Czech University of Life Sciences Prague

Faculty of Economics and Management

Department of Economics

Diploma Thesis

Foreign Trade in Petrochemical Industry of Iran

Abdoljabbar Bassam

CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Department of Economics

Faculty of Economics and Management

DIPLOMA THESIS ASSIGNMENT

Abdoljabbar Bassam

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Thesis title

Foreign Trade in Petrochemical Industry of Iran

Objectives of thesis

Because of the general economic importance of foreign trade for the national economy and considering the importance of petrochemical products export in Iran, this study attempts to achieve the following objective

The main objective of this research is the study of export-led growth hypothesis (ELG hypothesis) of Iran's economy in the petrochemical industry; investigate the impact of petrochemical products export revenue on economic growth

The central question addressed is whether the ELG hypothesis is valid in the case of Iran petrochemical industry

Methodology

Mathematical and statistical methods

Econometric techniques: Time series data over the period (1992-2010)

Ordinary Least Square (OLS) method

Excel and Gretel software
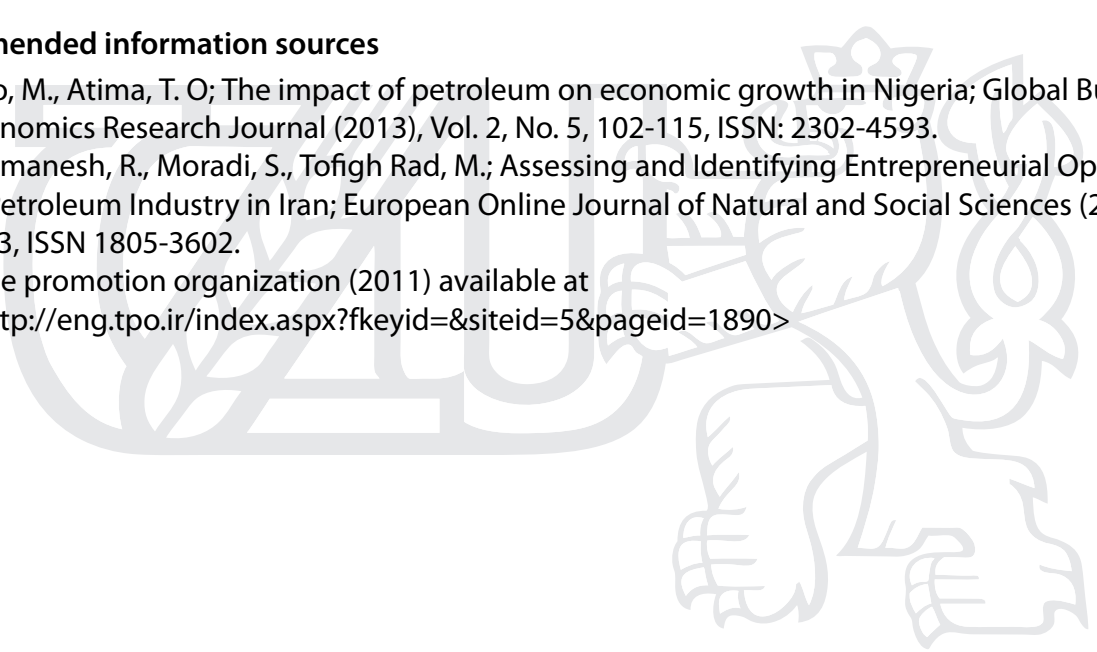
The proposed extent of the thesis

50-70 Pages

Recommended information sources

Baghebo, M., Atima, T. O; The impact of petroleum on economic growth in Nigeria; Global Business and Economics Research Journal (2013), Vol. 2, No. 5, 102-115, ISSN: 2302-4593.

Farboudmanesh, R., Moradi, S., Tofigh Rad, M.; Assessing and Identifying Entrepreneurial Opportunities in Petroleum Industry in Iran; European Online Journal of Natural and Social Sciences (2013), Vol.2, No.3, ISSN 1805-3602.

Iran trade promotion organization (2011) available at <http://eng.tpo.ir/index.aspx?fkeyid=&siteid=5&pageid=1890>

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The Diploma Thesis Supervisor

doc. Ing. Mansoor Maitah, Ph.D. et Ph.D.

Electronic approval: 30. 3. 2015

prof. Ing. Miroslav Svatoš, CSc.

Head of department

Electronic approval: 30. 3. 2015

Ing. Martin Pelikán, Ph.D.

Dean

Prague on 30. 03. 2015

Declaration

I declare that I have worked on my diploma thesis titled "Foreign Trade in Perochemical Industry of Iran" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the diploma thesis, I declare that the thesis does not break copyrights of any third person.

In Prague on 30.03.2015 _____

Abdoljabbar Bassam

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Zahraniční obchod petrochemického průmyslu v Íránu

Foriegn Trade in Petrochemical Industry of Iran

Souhrn

Íránská ekonomika je charakteristická svou silnou závislostí na ropném sektoru. Íránský petrochemický průmysl se dostal na jednu z nejvýznamnějších pozic na světě, a zároveň významně ovlivňuje íránskou ekonomiku. Existuje široká shoda na skutečnosti, že export průmyslového zboží představuje významný zdroj hospodářského růstu. Z výše uvedených důvodů má tato práce za cíl analyzovat dopad příjmů z exportu petrochemických produktů na íránskou ekonomiku. Hlavním cílem je prověření hypotézy o exportem taženém ekonomickém růstu (ELG) aplikovanou na Írán a jeho petrochemický průmysl. V práci je užito běžné metody nejmenších čtverců (OLS) pro popsání vztahu mezi HDP, exportem petrochemických produktů, směnným kurzem a inflací. Metodika vychází z časových řad pro období let 1990 – 2010. Výsledky práce ukazují pozitivní vztah mezi exportem petrochemických produktů a ekonomickým růstem, což potvrzuje hypotézu o exportem taženém ekonomickém růstu (ELG). Rovněž byl prokázán negativní vztah mezi inflací a směnným kurzem. Práce dále přináší SWOT analýzu íránského petrochemického průmyslu.

Summary

Iran's economy is characterized by over dependence on the oil sector. Iran has been gradually growing into a centre for production of petrochemicals in the world. Petrochemical industry is one of the significant components of oil industry and is one of the principal industries in Iran which has an influential role in Iran's economy. Although it is widely acknowledged that exports, particularly through manufactured components, play an important role as a potential source of economic growth. Hence, the aim of this research is to analysis the impact of petrochemical products export revenue on economic growth. Therefore the main objective of this research is the study of export-led growth hypothesis (ELG hypothesis) of Iran's economy in the petrochemical industry by taking a time series data for the period of 1990-2010. It applies ordinary least square (OLS) method to investigate the relationship between gross domestic product, exports of petrochemical products, real exchange rate and inflation. The results of the study show that there is a positive relationship between export of petrochemical products and economic growth which validate export-led growth hypothesis in petrochemical industry while negative impact of inflation and real exchnage rate is observed. Furthermore, in this study SWOT analysis of the Iran petrochemical industry is presented.

Contents

1. Introduction

1. 1 Background of study

The relation of exports on economic growth has been the subject of numerous debates in the economic development and related literatures. Export promotion policy can help to decrease the foreign exchange gap, and consequently promote the importing of capital goods and technical knowledge, encouraging the internal production that leads to reduction in the unemployment, increase profitability, improve capacity utilization which in overall would cause to economic growth. In addition it will raise competition between domestic firms for achieving better production technology and output and effective allocation of recourses. This, in turn results enhancing the sales of goods in domestic and foreign markets, increasing in the income, economic growth and productivity of a country, an order of events that called the Export-Led Growth Hypothesis (ELG) (Bhagwati, 1978 and Krueger, 1978).

The export-led growth (ELG) hypothesis has been generally applied to examine the impact of export on economic growth. There are numerous studies advocate this hypothesis with discovering the positive correlation between exports and economic growth (e.g., Tyler, 1981; Feder, 1982; Krueger, 1986, Grossman and Helpman, 1991; Giles and Williams, 2000). In fact export performance has beneficial effect on economic growth due to the expansion of export can demand for output of country which consequently the country increase its output. In addition export expansion may support specialization in the making of export goods which can increase productivity level which may lead to output growth. Also increasing of export might relax a foreign exchange restriction. This assists importing input and in turn output expansion (Giles and Williams, 2000). Therefore raising export can be suggested as a scheme that entitles an economy to growth.

Furthermore to date, the relation between inflation and economic growth is debatable issue (Yogeswari *et al*. 2012). There are several empirical studies such as Faira and Cameiro (2002) and Singh and Kalirajan (2003) that argued on negative impact of inflation on economic growth. In contrast researcher such as Tobin (1965), Lucas (1973) and Gillman (2002) stated the positive relation of inflation and economic growth. However some of research mentioned the mix relation of economic growth and inflation which have non-linear interactions (Lee and Wong, 2005; Hwang and Wu, 2011). In addition, real exchange rate has important in the literature on export-

led growth. Therefore earlier studies that link the real exchange rate with GDP are considered. Rodrik (2008) noted that overvaluation suffer growth which this idea supported by several researchers such as Paul (2006) and Gala (2007). Rodriks's study come under critical examination with subsequent studies (Gluzmann, 2012) which general accepted the positive relationship between higher growth and undervalued exchange rate, this relation can affect increasing saving and investment that facilitate growth and moreover higher real exchange rate assist diversify exports and increase technological intensity of exports (Mario *et al*.). Therefore in this context relationship between these macroeconomic variables, GDP, export, inflation and real exchange rate, are considered.

In addition due to oil dependency of developing countries and fluctuation of global oil market, this study turn its attention to the case of Iran which beside having huge reserves of oil resource and export, has tried to use a policies aim at increasing non oil exports. In fact the high rate of world oil prices has influenced the Iran government to have public investment, mainly in petrochemicals industries, and they achieve rapid grow. According to the economic development plan, the Iran government tries to elevate petrochemical output and because of this, the industry has obtained substantial foreign investment. Consequently, they doubt over the government's hope to make 47 petrochemical operations by the end of the fifth five-year development plan in 2015, adding a total of 43mn tones per annum (tpa) of capacity (Central Bank of IRAN, 2009). Based on officials, once the projects become operational, Iran will show at least 6.3% of global petrochemical output and 34% of Middle Eastern production. In the past, all Iranian petrochemical companies exported the products of Iran's petrochemical commercial company (IPCC) but today because of privatization in Iran, most of them export their products directly. Hence, nowadays, expansions of non-oil exports, especially petrochemical products are strategies for development of economy in Iran. Therefore this study tests the validity of ELG hypothesis in the case of petrochemical industry in Iran for the period of 1990-2010.

1. 2 Objective of study

It is widely acknowledged that exports, particularly through manufactured components, play an important role as a potential source of economic growth, the relationship between exports and economic growth is still ongoing. With regard to the general economic importance of foreign trade for the national economy and considering the importance of petrochemical products export in Iran, hence, the aim of this research is to analysis the impact of petrochemical products export revenue on economic growth. Therefore the main objective of this study is to investigate the relationship between export of petrochemical industry and economic growth of Iran. To do this, Ordinary Least Square (OLS) model are used. In particular, the study proposes to investigate link between export of petrochemical products and economic growth in order to test the degree of meaningful effects of export promotion policies in a branch of non-oil sector on the country's economic growth through empirical investigation of the Export-Led Growth (ELG) hypothesis. In other words, the study tried to find out whether the export of petrochemical industry as one of the main non-oil sector has promoted economic growth in Iran or not? Thus the main question addressed is whether the ELG hypothesis is valid in the case of Iran's petrochemical sector. For testing the hypothesis the following manner are proceeded:

➤ Theoretical and empirical works on the relation of export and GDP were reviewed.
➤ A model was developed to examine ELG hypothesis in the case of petrochemical industry based on reviewed literature regarding the export and GDP relationship. In particular four macroeconomic variables, GDP, export of petrochemical products, inflation and real exchange rate are used.
➤ Ordinary lease square (OLS) model for annual time series data over the period of 1990 to 2010 was applied to investigate the relationship between export of petrochemical products and economic growth.
➤ The effectiveness of export promotion of petrochemical industry on overall economic growth is examined.

1. 3 Research methodology framework

In responding to the aim and objective of the study, quantitative approaches with mathematical and statistical methods for the period of 1990-2010 were used. Therefore the hypothesis has been evaluated by using Gretl software and ordinary least square (OLS) method. The four variables are used for in this context which are; Gross Domestic Product (GDP), export of petrochemical products, inflation and real exchange rate. The data are collected from World Development Indicator online and Central Bank of Iran.

Furthermore, in this study the strengths, weaknesses, opportunities and threats (SWOT) analysis of the Iran petrochemical industry are presented.

1. 4 Organization of the thesis

This study is divided into five chapters. Chapter 2 of this research presents literature reviews which are divided into five sub-chapters. The first subchapter represents an overview of Iran's economy performance during the period under study (1990-2010) and provides historical background to the Iranian economy from partly pre-revolutionary times to post-revolutionary period. While showing a general picture of the main features of the Iranian economy, the sectoral composition of Iranian GDP is also partly highlighted. The review show that the country faced a number of structural changes, for example, revolution in 1979, following by eight years Iran-Iraq war, a number of huge instability in the oil price and recently sanction. Quantitative analysis indicates that dependency of Iran on oil has continued to influence the economy dramatically. In terms of GDP, it discovered that GDP performance closely follows the performance of oil sector. This dependency became even worse after revolution due to many challenging issues facing this sector mainly war effect and U.S. trade embargo. The enormous cost of war prevent the country of many opportunities for development, therefore the government planned to start Five Year Development Plans (FYDP) with aim of privatization and trade liberalization where four comprehensive FYDP were implemented and the fifth one is still in progress.

The second subchapter of chapter 2 focus on petroleum industry of Iran its history, developments as Iran is one of the world largest player in this sector.

The third subchapter of chapter 2 represents petrochemical industry of Iran. This part considered overview, trading and major challenging issue that faced this sector.

The forth subchapter of chapter 2 provide an analysis of the Iranian foreign trade sector, looking at import and export sector and country's major trading partners.

The last subchapter of chapter 2 reviews the theoretical literature, including the recent debate concerning the link between trade and growth. In fact this chapter include both the theoretical basis of the relation of the trade-GDP as well as empirical studies which measure the macroeconomic impact of trade especially export and inflation as well as real exchange rate on GDP.

Then in the third chapter the methodological related issues in particular focusing on the mathematical and statistical methods, data collection, and model specification will be discussed. Following in the forth chapter elucidation of data analysis and results with explaining the theoretical, methodological, limitation and managerial implications as well as SWOT analysis will be presented. In the last chapter, that includes a brief conclusion containing key recommendations for Iran's government planners and petrochemical industry leaders based on the study findings. Related references will be in the end of thesis.

