_2 LK + \alpha_3 LTX + \alpha_4 Lg + \alpha_5 (Lg)^2 + \alpha_6 D80 + \alpha_7 D88 \tag{13}$$

Model (II):

$$LY = \lambda_0 + \lambda_1 LL + \lambda_2 LK + \lambda_3 LBOX + \lambda_4 LOP + \lambda_5 Lg + \lambda_6 (Lg)^2 + \lambda_7 D80 + \lambda_8 D88 \tag{14}$$

Model (III):

$$LY = \gamma_0 + \gamma_1 LL + \gamma_2 LK + \gamma_3 LNX + \gamma_4 Lg + \gamma_5 (Lg)^2 + \gamma_6 D80 + \gamma_7 D88 \tag{15}$$

In the first equation, I have used the log of total exports (LTX),while in the second equation the log of oil prices (LOP) and the log of oil exports in terms of barrels (LBOX) have been used, and finally in the third equation, I have applied the log of non-oil exports LNX (as discussed before).

In this study, the dependent variable is logarithm of real gross domestic product (LY) as a proxy for economic growth.

Export is said to be an important catalyst in improving the economic growth. Balassa (1985) argued that in general the production of export goods is focused on those economic sectors which are already more efficient. Therefore, export expansion helps to concentrate investment in these sectors, which in turn increase the overall total productivity of the economy. Thus, export growth may also release the foreign exchange restriction, allowing capital goods to be imported to boost economic growth. So a positive relationship between exports and economic growth in each of the three models is expected to be found, (α_3,λ_3,γ_3>0).

The proxy used for oil prices is the price of light Iranian oil (LOP), which is expected to have positive effect on economic growth, (λ_4>0).

The relative size of government (g=G/Y) is defined as the ratio of government expenditures to gross domestic product. According to Armey(1995) and others, it is hypothesized that the impact of government size on economic growth follows a quadratic function with an inverted U-shape;$(Lg)^2$ is the square of (Lg). Initially very small relative size of government hampers economic growth while medium-sized government accelerates economic growth through the provision of basic infrastructure and improved legal framework. Beyond a certain level, a large government size hampers economic growth through bureaucratic delays and slow implementation of policies (Anaman,2004). According to Armey curve it is expected that (Lg) to have positive impact on economic growth and $(Lg)^2$ to have negative impact on economic growth, ($\alpha_4,\lambda_5,\gamma_4>0$, $\alpha_5,\lambda_6,\gamma_5<0$).

Labor force (LL) is considered to play a vital role in export-growth relationship. According to the neoclassical theory, as the input (labor and capital) increases total output will increase. It is therefore expected that labor force will have a positive relationship with economic growth, ($\alpha_1,\lambda_1,\gamma_1>0$).

Net capital stock (LK) has been used as a proxy for capital. The neoclassical theory specifies that an increase in capital as an input in production leads to increases in output. It is therefore expected that net capital stock will have a positive relationship with economic growth, ($\alpha_2,\lambda_2,\gamma_2>0$).

To capture the effect of the Iran/Iraq war period (1980-1988) as an important structural break in Iran's economy two intercept shift dummy variables (D80) and (D88) have been included in the model which D80 is equal to 1 if (t>1980) and zero otherwise. D88 is equal to 1 if (t>1988) and zero otherwise. After the Islamic revolution of Iran and specially after the starting of war with Iraq, the Iranian economy was faced with some serious restrictions which seem they have affected the economic growth negatively, ($\alpha_6,\lambda_7,\gamma_6<0$). On the other hand, after the end of the war, Iranian government started some programs to reconstruct the ruins which had remained from the war, Expatriate Iranians, who returned in large numbers after the war with Iraq, funnelled most of their funds into property. This fuelled a boom in the construction sector, particularly as private efforts to rebuild after the war were matched by the government's push for hurried reconstruction, and we expect they have affected the growth positively ($\alpha_7,\lambda_8,\gamma_7>0$).

5 Empirical results

5.1 Unit root test

Even though the ARDL framework does not require pre-testing variables to be done, the unit root test could convince us whether or not the ARDL model should be used. We use the ADF test (Dickey and Fuller, 1981) in order to establish the order of integration of the variables in our study.

As illustrated in table 4, all of the variables are non-stationary in their level at ten percent, five percent and one percent confidence levels. The results show that ADF t-values for all nine variables are greater than critical values; therefore, the series are nonstationary. The null hypothesis of a unit root in first difference is rejected for these variables at 5% level of confidence. Then they are integrated of order one, i.e. I(1).

