**A Study of the relationship between economic growth and Oil sector in the Iranian Economy**

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Petroleum and natural gas are the most important primary energy sources to provide financial resources. Iran has 9.2% of the total oil reservoir, and is placed at the fifth position after Saudi Arabia, Iraq, UAE and Kuwait in the Middle East. The population of Iran is 75 million in 2011 (SCI, 2011). Iran’s population has increased and simultaneously the residency pattern has favored the urban areas in the last decade, which accounts for almost two third of total population. Urbanism increase is an important index of progress in parallel with the production and growth of economy.

The main aim of this study is: to evaluate the relationship between oil sector and other sectors in the production process to meet growth rate. In the Iranian economy most of the activities and sectors largely depend on the petrodollars not oil product in the production process. According

to the Central Bank of Iran in 2010, about 90% of foreign exchange revenues are gained through exports of oil and gas (CBI, 2010). More over the oil sector is not dependent to the other sectors for producing output and is mostly relates to the import: machinery, equipments, etc. in this study we use input-output technique in which the inter-industry relations between economic sectors is well demonstrated. A comparative static analysis will be employed by using a 12-sector input-output table 2001.

*Paper to be presented to The 20th International Input-Output Conference, Bratislava, Slovakia, 26-29 June 2012.*

1. **Introduction**

Iran is the second largest oil producer in the Organization of the Petroleum Exporting Countries (OPEC) and the fifth largest globally (after Russia, Saudi Arabia, the United States and China). In 2010, it produced almost 3.7 million barrels per day. Its oil sector is one of the oldest in the world. Production started in 1908 and has one of the world’s most mature oil sectors. Iran has already produced 75 percent of its reserves, so the likelihood of other major discoveries is low. Iran has made some important new discoveries in the past decade, but they have not been sufficient to alter the trend in oil reserves depletion. Oil industry is a crucial industry in the economic system of Iran, as one of the main oil export countries in OPEC, and make it one of drives of economy, productivity growth, the standard of living improvement, and opportunity for more and high quality education since it was discovered in 1912 and improvement of its role in economy. Oil industry is one of the biggest and most influential industries all over the world, includes in Iran. The oil sector has provided the majority of income for many years in Iran and in fact, this sector plays the main role in the country’s economy. As figures in Table 1- indicate the 1973 oil price bust send the economy spiraling into crisis which has been repeated in 1980 and more or less continued to increase or decrease Iran’s oil export revenue and as a result on its foreign trade. Oil and gas undoubtedly constitute the most important industrial sector to Iran’s economy. As Table 1- shows the oil sector’s share of fixed GDP has declined from 30-40% in the 1970s to 10-20%, largely due to destruction of production facilities during the war and OPEC output ceilings and sanctions. Nevertheless, oil revenue accounts for the majority of export earnings and presents the bulk of government revenue (about 40%). This sector also receives the majority of domestic and foreign investment. Iran’s dependence on oil export revenues makes the country highly susceptible to the volatility of international oil prices. Iran’s non-oil exports have increased dramatically, which the government cites as a testament to its increased diversification. Non-oil exports, thus, may be able to alleviate economic harm from a future drop in oil prices, although the economy likely would still suffer.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Table 1**- Export and Import in Fixed Price 1997- billion Rials | | | | | |
