Iranian J Publ Health, Vol. 41, No.12, Dec 2012, pp.66-75

Original Article

Pharmaceutical Industry and Trade Liberalization Using Computable General Equilibrium Model

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(Received 13 Jun 2012; accepted 21 Oct 2012)

Abstract

Background: Computable general equilibrium models are known as a powerful instrument in economic analyses and widely have been used in order to evaluate trade liberalization effects. The purpose of this study was to provide the impacts of trade openness on pharmaceutical industry using CGE model.

Methods: Using a computable general equilibrium model in this study, the effects of decrease in tariffs as a symbol of trade liberalization on key variables of Iranian pharmaceutical products were studied. Simulation was performed via two scenarios in this study. The first scenario was the effect of decrease in tariffs of pharmaceutical products as 10, 30, 50, and 100 on key drug variables, and the second was the effect of decrease in other sectors except pharmaceutical products on vital and economic variables of pharmaceutical products. The required data were obtained and the model parameters were calibrated according to the social accounting matrix of Iran in 2006.

Results: The results associated with simulation demonstrated that the first scenario has increased import, export, drug supply to markets and household consumption, while import, export, supply of product to market, and household consumption of pharmaceutical products would averagely decrease in the second scenario. Ultimately, society welfare would improve in all scenarios.

Conclusion: We presents and synthesizes the CGE model which could be used to analyze trade liberalization policy issue in developing countries (like Iran), and thus provides information that policymakers can use to improve the pharmacy economics.

Keywords: Trade liberalization, Tariff, Pharmaceutical products, Computable general equilibrium model

Introduction

Today, pharmaceutical business is among greatest businesses of the world. By spending a lot in order to produce new drug, large pharmaceutical corporations take effort to greatly increase their property. In fact, while pharmaceutical industry is a sensitive one, it is an advantageous industry as well (1). Studies of drug status and recent anticipations indicate a progressive trend in world drug market, so that the rate of drug sale around world (world market) has reached 900 billion dollars in 2011 from 309 billion dollars in 1998 (around 2.9 times more) (2). It is expected that the drug world sale would go beyond 1 trillion (1043.4 billion) dollars in 2013, and reach 1.3 trillion dollars until 2020 (3). The drug world market during 1998 to 2008 had enjoyed an average growth of about 12%, while the rate is much lower in other industries. Naturally, the world market of pharmaceutical industry could be divided into four areas: United States, Japan, Europe, and the rest of the world (4).

Iran's pharmaceutical industry share is around 2 billion of the 750 billion dollars, while Turkey as one neighbor of Iran has a share of 6 billion dollars (1). Drug expense share is averagely 30% of the whole health expenses among different world countries. Drug expenses of Iran in 2011 have indicated an increase from 276 million to 829 million dollars for imported drugs. Generally, the ratio of Rial sale of imported drugs to the drugs produced inside the country has changed from 0.28 to 0.71 in recent years (5).

Since most world countries have joined world trade organization, Iran as a developing country with no significant role and presence of non-oil economy in world economy should not be in isolation from world progress and evolutions (6). Therefore, Iran's principal problem in this regard will be summarized in persistent and concentrated effort to make its membership possible with the least expense and the most profit. Hence precise recognition of effects and outcomes of membership in the organization will considerably help passing the membership path successfully (3). Therefore, studying effects of decreasing import tariff on major variants of drug field is a very important issue. Finally, we aimed to evaluate the impacts of trade openness on pharmaceutical industry using CGE model.

Methods

A standard computable general equilibrium model has been used in this study. Model details associated with activities, production factor, and Institutes are summarized in Table 1. The details are computed according to available data of SAM table. Activities include agriculture, pharmaceutical industry, industry and mine sector, construction sector, and finally service sector which use two factors of labor and capital for their products. Institutes include households, government, and the external world as well. The model utilized include product associated trades, household and government consumption, saving, investment, and foreign business.