TABLE 4
ADF Unit Root Test

Variables	Level	First difference
LY	-1.104	-3.47**
LL	-0.504	-3.047**
LK	0.396	-3.106**
LTX	-1.044	-7.34***
LBOX	-2.49	-4.57***
LNX	0.656	-4.53***
LOP	-2.244	-6.37***
Lg	-1.01	-5.35***
$(Lg)^2$	1.01	-5.35***

***: Null hypothesis rejection at 1%

**: Null hypothesis rejection at 5%

5.2 Estimation of the model (I)

As discussed before, in model(I), I use the total exports (LTX) in growth equation. In order to obtain robust results, the ARDL approach has been utilized to establish the existence of long-run and short-run relationships. ARDL is extremely useful because it allows us to describe the existence of an equilibrium/relationship in terms of long-run and short-run dynamics without losing long-run information. The maximum order of the lags in the ARDL model(I) has been chosen1.The error correction version of the ARDL model(I) is given by

$$LY = a_0 + b_1 DLY_{t-1} + b_2 DLL_{t-1} + b_3 DLK_{t-1} + b_4 DLTX_{t-1} + b_5 DLg_{t-1} + b_6 D(Lg)^2_{t-1} + \\ \delta_1 LY_{t-1} + \delta_2 LL_{t-1} + \delta_3 LK_{t-1} + \delta_4 LTX_{t-1} + \delta_5 Lg_{t-1} + \delta_6 (Lg)^2_{t-1} + u_t \tag{16}$$

The first part of the equation with $b_1,\ldots,b_6$ represents the short-run dynamics of the model whereas the parameters $\delta_1,\ldots,\delta_6$ represent the long-run relationship. The hypothesis that I will be testing is the null of 'non-existence of the long-run relationship' defined by

$$H_0 : \delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = \delta_6 = 0$$

Against

$$H_1 : \delta_1 \neq 0, \delta_2 \neq 0, \delta_3 \neq 0, \delta_4 \neq 0, \delta_5 \neq 0, \delta_6 \neq 0$$

The F-statistics for testing the joint null hypothesis that coefficients of these level variables are zero (namely there exists no long-run relationship between them) by assuming each of the variables as the dependent variable are given in table 5.

TABLE 5
Results of F-statistic for considering the existence of long-run relationship for model(I)

Dependent variable/…	F-statistic	Prob	Existence of long-run relationship
F(LY/LL,LK,LTX,Lg,$(Lg)^2$)	3.84	0.012	Accepted
F(LL/LY,LK,LTX,Lg,$(Lg)^2$)	0.91	0.513	Rejected
F(LK/LL,LY,LTX,Lg,$(Lg)^2$)	1.97	0.124	Rejected
F(LTX/LL,LK,LYLg,$(Lg)^2$)	4.23	0.009	Accepted
F(Lg/LL,LK,LTX,LY,$(Lg)^2$)	3.045	0.031	–
F($(Lg)^2$/LL,LK,LTX,Lg,LY)	3.15	0.027	–
Lower band of critical value at 5% level:2.649		Upper band of critical value at 5% level:3.805	

The above test results suggest that there exists a long-run relationship between our variables, and the variables LL, LK, LTX, Lg and $(Lg)^2$, can be treated as the long-run forcing variables for the explanation of LY.

The results of estimated optimal ARDL growth model are shown in table 6. The optimality of the model is determined using the Schwarz–Bayesian criterion. The optimal number of lags for each of the variables is shown as ARDL (1,0,1,1,0,0). Based on the various diagnostic tests, this model was good. There was absence of significant autocorrelation or heteroscedasticity based on various test results, which are also reported in Table 6. The error term was normally distributed based on the Jarque–Bera test thus making the standard t and F tests of the estimated equation theoretically valid. The power of the model was high given the very high values of the R^2, adjusted R^2 and F value.

TABLE 6
Results of estimated optimal ARDL growth model(I)
based on the Schwarz–Bayesian criterion

ARDL(1,0,1,1,0,0) based on Schwarz Bayesian Criterion Dependent Variable: LY			
Regressor	**coefficient**	**T-Ratio**	**prob**
LY(-1)	0.507	3.88	0.001
LL	0.24	1.73	0.098
LK	1.13	3.22	0.004
LK(-1)	-0.99	-3.83	0.001
LTX	0.054	2.48	0.021
LTX(-1)	0.040	1.71	0.102
Lg	1.3	2.06	0.051
$(Lg)^2$	-0.202	-2.07	0.05
Intercept	-1.21	-1.307	0.205
D80	-0.009	-0.28	0.78
D88	0.04	1.67	0.11
R^2	0.99	Adjusted R^2	0.99
F-stat	440.34		
Significance level of autocorrelation test based on Lagrange multiplier (LM) test			0.54
Significance level of Jarque-Bera test of normality of the error term			0.22
Significance level of the LM heteroscedasticity test			0.074

The estimated long-run relationships derived from the optimal ARDL model are reported in table 7. The results show that coefficients for all of the variables have the correct signs as predicted by theory and hypothesis. These results indicated that LL, LTX, Lg ,$(Lg)^2$, were statistically significant in influencing LY at the 10% level of significance. Economic growth has been influenced by total exports, strongly. The estimated coefficient of total export entails that 10 percent increase in total export will lead to 1.9 percent increase in real GDP in the long term.

