International Economic Studies
Vol. 51, No. 1, 2021
pp. 38-51
Received: 16-12-2020 Accepted: 05-05-2021

Dynamic Effects of Accession to the WTO on Industrial Sector in Iran: Application of the RDCGE Model

Mohammad Hassan Zare *
Assistant Professor, Department of Economics, Faculty of Economics, Management, and Accounting, Yazd University, Yazd, Iran

Abstract
The present study aims to analyze the long-term impact of tariff reductions to be mandated in the event of accession of Iran to the World Trade Organization (WTO) on the industrial sector using the Recursive Dynamic Computable General Equilibrium (RDCGE) model. For this purpose, the model was calibrated for the 2011 social accounting matrix of Iran. In the baseline scenario, it was assumed that the Iranian economy will experience annual growth of 2% without accession to the WTO, which is the same rate as the population growth. In the alternative scenario, the tariff reduction simulation was performed based on the average tariff commitments of 22 developing countries acceded to the WTO. Based on the results, industrial production and exports will shrink by 3.4 and 3.5%, respectively, over the 30 years after joining the WTO, leading to an 81% gap between the production levels in the alternative and baseline scenarios at the end of this period.

Keywords: World Trade Organization, Recursive Dynamic Computable General Equilibrium Model, Trade Liberalization, MFN Tariffs, Nash Equilibrium.

JEL Classification: I38, C68, F13.

* Corresponding Author, Email: mhzarea@yazd.ac.ir

1. Introduction

Today, all countries are engaged in a constant endeavor to maintain and improve their position in the global value chain and use all international means to reduce their production costs and increase the competitiveness of their exports. No country can achieve such goals without using international markets, capital, and technology. The same situation exists in Iran, which is seeking sustainable development through implementing a promotion export strategy. In this regard, one cannot ignore the significant role of the World Trade Organization (the WTO) which has 164-member states. Membership in the WTO protects the exports of a country against discriminatory practices in the markets of other members. In other words, the exports of non-members could be exposed to discriminatory practices in the area of tariffs, taxes, and domestic regulations, which can make it difficult to adopt a coherent export promotion strategy. The global experience has shown that the import substitution strategy often fails to achieve its economic growth and development goals. In contrast, accession to the WTO integrates the legal and regulatory frameworks of any country governing its economic activities into the international rules of this organization. Accordingly, it can generate confidence for foreign investors to participate in the domestic market, especially since they will be able to ask their governments to file a complaint in the dispute settlement system of this organization during a violation of the WTO rules. Therefore, there is no doubt about the immense advantages of joining the WTO.

However, this concern exists in many developing countries in which the trade liberalization and tariff reduction along with the accession to the WTO could greatly damage the domestic economy, especially their uncompetitive industrial sectors. To address such an issue, the WTO devised special mechanisms known as "safeguard measures". However, such measures can only be activated temporarily when fair compensation is made in other industrial subsectors, and thus cannot fully resolve the mentioned concern (www.WTO.org). This issue can be partially resolved by adopting appropriate negotiating positions during the process of accession and preparing the vulnerable industries before and during this process. Thus, predicting the implications of accession to the WTO is essential for the industrial sector. The present study aims to analyze the dynamic impact of the accession of Iran to the WTO regarding the production and export of the industrial sector.

The rest of this paper is as follows. Section 2 offers the literature review related to the WTO and multilateral disciplines. The model and data are introduced in Section 3. In Section 4, the results are analyzed, and conclusions and recommendations are presented in Section 5.

2. Review of the Related Literature

The theoretical foundations of the WTO are discussed in the framework of general equilibrium theory and game theory. In this framework, an improvement in the terms of trade and welfare of a country as a result of placing tariffs leads to a decline in the trade and welfare among its trading partners, which may take retaliatory actions. In this case, examining unilateral versus multilateral trade policy is highlighted. As shown in Figure 1, point C is considered as the equilibrium point when both countries impose tariffs on their imports. However, the equilibrium point shifts from C to A, leading to an increase in the welfare of both countries shown by the higher level of indifference curves in both countries when both countries decide to move to a free trade situation. If each of the countries removes the tariff, another country seeks to maintain it since it can improve its terms of trade and reach a higher level of welfare. At point D, the host country removes its tariff while the foreign country maintains its tariff and increases its welfare. The opposite

happens at point B, where the foreign country which increases its tariff will suffer from this situation. Hence, countries are engaged in a game similar to the prisoner's dilemma. Both countries have a better payoff in the free trade strategy than the protectionist strategy. However, no country will eliminate its tariffs unilaterally because a country that maintains its protectionist strategy is placed in the best welfare state, while the country which eliminated its tariff will be in the worst welfare state. Based on this approach, the protectionist strategy which is considered as the dominant strategy is represented by Nash equilibrium, and the free trade strategy is shown by Pareto optimum. Therefore, unilateral trade policy cannot push the countries to leave protectionism and adopt a free trade strategy. A trade agreement reducing tariffs for both countries can lead to better welfare than Nash equilibrium. At the international level, only a multilateral trade agreement with somewhat enforceable guarantees like GATT or the WTO can ensure that no member country is allowed to maximize its welfare by following a protectionist strategy at the expense of its trading partners which adhere to a free trade framework (Bagwell, 2003).

