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Studying the Effects of Non-Oil Exports on Targeted Economic Growth in Iranian 5th Development Plan: A Computable General Equilibrium Approach

Somayeh Jafari*
Department of Economics
Allameh Tabatabai University
Somayehj99@gmail.com

Rasul Bakhshi Dastjerdi
Department of Economics
University of Isfahan
bakhshirasul@gmail.com

Reza Moosavi Mohseni
School of Computer and Mathematical Science
Auchland University of Technology, Auckland, New Zealand
reza.moosavi.mohseni@aut.ac.nz

Abstract

This paper estimates the effects of an increase in Iran's non-oil exports on its economic growth as well as sectoral outputs, using a single country, comparative static, exogenous policy Computable General Equilibrium (CGE) model. The paper also investigates the share of tradable sectors in reaching to the targeted growth rate (8%) in 5th socio-economic development plan. For this purpose, the parameters of the model are calibrated based on Iran's Social Accounting Matrix (SAM) which carries a snapshot of the Iran's economy. The model is then used to simulate the impact of increasing the exports uniformly across all sectors by 10, 20, and 30 percent on endogenous variables, including sectoral outputs, and GDP. Results suggest that 2.03% of targeted economic growth rate would be achieved by encouraging a 6% growth in exports. Our finding also indicates that industry and mine sector in Iran, would have more influence on growth than other non-oil sectors.

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∗ The Corresponding Author

1. Introduction

According to general policies of Iranian 5th Socio-Economic Development Plan (2010-15), it is targeted that Iran's economy should experience a rapid annual economic growth rate equal to 8%. The fifth development plan sets the guidelines for the socio-economic development of the country over the next five years. The five-year plan is part of "Vision 2025", a plan for long-term sustainable growth. The target is self-reliance by 2015 and the implementation of an ambitious economic reform plan which includes subsidy, banking, taxation, currency, infrastructure and productivity as its main focus. Among the other main objectives of the fifth plan are: making improvements in public health care, and expanding international relations.

Iran's annual growth rate in 2010 was 2.6% where the targeted rate was 8%. Iran's non-oil exports stood at $16.3 billion in 2007, a rise of 47.2% from the previous and 21.3 billion dollars in 2009. It seems that exports sector in Iran's economy can play a significant role to achieve the targeted economic growth. How the export sector affects Iran's economic growth; and which of the exports subsectors can contribute to economic growth the most is virtually not known empirically. To date, most models for the analysis of the impact of increase in exports on economic growth in Iran have been partial equilibrium and econometric-based. Such models have their own unique strength but they are not capable of examining linkages across all economic sectors, explicitly and simultaneously.

This study employed a single country, comparative static, exogenous policy, general equilibrium approach capturing the Iran’s economic structure in to address the aforesaid questions. We provide a review of the empirical evidence that shows that increased non- oil exports increases the economic growth. We then assess the impact of an increase of 10, 20, and 30 percent in exports in different scenarios on endogenous variables. An illustration of the effects of a change in export on the variables of interest is then presented.

2. Literature Overview

Relationship between trade and economic growth is one of the most controversial issues in economics. There are many empirical studies on this topic. Dissension among economists about selecting exports development strategy or import replacement strategy is the most important reason for emerging these studies (Motevaseli, 1999).

From theoretical point of view, many reasons have been provided to confirm the hypothesis of growth based on promoting exports. First, empirical studies show that all developing countries suffer from suboptimal usage of their capacities. So, by exports promoting policies, useless capacities will be utilized. Second, consumers can obtain commodities in lower prices which may lead to an increase in welfare. Third, exports promoting policies can lead the economy toward utilizing its comparative advantages. Forth, these policies increase firm's efficiency by promoting competition among domestic and foreign producers.

2-1. Review of empirical studies

Most of empirical studies have used econometric approaches to examine the relationship between exports and economic growth. The results are mixed. Some researchers find the unilateral or bilateral relationships between exports and economic growth, while others find no significant relation between these variables.

Proxy variables for representing trade in empirical studies are exports, imports, share of exports in GDP and total foreign trade. Next, we review some related studies.

Balassa (1978) has used (Michalopoulous et al.1973) method to investigate the relationship between exports and economic growth for two periods (1966 - 73 and 1960 – 66) in 11 developing countries. The results show that 1% increase in exports can increase national product by 0.04%. It also shows that fiscal policies with exports oriented approach have more impact on economic growth than fiscal policies with import replacement approach. He also showed that there is a significant correlation between economic growth variables and non-exports GNP. This in turn, represents the indirect effects of exports on income and expenditures.