Both government size variables Lg and $(Lg)^2$ are significant and have the correct signs (according to Armey curve) confirming the hypothesised averted U-shape of government size impact on economic growth. Very high government sizes led to lower economic growth while moderate government sizes led to increased growth. Differentiating the equation with respect to Lg, the optimal government size based on maximizing economic growth, was determined as 24.41. Total government expenditures of the order of 24.41% of GDP maximize economic growth ceteris paribus.

$$\left(\frac{\partial LY}{\partial Lg}\right)_{long-run} = 0 \Rightarrow Lg = 3.195 \Rightarrow g = (G/Y) = 24.41$$

This figure is a little bigger than the size of government in some ending years of the period of this study, but it is smaller than the average amount of government size over the period of my study which is equal to 27.65. According to the figure 3, Iranian government has experienced larger sizes in 1970's and 1980's but after that there were some attempts to reduce the government size.

The labor force and net-capital account variables influenced economic growth in the expected positive direction. However, parameter estimate of LK was not statistically significant in the long-run, may be due to the limited sample size of the data.

TABLE 7
Results of estimated long-run relationship derived from the optimal ARDL growth model(I)

Regressor	coefficient	T-Ratio	prob
LL	0.48	1.95	0.06
LK	0.29	1.083	0.29
LTX	0.19	2.52	0.019*
Lg	2.62	1.86	0.076
$(Lg)^2$	-0.41	-1.85	0.078
Intercept	-2.47	-1.54	0.137
D80	-0.018	-0.29	0.77
D88	0.085	1.51	0.144

For D80 and D88 the coefficients have their expected signs but they are not significant. The estimated error correction model selected using SBC is given in table 8. With the exception of the coefficients of D80 all the other coefficients are statistically significant or closely to be significant (coefficients of (dLL) and (dD88)). Unlike the long-run in the short- run, the capital (LK) has significantly affected the economic growth. The magnitude of impacts of the variables which are related to government size (Lg and $(Lg)^2$) and also total exports(LTX),in the long-run are much higher than those of the short-run impacts, indicating that the impacts of change in government size and total exports are much stronger in the long-run.

The error correction term indicates the speed of the equilibrium restoring adjustment in the dynamic model. The ECM coefficient shows how quickly/slowly variables return to equilibrium and it should have a statistically significant coefficient with a negative sign. Bannerjee et al (1998) holds that a highly significant error correction term is further proof of the existence of a stable long-term relationship.

The error correction coefficient, estimated at -0.49 is statistically highly significant, has a correct sign and suggests a relatively high speed of convergence to equilibrium (suggesting that deviation from the long-term GDP path is corrected by 0.49 percent over the following year). The larger the error correction coefficient (in absolute value) the faster will be the economy's return to its equilibrium, after an exogenous shock.

TABLE 8
Error Correction Representation for the selected ARDL-Model(I)

ARDL (1,0,1,1,0,0) based on Schwarz Bayesian Criterion Dependent Variable: dLY			
Variables	**Coefficients**	**t-Values**	**Prob-Values**
dLL	0.24	1.73	0.097
dLK	1.13	3.22	0.004
dLTX	0.054	2.48	0.021
dLg	1.3	2.06	0.05
$d(Lg)^2$	-0.202	-2.07	0.049
d(INTP)	-1.21	-1.31	0.204
dD80	-0.009	-0.28	0.78
dD88	0.042	1.67	0.107
ecm(-1)	-0.49	-3.76	0.001
R-Squared= 0.85		Akaike Info Criterion= 16.446	
Adjusted R^2= 0.78		Schwarz Bayesian Criterion=58.54	
Durbin-Watson Stat= 1.84		F- Statistic = 15.38	

The underlying ARDL equation also passes all the diagnostic tests that are automatically computed by Microfit.

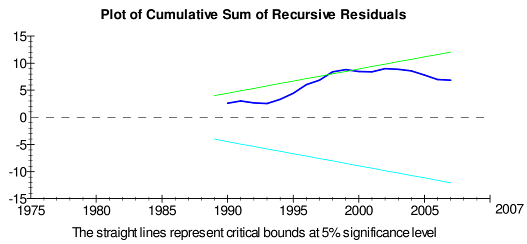
The optimum government size in the short run for the model(I) can be calculated as following:

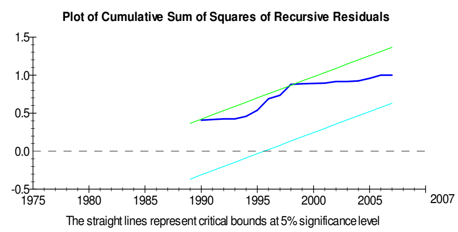
$$(\frac{\partial LY}{\partial Lg})_{short-run} = 0 \Rightarrow Lg = 3.2178 \Rightarrow g = (G/Y) = 24.97$$

The comparison of short run and long run results for the optimum size of the government indicates that in the long run the size of the government should be reduced.