2. Literature review

2.1 An overview of Iran's economy

2.1.1 Introduction

Before starting the practical process in this study, we must consider main marks of the Iran's economy during the period under study (1990-2010). During this period Iranian economy was subject to a number of major problems, disruptions and shocks namely Iran oil sanction. However before period under study economy of Iran faced many challenges due to political reasons. Before the 1979 revolution, the most important feature of the Iran's economy was the oil boom in 1973-74, which led the economy to sharp economic growth. The after-effect of revolution itself, the Iran-Iraq war following by U.S. sanctions hampered the economy that hindering it from fully realizing its potential. Therefore Iran was unable to take all advantages of its strategic geopolitical situation and its rich resources.

In this chapter geographical position and climate of Iran, an analysis of the population and the Iranian labour force, follow by the growth of the Iranian GDP and its sectoral composition was presented.

2.1.2 Geographical position of Iran

Iran, also known as Persia, is located in Middle East. The territory of Iran comprises 1.648 million square kilometres, of which 1.636 million square kilometres is land and 12,000 square kilometres water. Geographically location of Iran has been important to its politics and history. Iran is bounded on the north by Azerbaijan Republic, Armenia, Turkmenistan and Caspian Sea, to the west shares borders by Turkey and Iraq, to the east Afghanistan and Pakistan and south borders Persian Gulf, and Gulf of Oman (figure 1). Iran is a mountainous country. The Zagros Mountains bisect the country from north-west to south-east. Many peaks in the Zagros exceed 3,000 meters above sea level. Rimming the Caspian Sea are the Alborz Mountains, which are narrow but high. The volcanic Mount Damavand (5,671 meters), located in the centre of the Alborz, is Iran's highest peak; on clear days, it can be seen from Tehran. The central portion of Iran is referred to as the Central Plateau. The eastern part of the plateau is covered by two salt deserts, the Dasht-e Kavir (Great Desert) and the Dasht-e Lut (Barren Desert).

Iran has variable climate and varies considerably from region to region. The Caspian Sea area is humid with heavy rainfall. The mountain areas of the north are covered by snow and cold temperature. An extremely dry climate is found in the desert area which has extensive deposit of minerals, such as chlorides, carbonates and sulfates. The remaining part of the country has moderate temperature with rainfall.

Figure 1: map of Iran

In the north-west, winters are cold, with heavy snowfall and subfreezing temperatures during December and January. Spring and autumn are relatively mild, and summers are dry and hot. In the south, the winters are mild and the summers very hot, with an average daily maximum temperature in July exceeding 38 °C in some areas. Temperature and precipitation also vary with elevation, as winds bring heavy moisture from the Persian Gulf.

2.1.3 Population and employment

Population of Iran has multiplied significantly. The total population in Iran was last recorded at 77.5 million people in 2013 from 22.0 million in 1960, changing 253 percent during the last 50 years. Population in Iran averaged 49.02 Million from 1960 until 2013, reaching an all time high of 77.45 Million in 2013 and a record low of 21.96 Million in 1960 (World Bank). According to the Management and Planning Organization of Iran, the population growth rate raised from an average of 2.7 percent between 1966-1976 to 3.9 percent between 1978 and 1987. After 1989, due to the family planning effect and population controls programs, as well as health and education, the population growth rate decreased significantly and the annual average population growth rate was 2.4 percent between 1986 and 1991. This trend continued during the period between 1996 and 1998 decreasing to 1.4 percent and finally between 1996 and 1998 decreased to the lowest rate 0.9 percent. Nevertheless the population rate between the period 2004 and 2010 reached to 1.19 percent (figure 2).

Figure 2: yearly population growth rate (%)
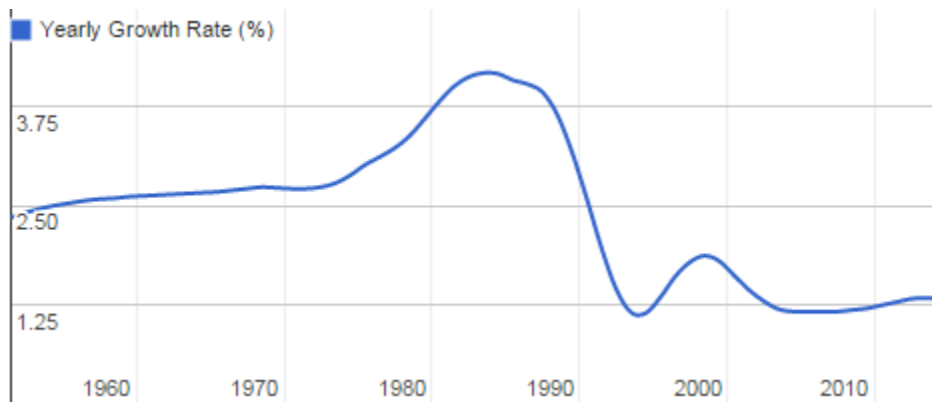
Source: World meters online database

It should be noted that due to significant increasing the population growth rate during the 1980s, the first decade after the revolution, and inability of government to produce job opportunaty, Iranian economey faced with the serious problem of unemployment. In fact, unemployment rate between 1966 and 1976 raised from 9.2 percent to 10.1 percent, however by 1986 unemployment had reached as high as 14.7 percent. However, after the ceasefire in 1988, due to huge reconstraction effort many job opportunety was created and therfore unemployment rate

decreased sharply. Unfortunately, after 1996 due to serious economic recession in the country and low economic performance by 2000 unemployment rate reached to 16.1 percent .

Unemployment Rate in Iran averaged 11.67 percent from 2001 until 2014, reaching an all time high of 14.70 percent in the first quarter of 2002 and a record low of 9.50 percent in the fourth quarter of 2008. Unemployment Rate in Iran increased to 10.50 percent in the fourth quarter of 2014 from 9.50 percent in the third quarter of 2014 (Central Bank of Iran).

Another interesting topic is the share of labour force employed by the private and by the public sectors of the economy. In 1976 private sector made up more than 80 percent of the total labour force and 19 percent the share of public sector. In 1986, ten years later, due to economic recession public sector share increase to 32 percent and share of private sector decreased to 64 percent due to the movement towards greater government intervention in the economy. Finally later in 1996 this strategy changed and share of private sector increased to 68 percent and government share fell to around 29.2 percent (Central Bank of Iran).

2.1.4 Gross domestic products (GDP) and its sectoral composition

Review the structure of GDP and its sectoral composition is one of the most crucial steps in analyzing the Iranian economy. Figure 3 indicates that the Iranian GDP growth performance between 1963-2014 was quite volatile. The pattern of GDP growth shows that before the revolution there was a considerable enhancing trend in GDP due to the oil price boom and increasing exports. The Iranian government's policies have always seen the oil industry as the leading sector, and the source of foreign exchange for development projects. According to the National Account of Iran (CBI, 2001b) during entire before revolution (1960-1978), GDP enjoyed an annual growth rate of about 9 percent. Significant share of oil revenues in GDP, the low inflation rate, the stable exchange rate caused high rate of economic growth in this period (Jalali-Naini, 2003).

Figure 3: Iran GDP annual growth rate (1963-2014)
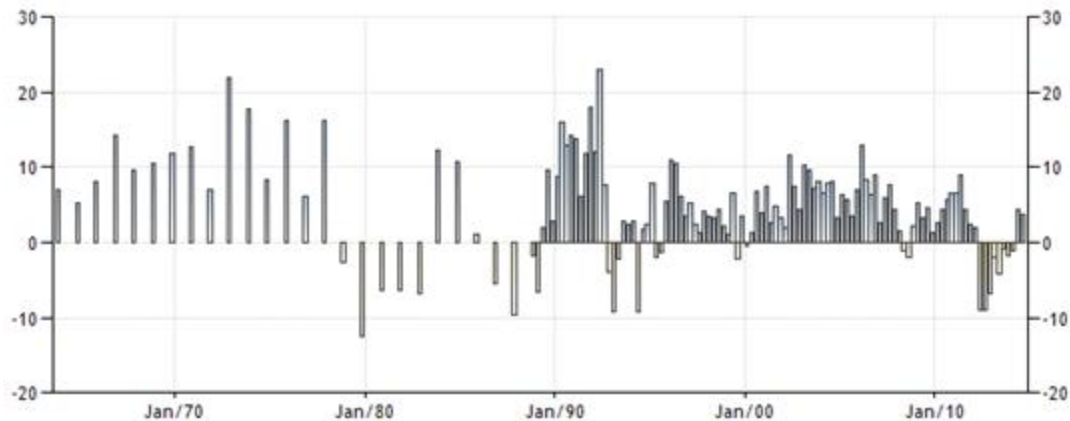
Source: Trading Economics online database

However, after 1979 revolution this upward trend stopped and brought about significant change in economic policies. There was huge state control on prices and extensive nationalization was undertaken. The policy was implemented in regard to banking system, insurance system, large scale modern industries as well as foreign trade (Jalali-Naini, 2003). The revolution, following by eight years Iran-Iraq war as well as unsuitable situation on the world oil market caused negative effects on GDP growth (Haerian, 1996). Indeed the Iran-Iraq war was highly destructive to the Iranian economy. The GDP significantly declined because of lost oil revenues due to war damage on the oil infrastructure and consequently oil exports. The physical damage of the war is revealed by the Iranian government at about 30,811 billion Rials (Mazarei, 1969) not to mention the toll in human suffering, the direct effects on the labour force and the loss of human capital due to emigration. Indeed, the two most important reasons for the low growth of economy during the first decade after the revolution were the cost of physical damage from Iran-Iraq war and negative effect of the war on the economy due to massive war related expenditure.

With the end of the war in late 1988, which are starting period of under study, a new period of post-war reconstruction efforts and economic adjustment policies was applied under the First Five-Year Development Plan (FYDP). The objective of the first FYDP was regenerate the economy, reconstruction the war damaged regions, improve foreign investment, to reform foreign exchange and implement trade liberalization policies (Pesaran, 2000). Real GDP

increased by 5.9 percent in 1990 within the beginning of this FYDP and reached to 14.1 percent in the second year (1991) of the plan.

Within the period of (1995-1999) government was planned the second FYDP, which completion of infrastructure and development projects started under the first FYDP were the main priorities of the second FYDP (Salehkhou, 1999). However, as a result of the oil price collapse during the second FYDP period, the projected GDP growth slowed down.

According to Salehkhou (1999) some of the most important strategies included; establishing the Export Guarantee Fund (EGF) and the Export Development Bank (EDB), environmental concerns especially air and soil pollution, long range policies in the areas of infrastructure and communication, privatization to gradually decrease the role of government in the economy.

At the end of the second FYDP in 1999, the Management and Planning Organization of Iran (MPOI) established the third FYDP for the period of 2000 to 2004. The policy framework was; establishment of the "High Administrative Council" to reform the administrative system, the assessment of the financial position of the national companies with the aim of privatization, the creation of "Oil Stabilization Fund (OSF) in order to protect the national economy from the negative effects of potential collapses in the oil price, the introduction of appropriate conditions for private banks and private non-bank credit institutions and the removal of non-tariff barriers in order to promote foreign trade.

During the first year of the third FYDP, GDP exceeded the projected target and grew by 5.1 percent due to overall improvement in general economic conditions. Positive upturn in oil market with increasing crude oil price, an increase in Iran's OPEC quota, a consequence rise in the production of crude oil and implementation of new foreign trade regulations which improved the export of non-oil production affected positive economic growth during the third FYDP.

The forth FYDP plan then started within the period of 2005-2009 with many quantitative targets to upgrade Iranian economy, political, and social international status. The forth FYDP emphasized a minor government role in the economy and pay attention to enterprise privatization, and tensioned more dependency on market force. The main objectives at the top were, rapid economic growth, job creation and reduce unemployment, curbed inflation and decrease income gap between various social strata, economic diversification along with increases in human capital, technology and total-factor productivity, self-sufficiency in basic agricultural

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products, enhanced international competitiveness and increased non-oil exports, budgetary reforms and reduced reliance on crude-oil exports, privatization of state enterprises and their transfer to the private sector, stabilization of the climate for domestic trade and business, provision of housing for low-income and rural groups; and attention to the supply, maintenance and use of water resources. However the 4th FYDP plan lost valuable opportunity to use high oil and gas revenues to facilitate an environment conductive to transferring the Iranian economy from a protracted unemployment, as well high inflation and low growth to higher standards of living. During the fourth FYDP the average GDP growth was 5.1%, below the predicted growth objective of 8%. The first year of 4th DYDP real GDP grew 4.7% due to high oil price. The positive trend continued in 2006 and 2007 with the growth rate of 6.2% and 6.4% respectively due to strong banking credit and high budgetary capital. Nevertheless, a decline in oil exports and a severe agricultural drought descended performance of growth in 2008 with GDP growth squeezed to 0.6%. However the final year of 4th FYDP with improvement in agricultural sector economic growth recovered to 3.9%. The prediction of average daily oil exports of 2.5 million barrels with an average price of 20$ per barrel, targeted gas and oil earning of 120 billion US$ supported the plan's annual growth rate of 8%. However the plan implementation deviated strongly. While in the 4th FYDP real oil and gas export earnings were three times more than planned, its economic impact was less, resulting in a real average growth rate for less than the plan's target.

However after the forth FYDP the government designed the fifth FYDP (2010-2015) with many objectives that were much less quantitative which data after 2010 excluded from period under study. The authorities failed to learn from the forth FYDP's results and further repeated their support to an aspiring growth target of 8% during the fifth FYDP. In spite of a rebound in the agricultural sector in the first year of the 5th FYDP, aggregate demand was limited due to subsidy reforms and higher energy prices, resulting in GDP growth of 2.0% in 2011. For the remaining plan period economic growth turned negative in 2012 and 2013, for the first time in two last decades due to harmful impact and expansion of international sanction in 2012 against Iran's central bank and oil exports which significantly reduced Iran's oil revenue. Iran continues to endure from high unemployment, currency collapses, oil export declines, high inflation, shipping difficulties and falling oil and industrial production. Sanctions have caused Iran to suffer its first gross domestic product contraction in two decades. An IMF (International Monetary Fund)

global report issued in late April 2013 said that Iran's economy shrank 1.9% from March 2012-March 2013, and will likely shrink another 1.3% in the subsequent one year period. U.S. officials testified on May 15, 2013, to a larger GDP drop for 2012-2013—on the order of about 5% - 8%. The recession has elevated the unemployment rate to about 20%.

