Original Article

Access this article online
Quick Response Code:

Website: www.jehp.net
DOI: 10.4103/jehp.jehp_199_23

Economic impact of government health expenditure: An application of the computable general equilibrium model to the Iran

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Abstract:

BACKGROUND: Considering the increase in health expenses and the government's role in health financing, this study investigated the economic impact of increases in the share of the health sector in the government budget while taxes remain unchanged and government spending is fixed.

MATERIAL AND METHODS: The economic model used in this study was a macroeconomic Computable General Equilibrium (CGE) model. This model was calibrated using a 2011 Social Accounting Matrix (SAM) Of Iran. The CGE model was solved with non-linear programming using the General Algebraic Modeling System package, version 2.50. The effect of this simulation on the government budget deficit, the production of different sectors of the economy, and the employment rate was investigated.

RESULTS: Based on our fundings the elasticity of substitution in the agricultural and industrial sectors is higher than in the health and service sector. Also, the biggest decrease in production occurred in the industry, agriculture, and service sectors, respectively. With the doubling of the share of government spending in the health sector, the employment rate of this sector has increased by 40.9%, but the highest decrease in the ignition rate is related to the service sectors (−2.7%), agriculture (−0.23%), and industry (−0.14%).

CONCLUSION: Increasing the share of government spending in the health sector in comparison with other sectors of the economy, provided that government spending is maintained in general, leads to a decrease in production and economic welfare. It seems that the Iranian government should seek to increase the sources of health financing and the share of government expenditures in the health sector with other ways in order to improve the health level of the society and have a positive effect on other economic sectors.

Keywords:

Economic model, health expenditure, healthcare financing, Iran

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Received: 13-02-2023
Accepted: 25-05-2023
Published: 29-04-2024

Introduction

The healthcare system is one of the determinants of health that participates with other factors in promoting population health. Without healthcare, there are many lost opportunities for significant improvements in population health.[1]

Health financing concerns mobilization, accumulation, and allocation of money to cover healthcare needs.[1]

Total health expenditure comprises of both public sources of finance (government general taxation, mandatory insurance contributions and external grants and loans) and private sources (private

How to cite this article: Mohammad-Pour S, Barkhordari S, Majdzadeh Tabatabaei S, Hadian M. Economic impact of government health expenditure: An application of the computable general equilibrium model to the Iran. J Edu Health Promot 2024;13:140.

insurance premiums, prepaid schemes, not-for-profit health expenditures and out-of-pocket (OOP) payments).[2]

Government health spending is the primary source of health funding throughout the world.[3] Levels of government spending on health in absolute terms and as a share of GDP and overall budget indicate government commitment to health.[4]

The challenges such as severe economic fluctuations, the budget's dependence on oil revenue, low tax efforts, imposed economic sanctions, an increasing budget deficiency, and other factors barriers to expanding fiscal space for health in Iran.

The unprecedented financial stress related to the battle against the COVID-19 pandemic has led to a sharpening of spending conditions and most of the studies reveal that healthcare capacity faces major challenges and vulnerabilities.[5,6] Also from an economic perspective, the spread of COVID-19, the ever-increasing number of patients, and the complications of the disease have imposed high direct medical and indirect costs on patients, the health system, and the government.

However, Noura noted that the gaps in healthcare systems already existed prior to the COVID-19 pandemic, and the inefficiency in resource allocation was just easier to explain in such a time of vulnerabilities.[6-8]

Makina and Laytonb revealed that the governments around the world responded to the COVID-19 crisis by aggressively deploying fiscal policy to boost health expenditure and the related public debt levels will put higher pressure on the governments around the world and will require concrete measures for fiscal consolidation.[5,6]

Some studies have used the computable general equilibrium (CGE) technique to assess the impact of health and healthcare policies on economics to assess health policy impact on economic indicators[9-13] considering that in recent years, the income of the Iranian government is mainly provided through the sale of oil and oil products. It has decreased due to American economic sanctions. Although many studies in different countries have investigated the effects of increasing the share of government spending in the health sector on the economy as well as in Iran, this issue can be investigated using econometric and general equilibrium models. But in the present study, we assumed that the government's expenditures were constant and only by increasing the share of health sector expenditures compared to other sectors, we examined its effects on macroeconomic variables.