Table 1: Model details in CGE Model

Set	Subset
Activities	Agriculture, pharmaceutical industry, industry and mine, construction, services
Production factors	labor and capital
Institutes	Household, government, and Rest of Row (Row)

It is assumed in this model that economic sectors use labor and capital as primary Institutes for production. In order to realize the model, beside primary Institutes, it is assumed that sectors use mediator Institutes for production as well. For more convenience, production stages are divided into two levels of top stage and bottom stage. It is assumed that in lower stage, additional value (composite primary factor) is obtained from composition of labor and capital with Cobb-Douglas type production function (equation 1) (7).

$$VA_j = B_j \prod FD_{hj}^{\beta_{hj}} \quad [1]$$

J as sectors index, h as index of primary production factors (labor and capital), VAj as additional value of jth sector, FDhj as demand for h th production factor by j sector, bj as efficiency parameter in production function, and Bhj as share parameter in production function or production elasticity of jth sector to hth Institutes ratio so that $\sum \beta_{hj} = 1$ and $1 \leq \beta_{hj} \leq \cdot$ are considered in this equation.

Using Leontief type production function in this stage, gross output is produced by combining additional value and mediator Institutes (8). According to these two stages with regard to production, each sector maximizes its profit function.

$$Y_j = \min\left(\frac{X_{ij}}{ax_{ij}}, \frac{VA_j}{ay_j}\right) \quad [2]$$

In this equation, I as sectors index, Yj as gross output of jth sector, axij as coefficient of minimum demand for mediator Institutes of jth in order to produce a gross output unit of jth sector (technical coefficients of input-output), ayi as coefficient of minimum need for additional value in order to produce one unit of gross output, Xij as ith sector production that is consumed as jth sec-

tor mediator are considered. According to these two stages, each sector maximizes its profit function with regard to its production. Therefore, these equations are resulted (9).

$$X_{ij=ax_{ij}.Y_j} \quad \forall_j \quad [3]$$

$$VA_j = ay_j.Y_j \quad [4]$$

$$FD_{hj} = \frac{\beta_{hj}.PN_j}{W_h}.VA_j \quad \forall_h \quad [5]$$

$$PS_{j=ay_j.} PN_j + \sum ax_{ij.} PQ_i \quad \forall_j \quad [6]$$

In these equations:

PNj as additional value price of jth sector, Wh as production factor wage, PSj as supply price of jth sector, and PQi as goods price of jth sector are considered.

It is assumed in this article that production factors (labor and capital) are in a state of equilibrium, and the supply of factors is constant (7). Hence change in tariffs does not change the whole demand of labor and capital, while just transmission of production factors from one sector to another takes place. In order to calculate private sector consumption (households), it is assumed that consumption basket is optimally selected by consumers (9). Their revenue is obtained from supply location of production factors (labor and capital) added by transmission payments of government to households and pure external moneys received. Household favorability depends on their amount of goods consumption in each sector. Here the favorability function is a Cobb-Douglas function which is maximized due to a budget equal to pure household revenue (household revenue minus direct tax amount and saving). The operation results in equation number 7(10).

$$PQ_i = \frac{C_i}{\lambda_{ci}(\sum W_h.FS_h - TAX_{dir} - SAV_{hoh})} \quad [7]$$

In this equation, Ci is considered as ith object household consumption, λ_{ci} as share parameter in favorability function or each object share in household consumption basket so that $0 \leq \lambda_{ci} \leq 1$ and $\sum \lambda_{ci} - 1$, FS_h the amount of primary hth factor supply (exogenous variable) is λ_{div} revenue derived tax of the households.

According to public sector consumption, it is assumed that government earns through implementation of sales tax, direct household income tax, and oil import and export tax. Government revenue is spent in its expenditures and saving (11).

$$TAX_{ind,j} = tx_j.PS_j.Y_j \quad [8]$$

$$TAX_{dir} = td.\sum W_h.FS_h \quad [9]$$

$$TARIFF_j = tm_j.PM_j.M_j \quad [10]$$

$$PQ_i = \frac{G_i}{\lambda_{gi}(TAX_{dir} + \sum TAX_{ind,j} + \sum TARIFF_j + E_{oil} - SAV_g} \quad [11]$$

In these equations, $TAX_{ind,j}$ is considered as indirect tax (sales tax), tx_j as sales tax rate, td as direct tax rate, $TARIF_j$ as import tariff, tm_j as import tariff rate, PM_j as import domestic price, M_j as import amount, $G_i$as government expenditures in jth sector, SAV_g as government saving, λ_{gi}as share parameter of government expenditure in each sector, and E_{oil} as oil export.