Finally, the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of the recursive residuals (CUSUMSQ) tests were applied to test for parameter constancy. Figure 6 plots the CUSUM and CUSUM of squares statistics for Eq. (16). The results generally indicate the absence of any instability of the coefficients during the investigated period because the plots of the two statistics are confined within the 5% critical bounds pertaining to the parameter stability.

FIGURE 6
Plots of CUSUM and CUSUMQ statistics for coefficients Stability Tests for model(I)





5.3 Estimation of the model (II)

In the model (II), we use the oil prices (LOP) and the amount of oil exports in terms of barrels (LBOX), as discussed before. The ARDL approach has been used to establish the existence of long-run and short-run relationships. After considering, I choose 2 as the maximum order of lags in the ARDL model and estimate for the period of 1973-2008. The error correction version of the ARDL model in our variables is given by

$$\begin{aligned} DLY &= a_0 + \sum_{i=1}^{2} b_i DLY_{t-i} + \sum_{i=1}^{2} c_i DLL_{t-i} + \sum_{i=1}^{2} d_i DLK_{t-i} + \sum_{i=1}^{2} e_i DLBOX_{t-i} + \sum_{i-1}^{2} f_i DLOP_{t-i} + \sum_{i=1}^{2} h_i DLg_{t-i} + \\ & \sum_{i=1}^{2} m_i D(Lg)^2_{t-i} + \delta_1 LY_{t-1} + \delta_2 LL_{t-1} + \delta_3 LK_{t-1} + \delta_4 LBOX_{t-1} + \delta_5 LOP_{t-1} + \delta_6 Lg_{t-1} + \delta_7 (Lg)^2_{t-1} + u_t \end{aligned} \tag{17}$$

At the first step the null hypothesis of 'non-existence of the long-run relationship' will be tested which is defined by

$$H_0 : \delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = \delta_6 = \delta_7 = 0$$

Against

$$H_1 : \delta_1 \neq 0, \delta_2 \neq 0, \delta_3 \neq 0, \delta_4 \neq 0, \delta_5 \neq 0, \delta_6 \neq 0, \delta_7 \neq 0$$

The calculated F-statistics for the cointegration test with considering each of the variables as the dependent variable is displayed in table 9.

TABLE 9
Results of F-statistic for considering the existence of long-run relationship for model (II)

Dependent variable/…	F-statistic	Prob	Existence of long-run relationship
F(LY/LL,LK,LBOX,LOP,Lg,$(Lg)^2$)	4.54	0.02	Accepted
F(LL/LY,LK,LBOX,LOP,Lg,$(Lg)^2$)	1.6	0.24	Rejected
F(LK/LL,LY,LBOX,LOP,Lg,$(Lg)^2$)	36.65	0.000	Accepted
F(LBOX/LL,LK,LY,LOP,Lg,$(Lg)^2$)	17.34	0.000	Accepted
F(LOP/LL,LK,LY,LBOX,Lg,$(Lg)^2$)	3.032	0.062	–
F(Lg/LL,LK,LBOX,LOP,LY,$(Lg)^2$)	9.13	0.003	Accepted
F($(Lg)^2$/LL,LK,LBOX,LOP,Lg,LY)	9.98	0.001	Accepted
Lower band of critical value at 5% level:2.47		Upper band of critical value at 5% level:3.64	

The above test results reject the null hypothesis of no cointegration at 5%, and indicates that variables LL, LK, LBOX,LOP, Lg and $(Lg)^2$, can be treated as the long-run forcing variables for the explanation of LY.

The results of the estimated optimal ARDL growth model are shown in Table 10. The optimal number of lags for each of the variables is shown as ARDL (1,0,1,0,0,0,0). Based on the various diagnostic tests, this model is good.