Materials and Methods

Study design and setting

This cross-sectional study was conducted in 2022 by using economic modeling. The economic model used in this study was a macroeconomic (CGE) model.[14] In this model, it was assumed that the factor market and product markets were perfectly competitive, meaning that all the primary factors of production were perfectly mobile. Although the model is a single-country model, it is an open economy model, meaning that foreign trade is captured through import and export functions. The differences between origins are encapsulated as follows. Domestically produced commodities are sold both in the domestic market and abroad. Sales abroad take the form of exports and are modeled using a Constant Elasticity of Transformation function. Domestic sales originate from domestic and foreign sources (imports), and this is modeled using a composite commodity and Armington assumption that determines the combination of domestically produced commodities and imports by means of a constant elasticity of substitution. Composite commodities can then be used as an input into the production process of the domestically produced commodities or sold for final consumption by households, government, or investment. The elasticity of substitution in the CGE model was obtained from the relevant literature.[2] Other parameters, such as the input-output coefficient and share parameters for these functions, need to be estimated and calibrated using the SAM table. The CGE model was solved with non-linear programming using the General Algebraic Modeling System package, version 2.50.[15] Also macro closure module is explained as follows: All prices are completely elastic and determined endogenously by the model. Full employment of the total social investment is endogenously determined by savings and real exchange rates are endogenous. The foreign savings are assumed to be exogenous to the modeled economy. The labor factor is also determined by the factor endowment given by the exogenous. In the end, the clearing of the commodity market, the clearing of the labor market, the clearing of the capital market, the balance of payments, and the balance of savings and investment are realized. This simulation increases the share of the health sector in the government budget while taxes remain unchanged and government spending is fixed in real terms. The effect of this simulation on the government budget deficit, the production of different sectors of the economy, and the employment rate were investigated.

Study participants and sampling

Sampling was not done in this study and all sectors of Iran's economy were included in the study.

Data collection tool technique

This model was calibrated using a 2011 Social Accounting Matrix (SAM) Of Iran. A SAM is a comprehensive,

economy-wide data framework representing the economy by capturing the financial value of transactions and transfers between all economic agents in the system, for a year. It is a square matrix with each account represented by a row (income) and a column (expenditure), i.e., the double entry system of accounting. The Iran SAM is a 96-96 matrix representing 71 activities (sector) including the agriculture, industry, education, oil, service and health sector, factors of production (capital and labor), and institutions, enterprises, households, government, and the rest of the world. In this model, we distinguished production across four sectors (activities) purposefully aggregated from the Iran SAM into health, agriculture, industry, and services sectors. Each sector produces one or more outputs and any commodity may be produced and marketed by more than one activity. In the commodity market, the supply-side domestic output is allocated between exports and domestic sales according to a constant elasticity of transformation function. On the demand-side total consumption is made up of domestic demand and final imports determined by the constant-elasticity-of-substitution function between imports and the corresponding composite domestic goods. There are four different institutions that the model distinguishes, namely, households, firms, government, and the rest of the world.

Households use their income to pay taxes, for consumption expenditure and for saving, according to their marginal propensities to save. They maximize the utility function subject to a budget constraint equaling the factor income less taxes to which remittances from abroad and governmental transfers are added.

This income is allocated to savings, private consumption, and direct taxes. Utility maximization is achieved using a Cobb-Douglas function. Households are assumed to purchase optimal quantities of composite private goods, treating domestic and imported goods as imperfect substitutes.[15] A representative firm for each sector uses capital, labor, and intermediate goods from other sectors as inputs. The government yields its income from taxation and spends it for public consumption, such as transport infrastructure, schools, or the health system.

Ethical consideration

This study was approved by the Ethics Committee of the Iran University of Medical Sciences with the number IR.IUMS.REC.1397.1171.

Results

The model used in this study includes three types of exogenous parameters: tax and tariff rates, supply and demand elasticities as well as transfer coefficients and shares in supply and demand equations. Table 1 shows these parameters. Tariff and tax rates in this model were calculated using the initial data of the model. Eta shows the elasticity of substitution of production factors, i.e., labor force and capital. As shown in the table, the elasticity of substitution in the agricultural and industrial sectors is higher than in the health and service sector. The parameters of transmission and share are exogenous values that were used in the supply and demand functions in this model.