Investment in every sector depends on total investment which is equal to total saving, and is obtained from private, public, and foreign savings together. Foreign saving is assumed as an exogenous variable. Therefore, foreign exchange rate establishes trade balance (12).

$$SAV_{hoh} = s_{hoh}\sum W_h.FS_h \quad [12]$$

$$SAV_g = s_g(\sum TAX_{ind,i} + \sum TARIFF_i + TAX_{dir} + E_{Oil} \quad [13]$$

$$SAVING = (SAV_h + SAV_{GOV} + EXR.SAV_f) \quad [14]$$

$$SAVING = INVEST \quad [15]$$

$$ID_i.PQ_i = \mu_i.INVEST \quad [16]$$

In these equations, S_{hoh} is considered as mean tendency of private sector saving, S_g as mean tendency of government saving, SAV_f as foreign saving, SAVING as total saving, INVEST as total investment, ID_i as investment demand of ith sector, μ_i as share parameter of ith sector investment, so that $0 \leq \mu_i \leq 1_i$ and $\sum \mu_i - 1$.

In external world and foreign trade, it is assumed that the country is small i.e. the country has no effect on world prices and international market.

Therefore, world prices of import and export are constant.

$$PE_i = pwe_i.EXR \quad [17]$$

$$PM_i = pwm_i.EXR \quad [18]$$

In these equations, PE_i is considered as domestic export price, pwe_i as world export price (exogenous variable), EXR as foreign exchange rate.

When the model is considered for an open economy, it is necessary to consider some precautions about alternating imported, exported and domestically supplied goods (12). In general equilibrium models, there is difference between imported and exported goods as well as goods produced for export and goods produced for domestic sale. It is assumed that imported and domestically supplied goods make composite good (Argminton good). This composite good is used as a mediator Institutes and ultimate consumptions. It is assumed that Institutes are an incomplete alternate to domestic productions (13). The theory is known as Argminton Assumption. The relation between imports and domestic production is indicated as a constant elasticity of substitution (CES) function (14).

$$Q_i = \gamma_i\left(\alpha_{mi}.M_i^{\rho mi} + \alpha_{di}.D_i^{\rho mi}\right)^{\frac{1}{\rho mi}} \quad [19]$$

In this equation, Q_i is considered as composite good, Di as domestically produced good, γ_i as efficiency parameter in production function of composite good, α_{mi} as share parameters in Argminton function, so that $\alpha_{mi} + \alpha_{di} \geq 0$ ، ρ_{mi} as Argminton function power or the parameter associated with substitution elasticity, so that $\rho_{mi} = \frac{(\eta_i - 1)}{\eta_i}$ and $\eta_i \leq 1$, η_i as Argminton function elasticity is $\eta_i = \frac{-d(M_i - D_i)}{M_i/D_i} / \frac{d(\frac{PM_i}{PD_i})}{PM_i/PD_i}$.

Regarding the aim of problem maximization, demand functions for import and domestic production would be as equations number 20 and 21.

$$M_i = \left(\frac{\gamma_i^{\rho mi}.\alpha_{mi}.PQ_i}{(1+tm_i).PM_i}\right)^{\frac{1}{1-\rho mi}}.Q_i \quad \forall_i \quad [20]$$

$$D_i = \left(\frac{\gamma_i^{\rho mi}.\alpha_{di}.PQ_i}{PD_i}\right)^{\frac{1}{1-\rho mi}}.Q_i \quad [21]$$

In this equation, PD_i would be the price of domestically produced good.