Kavousi (1984) attempted to study the relationship between export and economic growth for 73 developing countries. It shows that in both groups of low- and middle-income countries, exports expansion is associated with better economic performance and that an important cause of this association is the favorable impact of exports on total factor productivity. The paper also demonstrates that the effect of commodity composition of exports on the relationship between export expansion and economic growth is substantial in more advanced developing economies. Kavousi has concluded that there is a positive relationship between exports and economic growth, and this growth is not restricted to the countries with average income, rather it contains countries with low income as well.

Chow (1987) investigates the causal relationship between exports growth and industrial development in eight Industrializing Countries. Results of Sims' causality test show that for most of these countries, there is strong bidirectional causality between the growth of exports and industrial development. These findings support the export-led growth strategy in that expansion in exports not only promote the growth of national income but also lead to structural transformation of the developing countries. He concluded that exports growth and industry development could reinforce each other interactively.

Subhash et al. (1994) investigates the causal relationship between the exports and output growth in 30 developing countries over the period from 1960 to 1988 in a multivariate framework. This study identities a feedback prima facie causal relationship between exports and output growth in five countries, exports growth prima facie causes output growth in another six countries; output growth prima facie causes exports growth in a further eight countries; and no causal relationship was observed between export growth and output growth in the remaining 11 countries. They also have found that in 15 countries the foreign exchange rate prima facie caused exports growth, and that in 12 countries world output caused exports growth.

Michaely (1977) showed that, since exports is a part of national product, the problem of the correlation of these two variables is inevitable in the assessment of economic growth and exports growth models. In other words, the growth rate of national production is equal to the result of the sum of the growth of internal demand and exports. Therefore, high exports growth requires a relatively low internal demand.

Baradaran et al.(1999) has used Granger causality techniques and Feder’s growth model to study the effect of exports on the Iran’s economic growth during 1959 to 1993. Results show that there is one way relation from exports growth toward economic growth and among effective factors on economic growth, the coefficient of exports is the biggest one. According to her results, among GDP’s subsectors, agriculture export has no significant effect on economic growth, and it only affects growth agricultural sector. But industry and services' exports have affected total GDP growth and sectoral output.

Akbari et al. (2000) has tested the effect of exports on Iran's economic growth, with emphasis on oil and non-oil exports using SUR and simultaneous equations methods. He has concluded that capital formation is a positive function of exports growth. Industrial and oil exports have significant effect on economic growth in period 1969-95. According to his results, industrial exports has affected by exports development policies. But non-oil exports (except industrial exports) have no significant effect on economic growth, because non-industrial exports is containing of traditional and agricultural commodities.

Motevaseli (1999) in his study has tried to answer two questions: Can we rely on exports growth in order to achieve more rapid economic growth? And, can we apply growth statistics of previous period to improve the predictions of future growth of economy? In order to answer these questions, he useds a regression in which GNP is considered as a function of its lag values, exports and its lag values, and import and its lag values as following:

$$\log GDP = \alpha_0 + \sum_{i=1}^{r} \alpha_i \log GDP_{t-i} + \sum_{j=0}^{s} \beta_j \log X_{t-j} + \sum_{m=0}^{k} \gamma_m M_{t-m} + U_t$$

Where, X and M are exports and import respectively. According to his results, Granger causality test implies on existing a bilateral relationship between export and economic growth.

Estimated coefficients indicate that 1% increase in exports leads to 0.16 % increase in GNP growth, and 1% increase in GNP growth rate leads to 2.57 percent increase in exports growth rate. Comparison of the two above quantity reveals that increase of GNP growth, leads to more exports growth and its final effect is greater. With respect to these outcomes he strongly suggests export development strategy.

Haddad and Perobelli (2005) have used computable general equilibrium approach to investigate the effects of exports on economic growth for Brazil. They use CGE approach to enable them for studying substitution between domestic goods (interchangeable) and investigate change in relative price of import. Their model is containing of 8 production sectors, 8 goods sectors and 27 regions contain of households, federal government, regional government and the rest of the world. Using model, they conclude a positive strong relationship between exports and economic growth.