The most notable feature of this figure is that the Iranian GDP growth is not stable and faced many fluctuations. In fact upward and downward movement is evidence and they coincide the oil boom in 1974-75, the Islamic revolution in 1979, the war with Iraq in 1980-88, oil price collapse in 1986 and nowadays Iran oil sanction.

The following part considers the individual domestic sectors which make up GDP, such as agricultural sector, oil and gas, industries and mining, and services (Figure 4). Oil and gas sector contributed 26.5%, agriculture (10.9%), industry (18.7%), services (43.9%) of GDP (IMF, 2010). The Iran government is attempting to expand its economy well- being by investing revenues in other sectors. These sectors are aerospace industries, car manufacturing, consumer electronics, nuclear technology, and petrochemicals (Central Bank of Iran, 2009). The composition of the GDP shifted dramatically after the revolution. While the agricultural and the industrial contribution in GDP had a modest increase, the share of oil and gas sector of the GDP decreased significantly due to war damage and lack of investment and finally the service sector share in GDP increased significantly.

Figure 4: Sectoral composition of GDP (2010)
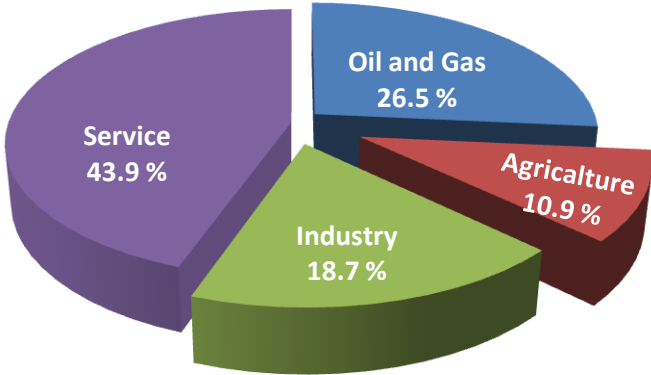
Source: IMF, 2010

2.2 Petroleum industry of Iran

Petroleum has been the main industry in Iran since the 1920s. Iran has the world's third largest petroleum reserves after Saudi Arabia and Canada with holding 10% of the world's total proven oil reserves and the second largest gas reserves following Russia. Economy of Iran relies strongly on crude oil export revenues that representing about 80% of total export earning and averagely 60% of government revenues in annual budgets. Iran has passed through periods of bust and boom as oil price have fallen and risen on the volatile international markets.

Nonetheless Iran faced some important internal and external challenges. Internal challenges include the huge dependency of government spending on oil export revenues and susceptibility to oil price fluctuations, high unemployment and inflation levels, domestic economic mismanagement and extensive economic inefficiency. The external problems are U.S. and U.N. sanctions against Iran which in some extent they have destroyed the Iranian oil industry and consequently the Iran's ability to export the oil. Therefore Iran's petroleum sector is experiencing a period of decline, not just because of external sanctions but also as a result of lack of investment in new capacities.

The oil and gas sector is heavily state-dominated. Oil and gas production and exploration are handled by the state-owned National Iranian Oil Company (NIOC). A NIOC subsidiary, the National Iranian South Oil Company (NISOC), represents the majority of local oil production. Prior to the revolution, Iran's daily crude oil production had been as high as 6 million barrels per day (Salehkhou, 1999). Following the Iran-Iraq war, this figure dropped to 2.9 million barrels per day in 1988 (the ceasefire year). As shown in figure 5 most of the crude oil reserves are in the southwestern region near the Iraqi border. Therefore Following the cease-fire the National Iranian Oil Company (NIOC) implemented an intensive reconstruction plan to restore fields destroyed by the war (EIU, 2000). Oil production capacity increased to 3.3 million barrels daily in 1991 and reached 3.7 million barrels daily by 1999/00. Recently Iran holds about 157 billion barrels of proven crude oil that the country's official production capacity is approximately around 4 million barrels per day (mbpd). In 2012 according to OPEC's secondary sources, Iran's real production capacity remained 2.7 mbpd, whereas Iran's official statistics suggest a production of 3.7 mbpd. The country's oil production is undermined due to a lack of technology, which is one of the direct results of sanctions on Iran's petroleum sector.

Figure 5: Iran oil, gas and refineries sites map

Recently the government increased their attention to gas sector development. Current gas production stands at 550 million cubic meters per day and is estimated to increase extensively by 2016. The strategy of government in using the gas over the past decade has been to enhance the role of the natural gas in the domestic energy basket. The main objective of this strategy is provide gas to domestic consumption to free up oil for exports, inject gas into oil reservoirs to enhance production, increase gas usage in domestic gas based industries, export gas via pipelines or any other methods. However still most of produced gas utilized in domestic usage and Iran has not yet become a major exporter. Nevertheless promoting the gas production and improving the efficiency in domestic energy consumption will open a path for increasing energy exports in the future.

Oil and natural gas are Iran's most important exports, accounting for 82 percent of the country's export revenues. Table 1 indicates Iran's oil and gas production, consumption and exports.

Table 1: Iran's oil and gas production, consumption and exports.

2013	Oil	Gas
Current production	33 mbpd	550 mcm
Current import (from Turkmenistan)	-	22 mcm
Domestic consumption	1.8 mbpd	545 mcm
Current exports	1.5 mbpd	27 cm

Source: The Iranian Ministry of Petroleum's statistics.

Evidently, Iran's oil production and exports have declined over the past few years; actually in 2012 Iran was exporting about 2.3 mbpd of oil. According to current Iranian state budget, about 33.2 % of the Treasury's income obtained from the export of oil and gas. According to the figure 6 the share of oil and gas revenues in the state budget peaked in 2010 at about 50% but has followed decreasing ever since. Estimation is shown that oil and gas export revenues will continue to contribute about one third of the Iranian government's income.

Figure 6: share of oil and gas revenues in the Iranian state budget.
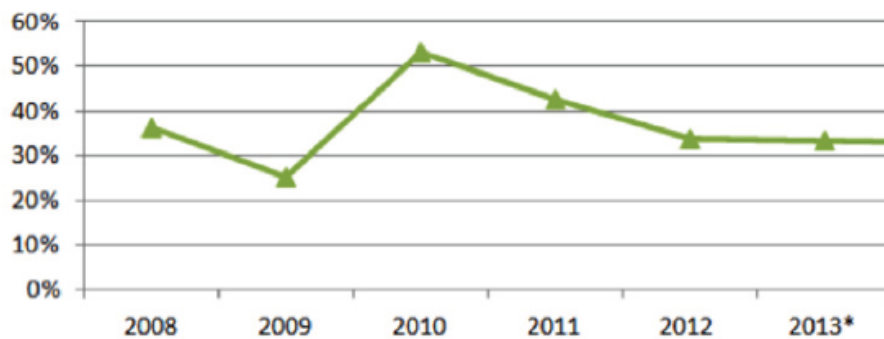
Source: The Iranian Ministry of Petroleum's statistics.

Iran's oil production will remain immobile for some years, especially due to sanctions and lack of investment. In fact, NIOC's new production will mainly make up for the depletion factor.

However, current sanctions on Iran's crude exports will compel Tehran to invest more in refining capacity which will lead to a growth in domestic consumption of oil (for production of petroleum products) and a decreasing of crude oil exports. This, in turn, will pave the way for other developments in the sector that will be significant for the country (especially the growth of the downstream sector). Gas production will enhance significantly and will facilitate the growth of energy exports in diverse forms. However it is believed that millions of barrels of oil are lost annually due to damage to reservoirs and these natural decreases. Additionally, 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 and access to new technology, due in part to U.S. sanctions.

Major export markets of oil of Iran are China, Japan, India, and South Korea and Italy. More than 40% of the world's oil traded goes through the Strait of Hormuz, a channel along Iran's border. The Strait of Hormuz is considered a global "choke point" because of its importance to global energy security. It is a narrow channel with a width of only 21 miles at its widest point through which large volumes of oil are shipped (The Iranian Ministry of Petroleum).

Considering all of above and in order to protect GDP from extensively reliance on oil exports, the diversification of the export must appear right at the top of the government's priority list. It should be noted that due to the huge oil reserves and comparative advantage of this sector, further investment in the petrochemical industry in Iran has obviously been a good place for government investment and one viable option involves a more intensive investment in the petrochemical industry as a whole. In following section effect of petrochemical export on economic growth will be considered in details.

2.3 Petrochemical industry of Iran

2.3.1 Overview

Development of Iranian petrochemical industry initially started in 1963 when a fertilizer plant was installed in Shiraz (south part of Iran). Following that in 1965 NPC (National Petrochemical Company) to undertake the operation and development of the petrochemical industry was established. Since then, NPC with joint investment with internationally recognized companies has settled many petrochemical plants which are handled by subsidiary companies that make different chemicals for domestic and foreign markets. Major activities of National Petrochemical Company are on production, manufacture, sale, distribution and export of products derived from hydrocarbons and related compounds which can be organic or inorganic.

Actually petrochemical industry is one of the main components of oil industry and one of the principal industries in Iran as well. Petrochemical industry can play effective role in Iran's economy due to its ability to fulfill the demands of several domestic industries, production and export of petrochemical products, and opening more job opportunities for the unemployed. Therefore it is important source of bringing money in the country (Vakhshri, 2006). Iran has huge reserves of oil and natural gas which made the petrochemical industry to have comparative advantages that can be improve also other Iranian industries (Vakhshri, 2006). With huge amount of energy resources and compounds available for petrochemical industry, several domestic and international markets, good connection to sea roads and global highway, professional and experienced staffs are major advantages of the Iranian petrochemical industry. Therefore Iran can influence the world petrochemical industry (Vakhshri, 2006). The high oil price has benefit for government to investment especially in petrochemical industry and recently, Iran started proficient planning for petrochemical industry and it has been given priority in development (Fizebakhsh, 2002). Iran has invested in several petrochemical projects in the past years. In order to decrease imports and increase exports, NPC has conducted different projects with in the FYDP started from 1989. Reconstruction of infrastructure was considered after war during the first FYDP. Therefore experience obtained from the first FYDP accelerated the second FYDP targets acquisition, the Iranian petrochemical industry was rapidly grown from 1997. In this year the feasibility study of many plants started. Then in the following years implementation of these plants was initiated. Therefore with enhancing the number of completed projects promotes the production rate from 5.2 million ton in 1997 to 24 million ton in 2007.

As at end of 2009, Iran's total annual petrochemical production capacity stood at 34 million tonnes. In 2010, Iran produced 26% of the total petrochemical output in the Middle East, second behind Saudi Arabia. The petrochemical industry accounts for 2 percent of the GDP, 44 percent of the non-oil exports and 55 percent of the industrial exports. In 2011, Iran earned 12 billion dollars from exporting petrochemical products to over 60 countries.

The manufacturers of petrochemical products in Middle East made up of Iran, Bahrain, Iraq, Israel, Qatar, Saudi Arabia, Turkey, and United Arab Emirates. Iran, Saudi Arabia, and Turkey are the biggest manufacturers. Qatar and Saudi Arabia is main competitor of Iran (Vakhshri, 2006). In the Middle East, petrochemical products are cheaper since they are produced with a five times lower energy cost, and they are produced based on ethane, a cheap by-product of gas extraction (Iran Oil Ministry, 2009). The price of gas has fixed rate most of the time compared to the price of oil. As a result, Iranian petrochemical can have a fixed price in the global market (Vakhshri, 2006). The competition with petrochemical firms that use gas as first material becomes stiff (Vakhshri, 2006). Europe's share of the world production of petrochemical product decrease from 31 to 27%, as Asia's production increases from 23% to 31%. The predictions show that producing 126 million ton of petrochemical products with $50 billion investment per year; Iran will be able to specify 34% of Middle East and 6.3% of international petrochemical product market (Iran Oil Ministry, 2009).

2.3.2 Trading

One of the most important issues in an economy of countries is exporting. Therefore most of the government effort to enhance the exporting due to make better the condition of domestic market. For decreasing dependency of Iran's economy on oil revenue solution can be the development of products that can improve the situation of domestic economy and improve an export to foreign markets (Zarin Negar and Vazife Dost, 2009). The target of the economic development project of Iran has concentrated on increasing the trade interaction with the international community and trying to be an active member in the global market (Vakhshri, 2006). Nowadays expand of non-oil exports is one of the important strategies in the Iran's economy development plan (Atiyehbahar, 2004). Iran has different options for exports and imports. The major exports include petroleum, chemicals and petrochemical products, nuts and fruits, and carpets. The

principal imports are industrial raw materials and intermediate goods, foodstuffs and other consumer goods, capital goods, and technical services.

Main importers of Iranian goods are United Arab Emirates (UAE), Iraq and China that scored the first, second and third position respectively (Iran's customs Administration, 2008). These three countries are then followed by Japan, India, South Korea, Turkey, Italy, Afghanistan and Germany (Iran Trade Promotion Organization, 2011). The principal partners of Iran's non-oil exports are mentioned in table 2.

Table 2: Main partners of Iran's Non-Oil Exports (March 2010-March 2011)

	Country	**Value (US% MILLION)**	**Share %**
1	UAE	2153	14.2
2	Iraq	1586	10.5
3	China	1231	8.1
4	Japan	927	6.1
5	India	830	5.5
6	South Korea	555	3.7
7	Turkey	553	3.6
8	Italy	518	3.4
9	Afghanistan	442	2.9
10	Germany	367	2.4
	Total ten countries	9165	60.4
	Total including others	15.172	100

Source: Iran Trade Promotion Organization, 2011

With regards to the data on Iran Trade Promotion Organization 2011, petrochemical products are the principal export product of the total non-oil exports. The percentage of the petrochemical sector from the all non-oil exports is 38.6%. The rank of non-oil export in 2010 is mentioned in table 3 (Iran Trade Promotion Organization 2011).

Table 3: Share of Non-oil Export Value 2010

Rank	Export Products	Percentage of total non-oil export
1	Petrochemical sector	38.6%
2	Industrial sector	32.2%
3	Agricultural sector	13.1%
4	Mineral sector	5.4%
5	Carpets and handicrafts	3.3%
6	Other	7.4%
	Total	100%

Source: Iran Trade Promotion Organization, 2011

The main exportable items in 2010 (NPC report 2010) fall into 5 main product categories; polymer, chemicals, fertilizers, aromatics and fuel and hydrocarbons. Recently petrochemical products exports have increase due to the substantial Iran government's investment in petrochemical projects (Iran Oil Ministry, 2010). The amount and value of export for period under study presented in figure 7 (NPC, 2011).