| **Year** | **Total Export** | **Oil and Gas** | **Other items** | **Oil Export share** | **Total Import** | **Net Export** |
| 1959 | 14736 | 13286 | 1450 | 0.902 | 9010 | 5726 |
| 1960 | 16273 | 14953 | 1320 | 0.919 | 9189 | 7084 |
| 1961 | 18245 | 16827 | 1418 | 0.922 | 8753 | 9492 |
| 1962 | 20650 | 19327 | 1323 | 0.936 | 8084 | 12566 |
| 1963 | 22744 | 21360 | 1384 | 0.939 | 7648 | 15096 |
| 1964 | 25568 | 24091 | 1477 | 0.942 | 10729 | 14839 |
| 1965 | 29758 | 27968 | 1790 | 0.940 | 12353 | 17405 |
| 1966 | 33475 | 31864 | 1611 | 0.952 | 14049 | 19426 |
| 1967 | 38903 | 37088 | 1815 | 0.953 | 17456 | 21447 |
| 1968 | 44439 | 42277 | 2162 | 0.951 | 20978 | 23461 |
| 1969 | 52578 | 50327 | 2251 | 0.957 | 23421 | 29157 |
| 1970 | 59253 | 56704 | 2549 | 0.957 | 25228 | 34025 |
| 1971 | 69449 | 66045 | 3404 | 0.951 | 30148 | 39301 |
| 1972 | 79428 | 76103 | 3324 | 0.958 | 35059 | 44369 |
| 1973 | 88541 | 78745 | 9796 | 0.889 | 44523 | 44018 |
| 1974 | 86921 | 77612 | 9309 | 0.893 | 79991 | 6930 |
| 1975 | 78036 | 68364 | 9672 | 0.876 | 120909 | -42873 |
| 1976 | 86522 | 78145 | 8377 | 0.903 | 118229 | -31707 |
| 1977 | 79730 | 71278 | 8453 | 0.894 | 134009 | -54278 |
| 1978 | 58031 | 51135 | 6896 | 0.881 | 93402 | -35371 |
| 1979 | 45219 | 38954 | 6265 | 0.861 | 70413 | -25194 |
| 1980 | 15327 | 11396 | 3931 | 0.744 | 71825 | -56498 |
| 1981 | 13690 | 11737 | 1953 | 0.857 | 68068 | -54378 |
| 1982 | 26467 | 24953 | 1514 | 0.943 | 60733 | -34266 |
| 1983 | 32260 | 30266 | 1994 | 0.938 | 84265 | -52004 |
| 1984 | 25604 | 23784 | 1820 | 0.929 | 57908 | -32305 |
| 1985 | 23190 | 21608 | 1581 | 0.932 | 53889 | -30700 |
| 1986 | 19407 | 18500 | 907 | 0.953 | 46920 | -27513 |
| 1987 | 28327 | 22881 | 5446 | 0.808 | 51612 | -23285 |
| 1988 | 32299 | 27837 | 4462 | 0.862 | 43924 | -11625 |
| 1989 | 34866 | 29339 | 5527 | 0.841 | 52991 | -18125 |
| 1990 | 44290 | 36375 | 7915 | 0.821 | 69743 | -25454 |
| 1991 | 51880 | 39784 | 12096 | 0.767 | 92826 | -40946 |
| 1992 | 53717 | 40782 | 12935 | 0.759 | 84378 | -30661 |
| 1993 | 62002 | 43196 | 18806 | 0.697 | 67809 | -5807 |
| 1994 | 66008 | 39698 | 26310 | 0.601 | 41337 | 24672 |
| 1995 | 52266 | 38389 | 13877 | 0.734 | 40953 | 11313 |
| 1996 | 53562 | 39997 | 13565 | 0.747 | 47816 | 5746 |
| 1997 | 51007 | 37542 | 13465 | 0.736 | 44728 | 6279 |
| 1998 | 56345 | 38107 | 18238 | 0.676 | 44887 | 11458 |
| 1999 | 57516 | 37659 | 19857 | 0.655 | 42521 | 14995 |
| 2000 | 58479 | 39913 | 18566 | 0.683 | 46047 | 12431 |
| 2001 | 57393 | 35538 | 21855 | 0.619 | 54006 | 3387 |
| 2002 | 62206 | 36836 | 25370 | 0.592 | 66566 | -4360 |
| 2003 | 70013 | 42931 | 27082 | 0.613 | 80262 | -10249 |
| 2004 | 69933 | 44635 | 25298 | 0.638 | 90636 | -20703 |
| 2005 | 73664 | 44619 | 29045 | 0.606 | 92645 | -18981 |
| 2006 | 79585 | 46259 | 33326 | 0.581 | 99241 | -19657 |

*Source: www.cbi.ir, National Accounts*

Regard to the fact that developing countries have limited resources and unlimited needs and cannot develop all the economical sectors at the same time; they should give priority to key sectors. This study attempted to identify the key sectors and scrutinize the oil industry as an important and a key sector in Iran’s economy, through Input-Output table of 2001 (Iran's last Input-Output table) which was aggregated into 12 main sectors.