Equation number 22 indicates the relation between export and domestic production which is stated on a constant elasticity of transmission (CET) as well.

$$Y_i = \left(\theta_i(\beta_{ei}.E_i^{\rho ei} + \beta_{di}.D_i^{\rho ei}\right)^{\frac{1}{\rho ei}} \quad \forall_i \quad [22]$$

In this equation, Ei is considered as the amount of export, Q_i as efficiency parameter of transmission function, β_{ei} and β_{di} as share parameters in transmission function, so that $\beta_{di} + \beta_{ei} \geq 0$, β_{ei} as transmission function power, or parameter associated with transmission elasticity, so that $\beta_{ei} = (\sigma_i + 1)/\sigma_i$, transmission elasticity as

$$\sigma_i = \frac{d(E_i/D_i)}{E_i/D_i} / \frac{d(\frac{PE_i}{PD_i})}{PE_i/PD_i}$$

Regarding maximization problem, export supply and domestic good functions would be the equations number 23 and 24 respectively.

$$E_i = \left(\frac{Q_i^{\rho ei}.\beta_{ei}.(tx_i + PS_i)}{PE_i}\right)^{\frac{1}{1-\rho ei}}.Y_i \quad [23]$$

$$D_i = \left(\frac{Q_i^{\rho ei}.\beta_{di}.(tx_i + PS_i)}{PD_i}\right)^{\frac{1}{1-\rho ei}}.Y_i \quad [24]$$

Associated prices are the modifying factors for supply and demand equality in each market in order to develop balance in four markets of labor, capital, composite good, and foreign exchange. Profit in labor market, composite good price in composite good market, and foreign exchange rate in foreign exchange market are mediating factors. This is indicated in equations number 25, 26, and 27(15).

$$\sum FD_{hj} = FS_h \quad \forall_h \quad [25]$$

$$Q_i = C_i + G_i + ID_i + \sum X_{ij} \quad [26]$$

$$\sum pwe_i.E_i + SAV_f + REMIT = \sum pwm_i.M_i$$ [27]

Since there are uncountable solutions with similar relative prices, price normalizing equation is used in order to assure there is just one solution which is equilibrium solution. Price index is constant in this equation and other price changes are measured in proportion to this price which is shown in equation number 28(16).

$$PINDEX=\sum w_i PQ_i$$ [28]

In order to solve applied general equilibrium models, a complete set of statistics and data is needed.

Results

Since the aim of research is to study the effect of decrease in tariff on key variables of pharmaceutical products, the decrease has been studied gradually in two general scenario formats. Each scenario has been studied as 10, 30, 50, and 100% gradual decrease of custom tariff rate:

1. 10, 30, 50, and 100% decrease in tariff rate of pharmaceutical products import on key variables of drug field
2. 10, 30, 50, and 100% decrease in tariff rate of other sectors (except pharmaceutical products) import on key variables of drug field

The results of scenarios simulation are summarized in Table 2. This table shows the impacts of tariff's cut for key variables during trade liberalization; decrease in import tariffs affects good import and services.Import changes also change good production and services in the country. Such changes might be positive or negative. Normally, increase in import of capital goods and mediator materials increases production, while good import and consumed services which decreases people demand for good and internal services decreases production.

According to results of table 2, when tariff decreases in pharmaceutical products, each sector import will increase as a function of tariff rate in that sector according to equation number 16. In fact, when tariff rate decreases, imported good price will decrease in the country which leads to increase in demand for export. Therefore, 10, 30, 50, and 100% decrease in tariff rate of pharmaceutical products in the first scenario will increase pharmaceutical product import by 0.2% on average, while decrease in tariff rate of agriculture sector (scenario 2) will decrease pharmaceutical product import by about 0.96% on average, and this variable will decrease by about 2.81% due to tariff rate decrease in industry and mine sector.