TABLE 10
Results of estimated optimal ARDL growth model(II) based on the Schwarz–Bayesian criterion

ARDL(1,0,1,0,0,0,0) based on Schwarz Bayesian Criterion Dependent Variable: LY			
Regressor	**Coefficient**	**T-Ratio**	**Prob-Values**
LY(-1)	0.46	4.32	0.000*
LL	0.037	0.23	0.82
LK	1.59	5.18	0.000*
LK(-1)	-1.174	-4.99	0.000*
LBOX	0.068	3.34	0.003*
LOP	0.057	2.93	0.008*
Lg	1.97	3.24	0.004*
$(Lg)^2$	-0.31	-3.27	0.004*
Intercept	-3.36	-3.56	0.002*
dD80	-0.068	-2.17	0.041*
dD88	0.80	3.38	0.003*
R^2	0.99	Adjusted R^2	0.99
F-stat	518.48		
Significance level of autocorrelation test based on Lagrange multiplier (LM) test			0.102
Significance level of Jarque-Bera test of normality of the error term			0.98
Significance level of the LM heteroscedasticity test			0.102

Table 11 shows the long-run coefficients of the variables under investigation. All of the variables have their expected signs. These results indicated that LK, LBOX, LOP,Lg ,$(Lg)^2$, D80 and D88 were statistically significant in influencing

LY in 5% level of significance. As expected for Iran, economic growth was strongly influenced by oil prices and real amount of oil exports in terms of barrels. The estimated coefficient of oil prices and oil exports in terms of barrels entail that 10 percent increase in oil prices and oil-exports in terms of barrels will respectively lead to 1.06 and 1.27 percent increase in real GDP in long term. These imply that both increases in oil prices and improvement of the ability of economy for exporting more oil barrels can cause positive and significant effects on Iranian economic growth.

TABLE 11
Results of estimated long-run relationship derived from the optimal ARDL growth model(II)

Regressor	coefficient	T-Ratio	prob
LL	0.068	0.233	0.817
LK	0.79	3.34	0.003*
LBOX	0.127	2.83	0.01*
LOP	0.106	2.49	0.021*
Lg	3.66	2.83	0.01*
$(Lg)^2$	-0.58	-2.82	0.01*
Intercept	-6.24	-3.94	0.001*
D80	-0.13	-2.25	0.035*
D88	0.15	2.75	0.012*

The variables which are related to the government size are significant and have the correct signs; Lg has positive sign and $(Lg)^2$ has negative sign, confirming the hypothesis averted U-shape form impact of government size on economic growth. It implies that very high government sizes and very small government sizes led to negative economic growth while moderate government sizes led to positive growth. Optimal government size based on maximizing economic growth, was determined as 23.44, which is very close to the figure we calculated for model (I). Probably this is because the oil exports comprise a big portion of Iranian total exports, so by using oil exports instead of total exports, we could obtain close amounts for the optimal size of government. Therefore total government expenditures of the order of 23.44% of GDP in the model (II) maximize economic growth ceteris paribus.

$$\left(\frac{\partial LY}{\partial Lg}\right)_{long-run} = 0 \Rightarrow Lg = 3.15 \Rightarrow g = (G/Y) = 23.441$$

The labor force and net-capital stock variables influenced economic growth in the expected positive direction. The parameter estimate of LL was not statistically significant in the long-run, and regarding to very small amount of its coefficient, maybe this can be attributed to the low productivity of labor force in Iran or the limited sample size of the data. According to the long-run results, 10% increase in net-capital stock has led to 7.9 percent increase in real GDP. It implies that attracting both foreign and domestic investment for developing the key industries can be an important factor for fueling the economic growth in Iran. The negative coefficient of D80 and positive coefficient of D88 are strongly significant. This implies that the 8year's war with Iraq has hampered economic growth, while stopping the war and starting some economic programs to revive the economy have affected the growth positively.

The results of the error correction model for economic growth in the second model are presented in table 12. All of the coefficients have the expected signs. Moreover, except dLL, other variables are statistically significant. The magnitude of impacts of the variables which are related to government size (Lg and $(Lg)^2$) and also oil price(LOP) and oil exports amount (LBOX), in the long-run are much higher than those of the short-run impacts, indicating that the impacts of change in government size, oil prices and amount of oil exports are much stronger in the long-run.

We apply a number of diagnostic tests to the ECM, finding no evidence of serial correlation, heteroskedasticity and ARCH (Autoregressive Conditional Heteroskedasticity) effect in the disturbances. The model also passes the Jarque-Bera normality test which suggests that the errors are normally distributed.

TABLE 12
Error Correction Representation for the selected ARDL-Model (II)

ARDL (1,0,1,0,0,0,0) based on Schwarz Bayesian Criterion
Dependent Variable: dLY

Variables	Coefficients	t-Values	Prob-Values
dLL	0.037	0.23	0.82
dLK	1.6	5.183	0.000
dLBOX	0.07	3.34	0.003
dLOP	0.057	2.93	0.008
dLg	1.97	3.24	0.004
$d(Lg)^2$	-0.31	-3.27	0.004
d(INTP)	-3.36	-3.56	0.002
dD80	-0.068	-2.17	0.041
dD88	0.08	3.39	0.003
ecm(-1)	-0.54	-5.06	0.000

R-Squared= 0.87	Akaike Info Criterion= 68.39
Adjusted R^2= 0.81	Schwarz Bayesian Criterion=60.34
Durbin-Watson Stat= 2.4	F- Statistic = 15.58