1. **Literature Review**

A considerable number of studies were carried out on the economic importance and economic impacts of oil on the different aspects of economy in Iran. Among them Behboodi *et. al.* (2009), investigated the effect of volatility of oil prices on GDP based on quarterly data in period (1988-2005). They found long-run relationship between oil price and private consumption expenditure, investment and net exports, and a significant positive effect on GDP. They also found that in the long-term, oil price and oil price volatility have a negative effect on GDP. Given the high dependence on oil and oil economy, the results are acceptable. Afrooz and Soory (2005), studied the impact of stability and volatility of oil price on growth rate in Iran and concluded that oil exports imposes its effects on economic growth from import side rather than export side. Sameti and Khanzadi (2009), they investigated the impact of oil income on distribution income, they have found the negative impact of oil income by increases on the money supply, and it generated inefficient government budget but on income distribution is unclear. Seyedmashahdi *et. al.* (2011), studied the economic importance of oil sector using input-output techniques, they found that if the oil industry is removed from the output, 119 billion Rials (Leontief model) and 137 billion Rials (Ghosh model) would be lost in production. Also, 130618 man (Leontief model) and 344108 man (Ghosh model) job opportunities would be lost. Concerning total output elasticity, the oil industry ranks 4 (among 34 sectors) and this shows that this industry is important and has an increasingly role in total output. But Concerning total employment elasticity, it ranks 23. In addition, the oil industry has the highest costs for job opportunities. In the present study, the main aim is to examine the economic importance of oil sector through input-output linkages by using hypothetical extraction method.

1. **Methodology**

The development of the input-output framework has enriched the importance of industry by tracing the inter-industry relation as its key theme. The inter-industry relationship can be analyzed through the comprehensive definition of sector and its linkages to other industries and sectors. Linkages in the input-output analysis have many measures. The simple form of the linkage is backward and forward linkages which can be derived from Leontief inverse matrices. This form proposed by Chenery and Watanabe (1958) and Rasmussen (1957) for the first time. Since then, linkages were one of the core issues in the input-output studies. More complicated form of economic linkage between sectors has been derived from partitioned matrix structure and extracted in the context of the inter-industry linkage measurement, then is called hypothetical extraction method (HEM). The (HEM) approach for sectors was first published in Schultz (1976, 1977). Many authors subsequently attempted to discover appropriate methods for measuring total sectoral linkages using (HEM) including; Hewings (1982), Harrigan and McGilvray (1988), Cella (1984,1988), Dietzenbacher and Linden(1993), (Dietzenbacher, Linden, and Steenge (1997), and Miller & Miller (2001). Most comprehensive form can be found in Cella (1984, 1988). The general concept of the HEM is; estimating the output reduction due to extract the sector from the economy in both demand and supply sides. When a sector remove from the economy, creates direct and indirect effects on other sectors and total GDP decreases. HEM provides the measure of the output reduction. Estimations are repeated for each sector and results are compared and ranked. The greatest difference between gross outputs in the economy without and with extracted sector shows the sector with the highest linkage. To formulate the output reduction in the HEM framework if we consider the standard representation of an *n*-sector input-output technical coefficients matrix that has been partitioned so that *k* sectors (*k* < *n*) are shown in the upper left square sub-matrix, identified as:. That is,



Then the Leontief inverse of this partitioned matrix can be expressed as



where and . Final demands and gross outputs can be partitioned similarly, so that we have;

 , , and then  (1)

this formulation provides a useful framework in which to measure various types of possible HEM linkages. Literature review on HEM methodology shows seven extraction methods on both the demand and the supply side of the economy Leontief's demand side input-output model (LDM) and Ghosh's supply side input-output model (GSM)) (Miller & Lahr 2001). In all methods, *n* sectors of economy are considered as two blocks: the first block including the sectors extracted from the economy hypothetically shown as sector one (or k) and the second block including the rest of sectors in the economy which are the second (n-k).