Mojaverhosseini (2006) by using a CGE model investigates the macroeconomic effects of entering Iran to World Trade Organization. His model is containing of 50 sectors. He has analyzed the results via two scenarios (entering scenario and no entering scenario). He study the model under different scenario policies, such as tariffs, tariff unification, exchange rates unification, foreign market access, income transfers because of removing subsidies to households and 20% increase in oil prices.

Khoshakhlagh and Moosavi (2006) Using a computable general equilibrium model to study Dutch disease in Iran's economy. Their oil revenues as the desired operating direction of Dutch disease in the economy have attention. Their model divides the economy into seven tradable and non-tradable sectors. These seven sectors are oil, industry, mining, water and electricity, gas and services they conclude that 50% increase in oil revenues, will weaken exchangeable sectors especially agriculture and industry sectors, but construction sector will be strengthened. It also strengthen real exchange rate and so import will be increased and exports will be decreased.

Tayyebi and Mesrinejad (2007) have focused specially on the effects of income distribution and welfare of households using a computable general equilibrium (CGE) models. They evaluate impacts of trade liberalization on Iran's agriculture sector on the welfare level of the Iranian households. By conducting several scenarios for reducing tariffs, they concluded that the welfare level of households is positively affected in conjunction with change in their income, consumption and saving.

By reviewing empirical studies, it seems that there aren't any general equilibrium studies on relation from exports to growth for Iranian economy. Thus we try to investigate this relation by using CGE approach. But before describing the model, it is useful to review the structure of computable general equilibrium models.

3. The Structure of Computable General Equilibrium Models

Computable general equilibrium (CGE) models replaced AGE models in the mid-1980s, as the CGE model was able to provide relatively quick and large computable models for the whole economy, and was used by governments and the World Bank. CGE models are very popular today. 'AGE' and 'CGE' are used inter-changeably in the literature. Scarf-type

AGE models have not been used since the mid-1980s. What is today referred to as AGE models, are based on static, simultaneously solved, macro balancing equations using a standard Keynesian macro model (Kahn et al. 2008).

There are two approaches used in applied economics: one is based on partial equilibrium model and the second is based on general equilibrium method. In partial equilibrium approach, the focus is on specific market. But general equilibrium theory is a branch of theoretical neoclassical economics which seeks to find a vector of relative prices that clears all markets. This approach allows to find long run equilibrium prices.

Until the 1970s general equilibrium analysis was not applied in empirical works. With advances in computing power and the development of input-output tables, it became possible to model national economies, or even the world economy, and attempts were made to solve for general equilibrium prices and quantities empirically.

Applied general equilibrium (AGE) models were pioneered by Herbert Scarf in 1967. In the 1980s, the AGE method lost its popularity due to their inability to provide a precise solution and its high cost of computation. AThe defects of Scarf's method is discussed by Velupillai (2006). However, this method paved the way to solve numerically the Arrow-Debreu General Equilibrium model. Whalley and Shoven are among the first researchers who implemented this method in 1991.

Computational General Equilibrium Models link all economic sectors, simultaneously; and take into account the consumers and producer optimizing behavior in line with economic theory. In these models different economic agents optimize their objective function subject to constraints that they face. General equilibrium models are able to examine the repercussions in the entire economy due to a certain policy change;

In order to solve the general equilibrium model numerically, GAMS software package can be used. This software is a powerful tool for solving linear and nonlinear equations. The most fundamental information basis for a general equilibrium model is social accounting matrix. This matrix is formed based on the cycle of the output. The foundation of the structure of social accounting matrix is based on the input-output table and national income accounting.

The model in this study includes 4 production sectors including agriculture, services, construction, mine and industry. These sectors are the products of the products by using a set of production factors (labor force and capital) and intermediate material in the model. These productive sections earn their income through selling their own products to consumers that contains both internal consumers (families and government) and external consumers (outside world). This income used to pay the production institution and to pay wages of primary production factors.

In practice, the interactions of variables in different economic sectors, institutions and outside world are provided based on various equations and functions. Iran is considered to be a small economy compared to the Rest of the World (ROW). In the other words, we can neither influence the global price of our imported goods nor have any effects on the global prices of our exports to the outside world. Our model allows to perform comparative static analysis.

This section briefly reviews the model equations. Tables 2 and 3 in the appendix, represent the endogenous and exogenous variables of the model.

4. Model

The model used for calibration is based on Lofgren (2003). The model has 39 equations including 8 equations for prices, 6 equations for production, 7 equations for foreign trade, 2 equations for consumption, 8 equations for income, and 8 equations for saving and investment.