Figure 7: export of petrochemical products
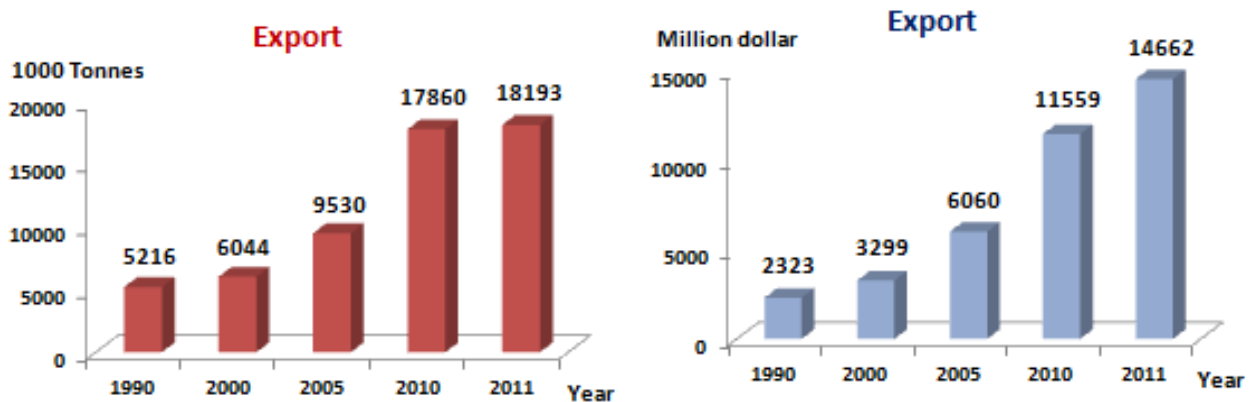
Source: NPC, 2011

Petrochemical products are exported to many countries such as Japan, UAE, India, China, South Korea, Italy, Singapore, Taiwan, China and others (Iran trade promotion organization, 2009). Saudi Arabia, Singapore, India, Spain, Taiwan, the Netherlands, Belgium, Indonesia, Malaysia, Qatar, Japan, China, South Korea and France are also among the major targets for the Iranian products (Iran Oil Ministry, 2009). Value export markets for petrochemical products in 2010 depicted in figure 8 (NPC, 2010)

Figure 8: Value export market in 2010.
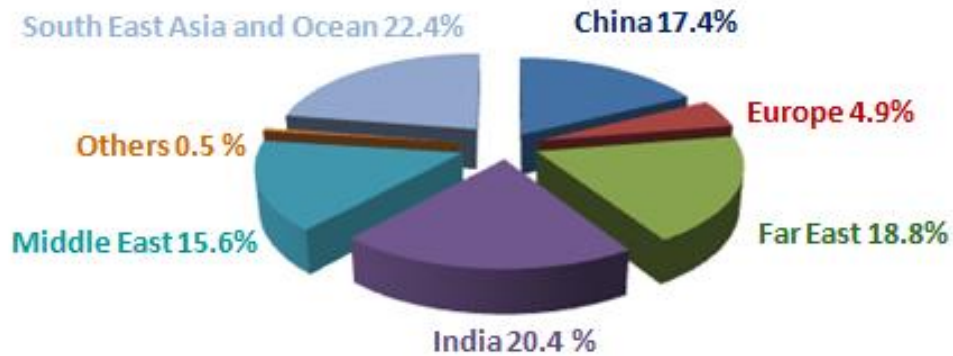
Source: NPC, 2011

In addition, Iran has comparative advantages in searching for investments into the petrochemical industry. This is because Iran is located within the boundary of Persian Gulf, and it is near to China and India, whereby both countries' markets that is the biggest consumer markets of petrochemical products. So, petrochemical firms can fulfill their objective of export to these markets (Vakhshri, 2006).

2.3.3 Major Challenges for petrochemical industry of Iran

In oil and gas based countries large scale projects such as petrochemical projects are an index of economic and social progress of a country. In recent decades, there has been a big growth in the number, size and complexity of large scale petrochemical projects in Iran. Monitoring and management of these projects inevitably requires dealing with substantial schedule and cost overruns. Iranian National Petrochemical Company (NPC) as a government firm is concerned about enhancing organizational performance for increasing its profit and approaching to Iranian Petrochemical industry twenty year's vision. NPC planned to operate a high number of projects

in 1997. In this year only two projects were under implementation. After four years, the number of ongoing projects was highly increased up to 22 projects. In current decade, the Iranian petrochemical projects have suffered significant delay and cost overrun due to NPC emphasize on national executing capacity. Because of the national project provisions, more than 50 percent of a Petrochemical Project will be done by Iranian. Although lost benefit of these large scale projects is considerable, 80% delay is a usual percent in these projects.

However in order to protect GDP from excessive reliance on oil exports, the diversification of the export base must appear right at the top of the government's priority list. With considering all of the above developments in production and consumption of energy, it can be estimated that by 2016 Iran will be a less exporter of crude oil but significant exporter of gas, petroleum products, electricity and petrochemicals. In petrochemical productions which are gas based, Iran targeted to be major producer and exporter. It is evident that Iran is moving away from being a crude oil exporter towards a diversified energy exporter in the forms of pipeline gas, petroleum products, electricity and gas-based industrial products. Tehran sees itself as a major energy provider in the region and believes that energy interdependency will enhance mutual cooperation. In other hand the petrochemical sector is also hit by external sanctions which restricting oil exports and investment in oil related projects. Therefore to some extent they can influence the ability of Iranian economy to export the oil and consequently its economic growth. There is no doubt that the current sanctions are slowing down Iranian development, but they are also compelling Iran to become a giant producer and exporter of energy-related products and services. The recent change of government in Iran and the emergence of a more moderate administration will offer an opportunity to ease some of the existing tensions, but a return to a tension-free relationship between western powers and Iran will require a longer period of time (NPC reports and Iran Trade Promotion Organization webpage)

2.4 The structure of the Iranian foreign trade sector

International trade countries entitle them to participate in and maximize their profit. Each country may have specialized in one or more activities in which have comparative advantage. Recently international trade contributes considerably to economy of Iran. Iran as one of the developing countries seems to have more advantages in the production of goods which in their production apply more labor. In addition Iran keeps second largest oil producer in the Organization of the Petroleum Exporting Countries (OPEC), which oil and gas reserves rank between the world largest. Therefore oil and gas build the most important industrial sector to Iran's economy. Nevertheless oil sector share of fixed GDP has decreased from revolution 1979 due to destruction of production facilities during the Iran-Iraq war, OPEC output ceilings and sanctions. However still oil revenue account for the prominent export earnings and government revenue. In addition this sector obtain the most domestic and foreign investment.

Due to dependency of Iran economy on oil export revenues, volatility of worldwide oil price and international sanction affects dramatically this sector. Therefore Iran has been working to decrease its dependency on oil export revenue by improving other sectors of economy and attempt to diversify its export especially in petrochemical industry as a non oil export. Hence, non-oil export might be able to decrease economic harm from a future drop in price of oil. Nevertheless economy of Iran would still suffer due to huge dependency on oil export revenue. The objective of this chapter is to shed some light on the structure of the Iranian foreign trade sector.

2.4.1 Export Sector

The structure of the export sector in Iran have always controlled by crude oil export revenues. In fact, since the late 1960s, petrodollars have been the mainstay of the Iranian economy, especially after the 1973-74 oil booms the oil sector has concerned as the leading sector in the Iranian economy. However revolution of 1979 caused reduction in both production of oil and export in this sector. During the period of the eight years Iran-Iraq war oil revenue made up about 80 percent of total export revenue and approximately 40-50 percent of the government budget (CBI, 2001).

According to Karshenas and Pesaran, 1995, "Oil export earnings can play three vital roles in the Iranian economy: provision of foreign exchange, addition to national savings, and contribution to

government revenues". In Fact fund granted by oil and gas sector should be applied for investment not only in this sector but also in other sectors of economy to make a path for improving the whole economy in the long term (Valadkhani, 1996). Unfortunately this has not been case and in Iran oil revenues have been applied into inefficient manufacturing industries. The result of this strategy was that instead of diversification and rapid growth of non-oil exports, which would have enables the economy to dependent less on imported intermediate goods, the oil sector actually made worse the country' dependency on imports (figure 9)(Valadkhani, 1996).

Figure 9: Export/GDP ratio and import/GDP ratio, Iran, 1995-2013, constant prices and exchange rates
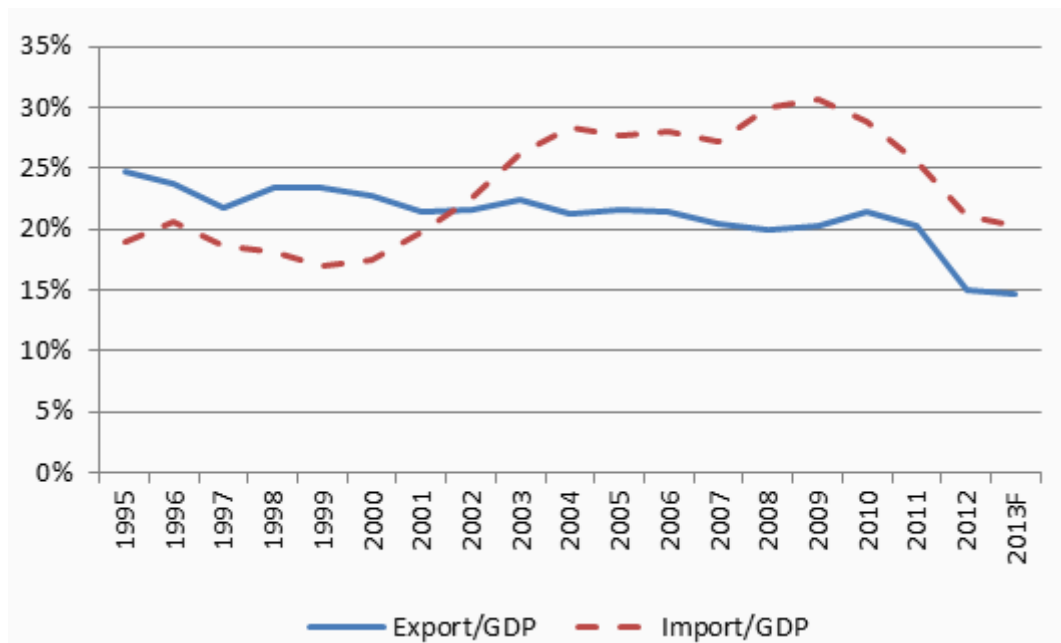
Source: Word Bank Database

The data in figure 10 show that the share of total exports (values at 1997 constant prices) as a ratio of the GDP increased to about 50 percent in 1974 due to oil boom 1973-74. The share decreased to about 26 percent at the starting of revolution (1978) and declined strongly to about 8 percent in 1981 due to the destructive war which has started in 1980. According to Amuzegar (1993), the major cause of less performance of the oil sector within 1978-1981 were mainly three months general strike in 1978 that reduced oil production and consequently export, and the next as a result of revolution and of course the strong damage of oil refineries due to Iran-Iraq war.

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However the total export share in GDP raised again in 1983 and turned up to 15 percent. This proportion declined to 10 percent in 1986 when oil prices dropped sharply. In 1989 with the ending the war and application of export promotion polices, this share raised during the first FYDP (1989-93) to about 20 percent of GDP. In addition this share reached to its peak of 25 percent in 1994. However after that, the share declined to an average of 18 percent of GDP during the second FYDP. After that the share of total export in GDP in some extent influenced by oil price, Iran trade policies and political conditions mainly sanction.

Figure 10: Share of the total exports in GDP (1960-2010)
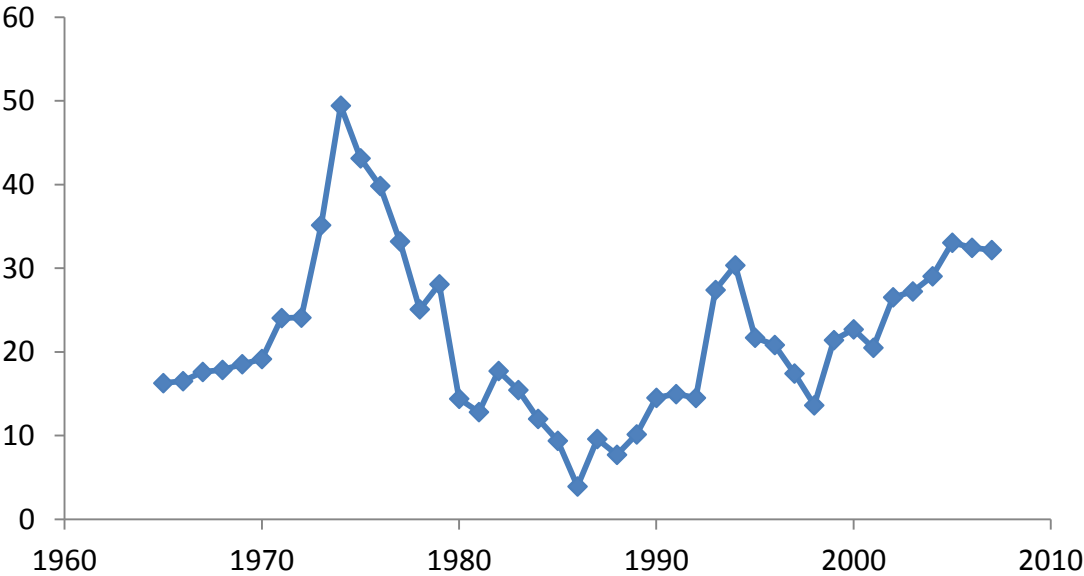
Source: Trading Economics Online Database

According to both the EIA (Energy Information Administration) and BP (British Petroleum), Iranian oil exports were in the 2.5 million barrels a day range, for most years in the 1992 to 2011 period. In 2012, Iran's oil exports dropped to 1.7 or 1.8 million barrels a day. Recent data from OPEC suggests Iranian oil exports (crude + products) have recently dropped to about 1.5 million barrels a day in May 2013 due to international sanctions which aimed at driving Iran's oil sales to a half (figure 11). (Tverberg, 2013).

Figure 11: Iranian oil exports, based on BP and on EIA data.