Now, if k=1, the technical coefficient matrix A in Leontief's demand side input-output model or B in Ghosh's model will be assumed as  (or  ) a sector can be extracted by seven methods, we considered the most important types. Each of methods can yield a sort of inter-sectoral linkages from the aspect of policy making; however, using all the seven method together in research makes calculation results analysis difficult. Hence, some researchers (Song, Liu, Langston (2006), Aydin (2007) and Andreosso & Yue (2000)) have reduced the seven extraction methods to four types.

* 1. **Original Extraction Method**

The main principle of this method is that one sector is hypothetically and originally extracted from the economy; then, the effect of this hypothetical extraction on other sectors is studied. Since the productive balance level equation in Leontief's demand side model is , the total production vector of the economy before extracting the target sector will be:

(1)  ×  

In which,  and  are the final demand and the gross production matrices of the two blocks.

Having extracting the related sector, the reduced production vector of the economy changes to equation (2):

(2)   

In this equation, and are the gross productions for sections one and two. Meanwhile, the power one indicates the first state of the seven methods. Equation (3) is thus the amount of change in production after extraction (the difference between vector X and X1).

(3)  × 

In other word, the above equation can be written as:

 (4)

Total Linkage (TL) also shows the total size of the significance of the extracted sector in the whole economic system which, in fact, reflects the total (inter-sectoral and intra-sectoral) linkage of a sector in relation to other sectors.

In Ghosh's supply side model, the productive balance level equation will be also . Accordingly, the total production vector before extraction in Ghosh's model is defined as follows:

(5)   ×   

And the economic production vector will change as follows:

(6)  ×  ****  ****

Here, the amount of the total production change in economy indicates the total linkage index on the supply side:

(7) ** ** 

In other words:

(8)  

* 1. **Cella’s Method**

Cella (1984) believed that we cannot distinguish the total linkage from backward and forward linkages in the original extraction method. In order to solve this problem, he thus modified the original extraction method i.e. he first analyzed A and defined the total linkage effect of each sector, then he divided it into backward and forward linkages. According to Cella's method, it is supposed that all the rows and columns related to one sector are extracted except for the internal transactions (elements on the main diameter) of that sector which is indeed the second method of the seven extraction ones. As a result, the output vector of all sectors on the demand side will be defined as follows after extraction:

(9)  × 

And the total amount of the production change in the economy resulting from the extraction of the linkages one sector has with others is obtained through the following equation:

(10)  

In other words:

(11)  

In fact in this equation, TL is a really appropriate criterion to measure external linkages (inter-sectoral linkages) in a sector from demander's view since it is assumed in Cella's Method that the inter-sectoral transaction in a sector are extracted and the internal transactions remain only. In TL formula, Cella called the statement  as FL and  as BL.

The production change amount is also defined as follows after extraction in Ghosh's model:

(12)   

This amount also assesses the inter-sectoral linkages of the related extracted sector on the supply side.

* 1. **Dietzenbacher and Vander Linden Method**

Dietzenbacher and Vander Linden (1997) improved cella's methodology by proposing the non-complete hypothetical extraction method. The above solution is based on the assumption that the backward linkage of a sector shows its dependence to the entities it use. Hence, the intermediate entities used by a sector of economy should be only extracted in assessing the backward linkage that sector. In fact, the entire column of the related sector is extracted based on the reason that extracting this column means the extraction of all the intermediate input of this sector (the third method of the seven extraction methods). As a result, the economy's production vector will change into the following equation after extraction:

(13)  ×  

The difference between the real total production and the production after extracting the target sector is the standard to calculate linkages:

(14)  ×  

In other words, we can write:

(15) 

According to the above method, it is similarly assumed that the target sector does not sell its products to other economical sectors in the forward linkage. In this case, the total production change indicates the forward linkage:

(16)    

In other words:

(17)  

* 1. **Song *et. al*. Method**

This method was introduced by Song et al. according to this method, it is supposed that the elements of the main diameter related to a particular sector are extracted based on the reason that extracting this sector means extracting the internal (inter-sectoral) transactions of the involved sector (the last method of the seven extraction methods). Therefore, after extracting the value X on the demand side from the below equation, we will have:

(18)  ×  

The difference between X and X' shows the internal linkage (IL) index:

(19)  ×  

In other words,  :

(20) L 

It does not seem that the above equation assess any particular type of Backward, Forward or Total linkages between the extracted sector and other ones; rather, it shows a standard of the internal linkage of the extracted sector.