Also, export variable has increased with decrease in tariff rate of pharmaceutical products in scenario 1. This result is completely logical since according to its direct relation with supply (equation 22), increase in pharmaceutical products supply will undoubtedly increase drug export rate. Mean increase in the first scenario is about 0.2%. Since most items of drug import are raw materials in Iran, it is natural that increase in pharmaceutical raw materials would increase manufactured drugs, and become the main factor in drug export. In various studies performed in Iran, trade liberalization has increased import variable of associated product while has decreased the product's import on the other side. Drug export has increased in this study due to the mentioned reason. It is worth noting that change percent and drug export growth is lower than drug import due to gradual decrease in tariff rate. Pharmaceutical product export indicates a 0.64% decrease due to decrease in tariff rate of agriculture sector, and 1.91% decrease due to decrease in custom tariff rate of industry and mine sector.

According to results, the supply rate of pharmaceutical products has gradually increased by decrease in tariffs which is a logical result; since the rate of goods supplied in markets will increase by decrease in pharmaceutical product tariff and increase in drug import. The mean increase is 0.02%. According to the second scenario, drug supply rate has decreased by 0.19% due to decrease in tariff rate of agriculture sector, and by 0.69% due to decrease in tariff rate of industry and mine sector.

Since labor market has been considered in equilibrium state and labor supply in entire economy has been assumed to be constant in the current study,

any change in tariffs would not change in total employment, while will change employment in the considered sectors. Therefore, if employment decreases in a sector, it means that labor has been transmitted to other sectors. Various studies indicate that one negative effect of globalization in developing countries is employment reduction in drug field; since due to competitiveness, these countries have to use new equipments and technology on one hand which reduces labor rate, and production of some pharmaceutical products will face problems due to lack of competitive advantage on the other hand which might lead to stopping drug production or unskillful labor unemployment. Results of the current study indicated that in the first scenario, gradual reduction of tariff rate will not make any change in labor employment in drug field due to model conditions; while in the second scenario, decrease in tariff rate of agriculture sector will reduce labor employment in drug field by 0.14% as compared to the first scenario. In the second scenario, decrease in tariff rate of industry and mine sector has led to a mean 0.35% decrease in labor employment of this field. However, according to capital factor, there is a mean 0.12% increase in capital factor employment in the first scenario, and about a mean 0.82% decrease due to decrease in tariff rate of agriculture sector, and about a mean 0.13% decrease in capital factor in drug field due to decrease in tariff rate of industry and mine sector.

Table 2: Impacts of trade openness on pharmaceutical industry variables

Variables	First scenario*					Second scenario: part a**					Second scenario: part b***				
	10 %	**30 %**	**50 %**	**100 %**	Mean effect	**10 %**	**30 %**	**50 %**	**100 %**	Mean effect	**10 %**	**30 %**	**50 %**	**100 %**	Mean effect
Import	0.7	0.14	0.21	0.36	0.2	-1.9	-1.3	-0.95	0.36	- 0.96	-5.04	-3.8	-2.7	0.36	- 2.81
Export	0	0.1	0.1	0.2	0.1	-1.29	-0.94	-0.58	0.23	- 0.64	-3.41	-2.5	-1.8	0.23	- 1.91
Supply to market	0	0	0.03	0.06	0.02	-0.36	-0.26	-0.19	-0.06	- 0.19	0.23	0.46	-1.07	1.003	0.69
Lab or employment	0	0	0	0	0	-0.23	-0.23	-0.11	0	-0.14	-.58	-0.47	-0.35	0	-0.35
Capital factor employment	0	0	0	0.48	0.12	-1.4	-0.94	-0.94	0	-0.82	-3.31	-2.8	-1.8	0	-2.01
Investment	0.02	0.01	0.01	0	0.1	0.1	0.07	0.05	0.003	0.05	0.22	0.18	0.13	0	0.13
Household consumption	0.06	0.1	30.1	0.22	0.31	-1.07	-0.07	-0.3	0.2	-0.52	-2.8	-2.1	-1.5	0.22	-1.57

Source: the study findings
*effect of decrease in tariff rate of pharmaceutical products on key drug variables
**effect of decrease in tariff rate of agriculture sector on key drug variables
***effect of decrease in tariff rate of industry and mine sector on key drug variables