Iranian Oil Exports
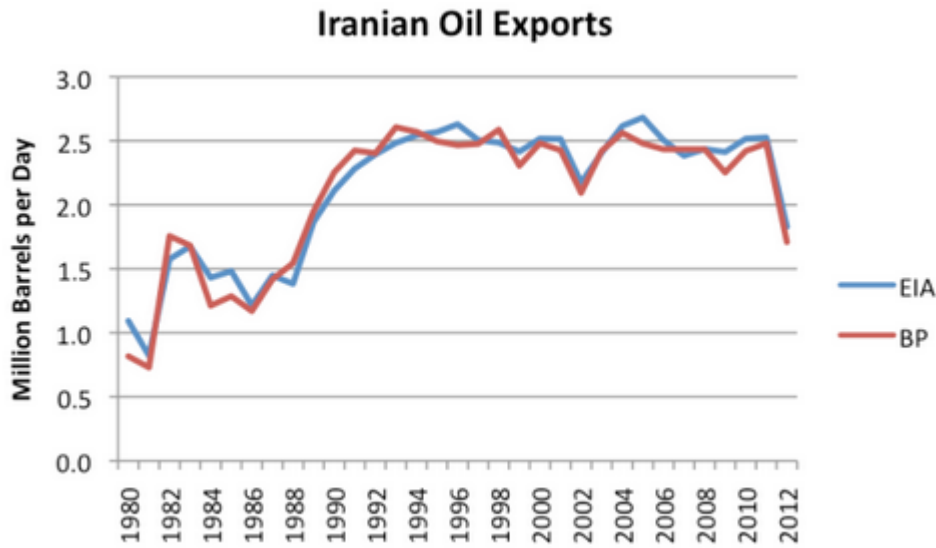
Source : Tverberg, 2013

With regard to dependency of Iran economy on oil export revenues which are affecting with oil price volatility and international sanction, Iran has been working to decrease its dependency on oil export revenue by making optimization in other sectors. Therefore with diversification of non-oil export mainly in petrochemical industry Iran might be able to decrease economic harm from a future drop in oil price.

Over the last two decade, the Iranian government has been trying to enhance non-oil exports. The idea for non-oil expansion initiated before revolution but later due to political change and war with Iraq, these policies were dropped (Iran Export Magazine, 2002). However due to oil price instability the government was forced to restart non-oil export improvement policies that gave access to foreign exchange.

According to Shafaeddin (2001) the present of oil resources are limited, hence dependency of economy on oil exports and revenues have high risks, and also cannot provide sufficient job opportunity for growing labour force. Moreover new source of energy may be replaced oil, the OPEC agreement is unstable and there still remains the general political risk of international trade embargos that make necessary diversification of exports (Shafaeddin 2001). Due to need of improvement in non-oil sector government applied diverse export policies during Five Year

Development Plan (FYDP). The removal of many trade obstacles and the liberalization of the exchange rate system led to a surge of non-oil exports which placed Iran among the best performing economies in the region (IMF, 2002).

Iran's non oil exports included namely, agricultural products, mining and mineral products, industrial products and carpets and handicrafts. During 1980s the nature of non-oil exported goods were traditional and agricultural products which reached to 82.8 percent of total non-oil exports in 1985 and industrial goods accounted for only 8.7 percent in this year (Amirahmadi, 1990). Following the implementation of the Five Year Development Plan (FYDP) exports of manufacturing and industrial products such as steel, petrochemical products, textiles and other industrial goods raised dramatically. Official data show that in 2010 export of petrochemical products reached to 38.6, other industrial sector to 32.2 percent while agricultural sector decreased to 13.1 percent of total non-oil exports as mentioned in table 3.

2.4.2 Import Sector

The import capacity of Iranian economy depends on oil exports. After 1988 ceasefire, during the first FYDP the country moved toward trade liberalization policies. Decreasing in some extend import restrictions during the first FYDP caused an increase in the importation of commodities. However given Iran's restricted export capacity, the high level of import led to downfall of the country's external current account. The large amounts of external debt were other problems that made pressure on the economy due to the high level of imports during this period. In fact high levels of external debt led to government apply compression policy that significantly decreased in the value of imports during the second FYDP (1995-99).

According to Dadkhah and Zangeneh (2001), there are many options that limit imports to Iran. Most of the goods require a license to be imported into Iran. There are quotas, customs, regulations, restrictions as well as outright bans and these are applied not only to imported goods but to the sale of foreign exchange obtained from export of goods and service as well.

Before period under study between 1960 and 1980, Iranian exports were almost equal to or exceeded Iranian imports and follow each other closely mainly during decade 1980s. It is worth noting that oil exports had been main resource of the financing as well as main source of capital and intermediate imports in the Iranian economy. However during the period under study due to

the implementation of import restriction polices export and imports no longer moved in tandem (see figure 12)

Figure 12: Iran total export and import
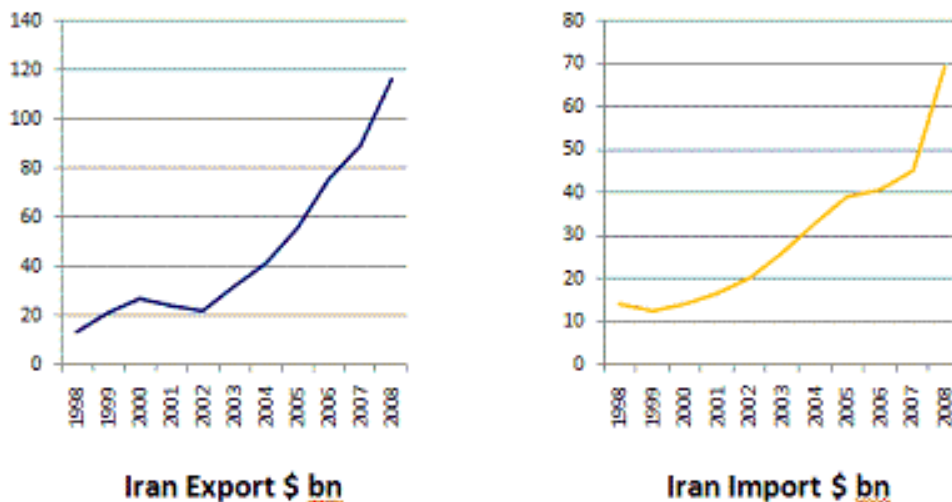
Source: Iran Trade Low

Official statistical data indicate that from 1960 to 1978, the share of intermediate goods and raw materials was never less than 50 percent of total imports, which show high dependency of Iranian industrial sector to foreign exchange. During the first decade after revolution 1979 share of capital imports over total import decreased and during the war period (1980-88) the government decided to import essential consumer goods like wheat, sugar, and rice as well as intermediate and capital inputs for industrial sector and the military needs of the war (Tayebi, 1996). Data during the second FYDP (1999) indicate that the share of raw materials and intermediate goods over total imports had enhanced however the share of capital imported goods as well as share of consumer goods in total imports declined (CBI, 2001a).

Turning to more recent data, shows the composition of imports include raw materials and intermediate goods. As mentioned earlier, this is simply because the structure of Iran's imports was dominated by the needs of the industrial sector. Recently, manufacturing inputs continue to be the largest component of Iran's imports due to the nature of Iran's manufacturing which consists primarily of the assembly of parts sourced from industrialized countries.

2.4.3 Iran's major trading partners

Since the revolution Iran has tried to increase the circle of its trading partners. From 1950 until revolution 1979, the United States was Iran's major economic and military partner, which had main role in the modernization of its infrastructure and industry. Official data indicate that imports from developed countries such as the ISA, Western Europe, Canada and Australia dropped to as low as 62.7 percent of Iran's total imports in 1982 in comparison to 85 percent of share in 1976 due to disconnection between Iran and most of developed countries after revolution (Tayebi, 1996). Since the mid 90's Iran has elevated its economic cooperation with other developing countries including Syria, India, China, South Africa, Cuba and Venezuela. Iran's trade with India passed the $13 billion mark in 2007, and 80% elevate in trade volume within a year, Iran is increasing its trade cooperation with Turkey and Pakistan as well.

Since 2003, Iran has enhanced investment in the economic development and reconstruction of neighboring countries such as Iraq and Afghanistan. However recent official data show that Iran's major commercial partners are China, India, Germany, South Korea, Japan, France, Russia and Italy. Figure 13 indicate that in export section Iran's top trade partners in 2010 are China, India, South Korea, Germany, Italy, France, Brazil, Japan, Belgium and Greece. Supplying markets for products imported by Iran in 2010 are China, Japan, Italy, South Korea, India, Greece, Germany, France, Belgium and Brazil (Central Bank of Iran).

Figure 13: Iran's trade partners based on imports and exports.

Source: Central Bank of Iran

As can be seen in figure 14, European countries, all together including Italy, Spain, Greece, France, Belgium, Netherland, Britain, Germany, Czech Republic, China, India, Japan, South Korea, Turkey, South Africa, Sri Lanka and Taiwan are top Iranian oil importers (Bond, 2012).

Figure 14: top Iranian oil importers 2010
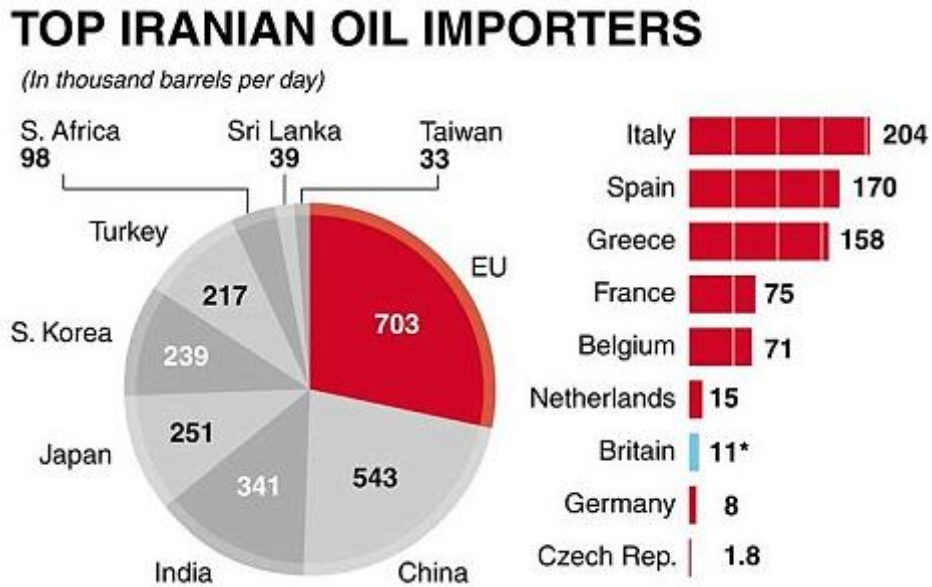
Source: Bond, 2012

In fact US sanction sent Iran into the arm of Asia. It should be considered that, the biggest customers for Iranian oil are China; moreover China has surpassed Germany as Iran's largest trading partner. And more investor in Iran's energy industry which led by China are also Asian (figure 15). The Chinese expect to more than double their consumption of oil within the next 10 years. The Chinese government has tried to be friend Iran while getting along with the United States.

Figure 15: Effect of US sanction on share of Iran Trade
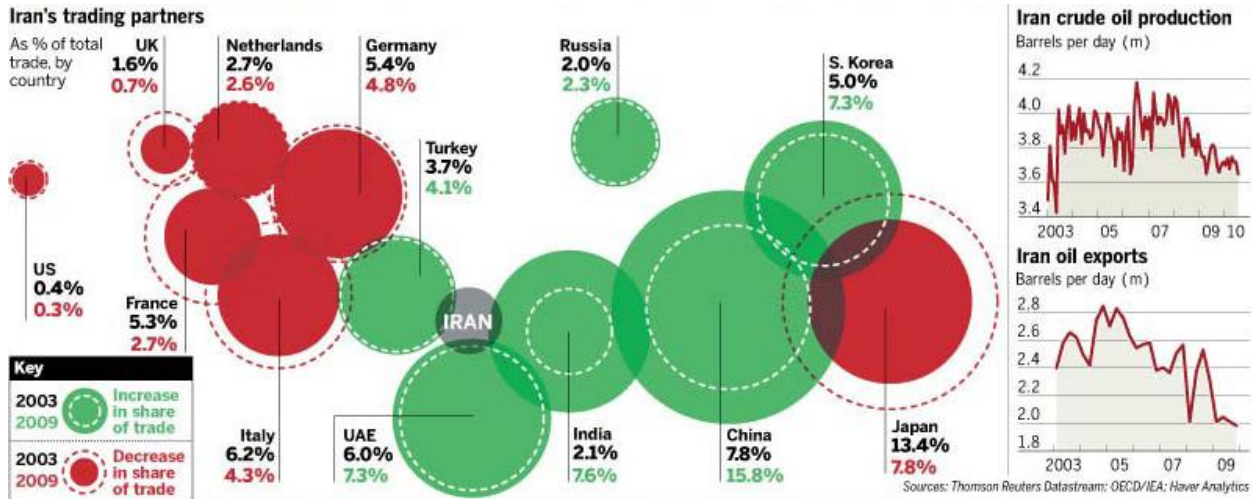
Source: Ebersole, 2014

The countries, to which Iran exports its non-oil products, are shown in Table 4, and they are UAE, Iraq, China, Japan, India, South Korea, Turkey, Italy, Afghanistan and Germany. UAE share in 2010/2011 was 14.2 percent which keep the first place among these countries. In fact it is estimated that Iranian who lives in Dubai/UAE handle over 20 percent of its domestic economy and counted for an equal ratio of its population. It should be noted, however, that the main reason for the large amount of trade from the UAE is the use of the Dubai Free Trade Zone in order to circumvent American trade sanctions. In addition UAE play its role as intermediary source of Iranian goods to the American market. In fact many Iranian living and doing business in the USA have established branches of their companies in the UAE so as to legally import as well as export goods which are banned from direct trade by American sanctions. Most of the commodities in the Dubai Free Trade Zone are originally imported from developed countries, especially the USA, and these are then re-exported to Iran and other countries in the Persian Gulf region.

Table 4: Main partners of Iran's Non-Oil Exports (March 2010-March 2011)

	Country	Value (US% MILLION)	Share %
1	UAE	2153	14.2
2	Iraq	1586	10.5
3	China	1231	8.1
4	Japan	927	6.1
5	India	830	5.5
6	South Korea	555	3.7
7	Turkey	553	3.6
8	Italy	518	3.4
9	Afghanistan	442	2.9
10	Germany	367	2.4
	Total ten countries	9165	60.4
	Total including others	15.172	100

Source: Iran Trade Promotion Organization, 2011

To sum up, in this chapter, an effort has been made to elucidate the structure of the Iranian foreign trade sector mainly on post-revolutionary period and recent years. In fact oil dependency is the most prominent property of Iranian economy and oil has always been the major source of foreign exchange for the economy of Iran. However oil revenue will not earn enough foreign exchange therefore the Iranian government especially since 1990 tried to obtain export diversification by discouraging over dependence on oil export and encouraging non oil exports. In fact due to huge price fluctuation on the international market the non-oil export enhancement policies were partially successful. However, the consequence of these exports has been less than what expected due to instability in government policies and U.S. sanctions on investment and trade as well which restricted the access of Iranian exports to global markets.