The production change amount is also defined as follows after extraction in Ghosh's model:

(21)    

However, the above calculated indices do not specify the average performance of each sector in comparison to the average performance of the total economy (which is a unit); the linkage indices of each method should be normalized to correct this deficiency *i.e.* the ratio of the linkage index value of each sector to the average linkage index of all economic sectors is obtained. In each method, the sector in either demand or supply side of the economy with a normalized linkage of more than one is a key sector of the economy.

1. **Data Base and Analysis the Results**

The main data base in this study is a national 9191 commodity by commodity input-output table of 2001 that has been constructed by statistical centre of Iran (SCI). We aggregated 9191commodities into 12 main sectors through calculating absorb and make matrices, in which one of them is mining sector and includes the oil and other mining sector in which its share is very low in the total mining sector. Sectors are shown in each table in the column of sector. Then each of 12 sectors is extracted from the economy using four types a, b, c, and d models described in the third part. This operation is repeated for all sectors two times one from demand side and the other from supply side of the economy. The results of calculations are organized in four tables: Table 2, 3, 4, and 5.

**Table 2**- Backward Linkages Leontief Demand Side

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Song *et. al.***  **(4)** | | | | **Dietzenbacker and Linden**  **(3)** | | **Cella**  **(1)** | | | **Original**  **(2)** | | | **Sector** | **Cod.** |
| **Rank** | **Billion rials** | **Rank** | | **Billion**  **rials** | | **Rank** | **Billion**  **rials** | | **Rank** | **Billion rials** |  |  |
| 2 | 29.447 | 2 | | 69.001 | | 2 | 102.299 | | 2 | 115.435 | Agriculture | 1 |
| 11 | 75 | 11 | | 6.762 | | 9 | 23.402 | | 9 | 23.464 | Mining | 2 |
| 1 | 125.477 | 1 | | 237.413 | | 1 | 242.860 | | 1 | 310.498 | Manufacturing | 3 |
| 4 | 9.803 | 9 | | 15.339 | | 8 | 27.400 | | 8 | 29641 | Utilities | 4 |
| 9 | 749 | 7 | | 29.909 | | 7 | 35.091 | | 7 | 35.418 | Construction | 5 |
| 5 | 7.354 | 3 | | 51.212 | | 5 | 50.851 | | 6 | 54.533 | Other construction | 6 |
| 7 | 2.796 | 6 | | 38.196 | | 3 | 83.217 | | 3 | 84.619 | Whole sale and retail | 7 |
| 12 | 16 | 10 | | 9.701 | | 12 | 11.811 | | 12 | 11.819 | Hotel and Restaurant | 8 |
| 3 | 11.539 | 5 | | 39.137 | | 4 | 67.795 | | 4 | 72.733 | Transportation and Communication | 9 |
| 8 | 1.450 | 12 | | 4.524 | | 11 | 15.566 | | 11 | 15.955 | Banking | 10 |
| 10 | 200 | 8 | | 19.364 | | 10 | 22.388 | | 10 | 22.546 | Real State | 11 |
| 6 | 6.969 | 4 | | 46.764 | | 6 | 50.435 | | 5 | 55.592 | Other services | 12 |
|  | 16.323 |  | | 47.275 | |  | 61.093 | |  | 69.354 | Average |  |

Source: Author’s calculations

Table (2) shows the absolute values of the reduced output in the entire economy according to two models, LDM and GSM in 2001. According to this table, the highest value of the reduced output of the entire economy belongs to the manufacturing sector and lowest to the hotel and restaurant. Mining is in the ninth among 12 sectors in the original and 11th place in the model (3) and (4), that is less than average of economy