4-1. Price Equations

The price equations are as follows:

$$PM_C = (1 + tm_C)\, pwm_c EXR \qquad c \in CM \quad (1)$$

Where PM_C is the indicator of the internal import price, pwm_c is the global import price and tm_c is the tariff rate and EXR is the foreign exchange rate, and c is the index for import goods.

$$PE_C = pwe_C (1 + te_c) EXR \qquad c \in CE \quad (2)$$

Where PE_C is the internal exports price, pwe_c is global exports price and te_c is the subsidy rate.

$$PQ_C = \frac{PD_C QD_C + PM_C QM_C}{Q_C} \qquad c \in C \quad (3)$$

Where PQ_C is the price of goods which are supplied in the market, PD_C is the price of domestic goods, QD_C is the amount of domestic goods, PM_C is the price of the imported goods, QM_C is the amount of imported goods and Q_C is the sum of goods which are supplied in the market.

$$PX_C = \frac{PD_C QD_C + PE_C QE_C}{QX_C} \qquad c \in C \quad (4)$$

Where, PX_C is the indicator of the price of domestic goods which are exported or consumed. PE_C is the price of exported goods, QE_C is the quantity of exports and QX_C is the total production.

$$PVA_a = PX_C(1 - ta_c) - \sum_{c \in C} ica_{ca} PQ_C \qquad a \in A \quad (5)$$

Where PVA_a is value added price and ta_c is the indirect tax and ica_{ca} is the fixed coefficient of input-output where a index refers to actives.

$$PK_c = \sum_{c \in C} PQ_c . b_{ac} \qquad a \in A, c \in C \quad (6)$$

Where PK_c is the total value of capital goods.

$$PA_a = \sum_{c \in C} PX_c \theta_{ac} \qquad a \in A \quad (7)$$

In the above relation, PA_a shows the price of activity branch as weighed average of domestic products (PX_C).

$$\overline{CPI} = \sum_{c \in C} PQ_C cwts_c \quad (8)$$

$\overline{CPI}$ is the index of model normalization rule in the form of the price for combined goods. Weights are indicated by $cwts_c$ which is the proportion of combined goods in the consumption bundle.

4-2. Production Equations

Producers earn their income from domestic and foreign markets. The gained income is used to buy intermediate goods and pay to production factors. Producers maximize their profit with respect to the production function.

$$QA_a = ad_a \prod_{f \in F} QF_{fa}^{\alpha_{fa}} \qquad a \in A \quad (9)$$

Where, QA_a is production function for activity a, ad_a is the efficiency parameter in the production function of activity a, QF_{fa} is demand for factor f in the activity a and α_{fa} shows the proportion of value added of factor f in activity a.

$$QINT_{ca} = ica_{ca} QA_a \qquad c \in C, a \in A (10)$$

$QINT_{ca}$ shows the amount of intermediate expenditure of activity a for good c, and ica_{ca} denotes the share of intermediate inputs (a) in final product (c). In this section, we face a matrix which the numbers of its rows are equal to the number of goods, which is shown by c, and its columns are equal to the number of activities which is shown by a.

$$QX_C = \sum_{a \in A} \theta_{ac} QA_a \qquad c \in C (11)$$

QX_C is the total domestic product of the good c, which is sold in domestic market (QD_C) or exported (QE_C). How this allocation would be done is illustrated in foreign trade equations.

$$WF_f WFDIST_{fa} = \frac{a_{fa} PVA_a QA_a}{QF_{fa}} \qquad f \in F, a \in A \quad (12)$$

The above relation shows the demand function for production factors in which WF_f is the average price of production factors, and $WFDIST_{fa}$ indicates the deviation of the production factor wage f from the average price of production factor f in activity a. If wages are the same in all activities, the value of $WFDIST_{fa}$ will be equal to one.

$$\sum_{a \in A} QF_{fa} = QFS_f \qquad f \in F \quad (13)$$

The above equation shows the equilibrium condition in the factors market. In fact this equation shows the balance and equilibrium of demand and supply. According to this relation, the sum of demands for production factors by activity branches ($\sum_{a \in A} QF_{fa}$) should be equal to supply of production factors (QFS_f).

$$QQ_C = \sum_{a \in A} QINT_{ca} + \sum_{h \in H} QH_{ch} + qg_c + QINV_c \qquad c \in C \quad (14)$$

Equation 14 shows total supply QQ_c and total demands of the economy which contains intermediate demand $\sum QINT_{ca}$, consumption demand of households ($\sum_{c \in C} QH_{ch}$), consumption demand of government (QG) and the investment demand ($QINV_c$).