2.5 Export led-growth hypothesis (survey)

Economic growth is a complex process which depends on many functions such as trade, price fluctuation, political conditions, geographical composition and capital accumulation. The Export –led growth (ELG) hypothesis postulate that export development is one of the major determinants of growth. In order to investigate the relationship between export and economic growth, researchers start using a several different empirical methodologies to the available of data. Earlier research studies such as Michaely (1977), Krueger (1978; 1986), Balassa (1978), and Tyler (1981) tests the correlation between export expansion and economic growth. They conclude that there is a positive correlation between export expansion and economic growth. Michaely (1977, argued that GDP in a country would be influence by the expansion of its exports only once it achieves a minimum level of development and growth. In 1978 Krueger examined the export growth of each of ten counties against the rate of GNP growth. He reported a strong positive correlation between the two variables. His next investigation in 1986 argues that a trade regime with ELG tends to produce more quality products for global markets. Balassa (1978) found a strong positive association between growths in real exports. He argues that export-oriented policies lead to better growth performance than policies favoring import substitution. The results of his study show that export growth favorably affects the rate of economic growth.

Tyler (1981) tested a cross section of 55 countries during the period of 1960-1977. He found dependency of GDP growth to export performance and capital formation as well. He found that there is strong positive correlation between economic growth and total export. From his investigation he realized a lower economic growth rate in the countries that did not use export development policies. It should be noted that some researcher argued that the obtained results might be misleading and in some extend involve fake correlation due to the fact that exports are a part of GDP. This argument led some researcher to use GDP excluding exports or other alternative variable as more appropriate measures.

Feder (1982) attempted to examine a kind of production function and they involve exports like other explanatory variable such as investment, labour, human capital, etc in their analysis. He takes into account the reallocation of existing resources from less efficient non-export sectors to higher productivity export sectors. He stated that productivity is larger in export sector and shifting the resources in export sector will gain more than that of inwards-oriented economies.

Moreover, he mentioned that export-oriented policies led to an optimal allocation of resources and enhanced productivity in the countries that pursued these policies. His researches show that there is a positive association between the expansion of exports and economic growth.

Blassa (1985) tested the export and economic growth relation for a group of developing countries after the 1973-74 oil shock. Later Ram (1987) also examined the role of export in economic growth, he found that the effect of export performance on growth was small in less developed countries during the first perid of his research (1960-70) while in later period (1970-77) this impact increased significantly. Later Amirkhalkhali and Dar (1995) considered the impact of export growth in a production function for 23 developing countries. Their result show that there is a strong positive association between export growth and economic growth for all of the developing countries which followed outward looking policies. However data for those countries that appliying inward looking policies did not support this relationship and the level of economic growth was larger in the former countries than in the latter ones.

To prevent the problem of bias in calculation with using single equation models, Sprout and Weaver (1993), Lee and Cole (1994) and others, all used simultanious equation models to consider the association between export and economic growth. Nevrtheless in comprehensive study of litrature regarding this relationship Giles and Williams (2002) stated that the main results of previous studies of export-GDP relation does not changed with applying simultanious equation models.

Ibrahim and MacPhee (2003) stated an updated and new economic estimate of the association between exports and GDP growth based on the Feder (1982) model. Simultaneous-equation models to determine the relationship between exports and economic growth were used. Their findings support the view that "higher productivity in the export sector is associated with the size and trade orientation of a country as well as the extent of manufacturing". They further reiterated that if the export sector heavily relies on primary products rather than manufactured products, then the positive externality effect of the export sector would be weaker and vice-versa.

According to investigation done in this field most authors would agree that promoting exports and obtaining export expansion are beneficial for both developed and developing countries for many reasons including as following:

- ✓ generate a greater capacity utilization
- ✓ take advantage of economies of scale
- ✓ bring about technological progress
- ✓ create employment and increase labour productivity
- ✓ improve allocation of scarce resources throughout the economy
- ✓ relax the current account pressures for foreign capital goods by increasing the country's external earnings and attracting foreign investment

In fact export performance has beneficial effect on economic growth due to the expansion of export can demand for output of country which consequently the country increase its output. In addition export expansion may support specialization in the making of export goods which can increase productivity level which may lead to output growth. Also increasing of export might relax a foreign exchange restriction. This assists importing input and in turn output expansion (Giles, J.A. and C.L. Williams, 2000)

Another factor considered in this study is inflation that is increasing in the general level of prices of service and goods over a period of time. In fact to date, the association amount inflation and economic growth is debatable results (Yogeswari, 2012). Some investigation mentioned the negative impact of inflation on economic growth such as Fisher (1983), Faira and Cameiro (2002) and Singh and Kalirajan (2003). Whereas some other researches confirm positive relation of inflation and economic growth such as Tobin (1965), Lucas (1973) and Gillman (2002). However several investigations such as Sarel (1995), Lee and Wong (2005), Hwang and Wu (2011) also argued that inflation has mix relationship on economic growth and interaction between inflation and economic growth is non-linear, and when inflation rate is slow the relationship is positive and in the case of high inflation rate the relationship is negative.

Dadgar *et al*. (2006) considered the association among inflation and economic growth for Iran during the period of 1959-2004. His conclusion was if there is low level of inflation casual relationship existing between inflation and economic growth. However for medium level of inflation this effect is positive and in the case of high level of inflations, above 26 percent, negative effect on economic growth appears. All of these empirical investigations confirm the significant relationship between economic growth and inflation, which this macroeconomic factor is considered in present study.

Real exchange rate has important role in the literature on export-led growth. Therefore earlier studies that link the real exchange rate with GDP are considered. Rodrik (2008) noted that overvaluation suffer growth which this idea supported by several researchers such as Paul (2006) and Gala (2007). He stated that "undervaluation facilitates growth and having constructed an index of undervaluation based on a purchasing power parity real exchange rate for countries, demonstrates robust evidence of growth enhancing effect of undervalued currencies". He also mentioned that tradable sectors are strongly affected by bad institution and market failures, which causing in their size being smaller than optimal and undervaluation of national currencies assist overcomes these problems. Rodriks's study comes under critical examination with subsequent studies, which in general accepted the positive relationship between higher growth and undervalued exchange rate. Gulzmann *et al*. (1965) stated that depreciated exchange rate does not affect the tradable sectors as proposed by Rodrik, but it has effect via increasing saving and investment that facilitate growth. Mbaye (2012) found that total factor productivity growth can be as a result of undervaluation. And Mario *et al*. provide further evidence that higher real exchange rate assist diversify exports and increase technological intensity of exports. It should be noted that undervaluation should be based on a norm or equilibrium rate. In spite of these studies some researches exist also on negative impact of depreciation on economic growth (Edwards, S. 1989). For example Aganor (1991) argued the negative effect of devaluation on output. In his research article mentioned "rationalizes the negative impact of devaluation by postulating that in a typical semi-industrialized country where outputs for manufacturing are largely imported and cannot easily be substituted for by domestic production and where the working capital that firms depend on from banks is subject to rationing, a sudden devaluation will sharply increase firm's input costs and need for working capital. But with credit rationed, these funds can only be obtained in the informal loan market where the sharp rise in demand may drive interest rates to such prohibitive levels that firms may choose instead to reduce production". In fact, the negative impact from higher cost of imported inputs will weigh against the production stimulus from higher relative price for domestically traded goods. Wijnbergen (1986) has also stated the impact of devaluation on local currency costs of intermediate inputs as well as its negative effect on the volume of real credit to firms needing funds to finance working capital.

In addition, there are some theoretical and empirical works that conducted on real and nominal exchange rate of Iran such as Abdullah-Milani, Masjedi and Mohammadi (1996), Khattaee and

Gharbali Moghaddam (2004), Mehrara and Sarkhosh (2010). Recently Alavinasab (2013) investigate relationship of growth and export of Iran by taking a time series data for the period of 1976-2010. He used ordinary least square (OLS), unit root tests and co-integration method to consider the link between gross domestic product (GDP), exports, inflation and real exchange rate. The results of his study indicate that positive and strong effect of export; inflation and real exchange rate on economic growth exist.

3. Research methodology

3.1 Introduction

As mentioned in the literature review, the growth theory demonstrates the impact of export expansion in enhancing productivity growth (Sharma and Dhakal, 1994). These linkages embody various beneficial aspects of exports such as greater capacity utilization as well as technological improvements and as a main source of foreign exchange. Consequently it can improve productivity in non-oil sectors via its positive externality effects.

In Fact, it is identified that export-lead growth (ELG) happens in two ways: through positive externalities from the export sector to the rest of the economy and through its greater efficiency leading to a factor productivity differential in favor of the export sector. Therefore a larger allocation of resources in the export contributes to higher GDP growth.

In the following section a model specified for identifying the relationship between exports of petrochemical products and economic growth (GDP) in Iran.

3.2 Data

The data are derived from both national and international statistical yearbooks. The principal national source was the data available online from the Central Bank of Iran (CBI), Economic Time Series Database. The principal international source of data was The World Band, The World Development Indicator Online. The variables used in the present study are Gross Domestic Product (GDP), Exports of petrochemical industry (EXP), Real Exchange Rate (RER) and Inflation rate (INF). The sample period covers time series data for the period from 1990 to 2010 (Table 5). In order to test the validity of Export-led Growth (ELG) hypothesis in petrochemical industry of Iran, Ordinary Least Square (OLS) method of estimation are applied. Gretl computer software has been used for results derivation.

Table 5: Gross Domestic Products (GDP), Exports of petrochemical industry (EXP), Real Exchange Rate (RER) and Inflation (INF) of Iran (1990-2010).

	(constant 2005 US$)	US$/Million	index (2010 = 100)	(Annual %)
YEAR	GDP	EXP	RER	INF
1990	1.01523E+11	35	137.8565536	7.6276749
1991	1.14309E+11	130	123.5277451	17.128568
1992	1.19168E+11	115	67.75330617	25.807723
1993	1.1729E+11	192	51.36871578	21.202631
1994	1.16879E+11	270	51.44788047	31.447028
1995	1.19979E+11	408	69.21910286	49.655986
1996	1.28499E+11	507	89.87858637	28.937344
1997	1.32848E+11	559	111.8497038	17.349226
1998	1.36489E+11	452	138.3448747	17.866134
1999	1.39129E+11	579	167.8833029	20.070708
2000	1.46284E+11	829	199.2508521	14.476751
2001	1.51652E+11	795	226.3743406	11.274247
2002	1.6305E+11	942	96.43758906	14.335934
2003	1.7465E+11	1225	66.31167554	16.468012
2004	1.8353E+11	1726	65.93335167	14.761509
2005	1.92015E+11	2323	68.46078848	13.433118
2006	2.03332E+11	3298	71.94903461	11.939552
2007	2.19242E+11	6060	75.23728573	17.213046
2008	2.20514E+11	7843	85.52536187	25.549845
2009	2.29202E+11	9219.4	97.08423956	13.500262
2010	2.42702E+11	11284.2	100	10.137147

Source: The World Band, The World Development Indicator Online. Export of petrochemical industries from Central Bank of Iran (CBI), Economic Time Series Database.

3.3 Model specification

The thesis uses Ordinary Least Square (OLS) model to test the export-led growth hypothesis in the context of the Iranian petrochemical exports products. Theoretically exports can contribute to economic growth by a simple model:

$$Y = f(X)$$

Where, Y refers to GDP and X to exports.

To capture the constant response of exports to GDP the below linear form model could be employed.

$$Y_t = \beta_0 + \beta_1 X_t$$

While for the non constant response of the same variable, the logarithmic model is effective.

$$Y_t = \beta_0 X_t^{\beta_1}$$

The following model is suggested for estimating the effect of exports in the case of petrochemical products on gross domestic products along with real exchange rate and inflation during the study period of 1990 to 2010.

$$GDP = f(EXP, RER, INF)$$

Where,

DGP: Gross Domestic product

EXP: Exports of petrochemical products

RER: Real Exchange Rate

INF: Inflation rate

In this study, Gross Domestic product (GDP) is the dependent variable, while the variables of Exports of petrochemical products (EXP), Real Exchange Rate (RER) and Inflation rate (INF) are the independent variables or explanatory variables.

On the base of above model, the following symbolic form of the logarithmic linear regression model are specified and estimated:

$$\ln(GDP) = \beta_0 + \beta_1 \ln(EXP) + \beta_2 \ln(RER) + \beta_3 \ln(INF) + \mu$$

As can be seen, the model is non-linear. The theoretical reason for this is that we do not necessarily expect a constant impact of an export stimulus on the economy over time, and hence a logarithmic model is more appropriate.

There are several ways of measuring economic growth in a country. These contain real gross domestic product, real per capita GDP and growth in real gross domestic product. This research applies real gross domestic product to measure economic growth, which are used by many researcher according to literature as dependent variable. In this study, GDP measured at constant 2005 US$ (GDP), have been used. Data obtained from The World Band, The World Development Indicator Online (Figure 16).

**Figure 16:** GDP of Iran at constant 2005 US$

Source: The World Development Indicator Online

Role of export is significantly more important in economic growth. In fact the demand of the country has increased when export is enhanced. An increase the export of country consequently enhances the interest in the more production of export products, which improve the efficiency of the export sector. Export that based on the relative advantage would approve the exploitation of economic of scale. This could lead to rise in economic growth. Although it is widely acknowledged that exports, particularly through manufactured components, play an important role as a potential source of economic growth. Petrochemical industry is one of the important

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components of oil industry and is one of the principal industries in Iran. Petrochemical industry has an effective role in Iran's economy because it can fulfill demands of many domestic industries, production and export of petrochemical products and creating more job opportunities for the unemployed. Thus it is a remarkable source for bringing money to the country. During the period under study the export of petrochemical products increased which were the objective of Five Year Development Plan (FYDP) to pay attention more on non-oil export sections (figure 17). Therefore in present study, exports of petrochemical products measured at constant 2005 US$ (EXP) is used as proxy for exports and expected a positive impact of this variable on GDP growth. The data obtained from the Central Bank of Iran (CBI), Economic Time Series Database.

