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AN ARDL Model of Factor Determining Iran's Oil Export Revenues (1971-2008)

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Iran's oil revenues are the main source of government export revenues. These revenues have been fluctuating during the last four decades .There have been a number of factors which affected Iran's oil revenues such as world oil supply and demand, oil price fluctuation, country's production capacities, Iran –Iraq war(1980-1988) , U.S-led sanctions and domestic consumption. This paper empirically examines the factors determining Iran's oil revenues using the time series data for 1970-2008. The error correction version of ARDL procedure is then employed, to specify the short – and long-term determinants of Iran oil export revenues in the presence of structural breaks. The model finds that factors such as oil production, oil price, and oil proved reserves have long run effects on Iran oil export revenues. Based on empirical findings obtained we conclude that, in the long –term, the effects of variables such as. Domestic oil consumption and world oil production are negative.

Key words: Oil production; Oil price; Oil revenues

1. Introduction

The purpose of this article is to shed some light on the type and magnitude of various factors affecting Iran oil revenues performance, we try to answer to the following question: what has been oil strategy of Iran as an oil exporting country since 1970? It will be argued that after 1979 revolution the government main obsession was the expansion of oil production capacities and maintain the share of Iran as one of the world largest oil producer. However oil consumption emerged as a serious problem and could hinder country's export soon. In other words, the larger domestic market, the more its growth will restrict the growth of exports. The next question is, devoted to the challenges that Iran faces to remain as a main oil exporter? It is noted that financial restrictions and international environment are two decisive elements that shape Iran future oil development strategy. Policies adapted to cope with external pressures and strength the bargaining power of Iran within the OPEC were only somewhat easing the effects of sanctions. And detailed analysis of oil revenues and prices and their trends is the subject of separate study.

The remaining of this paper is organized in five sections. The second section examines the relation between oil revenues and economic growth. Section three analyses Iran oil revenues performance since 1971. Section four will apply and ARDL model to estimate the important factors that have been affecting Iran oil export revenues between1971-2008.This section also discusses results and findings of the short and long-term determinants of Iran oil export revenues model. It is stresses the rather disproportionate role of oil price in determining Iran oil revenues which is almost unpredictable exogenous variable. Section five produce some concluding results.

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2. Oil Revenues and Economic Growth

The economic structure of Iran shows that the crude exports boost the oil revenues, which in turn help to finance government expenditures. These expenditures are used to stimulate economic growth and development as well as purchase goods and services for government consumption. Economic growth and development by themselves affect the economic system in two ways. one, by creating demand for goods and services needed for non-government consumption i.e., private consumption and investment expenditures, and the other by increasing the country's non-crude exports that can reduce dependence on crude oil exports. The demand for goods and services (resulting from government consumption and consumption due to economic growth and development) has had its effect on two economic activities: domestic production and imports of goods and services. Domestic production of goods and services stimulate demand for factors of production, so that all sectors in the economy are affected and lead to the expansion of GDP.

3. Iran's Oil Revenues ́An Overview of

3.1 The period of 1973-79

The shift in the balance of power between the oil companies and the members of OPEC decidedly in favor of the latter did not actually happen until the 1973 Arab-Israeli war. Within two weeks of the war, OPEC unilaterally cut production by 5 percent of global oil supply and embargoed supplies to the United States, the Netherlands and other countries that supported Israel in the war. The oil embargo occurred at a time of high global demand for oil, especially by the industrialized countries. OPEC's action led to huge increases in the price of oil from $1.35 per barrel in 1970 to $5.11 in October 1973. With no major reaction from the oil-consuming countries, OPEC again raised the benchmark price of crude oil to an unprecedented $11.65 per barrel in January 1974 – a four fold increase in oil prices since the outbreak of Arab- Israeli war in 1973(Rose, 2004). Iran's oil revenues per barrel jumped from $2.75/b in 1973 to $10.72/b in 1974 as a result of OPEC agreements. As a result, the government's oil revenues rose from the 1973 figure of $ 5.073 billion to $ 18.672 billion in 1974, an increase of 268 percent (Table .1). Government revenues in current prices also increased from 172.3 billion Rials in 1970 and 464.8 billion Rials in 1973 to a high of 2034.2 billion Rials in 1974 (Jazayeri, 1988). Overall, because of the sharp rise in world oil prices and world oil demand, Iran's oil revenues registered a strong positive trend in the 1970s, with both prices and revenues recording positive growth rates in all years except 1978. (Table.1).The hike in oil prices in 1973 triggered an economic recession in the industrialized countries in the mid 1970s. By the late 1970s, the increase in prices, particularly the large increases in 1973-74 and in 1979-80, resulted in a fall in oil consumption relative to forecasts of the early 1970s. Virtually all sections of the industry found it necessary to revise downwards their demand projections. On the other hand, through the 1970s the Iranian government increased oil production to near capacity in order to export more oil and garner additional revenues. Not surprisingly, oil revenues remained the most important source of export revenues, and the share of oil revenues in the foreign exchange receipts of the country peaked at 89 percent in 1975, after having touched 80 percent in 1973. Naturally, fluctuations in oil revenues came to have a strong impact on the Iranian economy.