It seems that investment rate in all scenarios have increased. Investment in each sector directly depends on total investment and reversely depends on composite good price in each sector. In the first scenario, decrease in custom tariff of pharmaceutical products will increase the capital rate by a mean of about 0.1%, and in the second scenario, decrease in custom tariff rate of agriculture sector will increase capital rate by about 0.05%, and the same effect in industry and mine sector

will lead to 0.13% increase. Therefore, trade liberalization will increase capital rate in all scenarios.
The next key variable is household consumption of pharmaceutical products. The model results indicated that decrease in custom tariff rate in the first scenario shows a mean 0.13 increase which is a thoroughly logical result, since household drug consumption will increase due to decrease in tariffs of pharmaceutical products and import increase, while in the second scenario, drug consumption rate will decrease by a mean of 0.52% of household consumption of pharmaceutical products due to decrease in tariffs of agriculture sector, and household drug consumption will 1.57% decrease due to decrease in tariffs of industry and mine sector.
Since the aimed function of this study model has been maximization in favorability function of society people, and this function indicates total society welfare, in the first scenario, total society welfare shows 0.63%, 0.64%, 0.96%, and 0.16% increase respectively with regard to the basic amount. However, according to effect of tariff decrease in agriculture sector, total society welfare has 0.83%, 0.60%, and 0.38% decreased respectively, and about 0.15% increased due to complete elimination of tariffs of agriculture sector. However, according to effect of tariff decrease in industry and mine sector, total welfare has 2.23%, 1.69%, and 1.15% decreased respectively, and 0.16% increased due to complete elimination (100%) of tariff in this sector. Therefore, total society welfare will increase with regard to basic year due to complete tariff elimination in other sectors (except pharmaceutical products), while society welfare will increase by an average of 0.09% due to gradual decrease in tariffs of pharmaceutical products.

Sensitivity Analysis

Sensitivity of results as compared to Argminton elasticity on import variable of different economic sectors has been surveyed in this study. Argminton function in CGE model indicates supply for composite good which is in fact a function with constant elasticity of transmission of demand for import and internal productions. Since this parameter evaluation has been selected exogenously from other studies, in order to model correctitude and define sensibility of results as compared with difference in this elasticity, it is assumed that the scenario of 50% decrease in tariff has taken place in all economic sectors, and Argminton elasticity changes from 50 to 150% of primary elasticity is in 25% intervals. Results demonstrate that import amount has increased in elasticity's lower than basis, while it has decreased in elasticities higher than basis. This is logical regarding what is mentioned as Argminton elasticity definition. This trend is the same in all sectors.

Table 3: Elasticity of substitution and elasticity of transformation in the Iranian's sectors

Elasticity	Agriculture sector	Manufacturing and Mining Sector	Construction Sector	Service sector	Pharmaceutical Products
Eta(i)	2.62	3	0	0.810	.49
Sigma(i)	-2.677	-4	0	-3.124	-.5
Omega(i)	0.108	0.5	.101	0.129	.129

- Eta(i) denotes elasticity of substitution
- Sigma(i) denotes elasticity of transformation
- Omega(i) denotes Price normalization coefficient

Table 3 shows the elasticity of substitution, elasticity of transformation that is so important for sensitivity analysis. Values of behavioral elasticity's

are usually estimated outside the model or taken from other studies. Considering the elasticity's drug in this research is critical and that is difference, we used it for sensitivity analysis.

Discussion

Although, CGE models are standard in the world and shows usually a multi-sector model based on real world data (e.g. Social Accounting Matrix table or I-O Table) (17) of one or several national economies to model the interactions of individual households and other agents on interdependent markets but CGE model maybe give different results when we reduced tariff (14) .In Iran and Brazil increased export and import aftershock of tariff cut but the quantity of increasing depends on structure of Pharmaceutical sector. In Iran, the most of drug's import are material raw that with reduction of tariff, volume of imports increased that this is natural. So, all of results in CGE models depends on real data in the countries.

Generally in Iran, no study associated with liberalization of pharmaceutical products was found. However, there are many studies related to different economic sectors some of which would be mentioned. According to precise searches of researchers up to mid 2012, four studies in the framework of general equilibrium in health field has been performed out of Iran which has been in England (Nottingham University) Brazil, Japan, and Ghana.