4-3. Foreign Trade Equations

The model contains the hypothesis of qualitative difference between domestic goods and imported goods. This qualitative difference has been considered by hypothesizing incomplete substitution between import and domestic goods. We use Armington function to explain this issue. This function indicates that imported goods are incomplete and imperfect substitutions for domestic goods.

According to this hypothesis, total demand of goods for each sector is defined as follow:

$$QQ_C = aq_c (\delta_c^q QM_C^{-p_c^q} + (1-\delta_c^q) QD_C^{-p_c^q})^{\frac{-1}{p_c^q}} \qquad c \in CM \quad (15)$$

where δ_c^q and $1-\delta_c^q$ are indicators of the proportion of import and domestic goods in Armingtom function, and p_c^q is the elasticity of substitution between import and domestic goods.

$$\frac{QM_C}{QD_C} = \left(\frac{PD_C}{PM_C} \frac{\delta_c^q}{1-\delta_c^q}\right)^{\frac{1}{1+p_c^q}} \qquad c \in CM \quad (16)$$

The above relation shows that the optimal amount of demand of these two groups of goods depends on their relative price.

$$QQ_C = QD_C \qquad c \in CNM \quad (17)$$

Equation 17 shows the amount of compound supply of non-imported goods. Similarly, an imperfect transferring is considered for domestic selling of goods and their foreign selling. That is, producers can supply products to domestic markets or exports them. Further, total supply function is defined as follows:

$$QX_C = at_c(\delta_c^t QE_c^{p_c^t} + (1-\delta_c^t)QD_c^t) \qquad c \in CE \quad (18)$$

The way of allocating these goods into domestic market and exports is determined by a CET function. In the above relation δ_c^t shows the proportion of each variable, p_c^t is derived from elasticity of substitution between domestic selling and exports and it indicates that these two goods were not perfect substitution for each other.

$$\frac{QE_C}{QD_C} = \left(\frac{PE_C}{PD_C}\frac{1-\delta_c^t}{\delta_c^t}\right)^{\frac{1}{p_c^t - 1}} \qquad c \in CE \quad (19)$$

In the above relation, the optimal amount of the supply of these two markets is determined by their relative price.

$$QX_C = QD_C \qquad c \in CNE \quad (20)$$

For non-exports goods, equation (20) indicates that there is a balance between domestic sells of goods and domestic goods.

$$BP = \sum_{c \in CM} pwm_c.QM_c - \sum pwe_c.QE_c - FSAV \qquad (21)$$

BP represents the current account balance with due attention to the account for rest of the world. It is necessary that the difference between exports and import must equal to foreign saving (FSAV).

4-4 Equations of consumption

$$QH_{ch} = \frac{\beta_{ch}.(1-mps_h).(1-ty_h)YH_h}{PQ_C} \qquad c \in C, h \in H \quad (22)$$

Equation 22 shows the households consumption where β_{ch} shows the proportion of good c from the total household consumption expenditure, mps_h is the final rate of the saving of household h, and ty_h shows the rate of tax on the household income. QH_{ch}, in the left side, shows the household consumption expenditure (the demand function for goods and services).

$$EG = \sum_c PQ_c.qg_c + \sum_{h \in H} tr_{h,gov} \qquad (23)$$

In equation 23, EG shows the government expenditure, which contained the sum of the multiplication of the price of compound goods PQ_c, by the amount of the consumed goods by government qg_c and households' transfer payments.

4-5 Equations of Income

The household institution is the owner of production factors such as labor force and capital. Therefore, one of the household's income resources is the income of production factors.

$$YF_f = \sum_{a \in A} WF_f WFDIST_{fa} QF_{fa} \qquad a \in A,\ f \in F \quad (24)$$

$$YF_{hf} = shry_{hf} \sum_{a \in A} WF_f WFDIST_{fa} . QF_{fa} \qquad h \in H,\ f \in F \quad (25)$$

Equation 25 shows the income of production factors. In this relation YF_{hf} shows the income of household h from factor f and $shry_{hf}$ is the proportion of household h from production factors income.

$$YH_h = \sum_{f \in F} YF_{hf} + tr_{h,gov} + EXR . tr_{h,row} \qquad h \in H \quad (26)$$