Based on the findings of the present study, increasing the share of government spending in the health sector increases the demand for the health sector and consequently increases the prices in the health sector. As shown in Table 2, changes in the government's income and budget deficit are based on the increase in the share of government expenditures in the health sector. By doubling the share of government spending in the health sector, and assuming no change in total government spending, creates very small changes in the government's income in a negative way and reduces the government's income by −0.012 percent.

Based on the findings, the biggest decrease in production occurred in the industry, agriculture, and service sectors, respectively. The production of the health sector has an effect on other sectors of the economy through increased productivity and effective labor supply. According to Table 3, if the government expenditure in the health sector is doubled, the production of the health sector will grow by less than fifty percent (41%).

With the increase in government spending in the health sector and due to the greater share of labor in the production of this sector, the demand for labor increases. In this model, it was assumed that the labor supply at the national level is constant and its supply curve is vertical and full employment. As shown in Table 4., with the doubling of the share of government spending in the health sector, the employment rate of this sector has increased by 40.9%, but the highest decrease in the ignition rate is related to the service sectors (−2.7%), agriculture (−0.23%), and industry (−0.14%).

Discussion

In this study, we examined the effects of increasing the share of government spending in the health sector, assuming the stability of government spending in general. Based on our knowledge, various methods are used in economics to evaluate the effects of policymaking, such as econometric and general equilibrium models. In the present study, computable general equilibrium models were used to evaluate this political intervention in government spending.

Table 1: Exogenous parameters in CGE modeling

Parameter	Definition	Sector			
		Agriculture	Industry	Service	Health
eta (i)	elasticity of substitution	2.618	1.42	0.801	0.901
sigma (i)	elasticity of transformation	2.66	2.732	3.145	4.146
rom (i)	substitution elasticity parameter	0.618	0.296	-0.248	-0.11
roe (i)	transformation elasticity parameter	1.376	1.366	1.318	1.241
b (j)	scale parameter in production func.	1.442	1.723	1.981	1.974
ay (j)	composite fact. input req. coeff.	0.585	0.517	0.768	0.828
lambdac (i)	share parameter in utility func.	0.094	0.37	0.503	0.033
lambdag (i)	government consumption share	0.007	0.000005	0.581	0.096
mu (i)	investment demand share	0.063	0.627	0.294	0.016
alpham (i)	share par. in Armington func.	0.29	0.315	0.019	0.01
alphad (i)	share par. in Armington func.	0.71	0.685	0.981	0.99
gamma (i)	scale par. in Armington func.	1.644	1.817	1.143	1.071
betae (i)	share par. in transformation func.	0.717	0.565	0.749	0.787
betad (i)	share par. in transformation func.	0.283	0.435	0.251	0.213
theta (i)	scale par. in transformation func.	2.567	2.005	2.858	3.464
cwts (i)	price normalization coefficient	0.094	0.37	0.503	0.033
eta	elasticity of substitution	2.618	1.42	0.801	0.901
sigma	elasticity of transformation	2.66	2.732	3.145	4.146
omega	price normalization coefficient	0.05	0.371	0.129	0.128
ax	intermediate input requirement coeff				
Agriculture		0.179	0.055	0.003	0.003
Industry		0.152	0.297	0.147	0.125
Service		0.084	0.13	0.082	0.039
Health		4.087E-05	0.000625	0.0001	0.005
beta	share parameter in production func				
Labor		0.88	0.234	0.57	0.581
Capital		0.12	0.766	0.43	0.419

Table 2: Impact of increase in the share of government spending on expenditure, income, and budget deficit