The study in England has been performed by Dr Martin Rotten (2009) in form of PhD thesis named "economic effect of providing health care: evaluation of a CGE model for England" in 2005.In this thesis, Nine economic sectors including agriculture, mine, pharmaceutical products, medical equipment, financial sector, defense sector, health sector, and other services has been considered, and production factors have been divided into two groups of work force (skilful and unskillful) and capital (10).

Households are also divided into five groups including employed households who have children, unemployed households who have children, unemployed households with children, employed households with children, and finally those who are retired.

The data of general equilibrium model is obtained from British SAM, 2005, and the alternative and transmission elasticity is considered to be 2. Four scenarios have been considered in the thesis including: a) effects of 10% increase in government expenditure on health care, b) 20% increase in prices for economic sectors, c) 10% increase in expert forces of medical fields from other countries, d) 10% increase in efficiency of production factors in health field. Results indicated about 8%, 1%, 7%, and eventually 5% improvement in health status by the first to fourth shock respectively. The scenarios have significantly affected on patient expectation list as well, so that there will be -15%, 3% -10% and -15% change in patient expectation list respectively.

The other study associated with trade liberalization has been performed by Francisco (2003) on Brazil labor using computable general equilibrium approach (18). 48 goods and two production factors, labor and capital have been used in this study. It has divided labor into two groups of skillful and unskillful. One object discussed in this study is pharmaceutical products. Three shock effects have also been implemented in form of three scenarios. The first scenario is to impose custom tariff rate of 1990 for Brazil economy structure in 1996. The second scenario is to 20% increase in skillful labor export. Ultimately, the third scenario is a 20% shock in increasing labor efficiency. Results of this study in different scenarios demonstrate that pharmaceutical products export would decrease 2.408% as well as 0.575 for drug pharmaceutical import in performing the model for the first scenario. The second shock will cause 15.7% increase in pharmaceutical export and 0.26% decrease in pharmaceutical import. Finally, pharmaceutical export will increase 9.66% and this would be 5.24% for pharmaceutical import in the third scenario. According to results of this study, the general society welfare increases by decrease in tariffs.

The third study named tax and subsidy policies of medical services and pharmaceutical industry has

been performed in the International University of Japan by Kato in 2003 using computable general equilibrium analysis. Decrease in import tax (custom tariff) of drugs will increase import and export and general society welfare. It is also worth to note that implementing the policy of decreasing custom tariff will cause import growth to be higher than export (19).
The fourth study named government expenditure effect on health, economic growth in wealthy country using computable equilibrium model by Ernest indicated that government expenditure has significant effect on health followed by economic growth. Social accounting matrix, 2004 is used in this study (20).

Conclusion

Results indicate that generally, tariff decrease in globalization process will increase imports of this sector in the present conditions of economic structure and pharmaceutical sector of the country. It is obvious that in each economic sector, those products which have production stability will have competitiveness and relative competitive advantage. However, since our pharmaceutical sector is strongly dependant on raw material import, competitiveness in this sector is reduced. Therefore, one significant way to increase competitiveness of pharmaceutical sector in the country is to decrease dependability on raw materials so that to decrease final price of such products by increasing efficiency and adopting suitable supports in the framework of one applied policy in pharmaceutical sector.
Finally, the most important efforts that should be made by Iran's pharmaceutical industry to increase exports include:
1. Promotion of drugs produced in accordance with GMP and DMF preparation guidelines and regulations on the pharmaceutical
2. Obtain international confirmations and verifications such as FDA, WHO and etc.
3. Develop skills and international expertise in the field of marketing for increasing of drug's export
4. Establish mechanisms and institutions needed for driving and reducing the risk of export services, such as transportation and insurance claims services exporters, especially in export markets in the region, Central Asia, Africa and so on.
5. Strategic planning for export markets
Finally, pharmaceutical factories should compare their product with the global reference product, using qualitative studies before it's supplied. Also, Iranian, pharmaceutical factories should attempt to offer various documents in the form of Drug Master File (DMF) international protocols to the Ministry of Health of target countries in order to provide proof of quality and register our pharmaceutical products.