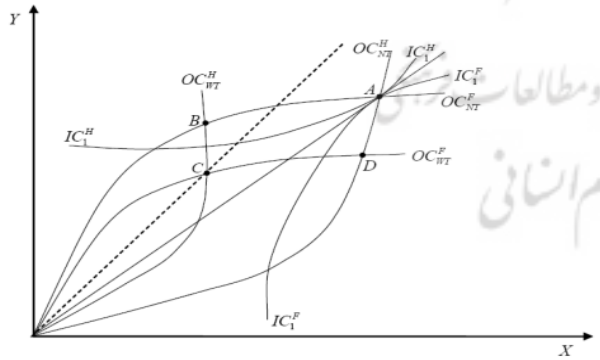

Fig.1. General Equilibrium Effects of a Tariff
Source: Salvatore (2013)

Salami (2000) studied the economic effects of Iran's accession to the WTO on the Iranian agriculture sector through a simulation performed with a static general equilibrium model with accession and non-accession scenarios. Based on this simulation, the Iranian agricultural sector can benefit from the accession and lose precious opportunities by staying out of the WTO. Mojaver-Hosseini and Fayazmanesh (2006) used a static computable general equilibrium model to evaluate the macroeconomic effects of accession to the WTO in Iran and indicated that joining the WTO can result in increasing the national income by less than half a percentage point, two-fifths of which can be related to the benefits of accessing to export markets. Mehrara and Barkhordari (2007) evaluated the effect of tariff reduction on the value-added and employment of different economic sectors in Iran. The study was conducted using a static general equilibrium model and the social accounting matrix of 2001 in two scenarios of 10 and 50% decrease in tariff rates. The results showed that the highest increase in value-added and employment was related to the oil sector and natural resource-centered industries in general, and the largest decrease was related to the food and clothing industries. Tayebi and Mesrinejad (2007) used a static general equilibrium model to predict the effects of trade liberalization in the agricultural sector on the income distribution and welfare among Iranian households. Based on the results, the change in import tariffs in line with the agricultural trade liberalization goals can improve the welfare of Iranian households, which can positively influence their income and consumption levels. Zoghipoor and Zibayi (2009) investigated the possible effects of trade liberalization in economic sectors in Iran with the help of a static computable general equilibrium model and reported that a reduction in tariffs by 50 and 100% in all sectors could lead to a decrease in the total product supply and investment, as well as increasing total exports, imports, household income, and consumption. In another study, Mesrinejad (2010) implemented a static general equilibrium model to examine the relationship between trade liberalization and global competitiveness in Iran and indicated

that trade liberalization, at least in the short term, could fail to affect the global competitiveness among Iranian economic sectors. Barghi (2015) reported that reducing the import tariff rates could result in increasing the employment level, while trade liberalization could lead to an increase in wage inequality.

Further, Farajzadeh, Zhu, and Bakhshudeh (2017), by developing a computable general equilibrium (CGE) model showed that removing import barriers completely can increase GDP by 8.9% and decrease greenhouse gas emissions in CO2 equivalents by 3% in Iran. Furthermore, it can create a welfare gain of 13.2% and 9.3% for urban and rural households, respectively, leading to an increase in the inequality between households in favor of urban and high-income groups. Levitt, Sabby, and Sqrenjen (2019) reported that the liberalized trade in China could significantly affect the GHG emissions of its trading partners. In addition, increased exposure to Chinese exports resulted in developing the growth of consumption-based emissions while reducing production-based emissions. An increase in consumption-based emissions was larger than a decrease in production emissions. In another study, Anderson (2020) focused on the impact of trade liberalization on poverty and inequality in developing countries by using a CGE model and suggested that trade liberalization may lead to a reduction in poverty, while it may increase inequality. However, it is worth noting that the predicted effects are relatively small. The variation in the size and direction of effects can be explained by selecting outcome measures, fiscal response to liberalization, type of CGE model, and certain country characteristics – but not the method used to link the CGE model to the distribution of income. Nejati and Bahmani (2020) studied the effect of FDI in the Oil and Gas (OIG) sector on Iran's economy using a regional CGE model. Based on the results, FDI causes Dutch disease in the economy of Iran leading to a decrease in production and employment in tradable and an increase in non-tradable sectors when FDI does not lead to productivity spillover. Further, the effect of Dutch disease results in reducing or eliminating when FDI improves the productivity in the firms. Therefore, production can be improved in all sectors, leading to a decrease in the index of consumer price.