Equation 26 shows the household income. In the above equation $tr_{h,gov}, tr_{h,row}$ are respectively the representative of payments of rest of the world to households and payments of government payments to households.

$$TARIF = \sum_{c \in CM} pwm_c QM_c . tm_c EXR \quad (27)$$

$$EXPSUB = \sum_{c \in CE} pwe_c . QE_c . te_c . EXR \quad (28)$$

$$HHTAX = \sum_{h \in H} YH_h . ty_h \quad (29)$$

$$INDTAX = \sum_{c \in C} tq_c (PD_c QD_c + PM_c QM_c) \quad (30)$$

$$YG = TARIF + HHTAX + INDTAX + Y_{oil} - EXPSUB \quad (31)$$

In equation 31, YG is the government income. The first sentence in the right side of above equation is the income obtained from tariffs. The second sentence is household taxes, the third is indirect taxes, the fourth is oil income, and finally the last is the sum of sectors' export subsidies which should be subtracted from the government income.

4-6 Equations of Saving and Investment

$$HHSAV = \sum_{h \in H} mps_h.(1-ty_h).YH_h \qquad (32)$$

$$GSAV = YG - EG \qquad (33)$$

$$DSTQ_a = dstr.QA_a \qquad (34)$$

$$QINV_c = \overline{qinv_c} IADJ \qquad c \in C \quad (35)$$

$$SAVING = INVESTMENT \qquad (36)$$

$$\sum_{h \in H} mps_h.(1-ty_h).YH_h + (YG - EG) + EXR.FSAV = \qquad (37)$$

$$\sum_{c \in C} PQ_c QINV_c + \sum_{c \in C} PQ_c.DSTAQ_A$$

$$PK_c.DK_c = \lambda_c.INVESTMENT \qquad (38)$$

$$ID_c = \sum_a b_{ca} DK_a \qquad (39)$$

Equation (35) shows the demand for investment goods. $\overline{qinv_c}$ is the primary amount of the investment. $IADJ$ is the index for adjustment of investment.

DK_c is the Coefficient for total fixed investment. Equation 39 is the final demand for each item.

5. Data and solving method

The first step in using a CGE model is designing a social accounting matrix which is compatible with the structure of the CGE model. A Social Accounting Matrix (SAM) represents flows of all economic transactions that take place within an economy (regional or national). It is at the core, a matrix representation of the National Accounts for a given country, but can be extended to include non-national accounting flows, and created for whole regions or area. SAMs refer to a single year providing a static picture of the economy. SAMs are square (columns equal rows) in the sense that all institutional agents (Firms, Households, Government and 'Rest of Economy' sector) are both buyers and sellers. Columns represent buyers (expenditures) and rows represent sellers (receipts). SAM's were created to identify all monetary flows from sources to recipients, within a disaggregated national account. The SAM is read from column to row, so each entry in the matrix comes from its column heading, going to the row heading. Finally columns and rows are added up, to ensure accounting consistency, and each column is added up to equal each corresponding row. We use Iran's 17×17 SAM for required data of the model in the paper. We use GAMS language and "MCP"[1] method to solve the model.

6. Discussion of results

Before any simulation is performed, it is imperative that the baseline parameters or coefficients for the endogenous variables are obtained. These coefficients and parameters are crucial as the quality of simulation results would depend entirely on the representativeness of the values. The initial values of the parameters of the model are determined by solving the model.

The simulation results, (i.e, the effects of an increase in exports on the output growth of agriculture; industry and mine; and entire economy) are reported in Table 1. It shall be noted here that the construction sector is a non-exports sector, and therefore is omitted from our discussion.

This paper appraises the impact of an increase in export in three different scenarios; a 10% increase in export, a 20% increase in export and a 30% increase in export. Simulation results, i.e, effects of the increase in export in different scenarios on the endogenous variables are listed in Table 1.

The results generally show a direct relation of long-run impact of an increase in exports on GDP growth, and the endogenous variables representing output of each economic sector. Considering the baseline scenario, a 10 percent increase in exports will result in about 9 percent increase in GDP. Among exportable non- oil sectors, industry and mine sector experiences the biggest growth (5.3 %), while services and agricultural sectors will experience the growth rate of 1.9 %, and 0.96%, respectively. This is attributable to the much larger share of industry and mine sector in Iran exports. According to this result, paying attention to reinforcement of non-oil exports, with great emphasis on industrial export, can facilitate and enhance Iran's economic growth. Further simulation also denotes that an increase of 20 percent and 30 percent of exports has a positive and significant impact on GDP and sectoral outputs.