Figure 17: Export of petrochemical products Iran at constant 2005 US$
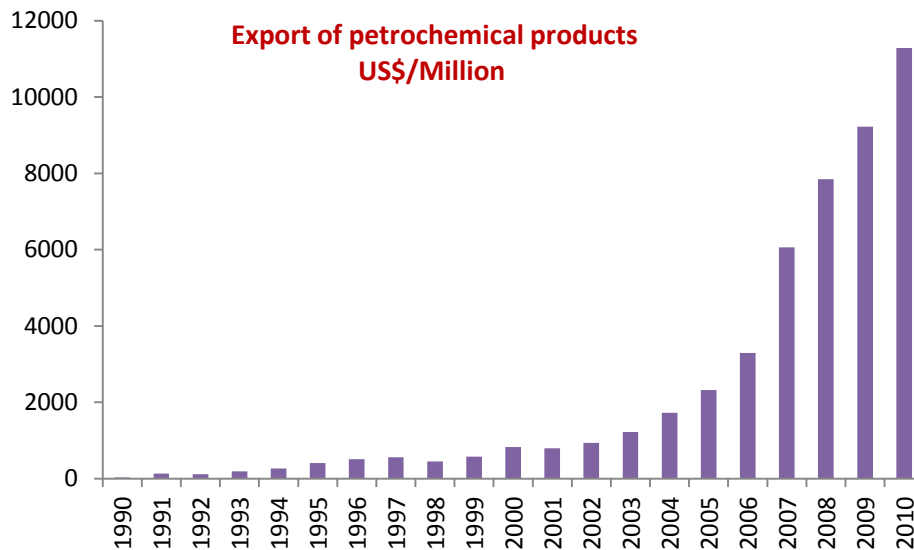
Source: The Central Bank of Iran (CBI), Economic Time Series Database.

According to literature several researcher supported the Rodrik's statement that confirming the positive relation between higher growth and undervalued exchange rate. Gulzmann *et al*. Provides results regarding to argue that depreciated exchange rate do not influence the tradable sectors as proposed by Rodrik, but it is through increased saving and investment that growth is facilitated. However Mbaye (2012) finds the evidence of total factor productivity growth due to undervaluation. Mario *et al*. obtained more evidence that higher RER helps diversity exports and increase technological intensity of exports. In spite of these studies some researches exist also on

negative impact of depreciation on economic growth (Edwards, S. 1989). For example Aganor (1991) argued the negative effect of devaluation on output which the negative impact from higher cost of imported inputs will weigh against the production stimulus from higher relative price for domestically traded goods. Wijnbergen (1986) has also stated the impact of devaluation on local currency costs of intermediate inputs as well as its negative effect on the volume of real credit to firms needing funds to finance working capital.

However according to figure 18 real effective exchange rate faced many fluctuations during period under study. In present study real effective exchange rate index (2010=100) is used as proxy for real exchange rate and expected a mix relationship between real exchange rate and GDP growth during the study period. Data obtained from The World Band, The World Development Indicator Online.

Figure 18: Real effective exchange rate index (2010=100)
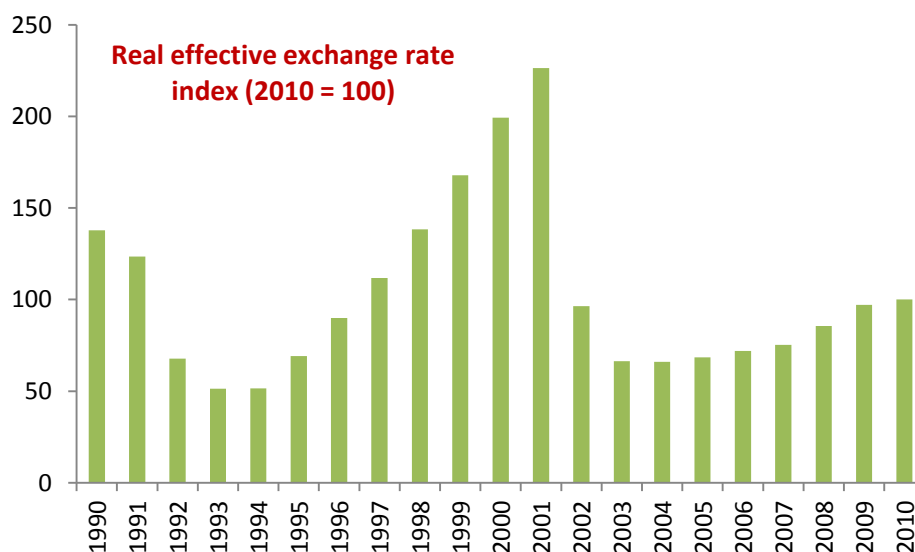
Source: The World Development Indicator Online

Another macroeconomic factor used in this study is Inflation (INF). The relation of inflation and economic growth is debatable. In fact to date several empirical studies confirm the existence of both positive and negative effects between these variables. Tobin (1965) confirmed that inflation effect the investment positively and predict a positive relationship between the rate of inflation and the rate of capital accumulation by shifting portfolio from money to capital, which

consequently implies a positive relationship on the rate of economic growth. However some researchers also confirm the negative impact of inflation on economic growth such as Barro (1991), Fisher (1983), Faira and Cameiro (2002) and Singh and Kalirajan (2003). According to Dadgar *et al*. (2006) if there is low level of inflation casual relationship existing between inflation and economic growth. However for medium level of inflation this effect is positive and in the case of high level of inflations, above 26 percent, negative effect on economic growth appears. According to figure 19, inflation in Iran during period under study is high; therefore we expect negative sign of inflation on GDP during the study period. In this study, inflation, consumer price index (2010=100) (annual %) is used as proxy for inflation.

Figure 19: Inflation, consumer price index (2010=100) (annual %)
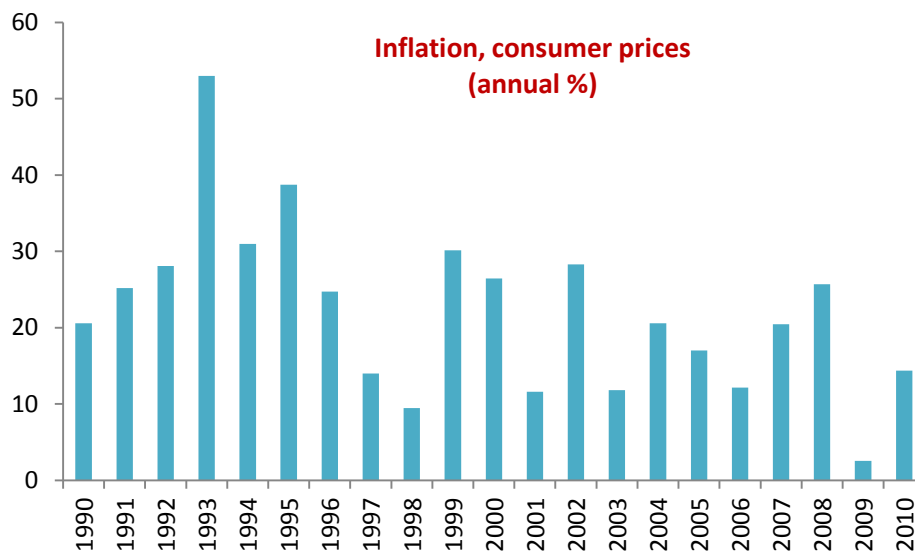
Source: The World Development Indicator Online

4. Results and discussion

4.1 Evaluation of Data

Regression through logarithmic technique prescribes relationship between independent and dependent variable. Table 6 indicates that there is a positive relationship between gross domestic product and exports of petrochemical products. In contrast both real exchange rate and inflation exhibit negative relationship with gross domestic product.

Table 6: OLS, using observations 1990-2010 (T = 21)

Dependent variable: GDP

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
Const	25.3805	0.169064	150.1238	<0.00001	***
EXP	0.159675	0.00602918	26.4838	<0.00001	***
RER	-0.0684502	0.0242158	-2.8267	0.01163	**
INF	-0.135221	0.0240522	-5.6220	0.00003	***

Mean dependent var	25.76188	S.D. dependent var	0.266225
Sum squared resid	0.027298	S.E. of regression	0.040072
R-squared	0.980742	Adjusted R-squared	0.977344
F(3, 17)	288.5830	P-value(F)	8.93e-15
Log-likelihood	39.97950	Akaike criterion	-71.95899
Schwarz criterion	-67.78090	Hannan-Quinn	-71.05224
rho	0.153192	Durbin-Watson	1.673244

Source: Author Computation from Gretl software

p-value shows the probability value for significance of variable. All of independent variables are showing significant part in economic growth. In addition t-value also confirms all of independent variables are significant at 5% of confidence level. R^2 shows how much variation in dependent variable is because of independent variable. Value of R^2 is 0.98 in this result, which it satisfied the required range.

In statistics, the Durbin Watson statistic is used to detect the presence of autocorrelation (a relationship between values separated from each other by a given time lag) in the residuals (prediction errors) from regression analysis. The Durbin-Watson test is based on the following statistic, If e_t is the residual associated with the observation at time t, then the test statistic is:

$$DW = \frac{\sum_{t=2}^{T}(e_t - e_{t-1})^2}{\sum_{t=1}^{T} e_t^2}$$

The Durbin Watson (DW) statistic is 1.67, that indicate DW is in the interval of <dU;2>, that means statistically no autocorrelation in 5% critical values for Durbin Watson statistic (table 7).

Table 7: Durbin Watson (DW) critical values

DW=	1.673244	dL	1.0262	4-dL	2.9738
		dU	1.6694	4-dU	2.3306

Source: Author Computation from Gretl software

The Breusch-Godfrey test is used also to assess the validity of some of the modeling assumptions inherent in applying regression-like models to observed data series. In particular, it tests for the presence of serial dependence that has not been included in a proposed model structure and which, if present, would mean that incorrect conclusions would be drawn from other tests, or that sub-optimal estimates of model parameters are obtained if it is not taken into account. The regression models to which the test can be applied include cases where lagged values of the dependent variables are used as independent variables in the model's representation for later observations. This type of structure is common in econometric models. Therefore for being sure if autocorrelation exist, Breusch-Godfrey test also calculated by Gretl software. According to calculation results there are not first order autocorrelation at 5% of confidence level (Table 8).

Table 8: Breusch-Godfrey test for first-order autocorrelation
OLS, using observations 1990-2010 (T = 21)
Dependent variable: uhat

	coefficient	std. error	t-ratio	p-value
Const	-0.0460943	0.184904	-0.2493	0.8063
Exp	-4.98887e-05	0.00612851	-0.008140	0.9936
RER	0.00631720	0.0263316	0.2399	0.8134
INF	0.00611990	0.0260733	0.2347	0.8174
uhat_1	0.185734	0.275116	0.6751	0.5092

Unadjusted R-squared = 0.027697

Test statistic: LMF = 0.455778,
with p-value = P(F(1,16) > 0.455778) = 0.509

Alternative statistic: TR^2 = 0.581640,
with p-value = P(Chi-square(1) > 0.58164) = 0.446

Ljung-Box Q' = 0.537034,
with p-value = P(Chi-square(1) > 0.537034) = 0.464

Source: Author Computation from Gretl software

The possible existence of heteroscedasticity is a major concern in the application of regression analysis, including the analysis of variance, because the presence of heteroscedasticity can invalidate statistical tests of significance that assume that the modeling errors are uncorrelated and normally distributed and that their variances do not vary with the effects being modeled. When using some statistical techniques, such as ordinary least squares (OLS), a number of assumptions are typically made. One of these is that the error term has a constant variance. This might not be true even if the error term is assumed to be drawn from identical distributions.

One of the assumptions of the classical linear regression model is that there is no heteroscedasticity. Heteroscedasticity does *not* cause ordinary least squares coefficient estimates to be biased, although it can cause ordinary least squares estimates of the variance (and, thus, standard errors) of the coefficients to be biased, possibly above or below the true or population variance. Thus, regression analysis using heteroscedastic data will still provide an unbiased

estimate for the relationship between the predictor variable and the outcome, but standard errors and therefore inferences obtained from data analysis are suspect. Biased standard errors lead to biased inference, so results of hypothesis tests are possibly wrong. For example, if OLS is performed on a heteroscedastic data set, yielding biased standard error estimation, a researcher might fail to reject a null hypothesis at a given significance level, when that null hypothesis was actually uncharacteristic of the actual population. The White test is a statistical test for detecting heteroskedasticity which are applied for data under study (Table 9). The calculation indicates that there are no Heteroscedasticity at 5% level of significant.

Table 9: White's test for heteroskedasticity
OLS, using observations 1905-06-12:1905-07-02 (T = 21)
Dependent variable: uhat^2

	coefficient	std. error	t-ratio	p-value
const	-0.0921111	0.220806	-0.4172	0.6846
EXP	-0.0156484	0.0123100	-1.271	0.2299
RER	0.0360778	0.0572793	0.6299	0.5416
INF	0.0450531	0.0524067	0.8597	0.4083
sq_x1	0.000193477	0.000241538	0.8010	0.4401
X2_X3	0.00265616	0.00225592	1.177	0.2639
X2_X4	0.000177643	0.00110159	0.1613	0.8748
sq_x2	-0.00448087	0.00426419	-1.051	0.3159
X3_X4	-0.00451917	0.00739296	-0.6113	0.5534
sq_x3	-0.00431552	0.00317780	-1.358	0.2017

Unadjusted R-squared = 0.583092

Test statistic: TR^2 = 12.244933,
with p-value = P(Chi-square(9) > 12.244933) = 0.199851

Source: Author Computation from Gretl software

An alternative to the White test is the Breusch–Pagan test. The Breusch–Pagan test is used to test for heteroscedasticity in a linear regression model. It tests whether the estimated variance of the residuals from a regression are dependent on the values of the independent variables. In fact the Breusch–Pagan test uses for conditional heteroscedasticity. It is a chi-squared test. If the

Breusch–Pagan test shows that there is conditional heteroscedasticity, the original regression can be corrected by using the Hansen method, using robust standard errors, or re-thinking the regression equation by changing and/or transforming independent variables. Therefore to be sure if heteroscedasticity exist, Breusch–Pagan test also applied, which the results presented in table 10. The calculation indicates that there are no Heteroscedasticity at 5% level of significant.

Table 10: Breusch-Pagan test for heteroskedasticity
OLS, using observations 1905-06-12:1905-07-02 (T = 21)
Dependent variable: scaled uhat^2

	coefficient	std. error	t-ratio	p-value
Const	5.24783	6.51641	0.8053	0.4318
Exp	-0.295565	0.232389	-1.272	0.2205
RER	-0.998958	0.933374	-1.070	0.2995
INF	0.801982	0.927070	0.8651	0.3990

Explained sum of squares = 12.6648

Test statistic: LM = 6.332389,
with p-value = P(Chi-square(3) > 6.332389) = 0.096512

Source: Author Computation from Gretl software

The last test to our data analysis is normality test (Table 11). Normality tests are used to determine if a data set is well-modeled by a normal distribution and to compute how likely it is for a random variable underlying the data set to be normally distributed. One application of normality tests is to the residuals from a linear regression model. If they are not normally distributed, the residuals should not be used in any tests derived from the normal distribution, such as t tests, F tests and chi-squared tests. If the residuals are not normally distributed, then the dependent variable or at least one explanatory variable may have the wrong functional form, or important variables may be missing, etc. Correcting one or more of these systematic errors may produce residuals that are normally distributed. The calculation indicates that random error has normal distribution at a 5% level of significant (figure 20).