The results of the present study could be important in two areas. First, Iran should join the WTO if it is interested in selecting the export expansion strategy as its development strategy. Otherwise, its exports are treated discriminately by the members of this organization in terms of tariffs, other border measures, as well as domestic regulations. The export expansion strategy is emphasized in the upstream development documents in Iran. A non-discrimination principle, that is, non-discriminatory treatment toward similar exports of trading partners and non-discriminatory treatment toward imported products against similar domestic products, is applied by each member only for the products of other members, without having any obligation for its application to non-member countries. Second, non-targeted and non-strategic accession can cause major damage to domestic industries without recognizing its effects. Thus, the present study can pave the way for evaluating the effects and consequences of accession in the industrial sector, which is the most challenging issue. However, it is important that authorities realize the importance of joining the WTO and take it more seriously and resume it through active trade and political diplomacy.

Considering the above-mentioned issues, the present study sought to evaluate the long-term effects of Iran’s accession to the WTO on its industrial sector by implementing a Recursive Dynamic Computable General Equilibrium model. Given the inability of static general equilibrium models to consider the effects of capital accumulation, they fail to account for the effects of economic policies on

growth. Thus, they should not be used in studying economic developments over long periods (Espinosa *et al.*, 2014). Most previous studies applied static CGE models.

Further, the tariff reduction (the alternative scenario) was simulated based on the experiences of 22 developing countries joined the WTO in order to ensure that the effects of membership are realistically elaborated. This approach is unique among the available studies regarding the effects of Iran's accession to the WTO. فاصله حذف شودIt is hypothesized that Iran will experience faster industrial production and export growth in the alternative scenario (accession to the WTO) compared to the baseline scenario (non-accession).

3. Methodology

In the present study, a recursive dynamic computable general equilibrium model was used. The static CGE models cannot be used to study the effects of economic policies on growth due to the lack of considering the effects of capital accumulation. In addition, they are not suitable for evaluating economies in the transition period and economic policies which are implemented in stages. Dynamic CGE includes forward-looking or intertemporal and forward-moving or recursive models. They are respectively based on adaptive and rational expectations. Intertemporal CGE models assuming economic agents have full predictability which is not compatible with the economic conditions of many countries, especially the developing countries. Thus, some experts believe that recursive CGE models are more realistic and reliable. Furthermore, such models are a series of statically computable general equilibrium models in different periods in which the relationship between periods is established by behavioral equations for endogenous variables such as the capital accumulation and updating of exogenous variables such as labor supply. Capital stock changes endogenously with the equation of capital accumulation and labor supply exogenously in the interval between periods (Annabi *et al.*, 2005). Finally, these models consist of static and dynamic components, which are explained in the following section.

3.1. Model Description

3.1.1. The Static Component of the Model

The model consists of activities (production), production factors, and institutions. The activities encompass industry, agriculture, and services. Production factors refer to labor and capital, while institutions consist of the households, government, and outside world.

Activities: Production takes place in two stages. It is assumed that industry/mining, agriculture, or services are represented by a firm. In the first stage of production, each firm combines the production factors to generate value-added according to the Cobb-Douglas production function. In the second stage, the generated value added is combined with intermediate inputs according to the Leontief function to produce the final product. At each stage, the firm aims to maximize its profit.

Households: They earn income by providing the production factors including labor and capital. In addition, they model the transactions related to the intra-household, government, and outside world. Households pay tax to the government and save a constant fraction of their disposable income. The demand function of households is obtained by maximizing their utility function. The goods produced in the production process are consumed by households, the government, the firms for investment, as well as intermediate inputs.

Outside World: It is assumed that the goods produced domestically and those imported from abroad are imperfect substitutions for each other (Armington assumption). Therefore, domestically produced goods and imported goods are combined into composite goods which are either consumed by institutions or fed back to the production process as an intermediate input based on a constant substitution elasticity function.

Regarding the supply side, the firms decide whether to export their goods or sell them domestically based on an optimization process with a constant elasticity of transformation (CET) function.

Government: The government collects a direct tax from the household income and an indirect tax from domestic and imported goods. Further, its expenses include the cost of consumption of goods, services, and transfer payments.

Equilibrium: General equilibrium refers to the situation in which the supply and demand of goods and production factors are in balance, and there is a balance between savings and investment (Annabi et al., 2005).

Macroclosures: The neoclassical closure of the model in this study is based on the Walrasian computable general equilibrium models, although it was modified based on the characteristics of the Iranian economy.

A complete list of the static part of the model equations is available in the appendix of the paper.

3.1.2. The Dynamic Component of the Model

The dynamic component of the model consists of equations that are set to relate each period to another. These equations are divided into the equations which update the variables increasing at a constant rate according to the population growth rate,n_t, as well as those controlling capital accumulation over time. Labor supply is considered as one of the variables which are assumed to increase according to the population growth rate as follows.

$$QFS_{l,t+1} = QFS_{l,t}(1 + n_t) \quad (1)$$

Other variables assumed to increase at the same rate as population growth include government expenses, external savings, exchange payments, and other exogenous variables of the model. The demand for capital in each sector is determined at the beginning of each period based on the amount of capital accumulation and the rate of return on investment (exogenous):

$$QF_{fjt} = ror.KK_{j,t} \quad (2)$$

where QF_{fjt} indicates the demand for capital, $KK_{j,t}$ shows the amount of capital accumulation in the sector j in time t, and ror is considered as the rate of return on investment. In this study, ror is considered to be 2%. Once committed to a sector, the capital stock cannot be shifted. Similarly, capital services resulting from this capital stock cannot be moved between sectors. The capital stock of each new period is determined by combining the capital of the previous period after depreciation with the new capital as follows.