3.2 The period of 1980 -88

Iran's oil production averaged 3.17 million barrels/day in 1979. The production went down to 1.7 million barrels/day in 1980 (Badeai and Bina, 1992). There were physical impediments to production created by the war in the oil producing regions of Iran, as well as an increased risks for buyers to which Iran did not react in time. Iran produced an average of about 2.10 million barrels day of oil between 1979-81 and 2.27 million barrels/day between 1982-84 (Table 2). As a result the country's oil exports rose. Iran's share of OPEC production which was 10.3 percent in 1979 declined to 6.14 percent in 1981 and then rose to 13.25 percent in 1985 (Table 2). There were some reasons that were responsible for the declining trend: i) Iraqi shelling of the Abadan refinery put the plant out of action; ii) Iraqi attacks on Iran's main export terminal at Kharg island; and iii) an increase in domestic consumption, which in mid 1982 was believed to be between 600,000 barrels/day and 700,000 barrels/day, of which some 300,000 barrels/day were being refined outside Iran. By 1982 Iran was offering a price discount, which helped sales to reach 2.2 million barrels/ day. During 1983 and 1984, Iran used a number of different schemes to maintain oil sales. Discounts were regularly offered from the official OPEC prices to bring sales prices more in line with spot quotations. Some cargoes were sold partly at the official price and partly at spot rates. Each deal was negotiated separately with the prospective buyers, with the OPEC official price acting as a reference rate. During the same period Iran also entered into some netback deals, whereby the oil price was linked to the final market value of the refined products made of the crude minus the costs of transportation, refining and marketing. In mid 1980s the heightening of tension within OPEC, to which Iran contributed, was to no one's advantage, as prices eventually collapsed in 1986. It was believed that the excess supply was the main reason for oil price crash. . Iran's oil revenues declined from $20.050 billion in 1982 to $6.255 billion in 1986. It is not clear that OPEC could have prevented the price collapse. The political divisions within OPEC helped to underline the economic fact that, in the face of inability to control members output, OPEC needed to adjust price downward without backbiting. The period from 1987 to 1989 was characterized by an increase in demand, as well as a rise in OPEC production, with especially persistent over production by some OPEC countries. Prices fluctuated widely. For example Arabian light, which fell again to $10.45/barrel in November 1988, rose to $19.10/barrel in April 1989. The rest of 1989 saw some stability with prices ranging between $16-18/barrel but, once again, in June 1990 prices fell to $12.45/barrel (Salehi Isfahani, 1996).

Table 1: Iran's Oil revenue & Oil prices				
Year	Oil prices (US $/b)	Rate of change	Oil & Gas revenues (US M$)	Rate of change
1971	2.18		1851	
1972	2.48	13.67	2360	27
1973	2.75	10.89	5073	115
1974	10.84	294.18	18672	268
1975	10.72	-1.11	19054	2
1976	11.51	7.37	20670	8
1977	12.40	7.73	29713	44
1978	14.50	16.94	17867	-40
1979	39.00	168.97	19316	8
1980	39.53	0.90	11607	-40
1981	37.00	-5.97	12456	7
1982	30.60	-17.30	20050	61
1983	28.63	-6.44	20200	1
1984	27.00	-5.69	16762	-17
1985	26.00	-3.70	13170	-21
1986	13.05	-49.81	6255	-53
1987	17.14	31.34	10755	72
1988	13.30	-22.20	9673	-10
1987	17.14	31.34	10755	72
1988	13.30	-22.20	9673	-10
1989	16.04	20.60	19607	103
1990	22.26	38.78	17933	-9
1991	18.66	-16.17	14802	-17
1992	18.77	0.59	16300	10
1993	15.77	-15.98	14333	-12
1994	14.87	-5.71	14603	2
1995	16.18	8.81	15103	3
1996	18.83	16.38	19271	28
1996	18.83	16.38	19271	28
1997	16.00	-15.03	15464	-20
1998	12.02	-24.88	9900	-36
1999	16.79	39.68	16300	65
2000	26.70	59.02	24280	48.96
2001	23.93	-10.36	19339	-20.35
2002	24.90	6.57	22966	18.75
2003	26.55	6.64	27033	17.71
2004	33.38	25.72	36315	34.33
2005	49.26	47.57	53820	48.20
2006	60.14	22.08	62011	15.21
2007	68.45	13.81	81567	31.53
2008	92.76	35.51	81855	0.35
1. Central Bank of Iran , Annual and Economic Reports ,Various Years 2. OPEC Annual Statistical Reports , Various Years				

3.3 The Period From 1990

In order to restructure the Iranian oil industry, in early 1989, the government issued a number of contracts for the construction and repair of offshore oil platforms destroyed during the Iran-Iraq war (1980-88) as a part of major expansion program. . The first five-year development plan's (1989-1993) target was average production of 3.528 million barrels/day for 1993 and was expected to increase by nearly 400,000 barrels/ day in that year. Offshore production had totaled some 500,000 barrels/day by the end of the war, but it was estimated that production had fallen to 250,000 barrels/day (Europa, 1999). On the other hand, the price factor once again became important in 1990. By mid 1990 oil prices had fallen to 14.40$ per barrel, Iran demanded that a minimum reference price of 25$ per barrel be fixed at the full OPEC meeting in summer 1990. OPEC temporality suspended output quotas, and asked key producers to pump as much oil as they could to make up the shortage. Iran, opposed the decision, arguing that international oil companies and western governments should use their commercial and strategic stocks of oil before asking OPEC to increase production. Iran had extracted a pledge from OPEC members to reimpose output cuts when the crisis came to the end. However, the minimum reference price was set at $21, with a 22.5 million barrels/day production ceiling. Nevertheless, the agreement indicated a new alliance between Iran, Iraq and Saudi Arabia, and its immediate effect was to raise prices