**Table 3-**Backrward Linkage (LDM) - percentage

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Song *et. al.***  **(4)** | | | | **Dietzenbacker and Linden**  **(3)** | | **Cella**  **(1)** | | | **Original**  **(2)** | | | **Sector** | | **Cod.** |
| **Rank** | **Percent** | **Rank** | | **Percent** | | **Rank** | **Percent** | | **Rank** | **Percent** | |  |  |
| 2 | 29/2 | 2 | | 36/5 | | 2 | 96/7 | | 2 | 97/8 | | Agriculture | 1 |
| 11 | 006/0 | 11 | | 52/0 | | 9 | 82/1 | | 9 | 82/1 | | Mining | 2 |
| 1 | 75/9 | 1 | | 46/18 | | 1 | 88/18 | | 1 | 14/24 | | Manufacturing | 3 |
| 4 | 76/0 | 9 | | 19/1 | | 8 | 13/2 | | 8 | 30/2 | | Utilities | 4 |
| 9 | 06/0 | 7 | | 32/2 | | 7 | 72/2 | | 7 | 75/2 | | Construction | 5 |
| 5 | 57/0 | 3 | | 98/3 | | 5 | 95/3 | | 6 | 24/4 | | Other construction | 6 |
| 7 | 22/0 | 6 | | 97/2 | | 3 | 47/6 | | 3 | 58/6 | | Whole sale and retail | 7 |
| 12 | 001/0 | 10 | | 75/0 | | 12 | 92/0 | | 12 | 91/0 | | Hotel and Restaurant | 8 |
| 3 | 90/0 | 5 | | 044/3 | | 4 | 27/5 | | 4 | 65/5 | | Transportation and Communication | 9 |
| 8 | 11/0 | 12 | | 35/0 | | 11 | 21/1 | | 11 | 24/1 | | Banking | 10 |
| 10 | 02/0 | 8 | | 50/1 | | 10 | 74/1 | | 10 | 75/1 | | Real State | 11 |
| 6 | 54/0 | 4 | | 63/3 | | 6 | 92/3 | | 5 | 32/4 | | Other services | 12 |
|  | 29/2 |  | | 36/5 | |  | 95/7 | |  | 97/8 | | Average |  |

Source: Author’s calculations

Table (3) shows the relative importance of sector using four types of extraction methods from demand sides. It can be seen that the first place of the sectoral importance is manufacturing with 24.14%, 18.88%, 18.46%, and 9.75% share of output reduction in four models respectively. However, the place of the oil and mining sector in comparison to the first in the ranking indicates that the amount of reduction in production as a result of extracting this section is not too large i.e. 1.82% , 1.82%, 0.52 and 0.006% in four models respectively with 9th and 11th rank. Hence, this sector has weak inter-sectoral linkages with other economic sectors.

**Table 4**- Forward Linkage (GSM) – absolute quantity- billion rials

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Song *et. al.***  **(4)** | | | | **Dietzenbacker and Linden**  **(3)** | | **Cella**  **(1)** | | | **Original**  **(2)** | | | **Sector** | **Cod.** |
| **Rank** | **Billion rials** | **Rank** | | **Billion**  **rials** | | **Rank** | **Billion**  **rials** | | **Rank** | **Billion rials** |  |  |
| 2 | 34.389 | 2 | | 100.441 | | 2 | 111.985 | | 2 | 128.480 | Agriculture | 1 |
| 11 | 87 | 6 | | 27.961 | | 7 | 32.166 | | 8 | 32.234 | Mining | 2 |
| 1 | 117.692 | 1 | | 203.673 | | 1 | 238.993 | | 1 | 299.918 | Manufacturing | 3 |
| 3 | 13.875 | 5 | | 30.107 | | 8 | 30.108 | | 7 | 35.666 | Utilities | 4 |
| 9 | 465 | 11 | | 6.326 | | 9 | 24.445 | | 9 | 24.615 | Construction | 5 |
| 6 | 4.310 | 9 | | 8.985 | | 6 | 36.614 | | 6 | 38.283 | Other construction | 6 |
| 7 | 3.457 | 3 | | 78.173 | | 3 | 97.393 | | 3 | 99.216 | Whole sale and retail | 7 |
| 12 | 11 | 12 | | 3.349 | | 12 | 9.162 | | 12 | 9.168 | Hotel and Restaurant | 8 |
| 4 | 13.656 | 4 | | 61.080 | | 4 | 73.598 | | 4 | 80.076 | Transportation and Communication | 9 |
| 8 | 2.404 | 8 | | 18.533 | | 10 | 19.539 | | 10 | 20.610 | Banking | 10 |
| 10 | 175 | 10 | | 6.430 | | 11 | 16.937 | | 11 | 17.080 | Real State | 11 |
| 5 | 6.057 | 7 | | 21.150 | | 5 | 41.234 | | 5 | 45.809 | Other services | 12 |
|  | 16.382 |  | | 47.184 | |  | 61.014 | |  | 69.263 | Average |  |

Source: Author’s calculations

According to the findings in table (4) using four types of GSM methods, the highest reduced value of the output is also related to the manufacturing sector 299.918, 238.993, 203.673, and 117.692 billion rials, which shows strongest forward linkages in the supply side in all models.