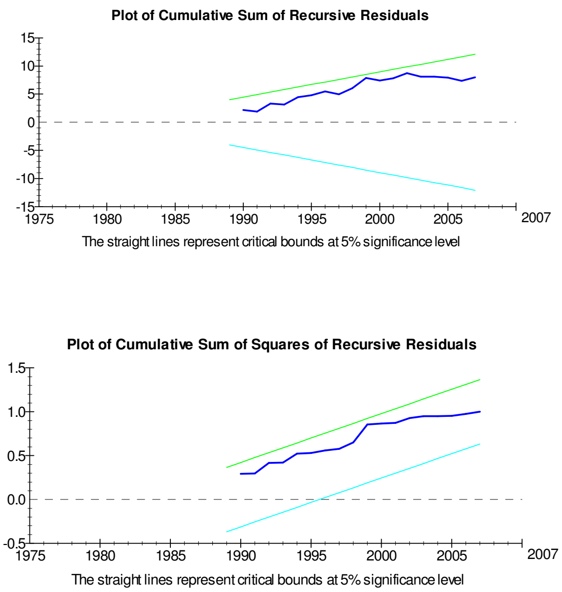
The significance of an error correction term (ECT) shows causality in at least one direction. The error correction coefficient in our results is negative and highly significant. The coefficient of -0.54 indicates a relatively high rate of convergence to equilibrium, which implies that deviation from the long-term equilibrium is corrected by 54% over each year.

In addition, the optimum government size for the model(II) in the short run obtains as following:

$$(\frac{\partial LY}{\partial Lg})_{short-run} = 0 \Rightarrow Lg = 3.177 \Rightarrow g = (G/Y) = 23.984$$

The comparison of the optimum government size in short run and long run for model(II), shows that in the long run the size of government should reduce. Moreover, according to the figure 7, the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMQ) are within the 5% significance lines, which imply to the in-sample stability of the model.

FIGURE 7
Plots of CUSUM and CUSUMQ statistics for coefficients Stability Tests for model (II)



5.4 Estimation of the model (III)

In the model (III), we use the non-oil exports as discussed before. The maximum order of lags in the ARDL model has been selected 2. The error correction version of the ARDL model in our variables is given by

$$\begin{aligned} DLY &= a_0 + \sum_{i=1}^{2} b_i DLY_{t-i} + \sum_{i=1}^{2} c_i DLL_{t-i} + \sum_{i=1}^{2} d_i DLK_{t-i} + \sum_{i=1}^{2} e_i DLNX_{t-i} + \sum_{i=1}^{2} h_i DLg_{t-i} + \sum_{i=1}^{2} m_i D(Lg)^2_{t-i} + \\ &\delta_1 LY_{t-1} + \delta_2 LL_{t-1} + \delta_3 LK_{t-1} + \delta_4 LBOX_{t-1} + \delta_5 LOP_{t-1} + \delta_6 Lg_{t-1} + \delta_7 (Lg)^2_{t-1} + u_t \end{aligned} \tag{18}$$

The calculated F-statistics for the cointegration test with considering each of the variables as the dependent variable is displayed in table 13.

TABLE 13
Results of F-statistic for considering the existence of long-run relationship for model(III)

Dependent variable/…	F-statistic	Prob	Existence of long-run relationship
F(LY/LL,LK,LNX,Lg,$(Lg)^2$)	6.89	0.002	Accepted
F(LL/LY,LK,LNX,Lg,(Lg)2)	2.42	0.11	Rejected
F(LK/LL,LY,LNX, Lg,(Lg)2)	6.89	0.002	Accepted
F(LNX/LL,LK,LY, Lg,(Lg)2)	3.35	0.036	–
F(Lg/LL,LK,LNX,LY,(Lg)2)	3.93	0.021	Accepted
F((Lg)2 /LL,LK,LNXN,Lg,LY)	3.88	0.022	Accepted
Lower band of critical value at 5% level:2.64		Upper band of critical value at 5% level:3.805	

The above test results indicate that the null hypothesis of no cointegration is rejected at 5%, and the variables LL, LK, LNX, Lg and $(Lg)^2$, can be treated as the long-run forcing variables for the explanation of LY.

The results of estimated optimal ARDL growth model are shown in table 14. The optimal number of lags for each of the variables is shown as ARDL (1,0,1,1,2,0). Based on the various diagnostic tests, this model was better.