The economic sanctions imposed on Iraq by the international community as a result of UN Security Council resolution no 661, suddenly changed world oil market conditions – from a situation of glut to one of inadequate supply in 1990. The loss of access to around 4.3 million barrels/day of oil from Iraq and Kuwait, which represented more than seven percent of the world's oil production and consumption in 1990, created chaos in the global oil market. OPEC provided an additional volume of 3.6 million barrels/day of crude oil in October 1990 compared with the pre crisis level, in order to offset the shortfall in crude oil normally supplied by Iraq and Kuwait. An increase in capacity occurred with the reconstruction of the Abadan refinery with total capacity of 320,000 barrels /day and construction of Bandar Abas refinery with capacity of 232000 barrels/day in mid 1990s (Europa, 1999). Oil prices fell to $18.77 in 1992, the declining trend continued to 1993 when oil prices once again fell to $15.77. This trend continued until 1994 when Iran's oil revenues touched $14.603 billion (Table1). Iran's response was to increase oil production from 3,500,000 barrels day in 1991 to 3,600,000 barrels/day in 1993 (Table 2). Iran's average oil production in 1996 was 3.66 million barrels/day, compared with 3.57 million barrels/day in 1995. The price of a barrel of oil which in 1992 was $18.77, declined to $12.02 in 1998 (Table1). The dramatic decrease in the world oil prices from late 1997, below early 1973 levels, prompted OPEC to decree that its members should reduce production from 1 April 1998 in an effort to boost prices. Iran's allotted cut was 140000 barrels/ day, so that its quota became 3.942 million barrels/day. This action failed to bring about the desired effect. OPEC thus implemented further cuts on 1 July, whereby Iran agreed to reduce its output by 300,000 barrels/day (although Iran maintained that its reduction should be taken from a baseline of 3.9 million barrels/day rather than 3.6 million barrels/day, which had the effect of undermining the OPEC deal). The East Asian financial crisis, which reduced world consumption, led to a further decrease in oil prices. OPEC had decided that its members should reduce production from 1 April 1998 in an effort to boost prices. Iran's allotted cut was 140000 barrels/ day, so that its quota became 3.942 million barrels/day. This action failed to bring about the desired effect. OPEC thus implemented further cuts on 1 July, whereby

Iran agreed to reduce its output by 300,000 barrels/day (although Iran maintained that its reduction should be taken from a baseline of 3.9 million barrels/day rather than 3.6 million barrels/day, which had the effect of undermining the OPEC deal). In March 1999, as OPEC agreed to a new round of output restrictions, Iran accepted that the benchmark for its future production cuts should be 3.6 million barrels /day. Under this arrangement Iran agreed to reduce its output by 7.3 percent to 3.359 million barrels/day (Europa, 2001). Iranian daily oil production in 1999 and early 2000 was somewhat above its OPEC quota. When in March 2000 OPEC responded to what was seen as a dangerously high oil price of around $30 per barrel by increasing aggregate production quotas by 1.7 million barrels/day from 1 April 1998, only Iran declined to accept the Saudi-proposed plan, on the grounds that OPEC was buckling to US pressure for lower oil prices. However, in June Iran agreed to further increase in OPEC output targets, the new Iranian quota being 3.727 million barrels/day from 1 July a further increase 3.844 million barrels/day (Europa, 2001). From the beginning of November 2000 Iran's OPEC quota was further raised to 3.917 million barrels day as OPEC continued to respond to upward price pressures in world oil markets. The trends in Iran's oil production are shown in table 2. And the trends in Iranian oil revenues are shown in table 1 .These trends reflect sharp variations over time because of the impact of changes in oil prices, and drop in Iranian oil production during the revolution and Iran-Iraq war (1980-88). Iran's oil production in 2001 was reported to have been above the OPEC quota, averaging some 3.66 million barrels/d. The country's oil production reduced in 2002 to 3.42 million barrels/d, but it rose to 3.75 million barrels/d in 2003, the highest level of oil production after 1979 revolution. Iran's average oil production was 3.63 million barrels /d between 2000-2003(Table 2). Iran had experienced a growth in oil export revenues between 2004-2007, so that the share of Iran as a percentage of total world production had reached to 5.6 percent .However, the share of Iran as percentage of total OPEC production from 13.48 percent in 2000-2003 reduced to 12.5 percent between 2004-2007 (Table 2) . Iran oil production had reached to 4.1 million barrel daily since 2005.

4. Demand Expansion of Energy Products in Iran

The demand for energy in Iran is dominated by petroleum products and natural gas. The four main products-gasoline, kerosene, gas oil and fuel oil account for the major portion of oil products used in Iran. The demand for energy consumption during the past two decades has been increasing substantially. Factors which affected the demand for energy are: i) General economic growth and industrialization; ii) population growth and urbanization. Iran's population increased from 55.8 million in 1986 to 60 million in 1996. This figure reached to 70 million in 2006(Iran statistical Year Book, 2007). Throughout the post revolutionary decades, the flow of rural migrants to the cities continued, a trend that accelerated urbanization. In 2006, 68.48 percent of the population of Iran lived in the urban area. In 1986 only 57.02 percent in urban areas (Iran Statistical Centre, 2007).iii) the transportation sector is the main consumer of gasoline in Iran. Light-duty vehicles (LDVs) fleet in transportation sector consumes 99 percent. The number of produced cars has increased considerably. Domestic produced cars registered annual growth rate of 34.19 percent during 2000-2005. Other sectors including power plants, public buildings, commercial and agriculture constitute only 1 percent motor gasoline consumption [i]. And iv) relatively low administered energy prices. In early 1994, the *Majlis* approved the outline of the second five–year development plan which included cuts in fuel and energy subsidies which cost the country $ 11 m a year. Authorities recommended in 1995 that domestic petrol prices be raised by 40 percent and pointed out that if Iran adopted

prices for oil products similar to those in other Persian Gulf countries, domestic consumption of 1 to 1.3 million barrels/day could be reduced by 200,000-300,000 barrels /day(Tarki,2005) .At the rate of consumption that prevailed then, Iran's refinery capacity could not fully provide for the country's need for refined products.Consumption as a percentage of production during 1980-1990 registered annual growth rate of -1.6 percent in Iran, whereas during the 1990-2007 it rose to 1.6 percent. It was to be expected that, given the continued high-energy consumption growth rate, the domestic primary energy demand would soon devour Iran's entire oil production and that the country's oil exporting capacity. The government of Iran has introduced new plans and measures to use renewable energies [II]. Iran also has a policy of increasing use of nuclear. Slowing the growth of domestic energy consumption would also prolong and reduce the period of transition to lower dependence on oil. Generally speaking, Oil exporting countries need energy policies that look forward to a future mix of fuels which optimize the balance between domestic consumption and exports.