Table 1: The Simulation Results of on Increase in Exports on

Economic Growth

Sectors	First Scenarios (A %10 increase in export)	Second scenarios (A %20 increase in export)	Third scenarios (A %30 increase in export)
Agriculture	0.96%	2.047%	3.08%
Industry and Mine	5.3%	9.12%	12.81%
Construction	-	-	-
Services	1.9%	3.021%	4.07%
Total	**8.96%**	**14.80%**	**19.96%**

Source: Researchers' Computations

7. Conclusion

The Iran's 5th Socio-Economic Development Plan (2010-15), targeted the annual growth rate of 8% for the five year period beginning from 2015. This paper simulated the effect of an increase in Iran exports. Most empirical studies in Iran are based on partial equilibrium methods. This study uses general equilibrium approach. We employed a single country, comparative static, exogenous policy, computable general equilibrium model to assess the impact of increasing the exports uniformly across all sectors by 10 percent (baseline scenario), 20 and 30 percent.

Results show that there is a positive and significant impact of an increase in exports on different output sectors as well as economic growth. Results also show that the Industry and mine sector has the greatest effect on economic growth among all non-oil exportable sectors. According to this result, paying attention to reinforcement of non-oil exports, with great emphasis on industrial exports, can facilitate and enhance Iran’s economic growth.

According to the Iran’s fifth development plan, in order to achieve annual growth rate of 8%, an increase in exports can fulfill some part of the targeted annual growth rate. For example, selecting the third scenario which contains 30% increase in exports over five years, can affect Iran's economic growth by 19.96%. In this case, the share of exports in realization of targeted 8% annual growth rate is equal to 2.03%. If exports grows annually by 6%, national output grows by 2.03%.

Endnote

1. Mixed Complementarily Programming.

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Appendix 1: Endogenous and Exogenous Variables of the Model

Table 2: Exogenous Variables

Definition	Variable	Definition	Variable
Exchange Rate	EXR	Oil Incomes	Y_{oil}
Supply of Production factors	QFS_f	Consumed Goods by Government	qg
Index of the Model Normalization Rule	$\overline{CPI}$	Global Export Price	pwe_c
		Global Import Price	pwm_c

Table 3: Endogenous Variables

Definition	Variable	Definition	Variable
Government Expenditure	EG	Production	QQ_c
Production factors' Income	YF_f	Investment Sector Destination	ID_c
Household's Income from factors of production	YF_{hf}	Domestic Product	QD_c

Direct Taxes	$HHTAX$	Activities Production Level	QA_a
Indirect Taxes	$INDTAX$	Demand for Intermediates	$QINT_{ca}$
Exports Subsidies	EXPSUB	Demand for Production Factors	QF_{fa}
Imports Tariffs	$TARIF$	Price of production factors	WF_f
Government Income	YG	Value Added Price	PVA_a
Household's Saving	HHSAV	Import Price	PM_c
Household's Consumption Expenditures	QH_{ch}	Export Price	PE_c
Government Saving	$GSAV$	price of Domestic Goods	PD_c
Foreign Saving	$FSAV$	Price of supplied goods in the market	PQ_c
Total Saving	$SAVING$	Price of the compound goods (domestic and export)	PX_c
Total investment	INVESTMENT	Price capital	PK_c
Inventory Stock	$DSTAQ_a$	Sum of goods which are supplied in the market	Q_c
Investment Sector origin	DK_c	Total production of each sector	QX_c
		Balance of Payments	BP

Appendix 2. Social Accounting Matrix

Social Accounting Matrix for Iran (2001) – Summarized Version

		activities	Commodities	Production Factors		Institutions		Capital Account	Rest of the World	Total
				Labor	Capital	Household	Government			
Activities			800825.5				12205.3		133145	946212.2
Commodities		304497				304570.4	2.97219	223660		946212.2
Production Factors	**Labor**	143813.4								143813
	Capital	482092								482092
Institutions	**Household**			143813	482092		10468		2093	638466
	Government	3.15810	6870.8			22986.4			2.108367	154024.8
Capital Account						310909.4	34132.3		121382-	223660
Rest of the World			122223							122223
Total		946212.2	946212.2	143813	482092	638466	154024.8	223660	122223	3640437