$$KK_{j,t+1} = (1 - \delta).KK_{j,t} + QINV_{j,t} \quad (3)$$

where δ is the capital depreciation rate, and $QINV_{j,t}$ shows the demand for investment in the sector j in time t. In the present study, the rate of depreciation is assumed to be 11%. In this model, the composite good investment function is assumed to be of Cobb-Douglas type as follows.

$$\sum_j QINV_{j,t} = \iota \prod_i QINV_{it}^{\lambda_i} \quad (4)$$

where $QINV_{it}$is considered as the demand for investment in each good, λ_i represents the share of each good in the composite investment function, and ι indicates the transmission parameter of the function. Here, $\sum_j QINV_{j,t}$ is the sum of investments in different sectors, which is equal to the total investment. This equation is one of the conditions of capital market equilibrium in dynamic models as follows.

$$\sum_j QINV_{j,t} = \sum_i PQ_{it}.QINV_{it} \quad (5)$$

In the research model, which is a recursive dynamic saving-based model, the total household saving is equal to the household tendency to save the disposable income:

$$S_t^p = mps_t(1 - ty_t)YH_t \quad (6)$$

As shown in Equation (16), the total saving of the economy consists of household savings and external savings. External saving is an exogenous variable that increases periodically at the same rate as population growth as other exogenous variables.

$$S_{t+1}^f = S_t^f(1 + n_t) \quad (7)$$

Total saving is used to finance the purchase of composite investment goods to invest in production sectors such as industry, agriculture, and services. In this regard, these goods become a part of the capital stock in these sectors. In this model, composite investment goods are assumed to be allocated based on the sectoral share of operating surplus based on the following equation:

$$p_t^k QINV_{j,t} = \frac{\hat{p}_{fjt+1}{}^{\zeta}.\widehat{QF}_{fjt+1}}{\sum_i \hat{p}_{fit+1}{}^{\zeta}.\widehat{QF}_{fit+1}}(S_t^p + EXR.S_t^f) \quad (8)$$

where p_t^k is the price of composite investment goods, $\hat{p}_{fjt+1}$ shows the expected price of capital services, and $\widehat{QF}_{fjt+1}$is considered as the expected demand for capital in the sector *j* in the coming period. The new capital is allocated to the sectors based on the sectoral expected return on capital. The expected return on capital in each sector depends on the expected cost of capital services and the expected capital demand in that sector. A higher expected price and demand for capital in a sector leads to a higher new capital allocated to that sector.

Future capital prices and stock can be replaced with the current price (p_{fjt}) and the current stock after applying the increase according to the population growth rate ($(1 + n_t)QF_{fjt}$)when the model is based on adoptive expectations, or when it is assumed that economic agents do not have perfect expectations. Thus, we have:

$$p_t^k QINV_{j,t} = \frac{p_{fjt}{}^{\zeta}.QF_{fjt}}{\sum_i p_{fit}{}^{\zeta}.QF_{fit}}(S_t^p + EXR.S_t^f) \quad (9)$$

where the parameter ζ can be interpreted as a weight factor representing the sensitivity of allocating investment goods to the cost of capital services in different sectors (Hosoe, 2015).

3.1. Data

This study used the 2011 social accounting matrix in Iran, which was developed by the Iranian Parliament (Majlis) Research Center. The effects of tariff reduction on the production and export of Iran's industrial sector were simulated after solving the model by the calibration method and creating tariff reduction scenarios based on the experience of 22 developing countries in the accession to the WTO. The GAMS software was used to solve the model and perform the simulation of tariff reduction.

3.2. Calibration and Numerical Solution

Recursive dynamic CGE models can be easily calibrated by considering the data related to the base year since we assume that the parameters calibrated for the base year do not change. The model of this study was calibrated based on the 2011 social accounting matrix and was numerically solved for the baseline scenario with the assumption that exogenous variables increase at the same rate as population growth (2%). The numerical solution of the model reproduced the entire data of the base year, showing that the model was robust. Calibration results are provided in Table 1.

Table 1. Model parameters and elasticity profile

Function	Parameter/Elasticity		Sector		
			Agriculture	Industry	Service
Consumption function	Goods share		0.231	0.184	0.585
	Household marginal propensity for saving		0.633	0.633	0.633
Value-added production function (Cobb-Douglas)	Transfer parameter or total productivity of factors		1.826	1.423	1.903
	Production factor share	Labor	0.290	0.113	0.343
		Capital	0.710	0.887	0.657
Final production function (Leontief)	Intermediate input share	Agriculture	0.369	0.011	0.009
		Industry	0.067	0.288	0.119
		Service	0.106	0.169	0.147
	Value-added share		0.458	0.531	0.725
Armington function (Composite goods)	Substitution elasticity		1.4	1.4	1.4
	Import share		0.276	0.461	0.078
	Transfer parameter		1.833	2.201	1.231
Transformation function	Transformation elasticity		1.2	1.2	1.2
	Export share		0.882	0.524	0.934
	Transfer parameter		3.342	2.003	4.476