Table 2: Iran's Oil production as a share of OPEC and World production						
Year	World Total mb/d	OPEC mb/d	Iran mb/d	OPEC Shares (%)	Iran's Share (%) World	Iran's Share (%) OPEC
1979	62.5	31	3.2	49.60	5.12	10.32
1980	59.4	27	1.7	45.45	2.86	6.30
1981	56	22.8	1.4	40.71	2.50	6.14
Average	59.30	26.93	2.10	45.25	3.49	7.59
1982	53.2	19	2.2	35.71	4.14	11.58
1983	53	17.9	2.4	33.77	4.53	13.41
1984	54.2	17.9	2.2	33.03	4.06	12.29
Average	53.47	18.27	2.27	34.17	4.24	12.43
1985	53.6	16.6	2.2	30.97	4.10	13.25
1986	55.9	18.7	2	33.45	3.58	10.70
1987	56.3	18.8	2.3	33.39	4.09	12.23
Average	55.27	18.03	2.17	32.60	3.92	12.06
1988	58.5	21	2.3	35.90	3.93	10.95
1989	59.5	22.6	2.9	37.98	4.87	12.83
1990	61.2	24.3	2.9	39.71	4.74	11.93
Average	59.73	22.63	2.70	37.86	4.51	11.90
1991	65.56	25.27	3.5	38.54	5.34	13.85
1992	65.58	26.52	3.53	40.44	5.38	13.31
1993	65.99	27.9	3.6	42.28	5.46	12.90
Average	65.71	26.56	3.54	40.42	5.39	13.35
1994	66.66	27.28	3.6	40.92	5.40	13.20
1995	67.54	27.59	3.6	40.85	5.33	13.05
1996	69.75	28.26	3.71	40.52	5.32	13.13
Average	67.98	27.71	3.64	40.76	5.35	13.13
1997	71.93	29.56	3.73	41.10	5.19	12.62
1998	73.29	30.81	3.8	42.04	5.18	12.33
1999	71.85	29.3	3.56	40.78	4.95	12.15
Average	72.36	29.89	3.70	41.31	5.11	12.37
2000	77.0	28.0	3.67	36.36	4.77	13.11
2001	77.2	27.2	3.66	35.23	4.74	13.46
2002	76.7	25.4	3.42	33.12	4.46	13.46
2003	79.3	27.0	3.75	34.05	4.73	13.89
Average	77.55	26.90	3.63	34.69	4.67	13.48
2004	70.5	31.1	3.83	44.11	5.43	12.32
2005	71.6	32.3	4.09	45.11	5.71	12.66
2006	71.7	32.4	4.07	45.19	5.68	12.56
2007	71.5	32.1	4.03	44.90	5.64	12.55
Average	71.3	32.0	4.0	44.8	5.6	12.5

Source: 1. Central Bank of Iran, annual reports, various years (1991-2000).
2. Data from 2000 -2003 from OPEC Bulletin
3. Data from 2004 onwards from OEC Statistical Bulletin 2007

5. Challenges of Foreign Direct Investment in Iran's Oil Sector

The role of foreign firms in the Iranian oil industry was strengthened once again by the reconstruction and expansion program that began in 1988. By this time projects had become much more complex and foreign technology and capital became essential. In particular, technically complex offshore development projects could no longer rely on domestic skills. Two obstacles slowed down full cooperation with foreign companies. First the pressure from the United States on its western allies not to do business with Iran, especially, where transfer of advanced technology was required. Since mid-1990s mechanisms for encouraging foreign involvement in oil projects were developed as an alternative. In 1995 a buy-back production sharing system was developed by National Iranian Oil Company(NIOC) whereby foreign oil companies can invest in Iran oil fields and recover their investments and profits through the sale of produced oil. Thus, for instance, a number of international oil companies showed renewed interest in Iranian offshore fields in the Persian Gulf. An agreement was concluded in March 1995 with U.S-based Conoco of Houston, which had submitted a proposal to develop the offshore Sirri crude oil field. This field contained reserves estimated at nearly 500 million barrels and was expected to produce 120,000 barrels of crude a day. The $500 million-scheme was to have been financed through a buy-back agreement. However the US administration passed an executive order banning US companies from developing Iranian oil [iii]. Conoco subsequently announced that it was withdrawing from the agreement, which was the first oil field development scheme awarded to a foreign company after 1979. In July 1995 the contract was awarded to Total of France. The US administration's economic embargo on Iran provided an opportunity for other countries as well. In late December 1995 Russia signed a provisional agreement with Iran to establish joint venture companies in oil exploration, production and sales. In December 1995 the US senate approved legislation for a secondary economic boycott of Iran, which was apparently aimed at paralyzing the Iranian oil industry. And in 1996 the US President finally endorsed legislation which would penalize non-US companies which invested more than $40 million in a year in oil and gas projects in Iran and Libya (Katzman, 2007) .However, in spite of US pressures, NIOC continued with its programs to expand offshore production, but production at some of its fields may have been affected due to problems in obtaining spare parts for equipment already supplied by US companies. However, as table 3 shows foreign investment in Iran energy sector since 1999 had increased Iran oil production to four million barrels per day in 2005. In spite of attempts to boost foreign investment in oil sector, Iran has been facing serious difficulties in maintaining its share of oil production and exports among OPEC members. Oil exporting countries such as Saudi Arabia, UAE, Kuwait, Nigeria and Angola have long term plans to increase oil production and exports. In fact U.S led sanctions not only prevent the expansion of oil sector production and export, but also reduce the bargaining power of the country, oil revenues and reduction in the rate of growth of the economy.