TABLE 14
Results of estimated optimal ARDL growth model (III) based on the Schwarz–Bayesian criterion

ARDL(1,0,1,0,0,0,0) based on Schwarz Bayesian Criterion Dependent Variable: LY			
Regressor	**Coefficient**	**T-Ratio**	**Prob-Values**
LY(-1)	0.40	2.91	0.009*
LL	0.018	0.104	0.918
LK	1.93	5.65	0.000*
LK(-1)	-1.43	-5.86	0.000*
LNX	0.083	2.57	0.019*
LNX(-1)	-0.063	-2.72	0.013*
Lg	1.49	2.29	0.034*
Lg(-1)	-0.04	-0.54	0.59
Lg(-2)	0.16	2.032	0.056
$(Lg)^2$	-0.23	-2.27	0.035*
Intercept	-2.77	-2.72	0.014*
dD80	0.035	0.78	0.444
dD88	0.102	3.63	0.002*
R^2	0.99	Adjusted R^2	0.99
F-stat	364.75		
Significance level of autocorrelation test based on Lagrange multiplier (LM) test			0.075
Significance level of Jarque-Bera test of normality of the error term			0.988
Significance level of the LM heteroscedasticity test			0.296

The long-run coefficients of the variables are shown in table 15. Except D80 which has a positive but insignificant coefficient all variables have their expected signs. These results indicated that LK, Lg ,$(Lg)^2$ and D88 were statistically significant in influencing LY in 5% level of significance. The coefficient of non-oil exports is both small and insignificant and it can attributed to this fact that the amount of Iranian non-oil exports are negligible in comparison with its oil exports, and non-oil exports could not affect the growth significantly in long run.

TABLE 15
Results of estimated long-run relationship derived from the optimal ARDL growth model (III)

Regressor	coefficient	T-Ratio	prob
LL	0.031	0.104	0.918
LK	0.84	4.15	0.001*
LNX	0.035	0.84	0.41
Lg	2.71	2.25	0.036*
$(Lg)^2$	-0.39	-2.08	0.051
Intercept	-4.65	-2.55	0.02*
D80	0.059	0.78	0.44
D88	0.173	2.55	0.019*

The coefficients for Lg, and $(Lg)^2$, have correct signs as has been hypothesized by Armey and others, and they are statistically significant. In the model (III), the optimal amount of government size has been obtained equal to

$$(\frac{\partial LY}{\partial Lg})_{long-run} = 0 \Rightarrow Lg = 3.45 \Rightarrow g = (G/Y) = 31.5$$

This amount is bigger than the average amount of the government size over the period of my study which was equal to 27.65.

This relatively high level for the optimal government size, can imply that without oil revenues, Iranian government will need to increase its expenditures to compensate the negative effects of the lack of oil exports on GDP. Without the oil revenues the Iranian government should invest in other sectors of the economy to create new resources for its revenues and this can lead to the larger size of the government.

The calculated optimal size of government in model (III) (without oil exports) cannot be reliable for Iranian economy, although the estimations for the third model still confirm the hypothesized quadratic effect of government size on economic growth.

The results of the ECM for the third model are presented in table 16. Except for dD80, all of the other coefficients have their correct expected signs. Most of the coefficients in the short run are significant, except for dLL and dD80. Unlike the long-run, in the short-run non-oil exports have affected the economic growth significantly. The magnitude of impacts of the variables which are related to government size (Lg and $(Lg)^2$) in the short-run are much smaller than that of the long-run impact, indicating that the impact of change in government size is much stronger in the long-run.

TABLE 16
Error Correction Representation for the selected ARDL-Model (III)

ARDL (1,0,1,1,2,0) based on Schwarz Bayesian Criterion
Dependent Variable: dLY

Variables	Coefficients	t-Values	Prob-Values
dLL	0.018	0.104	0.92
dLK	1.93	5.64	0.000
dLNX	0.083	2.57	0.017
dLg	1.49	2.29	0.032
dLg1	-0.16	-2.03	0.054
$d(Lg)^2$	-0.23	-2.27	0.033
d(INTP)	-2.77	-2.72	0.012
dD80	0.035	0.78	0.44
dD88	0.102	3.63	0.001
ecm(-1)	-0.59	-4.28	0.000

R-Squared = 0.86	Akaike Info Criterion = 65.29
Adjusted R^2 = 0.77	Schwarz Bayesian Criterion = 55.76
Durbin-Watson Stat = 2.4	F- Statistic = 13.019

Also the lagged error term (ecm(-1)) in model(III) is negative and highly significant. The coefficient of -0.59 indicates a high rate of convergence to equilibrium, which implies that deviation from the long-term equilibrium is corrected by 59% over each year.