Note: Elasticity values were derived from the related studies.
Source: Author

4. Results

In the alternative scenario, that is, the scenario of accession to the WTO, tariff reduction in Iran was simulated based on the experience of developing countries which joined this organization. The related data for these countries were extracted from the WTO website. Based on the data analysis, the average nominal bound tariff[2] in these countries in the industrial sector was 10.9%. In the alternative scenario, it was assumed that Iran commits to the reduction of its average tariff rate to 10.9%. The modeling period was set to 30 years since the model was dynamic. In the baseline scenario, it was assumed that the economy will experience a recursive expansion with the Business As Usual (BAU) condition leading to the growth with the same rate as population growth (2%). In dynamic models, the analysis is based on the comparison of variables in the baseline scenario (non-accession with 2% growth in the economy) and the alternative scenario (accession).

Based on the estimates, the average rate of growth in the Iranian industrial sector in the modeling period becomes negative 3.4% following the defined tariff reduction. Regarding the baseline scenario, the industry grows by an average of 2%. After the

[2] "Bound tariffs" refers to the rate of tariffs that member states are committed in accession negotiations. Therefore, the applied tariffs should always be less than or at most equal to these rates.

accession to the WTO, the Iranian industry will experience negative growth in all of the modeled periods, while the magnitude of this shrinking may decrease over time (Figure 2).

Regarding the difference between the average growth rates in the alternative scenario and the baseline scenario, the Iranian industrial sector may experience a bad situation following the accession to the World Trade Organization. Figure 3 compares the trends of the Iranian industrial sector in the alternative and baseline scenarios. In the alternative scenario, production in this sector decreases every year leading to about an 81% gap between the production levels in the alternative and baseline scenarios at the end of the period (Figure 4).

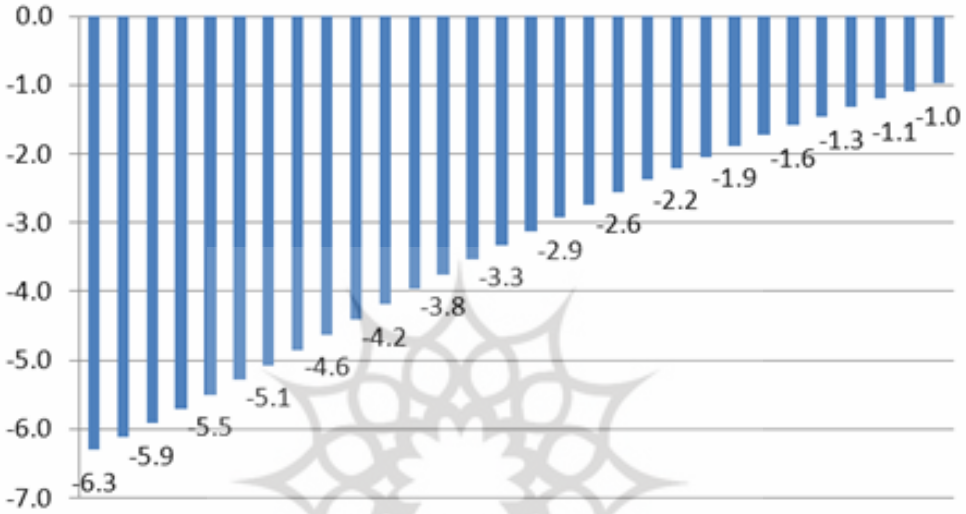

Fig. 2. Growth of the Iranian industrial sector in the alternative scenario (%)

Source: Author

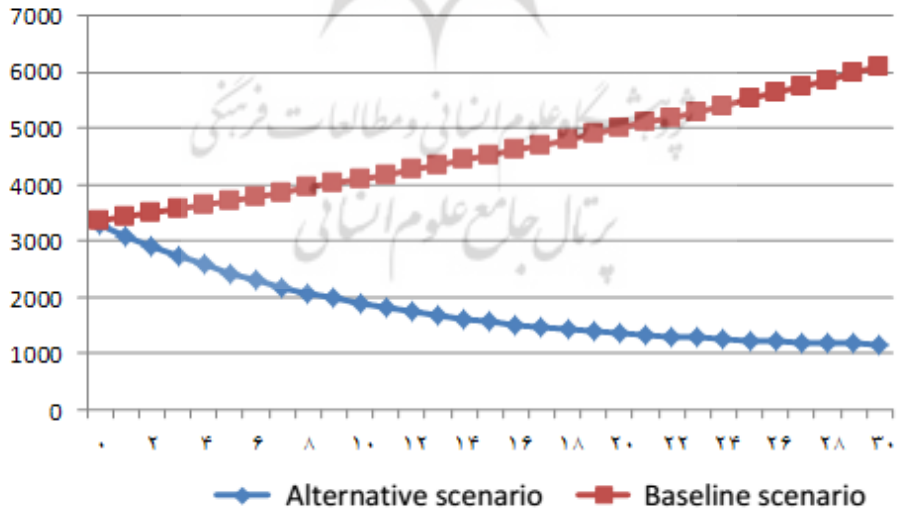

Fig. 3. The production of the industrial sector in the baseline and alternative scenarios (Thousand billion Rials)