Table 3: Foreign Investment in Iran Energy sector(1999- 2007)

Date	Field	Company (ies)	Value	Output Goal
Feb. 1999	Doroud (oil)	Total fina Elf (France)/ENI (Italy)	$ 1 billion	205.000 bpd
Apr. 1999	Balal (oil)	Total fina Elf/Bow Valley (Canada)/ENI	$ 300 million	40.000 bpd
Nov. 1999	Soroush and Nowruz (oil)	Royal Dutch shell	$ 800 million	190.000 bpd
Apr. 2000	Anaran (oil)	Norsk Hydro (Norway)		?
July 2000	Phase 4 and 5, South pars (gas)	ENI	$ 1.9 billion	2 billion Cuft./day
Mar. 2001	Caspian Sea oil Exploration	GVA Consultants (Sweden)	$ 225 million	?
June 2001	Darkhovin (oil)	ENI	$ 1 billion	160.000 bpd
May 2002	Masjid-e-Soleyman (oil)	Sheer Energy (Canada)	$ 80 million	25.000 bpd
Sep. 2002	Phase 9 and 10, South pars (gas)	LG (South korea)	$ 1.6 billion	?
Oct. 2002	Phase 6, 7, 8, South pars (gas)	Statoil (Norway)	$ 2.65 billion	3 billion Cu.ft./day
Feb. 2004	Azadegan (oil)	Inpex (Japan) 10% stake	$ 200 million Japan stake	260.000 bpd
Oct. 2004	Yadavaran (oil); deal includes gas purchases for 30 years	Sinopec (China) and ONGC (India)	$ 70 billion (value of exploration not known)	300.000 bpd
June 2006	Gamsar block (oil)	Sinopec (China)	$ 50 million	?
Jan 2007	Golshan and Ferdows (offshore gas, includes downstream development and transportation)	SKS Ventures (Malaysia)	$ 20 billion	100 million Cu.ft/day
Totals			$ 100 Billion +	oil: 1.2 million bpd Gas: 5.1 billion cu.ft/day+

Source :(Katzman, K, 2009)

6. Methodology

For investigating the long run equilibrium (co-integration) among time series variables, several econometrics methods are proposed in the twenty five years ago.

The problem of previous econometrics models was that most time series variables contain one or more unit roots, which make them non stationary .In such circumstances, we cannot use standard t-ratios to judge the level of integration analysis developed by Engle and Granger (1987) Johanson (1987) attempts to remedy the problem. Univariate co-integration examples include Engle-Granger (1987) and fully modified OLS procedures of Philip Hansen's (1990).With regard to multivariate co-integration, Johansen (1988) and Johansen and Juselius (1990) procedure and Johansen's (1995) full information maximum likelihood procedures are used in empirical research. According to Pesaran and Pesaran (1997) .The distribution of this F-statistics is non-standard irrespective of whether the variables in the system are I (0) or I (1). Pesaran et al. (1996) provide two sets of critical values in which one set is computed with the assumption that all variables in the ARDL model are I(1), and another with the assumption that they are I(0). For each application, the two sets provide the band covering all the possible classification of the variables into I(0) and I(1), or even fractionally integrated ones.

The main data source used in this study is the Iran central Bank statistics and BP statistics. The key determinants of oil export revenues include:

Ex: Iran Oil Export Revenues (in US$)

PROLY: Iran Annual Oil Production (in Million barrels)

OP: Oil Price (in US$)

PROLY2: World Oil Production (in Million barrels)

CONLY: Iran Oil Annual Consumption (in million barrels)

OPR1: Iran Oil Proved Reserves (in million barrels)

Du: Dummy Variable Iran-Iraq War (1980-88)

Fodi : U.S Led Economic Sanctions (1995-2008)

EX= f (Proly, Op, Proly2 , Conly, OPr1)

$$In\,EX_t = a_0 + a_1 In\,PROLY + a_2 In\,PROLY_2 + a_3 InOP + a_4 In\,CONLY + a_5\,OPR_1 + DU + FODI + \varepsilon \qquad (1)$$

Therefore the error correction representation of the ARDL model, by considering the above variables, can be shown as follows:

$$\Delta In\,EX_t = a_0 + \sum_{i=1}^{m} a_1 j \Delta In\,PROLY_{t-i} + \sum_{i=0}^{n} a_{2i} In\,\Delta InPROLY\,2_{t-i} + \sum_{i=0}^{n} a_{3i}\,\Delta InOP_{t-i} +$$

$$\sum_{i=0}^{n} a_4 i \Delta InCONLY_{t-i} + \sum_{i=0}^{n} a_5 iOPR1_{t-i} + a_6 In\,EX_{t-1} + a_7 In\,PROLY_{t-1} + a_8 InPROLY\,2_{t-1} + \qquad (2)$$

$$a_9 aiOP_{t-1} + a_{10} In\,CONLY_{t-1} + a_{11} In\,OPR1_{t-1} + \varepsilon_t$$

The parameter δ_i where i=1,2,3,4,5,6 is the corresponding long-run multiplier, while the parameters $b_j, c_j, d_j, e_j, f_j, g_j, h_j, k_j, l_j, o_j, and q_j$ are the short-run dynamic

coefficients of underlying ARDL model. The null hypothesis (i.e. $H_0 : \delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = \delta_6 = \delta_7 = \delta_8 = \delta_9 = \delta_{10} = \delta_{11} = 0$, implying no co-integration) in the first step is tested by computing a general F-statistic using all the variables appearing in log levels. At this stage we first need to calculate the F-statistics. The calculated F-statistic is compared with the critical value tabulated by Pesaran et al (2001). The null hypothesis of null co- integration 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 co-integration can not be rejected. We had chosen 2 as the maximum lag length in the ARDL model and the calculated F-statistics is equal 3.53, given that is below the lower critical bounds value , it implies no cointegration .In this step, the lag order of the variables are chosen using selecting Akaike Information criteria (AIC) or Schwartez Bayesian Criteria (SBC). The step of the lag orders of variables is very important because the appropriate lag selection able us to identify the true dynamics of the models. To check the performance of the estimated model, we also present the diagnostic tests associated with the model that examine the serial correlation, functional form and heteroscedasticity.