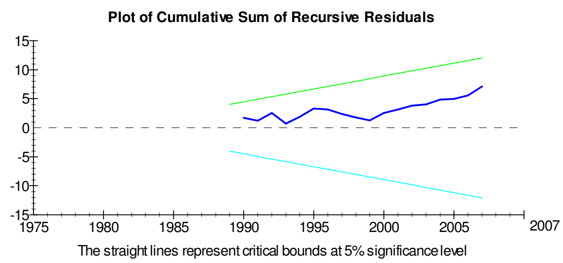
The optimum size of the government in short run for the model(III) is as following:

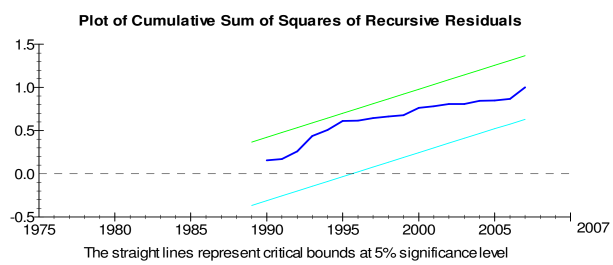
$$(\frac{\partial LY}{\partial Lg})_{short-run} = 0 \Rightarrow Lg = 3.239 \Rightarrow g = (G/Y) = 25.508$$

The small optimal size of the government in short run compared with long run for model(III), indicates that without oil exports, Iranian government has to develop the other sources of revenues (such as taxes) to finance its expenditures and this can lead to a bigger size of the government in long run.

In addition, when analysing the stability of the long-run coefficients together with the short-run dynamics, the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMQ), point to the in-sample stability of the model.

FIGURE 8
Plots of CUSUM and CUSUMQ statistics for coefficients Stability Tests for model (III)





6 Discussion and conclusions

In this study, I use a bounds testing approach to cointegration, developed within an ARDL framework to investigate the impacts of exports and government size (in addition to labor and capital) on the long run and short run growth of Iranian economy. In particular because of special characteristics of a developing oil export based economy like Iran, which make them to be heavily relied on oil export revenues, I use a modified form of Ram's model(1986) to include both government size and exports in growth model. According to the recent studies on the relationship between government size and economic growth, I include the government size in a quadratic form in growth model to test the validity of Armey curve in Iranian economy. Moreover I want to investigate the effects of aggregate exports and disaggregate exports (oil exports and non-oil exports) on economic growth. As a result I will have three models to examine. The differences of these models are due to the proxies which I have used for exports in each model. Total exports, oil exports (separated to oil price and real amount of oil exports in terms of barrels) and non-oil exports have been used respectively in first, second and third models.

All of the models of this study significantly confirm the validity of Armey curve in Iranian economy both in long run and short run. According to the coefficients which are related to government size, all of the models show that the effects of government size on Iranian economic growth in long run are stronger than short run. The calculating the optimum government size for the first and second models points out that the optimum sizes of government in long run are smaller than those in short run, implying that in long run the size of the government should be reduced. Moreover in both models the calculated optimum sizes for government in both short run and long run are bigger than the average size of the government over the period of this study. My consideration shows that the Iranian government had too big sizes in 1970's and 1980's, but in recent years to some extent it has tried to reduce its size.

In contrast, the third model shows a bigger optimum government size in long run compared with short run, maybe implying that without oil revenues Iranian government should expand taxes system or other recourses to finance its expenditures, and also without the oil exports the government should increase its expenditures to compensate the negative effects of the lack of the oil exports on GDP.

My findings show that total exports in first model and oil prices and amounts of oil exports in terms of barrels in second model have significant and positive effects on Iranian growth in both long run and short run. Total exports, oil exports and oil prices have affected the growth in the long run stronger than short run. Moreover with the third model, I could find the positive significant effect of non-oil exports on economic growth in short run.

Labor force and net capital stock have their correct positive sign in all of the models. Nonetheless, the labor force does not show significant effect in the second and third models, and maybe this is due to the less productivity of labor force in Iranian oil depended economy.

The dummy variables D80 and D88 which I have used for capturing the structural breaks of war with Iraq and restructure of the economy after war show their expected signs in first and second model, indicating that the war has damaged the economic growth while ending the war and starting some positive programs for developing the economy have improved the economic growth.

Applying the ECM version of the ARDL approach for each of the models shows that the error correction coefficient, which determines the speed of adjustment, has an expected and highly significant negative sign.

The graphical evidence (CUSUM and CUSUMQ) for each of the three models indicate that the model is stable during the sample period.

Our result indicate that Iranian economy should adjust its size in long run to improve its economic growth, for creating a more stable and healthy economy, the government should be released from strong dependence on oil revenues. Also shifting the composition of the government expenditures from consumption expenditures to more investment expenditures can provide more credits to finance some projects for improving the structure of the economy and expanding the key industries, which can have determinant effects on the long run growth.

In a short run Iran should try to attract more foreign investment and new technologies to improve its aging oil infrastructure to strengthen its ability to compete in oil markets. Moreover Iran should use the oil revenues to develop the other sectors of its economy to reduce its deeply reliance on oil revenues in the future. The diversification of non-oil exports can reduce the adverse effects of oil price fluctuations. Moreover, the oil resources finishing and problems caused by one product economy makes it necessary for Iranian economy to regard to non-oil exports.

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