Table 11: Frequency distribution for uhat1, obs 1-21
number of bins = 7, mean = 1.52259e-015, sd = 0.0400723

interval	midpt	frequency	rel.	cum.	
< -0.055809	-0.069409	1	4.76%	4.76%	*
-0.055809 - -0.028610	-0.042210	3	14.29%	19.05%	*****
-0.028610 - -0.0014112	-0.015011	6	28.57%	47.62%	**********
-0.0014112 - 0.025788	0.012188	8	38.10%	85.71%	*************
0.025788 - 0.052987	0.039387	2	9.52%	95.24%	***
0.052987 - 0.080186	0.066587	0	0.00%	95.24%	
>= 0.080186	0.093786	1	4.76%	100.00%	*

Test for null hypothesis of normal distribution:
Chi-square(2) = 3.255 with p-value 0.19646

Source: Author Computation from Gretl software

Figure 20: test of normality of residual
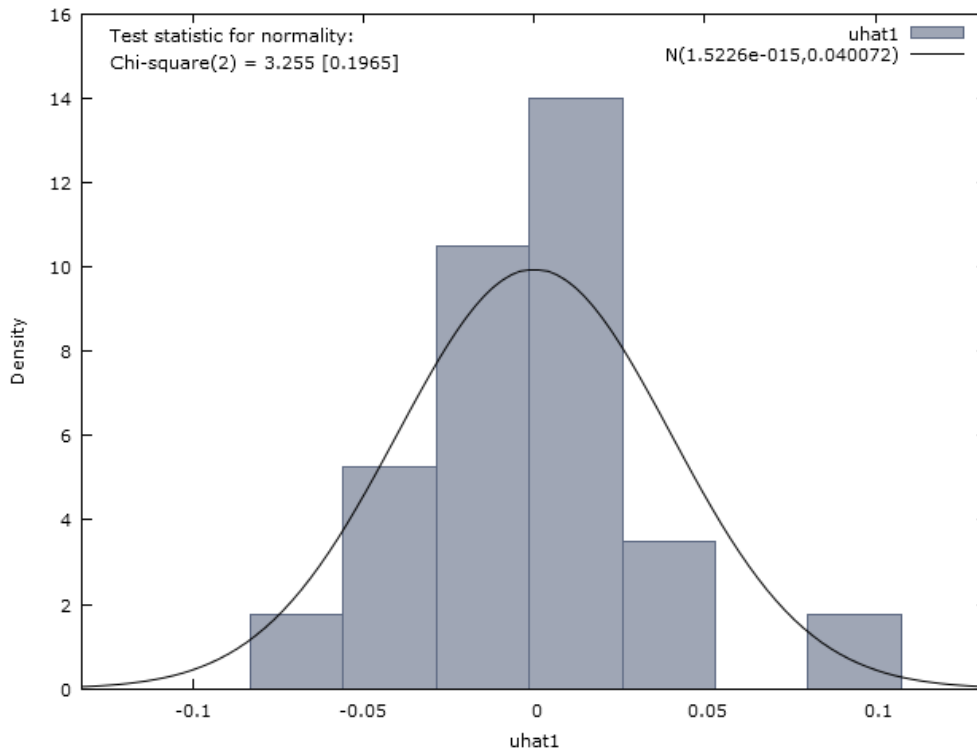
Source: Author Computation from Gretl software

Conclusion of tests:

If we consider $\alpha = 0.05$ as a main level of significance for final decision, there are no autocorrelation in the model. Heteroscedasticity as well not exist in the model which is measured by white test and the Breusch–Pagan test. Normality of random variable is also in satisfying range. The summary is presented in table 12.

Table 12: Evaluation of econometric verification at a 5% level of significance

p-value	comparison	α	conclusion
Autocorrelation (Breusch-Godfrey test)			
0.509	>	0.05	no authocorrelation
0.446	>	0.05	no authocorrelation
0.464	>	0.05	no authocorrelation
Heteroscedasticy (White's test)			
0.199851	>	0.05	homoscedasticy
Heteroscedasticy (Breusch-Pagan test)			
0.096512	>	0.05	homoscedasticy
Normality of random variable			
0.19646	>	0.05	normal distribution

Source: Author Computation from Gretl software

4.2 Policy Implications and Recommendations

The result of our analysis indicates that there is a positive relationship between exports of petrochemical products and economic growth of Iran. This implies that increasing in this variable encourage better performance while a fall decrease economic growth. Data fully is in agreement of export-led growth hypothesis. Growth of economy can be enhanced by exports of petrochemical product as a non-oil export through accessing the markets globally that in turn enhances economics of scale. Iran can enlarge its market for petrochemical products by

exporting to international markets and with outward oriented strategy, able to account for an important share of the global market. Therefore policies concentrating on export promotion, especially for petrochemical products which raw material is easily accessible in domestic market, should use effectively to fabricate export capacity in order to increase economic growth. Therefore trade barrier in this context should be overcome through proper policies with new and high technology should be considered. In addition In order to achieve high and stable economic growth and to protect the economy from the negative effects of oil price fluctuations, the Iranian government should continue its quest for more efficient and effective non-oil export promotion policies as well as its diversification strategies aimed at weaning the economy from its dependence on the oil sector.

It is evident that even the best policies cannot achieve the expected outcomes overnight. It is however, necessary to look at long-term results. In fact export promotion strategies are lead to economic growth. In particular, the diversion of resources from the non-export sector to the export sector can enhance the overall productivity of the economy. Iran should apply policies to make non-oil exports especially in petrochemical industry more competitive in order to gain access to international markets. For this reason, joining the WTO and raising the share of and diversity of non-oil exports in total exports should be considered as top priorities. Raising the quality of petrochemical export products, stabilizing the exchange rate, deregulating the banking sector as well as reforming the public sector would also lead to non-oil export expansion.

However oil will undoubtedly continue to be the leading sector of the Iranian economy, pulling the other sectors in its wake. In order to exploit its comparative advantages, Iran should apply oil as much as possible in the domestic industrial sector via extensive enlargement of energy-based industries such as petrochemical industries. In addition, since the price of both crude oil and natural gas fluctuates highly, the Iranian government needs to look beyond these unrefined products. More investment in other petrochemical products (e.g. plastics, polymers and etc.) will be necessary in order to exploit Iran's comparative advantage in oil- and gas-based industries as well as support the country from the wild fluctuations of these resources in their unrefined state.

In this context trade barrier should be overcome through proper policies and an open trade policy will be an effective strategy for Iran in the long run. Therefore, it is proposed that the Iranian government continue the policy of trade liberalization, increasing its global competitiveness by decreasing barriers and restrictions on exports and imports. There is a political dimension to this

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issue as well. American economic sanctions cause Iran to pay much more for its capital imports. Since the U.S. and most European countries remain off-limits to Iran, it can only deal with countries like the U.A.E. and Turkey, which play as intermediates in the exchange, thus ramping up the cost. In order to overcome this, in addition to diplomatic and other initiatives aimed in the long run at the omitting of such sanctions, Iran should enhance its trade relationship with countries such as the newly industrialized countries of East Asia. In other words, more South-South trade should be considered as another way of offset the deleterious effects of the US trade embargo. It should be considered that a stable political and macroeconomic environment will play a significant role in this process.

According to theoretical framework constructed in previous chapters' exchange rate can effect positively or negatively in growth of economy. Our empirical investigation in this research work indicates the negative relationship of exchange rate on economic growth. Therefore government should pay attention to exchange rate policies to offset negative impact of it on growth of economy. In fact proper exchange rate policies can lead to maintain international competitiveness and create sustainable external balance of payments, hence, exchange rate policies should be revised and eliminate exchange rate instability. The stabilization of the exchange rate helps to prevent overvaluation or devaluation, which can blunt the international competitiveness of potential export industries.

Also, several studies indicate that inflation has a mix relationship with economic growth. Recently numerous empirical studies found that inflation growth interaction is non-linear and concave, and found that a positive relationship between these two variables exists when inflation rate is slow and a negative relationship exists when the inflation rate is high. As described in previous chapter inflation in Iran during period under study is high; therefore negative relationship of inflation on GDP during the study period observed. Therefore it is highly recommended to control fluctuation of inflation to overcome its negative impact on economic growth to achievement of macroeconomic stability through monetary and fiscal policies reforms which target inflation. Internal and external balances are necessary for macroeconomic stability, which leads to the trade-growth nexus dynamic.

4.3 SWOT analysis

SWOT analysis is the way that presents the managerial environment of any industry. In this procedure a SWOT matrix is constructed. The matrix is containing four cells (figure 21). Two cells analyzed the industry on the basis of the industry's internal resources which represent "strengths" and "weaknesses". Another two cells analyzed the industry based on the external factors which are "opportunities" and "threats".

Figure 21: SWOT matrix structure

The SWOT matrix then comes up with several managerial questions connected to the future prospects of the industry. Firstly, the strategies should be designed that could enhance the strengths of the industry. Secondly, the strategies that can reduce the weaknesses need to be planned. And lastly, the industry must take policies that could face the threats with the help of the opportunities confronted by the industry. This section identifies the strengths, weaknesses, opportunities and threats of the Iran petrochemicals industry.

Strengths:

During the last thirty years, Iran has evolved as a major petrochemical producer and exporter of the world. Apart from its own production capability, the industry enjoys several internal strengths regarding the production, infrastructure and management. The production cost of petrochemicals is lowest in comparison to other oil-producing countries of the world. This is due to the much abundance of the resources of the petrochemical production. Along with the

abundant resources, the improved technology and motivated employees used by the industry also helps the production a lot.

- ✓ Large petrochemicals production capacity
- ✓ Low production cost using abundant natural gas and crude oil
- ✓ High level security for petrochemicals infrastructure
- ✓ Much advanced technology and infrastructure
- ✓ Efficient and motivated employees
- ✓ The increase in the amount and variety of export products
- ✓ Long time export experience
- ✓ A very broad and diverse range of products ranging from plastics and synthetics to basic chemicals.
- ✓ World class plant sites in Petrochemical Complex with extensive focus on R&D in areas like processing, specialty, chemicals and the environment.

Weaknesses:
- ➢ Dependence on a selling of only petroleum related products
- ➢ Lack of establishment of scientific management and systematic thinking
- ➢ Lack of up to date performance evaluation systems.
- ➢ Lack of a comprehensive and integrated information system and not being equipped with new information technology.
- ➢ Lack of development of an organizational structure along with Petrochemical industry growth.
- ➢ Lack of establishment of economic thought and entrepreneurship.
- ➢ Lack of establishment of customer –oriented thought.

Opportunities
- ❖ Increasing petrochemical demand.
- ❖ High capital inflow
- ❖ Agreement with WTO
- ❖ The existence of raw material in the country

❖ The presence of contractors, consultants, providers and various local manufactures

❖ Availability of energy

❖ The presence of educated and young human force

❖ The presence and increase of research centers and competent universities in the country

❖ The free price of petrochemical products

❖ Privatization of national petrochemical company

❖ Having access to international free water, land and rail ways

❖ The establishment of new markets in Asia, east of Asia, China, India and etc.

❖ Having access to big local markets

❖ The possibility to integrate with the regional competing companies and participation in councils and regional contracts.

Threats

➢ Price slowdown following global recession

➢ High global competition

➢ Tariff protection from many countries

➢ Increasing demand for petro-products in the domestic market followed by shortage in potential gas supply

➢ Unstable policies in pricing food and the energy used in petrochemical industry

➢ Global economic crisis and decrease in demand and the price of the products.

➢ The limitation in using external facilities due to economic sanction including finance, technology and etc.

➢ The lack of providing adequate food (including gas condensates for petrochemical plans)

➢ Extensive investment of competitors for the production of products and attaining great share of the market.

➢ The lack of the presence of conditions, facilities and legal supports to attract investors.

5. Conclusion

The main objective of this study attempt to study the impact of exports of petrochemical products on real economic growth in Iran from 1990 to 2010. Making use of time series analysis, this study tries to shed light on the source of economic growth. In particular, this research examined the hypothesis of export-led growth in the petrochemical industry of Iran and the emperical results of this study assent the export-led growth hypothesis in the Iran petrochemical sector. In this regard, Ordinary Least Squar (OLS) method is applied. In doing this, model specified with including GDP as dependent variable and exports of petrochemical products (EXP), real exchange rate (RER) and inflation rate (INF) as independent variables or the explanatory variables. The data are derived from both national and international statistical yearbooks. The principal national source was the data available online from the Central Bank of Iran (CBI), Economic Time Series Database. The principal international source of data was The World Band, The World Development Indicator Online. For evaluation of Data Gretl computer software has been used for results derivation. SWOT analysis also performed in the case of petrochemical industry framework.

The result of our study shows that there is a positive relationship between export of petrochemical products and economic growth of Iran and validate export-led growth hypothesis. This shows that any increase in the export of petrochemical products can lead growth of economy, while any decreasing in the export of petrochemical products will decline economic growth. In fact growth of export can be raised by exports of petrochemical products via accessing the global markets that in turn increase economic growth.

Therefore Iran should apply policies to make non-oil exports especially in petrochemical industry more competitive in order to gain access to international markets. For this reason, joining the WTO and raising the share of and diversity of non-oil exports in total exports should be considered as high priorities. Raising the quality of petrochemical export products, stabilizing the exchange rate, deregulating the banking sector as well as reforming the public sector would also lead to non-oil export expansion. As well, in order to utilize its comparative advantages, Iran should apply oil as much as possible in the domestic industrial sector via extensive enlargement of energy-based industries such as petrochemical industries. In addition, since the price of both crude oil and natural gas fluctuates highly, the Iranian government needs to look beyond these unrefined products. More investment in other petrochemical products will be necessary in order

to use Iran's comparative advantage in oil- and gas-based industries as well as support the country from the wild fluctuations of these resources in their unrefined state.

However based on our data analysis inflation rate and real exchange rate exhibit negative relationship with GDP therefore it is better to apply proper exchange rate policy in the country to maintain international competitiveness and sustainable external balance of payments, hence, exchange rate policies should be revised and eliminate exchange rate instability.

In addition it is highly recommended to control fluctuation of inflation to overcome its negative impact on economic growth to achievement of macroeconomic stability through monetary and fiscal policies reforms which target inflation. Internal and external balances are necessary for macroeconomic stability, which leads to the trade-growth nexus dynamic.

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