Table 4: Autoregressive Distributed Lag Estimates selected Based on SBC

ARDL(1,0,2,0,0,2) selected based on Schwarz Bayesian Criterion
Dependent variable is LEX
35 observations used for estimation from 1973 to 2007

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
LEX(-1)	.28374	.090657	3.1298[.005]
LPROLY	.78071	.15203	5.1353[.000]
LPROLY2	-.63405	.90212	-.70284[.490]
LPROLY2(-1)	-3.5250	1.3917	-2.5329[.019]
LPROLY2(-2)	-4.7669	1.1608	-4.1066[.001]
LOP	1.3309	.13141	10.1272[.000]
LOPR1	.42106	.22144	1.9015[.071]
LCONLY	-2.3464	.69351	-3.3834[.003]
LCONLY(-1)	-2.2705	.61438	-3.6956[.001]
LCONLY(-2)	1.9203	.46246	4.1523[.000]
C	172.8762	32.0081	5.4010[.000]
T	.14171	.031775	4.4598[.000]
DU	-.37690	.13606	-2.7701[.011]
FODI	.34089	.11469	2.9722[.007]

****

R-Squared .97090 R-Bar-Squared .95289
S.E. of Regression .12066 F-Stat. F(13,21) 53.8993[.000]
Mean of Dependent Variable 9.8075 S.D. of Dependent Variable .55589
Residual Sum of Squares .30572 Equation Log-likelihood 33.2948
Akaike Info. Criterion 19.2948 Schwarz Bayesian Criterion 8.4074
DW-statistic 2.4755 Durbin's h-statistic -1.6667[.096]

****

Testing for existence of a level relationship among the variables in the ARDL model

****

F-statistic	95% Lower Bound	95% Upper Bound	90% Lower Bound	90% Upper Bound
3.5358	4.5301	5.7990	3.8165	4.9179

W-statistic	95% Lower Bound	95% Upper Bound	90% Lower Bound	90% Upper Bound
21.2150	27.1808	34.7941	22.8991	29.5073

Table 5: Estimated Long Run Coefficients using the ARDL Approach

ARDL(1,0,2,0,0,2) selected based on Schwarz Bayesian Criterion
Dependent variable is LEX
35 observations used for estimation from 1973 to 2007

Regressor	*Coefficient*	*Standard Error*	*T-Ratio[Prob]*
LPROLY	*1.0900*	*.21083*	*5.1700[.000]*
LPROLY2	*-12.4619*	*3.0438*	*-4.0942[.001]*
LOP	*1.8581*	*.24302*	*7.6458[.000]*
LOPR1	*.58785*	*.33049*	*1.7787[.090]*
LCONLY	*-3.7648*	*1.2089*	*-3.1144[.005]*
C	*241.3583*	*61.5622*	*3.9206[.001]*
T	*.19785*	*.059766*	*3.3104[.003]*
DU	*-.52620*	*.19465*	*-2.7033[.013]*
FODI	*.47592*	*.18257*	*2.6069[.016]*

Error Correction Representation for the Selected ARDL Model
ARDL(1,0,2,0,0,2) selected based on Schwarz Bayesian Criterion
****
Dependent variable is dLEX
35 observations used for estimation from 1973 to 2007

7. Discussion of Findings

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 functions. The optimal number of lags for each of the variables is shown as ARDL (1, 0, 0, 1, 2, 0, 1). The results in table 2 shows that in the long oil production, oil price and oil proved reserves will give rise to oil export revenue. In the long run one percent increase in production leads to 1.029 increase in oil export revenues. This indicates that production does have a substantial effect on oil export revenues. The empirical results also show that one percent increase in oil price leads to 1.85 percent increase in oil export revenues. Similarly, increase in consumption of oil products and world oil production have negative effect on oil export revenues.

Table 6: Short –run Error Correction Model (ECM)

Regressor	*Coefficient*	*Standard Error*	*T-Ratio[Prob]*
dLPROLY	*.78071*	*.15203*	*5.1353[.000]*
dLPROLY2	*-.63405*	*.90212*	*-.70284[.489]*
dLPROLY21	*4.7669*	*1.1608*	*4.1066[.000]*
dLOP	*1.3309*	*.13141*	*10.1272[.000]*
dLOPR1	*.42106*	*.22144*	*1.9015[.070]*
dLCONLY	*-2.3464*	*.69351*	*-3.3834[.003]*
dLCONLY1	*-1.9203*	*.46246*	*-4.1523[.000]*
dT	*.14171*	*.031775*	*4.4598[.000]*
dDU	*-.37690*	*.13606*	*-2.7701[.011]*
dFODI	*.34089*	*.11469*	*2.9722[.007]*
ecm(-1)	*-.71626*	*.090657*	*-7.9008[.000]*

****

R-Squared .94444 R-Bar-Squared .91005
S.E. of Regression .12066 F-Stat. F(11,23) 32.4517[.000]
Mean of Dependent Variable .10122 S.D. of Dependent Variable .40229
Residual Sum of Squares .30572 Equation Log-likelihood 33.2948
Akaike Info. Criterion 19.2948 Schwarz Bayesian Criterion 8.4074
DW-statistic 2.4755

As can be seen from table 5, the long run results are very similar with regard to coefficient magnitudes and statistical significance. Model display the expected signs for the regressors and they are highly statistically significant**.** Table 6 indicates that the expected negative sign of the ECM is highly significant. The estimated coefficient of the ECM is equal to.-65, suggesting that deviation from the long –term inflation path is corrected around 0.65 percent over the following year. Figure 1 represents the forecasting errors and the plots of the actual and forecast values. The graphical evidence presented in figure 1 also indicates the estimated model tracks the historical data well. We also present the graph of CUSUM and CUSUMQ stability tests for SBC-based error correction model. It can be seen from figure 2, the plots of CUSUM and CUSUMQ statistics are well within the critical bounds implying that error correction model are stable.