Source:Author

Based on the average obligations of developing countries that joined the WTO, Iran's average tariffs in the industrial sector will decrease by about 56% after joining this

organization. Based on the estimates, this sudden reduction in tariff, accompanied by removing all non-tariff barriers, can cause an approximately 21% increase in industrial imports in the first year after accession. Given that the accession to the WTO results in reducing tariff dispersion significantly, the goods which currently have high tariffs may experience a greater increase in imports. Moreover, a large part of these obligations must be implemented immediately after accession. Based on the results of this study, the countries which joined the WTO, especially in the last ten years, were allowed a very short transitional period.

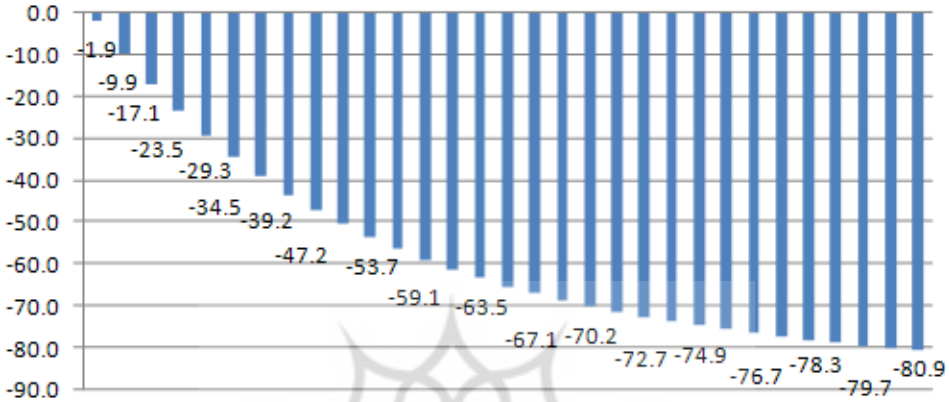

Fig. 4. The difference between production levels of the Iranian industrial sector in the baseline and alternative scenarios (%)

Source: Author

Following the accession to the WTO, the Iranian industrial sector, which has long been accustomed to preferential support and has been suffering from low competitiveness, may be badly damaged by a relative decrease in prices, an increase in imports, as well as substituting domestic products in the household's consumption basket with imported goods. The weighted average of tariffs in Iran is roughly half of the nominal average (The weighted and normal average in 2018was was 8.9 and 18.2%, respectively). In other words, imports are mainly conducted for low-tariff goods. After joining the WTO, the goods which currently have high tariff rates will experience a greater reduction in the tariff rate due to a sudden reduction of tariff dispersion. Therefore, the industries producing such goods are expected to be more vulnerable to the effects of accession to the WTO. Comparing Iran and the WTO members in terms of average tariffs on the classified goods based on two-digit ISIC codes, it is shown that Iran collects markedly higher tariffs than the members of the WTO for all classes of goods, except tobacco and oil as well as petroleum products. The greatest difference can be observed in the tariffs placed on clothing, textiles, vegetables and fruits, leather and leather products, and fish products. Some important goods have high tariff rates, but the average tariff of their commodity class is not rather high. It is worth noting that the class of motor vehicles is considered as one of such commodity classes. After the accession to the WTO, such tariffs are greatly reduced, and Iran is expected to reduce its tariffs to the same level since the average tariff rate of new WTO members is about 12%.

In addition, the average tariff placed on consumer goods in Iran is about three times more than the average tariff placed on capital and intermediate goods. Further, the accession to the WTO could lead to a significant increase in importing consumer goods making it more difficult to maintain a stepwise tariff. However, the results of the present study indicated that most WTO members are

currently applying MFN (most favored nation) tariffs on Iranian exports, which are similar to the rates they apply for the WTO members. Therefore, joining the WTO cannot create a considerable change in the tariffs on Iranian exports. In total, based on the model estimate, the Iranian industrial exports will decline by an average of -3.5% over the next 30 years after joining the WTO, which is consistent with the average negative growth rate predicted for industrial production (3.4%). Table 2 shows the average growth in GDP, total exports, industrial production, and industrial exports in the two scenarios.

Table 2. Growth of Economic Indices in the Baseline and Alternative Scenarios (%)

Variable	Alternative scenario (accession)	Baseline scenario (non-accession)
GDP	-1.2	2
Total exports	-2.5	2
Industrial production	-3.4	2
Industrial exports	-3.5	2

Source: Author

5. Conclusion and Recommendations

The present paper aimed to predict the dynamic effect of tariff reduction in Iran after accession to the WTO on the industrial production and exports of this country. To this aim, the long-term effects of accession were analyzed by using a dynamic computable equilibrium model combined with a tariff reduction simulation based on the experiences of 22 developing countries joined the WTO to obtain more realistic estimates about the effect of membership. The modeling database was the 2011 social accounting matrix developed by the Iranian Parliament (Majlis) Research Center.