The increase in the share of government spending	Government expenditure	GRC*	Government income	GRC	Budget deficit	GRC
0.1	682048987.9	-0.001%	2852508068	-0.001%	2170459080	-0.001%
0.2	682045191.7	-0.001%	2852472532	-0.002%	2170427340	-0.003%
0.3	682041373.2	-0.002%	2852436996	-0.004%	2170395623	-0.004%
0.4	682037532.2	-0.002%	2852401460	-0.005%	2170363928	-0.006%
0.5	682033668.8	-0.003%	2852365923	-0.006%	2170332255	-0.007%
0.6	682029782.9	-0.003%	2852330387	-0.007%	2170300604	-0.009%
0.7	682025874.7	-0.004%	2852294850	-0.009%	2170268976	-0.010%
0.8	682021944	-0.005%	2852259314	-0.010%	2170237370	-0.012%
0.9	682017990.9	-0.005%	2852223777	-0.011%	2170205786	-0.013%
1	682014015.4	-0.006%	2852188240	-0.012%	2170174224	-0.015%

*Growth rate compared to the base state

The increase in government spending in the health sector, as one of the types of productive spending by the government, has both intersectoral effects and a positive effect on the health of the workforce, but most of the studies conducted in this field in Iran have used the partial equilibrium models, which are not able to consider inter-sectoral effects at the same time,[1,16-19] and are completely unable to show the results of the consequences of implementing a policy.

It should be kept in mind that access to public financial resources is a basic condition for the functioning of health systems, and the occurrence of global financial crises such as the Covid-19 epidemic causes economic shocks to intensify, increase people's need for healthcare, threaten the performance of the health system, and create deviations in the allocation of resources. It becomes public.[6,20-24]

Government spending on health is a function of their capacity to provide resources and their willingness to prioritize health in the budget. Although the per capita spending on health is increasing, it is not proportional to the growth of GDP, which clearly shows that health is not a priority.[4,25,26]

Table 3: Impact of increase in the share of government spending on sectors production

The increase in the share of government spending	Agriculture		Industry		Service		Health	
	Production	GRC	Production	GRC	Production	GRC	Production	GRC
0.1	868369636.9	-0.02%	5148731522	-0.01%	3695448515	-0.3%	240420035.1	4.1%
0.2	868177704.7	-0.04%	5148380566	-0.01%	3685618273	-0.5%	249888360.6	8.2%
0.3	867985784.6	-0.07%	5148029586	-0.02%	3675788165	-0.8%	259356554.6	12.3%
0.4	867793876.5	-0.09%	5147678584	-0.03%	3665958194	-1.1%	268824617.3	16.4%
0.5	867601980.3	-0.11%	5147327558	-0.03%	3656128357	-1.3%	278292548.5	20.5%
0.6	867410096.1	-0.13%	5146976509	-0.04%	3646298656	-1.6%	287760348.3	24.6%
0.7	867218224	-0.15%	5146625436	-0.05%	3636469091	-1.9%	297228016.8	28.7%
0.8	867026363.8	-0.18%	5146274341	-0.05%	3626639661	-2.1%	306695553.8	32.8%
0.9	866834515.6	-0.20%	5145923222	-0.06%	3616810367	-2.4%	316162959.4	36.9%
1	866642679.4	-0.22%	5145572079	-0.07%	3606981208	-2.7%	325630233.7	41.0%

Table 4: Impact of increase in the share of government spending on sectors employment

The increase in the share of government spending	Agriculture		Industry		Service		Health	
	Employment	GRC	Employment	GRC	Employment	GRC	Employment	GRC
0.1	447,362,443	-0.02%	624,004,644	-0.01%	1,616,710,815	-0.3%	115,635,400	4.1%
0.2	447,258,869	-0.05%	623,920,147	-0.03%	1,612,349,290	-0.5%	120,184,978	8.2%
0.3	447,155,303	-0.07%	623,835,655	-0.04%	1,607,988,151	-0.8%	124,734,157	12.3%
0.4	447,051,745	-0.09%	623,751,169	-0.05%	1,603,627,398	-1.1%	129,282,938	16.4%
0.5	446,948,196	-0.12%	623,666,687	-0.07%	1,599,267,030	-1.3%	133,831,321	20.5%
0.6	446,844,654	-0.14%	623,582,210	-0.08%	1,594,907,047	-1.6%	138,379,305	24.6%
0.7	446,741,121	-0.16%	623,497,738	-0.09%	1,590,547,449	-1.9%	142,926,890	28.7%
0.8	446,637,596	-0.19%	623,413,271	-0.11%	1,586,188,237	-2.2%	147,474,077	32.8%
0.9	446,534,079	-0.21%	623,328,809	-0.12%	1,581,829,410	-2.4%	152,020,866	36.9%
1	446,430,571	-0.23%	623,244,352	-0.14%	1,577,470,968	-2.7%	156,567,257	40.9%