Figure 1:

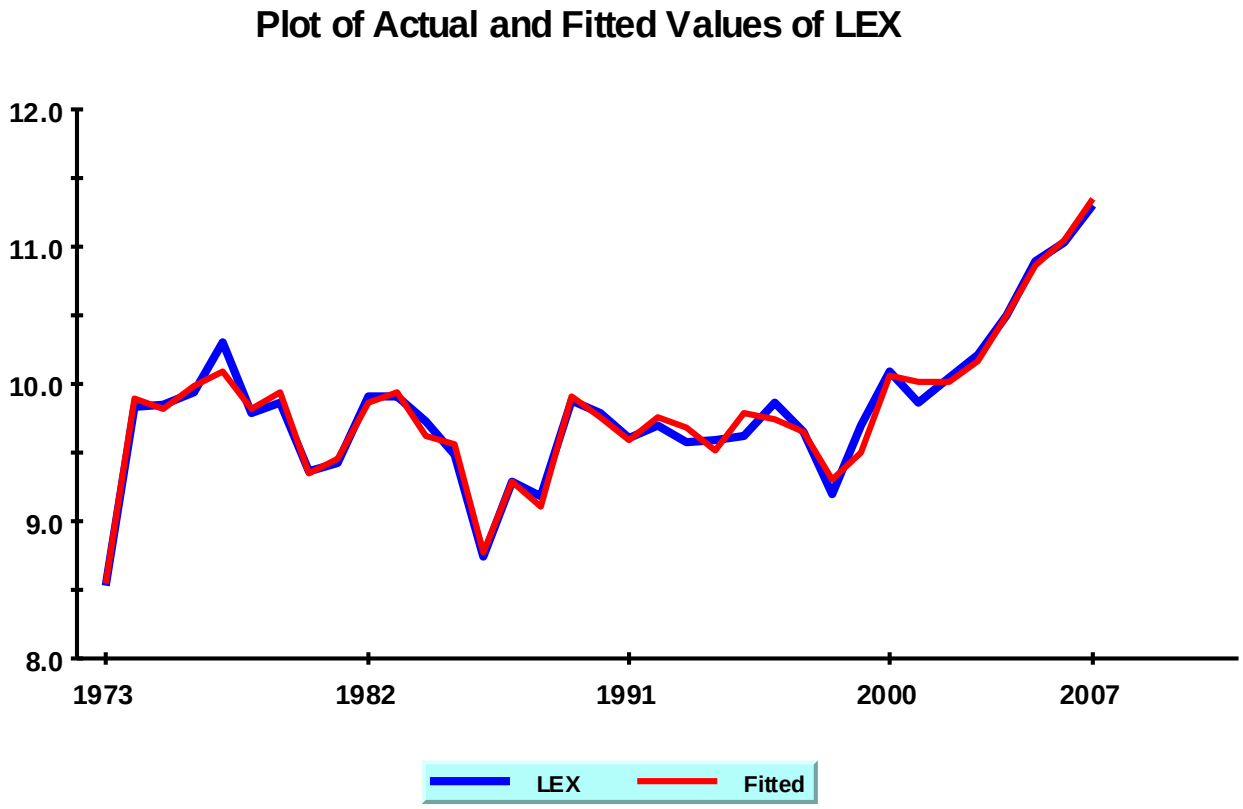
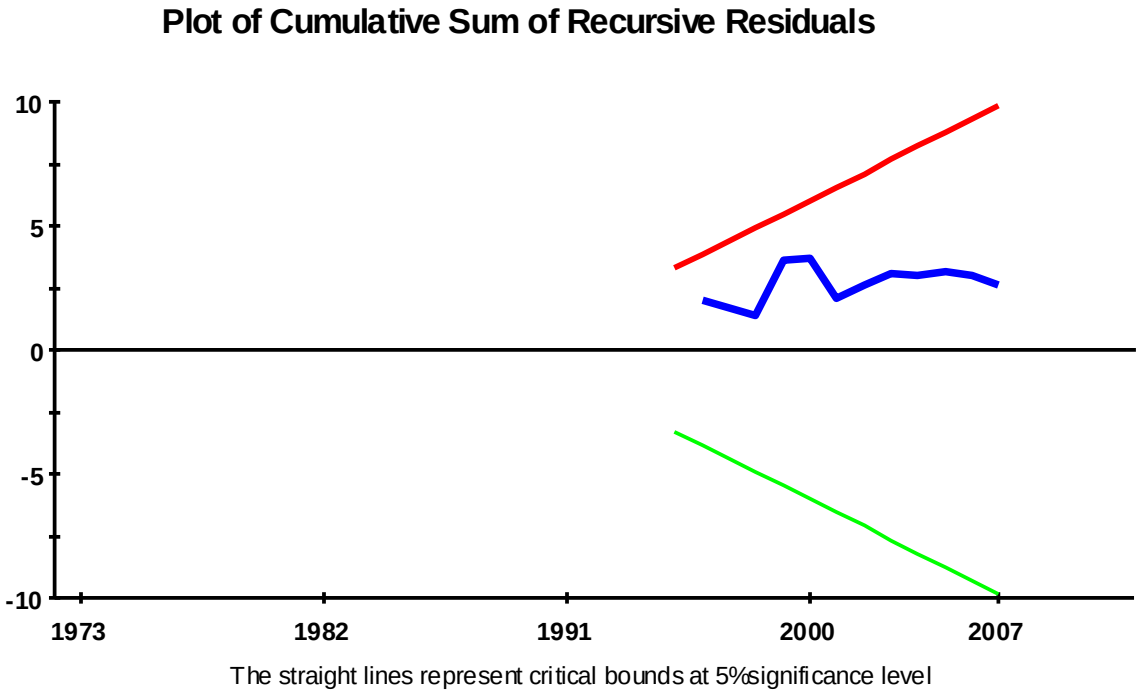
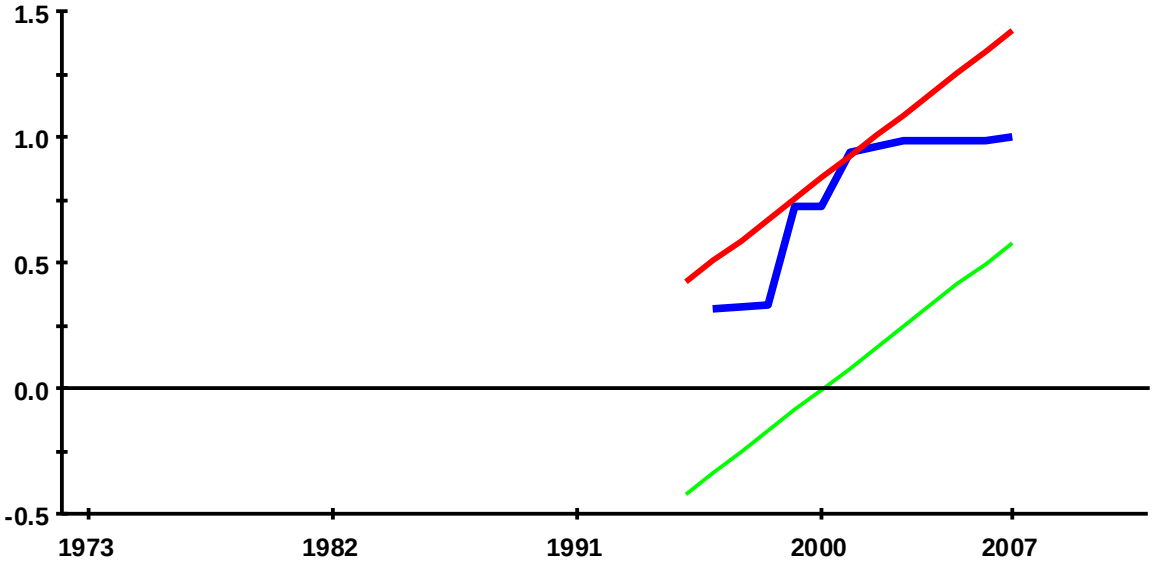