Based on the results, regarding the average obligations of the recently joined developing countries, Iran's average tariffs in the industrial sector would decrease by about 56% after accession to the WTO, leading to about a 21% increase in imports. In addition, industrial production and exports in Iran would shrink by 3.4 and 3.5% over the 30 years after joining the WTO, respectively. The main reasons for the negative impact are related to the sudden reduction in tariffs, greater decrease in tariffs of the goods with the present higher tariff rates, which are mainly consumer goods, low competitiveness of the Iranian industrial sector, as well as little change in the current tariffs on Iranian exports by joining the WTO.

On one hand, Iran cannot succeed in its export promotion strategy and integrate into the global value chain without joining the WTO since staying out of this organization makes it vulnerable to discriminatory practices toward its export goods and its investors in international markets. Although most WTO members are not engaged in this kind of practice toward Iranian products, it can be related to Iran's low share of global exports, which is not guaranteed to continue. On the other hand, regarding the present conditions, Iran's accession to the WTO is detrimental to its industry. Therefore, a change from the broad and non-selective tariff-centered support of uncompetitive industries to selective and dynamic support in line with the plans for industrial development, stabilization of tariffs for increasing the transparency and predictability of the trade system in Iran, and a gradual reduction of tariffs to avoid shock effects at the time of accession seem to be long overdue. Signing preferential trade agreements before accession to the WTO can help the Iranian industry to prepare for more serious competition within this organization. The use of detailed classifications for national tariff codes can help the government provide more selective and effective support for the industry. Further, some measures such as encouraging the merger of manufacturing companies, pushing towards economies of scale, and liberalizing trade in key services sectors such as financial services, telecommunications, and transportation can result in increasing competitiveness among industrial products. Finally, it is recommended to devise the institutional and regulatory framework needed for adopting contingency measures such as

safeguard measures for controlling the damage created for the industry by flooding imports, anti-dumping measures to counter the dumping practices, and countervailing measures to deal with subsidized exports of other countries which damage the domestic industry, which are permitted under the regulations of the WTO.

References

Anderson, E. (2020). The Impact of Trade Liberalization on Poverty and Inequality: Evidence from CGE Models. *Journal of Policy Modeling, 42*(6), 1208-1227.

Annabi, N., Cockburn, J., & Decaluwe, B. (2005). *Trade Liberalization, Growth and Poverty in Senegal: A Dynamic Microsimulation CGE Model Analysis*. Center Detudesprospectives Et DinformationsInternationales (CEPII).

Bagwell, K., & Staiger, R. (2003). Economic Theory and the Interpretation of GATT/WTO. *The American Economist, 46*(2), 3-19.

Barghi Oskooi, M. M. (2015). The Effect of Import Tariff Reduction on the Labor Market in Iran (Case Study: Agriculture Sector and Food, Clothing and Textiles Industries). *Quarterly Journal of Economic Modeling, 9*(32), 25-40.

Burfisher, M. (2013). Introduction to Computable General Equilibrium Models. Translated by Fatemeh Bazazan, Tehran: Ney publication.

Cling, J. P. (2009). The Distributive Impact of Vietnam's Accession to WTO. *Economie Internationale, 43-71*.

Decaluwe, B. (2010). Computable General Equilibrium Model Single Country, Recursive Dynamic Version, Poverty and Economic Policy (PEP). *Research Network, 11-55.*

Eromenko, I. (2010). *Accession to WTO, Computable General Equilibrium Analysis: The Case of Ukraine.* Munich Personal Repe Archive (MPRA).

Espinosa, M., Psaltopoulos, D., Santini, F., Phimister, E., Roberts, D., Mary, S., & Gomez y Paloma, S. (2014). Ex-ante Analysis of the Regional Impacts of the Common Agricultural Policy: A Rural–urban Recursive Dynamic CGE Model Approach. *European Planning Studies*, *22*(7), 1342-1367.

Farajzadeh, Z., Zhu, X., & Bakhshudeh, M. (2017). Trade Reform in Iran for Accession to the World Trade Organization: Analysis of Welfare and Environmental Impacts. *Economic Modeling*, 63, 75-85.

Hosoe, N. (2015). *Textbook of Computable General Equilibrium Modeling, Programming and Simulations*. England: Palgrave Macmillan.

J.Levitt, C., Sabby, M., & SQrenjen, A. (2019). Impact of China Trade Liberalization on the Greenhouse Gas Emissions of WTO Countries. *China Economic Review*, 54, 113-134.

Lofgren, H., Lee, R., & Robinson, S. (2002). *A Standard Computable General Equilibrium (CGE) Model in GAMS.* International Food Policy Research Institute.

Masrinejad, Sh. (2010). Trade Liberalization and Global Competitiveness in Iran: Application of Computable General Equilibrium Model. *Journal of International Economic Studies*, 21(37), 101-116.