Ethical considerations

Ethical issues (Including plagiarism, Informed Con- sent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc) have been completely observed by the authors.

Acknowledgment

This paper was Ph.D. thesis article of first author. This thesis supported by Tehran University of Medical Sciences (Grant No: 17246/91).We would like to thank Dr Manucher Asgari for helping in GAMS software and Dr Juan Carlos Parra from World Bank for Sim SIP_ SAM software that it's required for sector's aggregation in database of the CGE Model. The authors declare that there is no conflict of interest.

References

1. Cheraghali A (2008). Iran Pharmaceutical Market. *Iran J Pharm Res*, 2(1): 1-7.
2. Iran National Drug Policy (2010). Department of Food and Drug. Iranian Ministry of Health, Tehran,pp:12-18.
3. Olcay M, Laing R (2005). Pharmaceutical tariffs: what is their effect on prices, protection of local industry and revenue genera-

tion? Available from: www.who.int/intellectualproperty/studies/tariffs_data
4. Mohamed N, Al-Arifi A (2012). Patient's perception views and satisfaction with pharmacist's role as health care provider in community pharmacy setting at Riyadh. *Saudi Pharm J*, 20(4): 323-330.
5. Ministry of health in Iran (2011). Pharmaceutical and food office, pp: 8-14.
6. Introduction to Iran Food and Drug Department (2011). Ministry of Health. Available from: www.fdo.ir
7. Byron R (1978). The Estimation of Large Social Account Matrices. *J Roy* Statist *Soc,* 141 (3):359-367.
8. Pyatt G (1988). A SAM approach to modeling. *Journal of Policy Modeling*, 10(3):327-352.
9. Thorbecke E, Hong-Sang J (1996). A multiplier decomposition method to analyze poverty alleviation. *Journal of Development Economics*, 48 (2): 279-300.
10. Rutten M, Reed G (2009). A comparative analysis of some policy options to reduce rationing in the UK's NHS: lessons from a General Equilibrium Model Incorporating positive health effects. *Journal of Health Economics*, 28: 221–233.
11. Simeon E, Odior O (2011). Government expenditure on health, economic growth and long waves in A CGE micro-simulation analysis: the case of Nigeria. *European Journal Economics, Finance and Administrative Sciences*, 31:99-110.
12. Mauricio V. The impact of trade liberalization and macroeconomic instability on the Brazilian economy [PhD thesis].Ohio state university, USA; 2004.
13. Arming ton P (1969). A Theory of Demand for Products Distinguished by Place of Production, IMF Staff Papers 16(1): pp: 170-201.
14. Sassi O, Crassous R, Hourcade JC, Gitz V, Waisman H, Guivarch C (2010). A modeling framework to simulate sustainable development pathways. *International Journal of Global Environmental,* 10(1): 5–24.
15. Stern DI (2007). The effect of NAFTA on energy and environmental efficiency inMexico. *Policy Studies Journal*, 35(2): 291-322
16. McKibbin W, Ross M, Shackleton R, Wilcoxen P (1999). Emissions Trading, Capital Flows and the Kyoto Protocol. *The Energy Journal,* 12(2): 287-334.
17. Rotmans J , Loorbach D (2009). Complexity and Transition Management. *Journal of Industrial Ecology, 13*(2):8-9.
18. Carneiro Francisco G, Arbache J Saba (2003). The impacts of trade on the Brazilian labor market: a CGE model approach. *World Development Journal*, 31(9):1581–1595.
19. Kato R (2010).Tax and Subsidy Policies for the Medical Service Sector and the Pharmaceutical Industry: A Computable General Equilibrium Approach. Working Papers EMS. Research Institute. International University of Japan.pp:18-32.
20. Ernest S (2011). Government spending on education, economic growth and long waves in a CGE micro-simulation analysis: The case of Nigeria. *British Journal of Economics, Finance and Management Sciences,*1(2): 74-87.