**Table (5)-** Forward Linkages (GSM) - Percent

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Song *et. al.***  **(4)** | | | | **Dietzenbacker and Linden**  **(3)** | | **Cella**  **(1)** | | | **Original**  **(2)** | | **Sector** | **Cod.** |
| **Rank** | **Percent** | **Rank** | | **Percent** | **Rank** | **Percent** | **Rank** | | **Percent** |  |  |
| 2 | 672. | 2 | | 817. | 2 | 8.703 ر941 | 2 | | 9.92 | Agriculture | 1 |
| 11 | 0070. | 6 | | 172. | 7 | 2.50 | 8 | | 2.50 | Mining | 2 |
| 1 | 159. | 1 | | 8415. | 1 | 5818. | 1 | | 23.23 | Manufacturing | 3 |
| 3 | 071. | 5 | | 342. | 8 | 342. | 7 | | 2.77 | Utilities | 4 |
| 9 | 030. | 11 | | 490. | 9 | 901. | 9 | | 1.91 | Construction | 5 |
| 6 | 330. | 9 | | 690. | 6 | 842. | 6 | | 2.94 | Other construction | 6 |
| 7 | 260. | 3 | | 086. | 3 | 577. | 3 | | 7.71 | Whole sale and retail | 7 |
| 12 | 0010. | 12 | | 260. | 12 | 710. | 12 | | 0.71 | Hotel and Restaurant | 8 |
| 4 | 061. | 4 | | 754. | 4 | 5.72 | 4 | | 6.22 | Transportation and Communication | 9 |
| 8 | 180. | 8 | | 441. | 10 | 521. | 10 | | 1.60 | Banking | 10 |
| 10 | 010. | 10 | | 500. | 11 | 311. | 11 | | 1.32 | Real State | 11 |
| 5 | 470. | 7 | | 641. | 5 | 203. | 5 | | 3.56 | Other services | 12 |
|  | 672. |  | | 817. |  | 708.3 ر941 |  | | 9.99 | Average |  |

Source: Author’s calculations

According to the findings in table (5), the lowest reduced value of the output belongs to sector the hotel and restaurant sector in all models, which means that this sector makes a small portion of its products available for other sectors. Now if the relationship between the oil sector and other sectors or its subsectors from buyer's view is extracted from the whole economic system, the whole economic output decreases by 2.50 percent and places 8th, 7th, 6th, and 11th positions out of 12. In this case, the position of the oil sector on both the demand and the supply sides signifies weak backward and weaker forward linkages of this sector among the other 12 sectors on the whole economy.

1. **Conclusions Remark**

This study is an empirical experience to determine the significance of the oil sector in the economic structure of Iranian economy in 2001. In order to do so, the intersectoral linkages of the economy focusing on the oil sector were calculated using four types of extraction methods: the original extraction, Cella, Dietzenbacher and Vander Linden and Song *et. al.* methods. According to the calculations, although expectation on the importance of oil sector is clear to the economy, the oil sector has a low position in the whole economy in terms of total, backward, forwards and internal linkages. We observed that this sector is averagely the 7th, 11th in the ranking among the 12 sectors on both the demand and the supply sides. This position is not desirable because the reduction in the total output of the economy is really small after extracting the housing sector in comparison to the conditions before extraction.

For oil sector the share of the final demand from the total production is rather high (86.93percent), which means that a large portion of the production of this sector does not insert any considerable effect on the production process of output. As a result, does not have a significant role in providing the intermediate needs of the other sectors. Hence, oil cannot be considered as a key sector in the economy. The main role of oil in the economy is to provide income for other sectors by export.

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