Mehrara, M., & Barkhordari, S. (2007). Investigation of Effects of Tariff Reduction on Economic Sectors Using a Computable General Equilibrium Model. *Journal of Economic Research*, 80, 171-194.

Mojaver Hosseini, F., & Fayazmanesh, F. (2006). Estimation of Macroeconomic Impacts of Iran's Accession to the WTO Using a Computable General Equilibrium Model. *Journal of Commerce Research*, 39, 1-38.

Nejati, M., & Bahmani, M. (2020). The Economic Impact of Foreign Direct Investment in Oil and Gas Sector: A CGE Analysis for Iranian Economy. *Journal of Energy Strategy Reviews*, 32, 20-35.

Omolo, M. (2011). *The Impact of Trade Liberalization on Poverty in Kenya*. Nairobi: Institute of Economic Affairs.

Salami, H. (2000). *Economic Effects of Iran's Accession to the WTO on Agriculture.* Master Thesis, Faculty of Economics, University of Tehran.

Salvatore, D. (2013). *International Economics*. Eleventh Edition. USA: Fordham University.

Tayebi, S. K., & Mesirinejad, Sh. (2007). Trade Liberalization in Agricultural Sector and Application of Computable General Equilibrium Models: A Study of Iranian Households. *Quarterly Journal of Economic Studies*, 1, 5-23.

WTO (2002). The Results of the Uruguay Round of Multilateral Trade Negotiations. *Geneva: the WTO publications*.

WTO website: www. wto.org.

Zoghipoor, A., & Zibayi, M. (2009). Effects of Trade Liberalization on Iran's Economic Sectors: A Computable General Equilibrium Model. *Journal of Economic*

Appendix: Static Part of the Model

1- Prices

$$PM_{it} = (1 + tm_{it}).EXR.pwm_{it}$$

$$PE_{it} = (1 - te_{it}).EXR.pwe_{it}$$

$$PQ_{it}.QQ_{it} = [PD_{it}.QD_{it} + PM_{it}.QM_{it}](1 + tq_{it})$$

$$PX_{it}.QX_{it} = PD_{it}.QD_{it} + PE_{it}.QE_{it}$$

$$PX_{jt} = a_{VA}.PVA_{jt} + \sum_i a_{i,j}.PQ_{it}$$

$$\sum_i PQ_{it}.cwts_i = cpi_t$$

2- Production

$$F \quad QVA_{jt} = ad_j \prod_{f \in F} QF_{fjt}^{\alpha_{fj}}$$

$$WF_f.WFDIST_{fj} = \frac{\alpha_{fj}.PVA_{jt}QVA_{jt}}{QF_{fjt}} \qquad QX_{jt} = \min\left(\frac{QVA_{jt}}{a_{VA}}, \frac{QINT_{i,j,t}}{a_{i,j}}\right)$$

$$QQ_{it} = aq_i.\left(\delta_i^q.QM_{it}^{-p_i^q} + \left(1 - \delta_i^q\right).QD_{it}^{-p_i^q}\right)^{-\frac{1}{p_i^q}}$$

$$\frac{QM_{it}}{QD_{it}} = \left(\frac{PD_{it}}{PM_{it}}.\frac{\delta_i^q}{1-\delta_i^q}\right)^{\frac{1}{1+p_i^q}}$$

CET $$\left(QX_{it} = at_i.\left(\delta_i^t.QE_{it}^{p_i^t} + (1 - \delta_i^t).QD_{it}^{p_i^t}\right)^{\frac{1}{p_i^t}}\right.$$

$$\frac{QE_{it}}{QD_{it}} = \left(\frac{PE_{it}}{PD_{it}}.\frac{1-\delta_i^t}{\delta_i^t}\right)^{\frac{1}{p_i^t - 1}}$$

3- Institutions

$$YH_t = \sum_{f \in F} YF_{h,f,t} + tr_{h,gov,t} + EXR.tr_{h,row,t}$$

$$QH_{it} = \frac{\beta_i.(1-mps)(1-ty).YH_t}{PQ_{it}}$$

$$\mathrm{YG_t} = \mathrm{U?\ DT_{gov,t}} + \mathrm{IDT_{gov,t}}$$

$$\mathrm{IDT_{gov,t}} = \sum_i tq_i.(PD_{it}.QD_{it} + PM_{it}.QM_{it}) + \sum_i tm_{it}EXR.pwm_{it}.QM_{it}$$

$$\mathrm{DT_{gov,t}} = \mathrm{EG_t} - \mathrm{IDT_{gov,t}}$$

$$EG_t = tr_{h,gov,t} + \sum_i PQ_{it}.QG_{it}$$

4- Constraints

$$\sum_{j \in J} QF_{fjt} = QFS_{ft}$$

$$QQ_{it} = \sum_i QINT_{it} + \sum QH_{it} + QG_{it} + QINV_{it}$$

$$\sum pwe_{it}QE_{it} + \sum_{ins} tr_{ins,row} + S_t^f = \sum pwm_{it}.QM_{it}$$

$$mps.(1 - ty_t)YH_t + EXR.S_t^f = \sum_i PQ_{it}.QINV_{it} + WALRAS_t$$