Figure 2:CUSUM and CUSUMQ Plots for Stability Tests



The straight lines represent critical bounds at 5%significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5%significance level

8. Conclusion

The increase in oil prices, particularly the large increases in 1973-74 and in 1979-80 registered a strong positive growth with both prices and revenues in all years except 1978. The Iran-Iraq war (1980-88) resulted in a reduction in the country's oil production capacity. In the late 1980s Iran's production was at just half the level recorded in the 1970s. However, other OPEC members increased their levels of supply, so that oil prices fell in 1986 due to excess supply. The government attempted to increase production capacity since the early 1990s, in order to meet sudden increases in oil demand .For the period 2001-2008 average growth of Iran oil price had been 47.42 percent .This shows that oil price had registered the highest growth rate after 1974. As a result during the above mentioned period Iran had a significant positive growth in its oil revenues. The implication is that the main source of country foreign exchange is driven by external forces .Since, oil prices are determined by exogenous factors. And also an analysis of coefficient variables for oil export revenues of some OPEC members (Iran , Saudi Arabia , Kuwait , UAE ,Venezuela and Nigeria) shows that Iran oil exports revenues has been fluctuating more than other OPEC members for the last three decades. Besides, instability in the OPEC agreement, if its breakdown, leading to instability in price, production and thus export revenues of member countries. This risk is in addition to the risk of instability in the demand for oil caused by changes in the rate of growth of developed economies and NICs. It has been discussed that the price declines during the 1980s and 1990s were partly caused by the week OPEC performance. Another important relationship in the results is the inverse relationship between oil products consumption and oil export revenues. During the same period the average growth rate for the consumption of oil products had experienced an increase of 3.65 percent. The same result for the average growth rate of production was 1.7 percent, which correspondingly translates to a considerable loss of foreign exchange due to low level of increase in oil production.

Endnotes

i. Computed based on data from Iranian fuel Conservation Company.

ii Iran Energy Efficiency Organization (IEEO) and Iran Renewable Energy organization (IREO) were established in 1995. Originally, these two companies were private-cum- government organization .In 2002, these two organization were transferred into *Tavanir* specialized holding company

iii. The first formal U.S sanctions against Iran were ordered by President Carter in April 1980, following the break in diplomatic relations between two countries .The sanctions banned U.S exports to Iran .Although the U.S was able to secure support among its allies for the sanctions, they were short lived .In 1984, the Reagan administration renewed sanctions against Iran .The government restricted the list of products which American companies could export to Iran. Exports of certain goods such as aircraft and vehicles as well as products with potential military applications were effectively terminated. However, the American companies continued to extract Iranian crude oil for imports to the U.S. In 1993 the "dual containment" policy was initiated by Clinton administration focusing on the twin threats of Iran and Iraq. The Clinton administration began to persuade Europe and Japan to limit their involvement in Iran. In 1996 the dual containment took a special focus on Iran, through investment sanctions aimed at halting the development of Iran's oil industry. Therefore non-U.S firms investing more than $40 million in any one year period in Iran's oil industry were subject to a series of sanctions by the U.S government. The sanctions were further amplified in mid-1997 by reducing the trigger investment amount from the original $40 million to $20 million per year (Estelami,1999).

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