In this study, the effect of increasing the share of government spending in the health sector on production, employment, and government budget deficit was investigated. Considering that the production of the health sector is dependent on intermediary inputs from other sectors of the economy, stimulating the production of the health sector can be effective in the production of other economic sectors. Considering that the production of the health sector is dependent on intermediary inputs from other sectors of the economy, stimulating the production of the health sector can be effective in the production of other economic sectors. Fumi Wang showed that when the ratio of health expenses to GDP is less than the optimal level of 7.5%; increasing health spending effectively leads to better economic performance. Of course, more cost does not equal better care.[27]

About 43% of the changes in health expenditure growth in the world can be explained by economic growth. Income shocks affect health expenditures in high-income countries more than in low-income countries. For all income levels of countries, the income elasticity of health expenditure is less than one; therefore, healthcare is a necessary commodity and governments, compared to markets, to provide healthcare services, especially in countries where GDP growth does not have an effect on increasing health expenditure. They have more commitment.[28]

Simulating the increase of government spending in the health sector on Nigeria's economic growth using calculable general equilibrium models showed that due to the effect of health spending on economic growth and labor productivity, public health spending should be a priority of the Nigerian government.[29,30] The findings of a study in Uganda showed that increasing the share of government spending in the health sector leads to the improvement of the health of the population, further growth of the sectors and reduction of poverty. In this study, which was carried out using general equilibrium models, the agricultural sector had the highest growth compared to the service and industry sectors.[2] On the other hand, the simulation of the effects of increasing government spending and taxes on the Japanese economy showed that there was no difference in the financing of government spending by using consumption taxes and income taxes.[2]

The growth of health expenses and GDP in different income levels of countries has a different causal relationship, and about 43% of changes in the growth of global health expenses can be explained by economic growth. Income shocks have had a greater impact on health expenditures in high-income countries than in low-income countries. The income elasticity of health expenditure is less than one for all income levels of countries. Therefore, healthcare is a necessity.

And governments are more committed to providing healthcare services. Of course, in low-income countries, GDP growth has not increased health expenditures.[28]

Based on the results of the present study, increasing the share of government spending in the health sector leads to an increase in the budget deficit of the Iranian government. Dependence on oil is one of the important features that has caused the balance of the Iranian government's budget to fluctuate in the past periods. The average ratio of oil revenues to total budget expenditures is more than 50% until the 1990s. Studies indicate the dependence of the government budget on the evolution of oil revenues so that there is a direct relationship between government payments and revenues from oil exports. Current expenses of the government have been from 60% to 85% of the total expenses in the last 50 years. During the period of increase in oil revenues, the cost payments increased faster than the acquisition costs of capital assets, while during the decrease of oil revenues, the cost of acquisition of capital assets decreased more than the cost payments.[31]

Based on the findings of a study, if Iran's oil revenues increase by 5%, the average growth rate of domestic production will increase by 2% until 2030. Also, total health expenditure as a percentage of GDP will increase from 9.6% in 2016 to 10.7% in 2030. This forecast showed that 22.2% of the total health expenses will be covered by the government.[1]

This is while health expenses for providing inpatient and outpatient services increased after the health transformation plan. This massive increase in costs has pushed healthcare policies toward higher premiums, higher OOP payments, and attracting more public resources.[32]

Limitations and recommendation

The most important limitation of the current study was the existing database for Iran's economy, which could not accurately help us in modeling Iran's economy due to years of its production. Also, some assumptions in this modeling were not realistic.

This study has investigated the effects of increasing the share of government spending in the health sector on different sectors of the economy by using general equilibrium modeling. In this study, we investigated the political effect by modeling all the economic sectors of specifying the behavior of various agents of the economy.

Conclusion

Considering that increasing the share of government spending in the health sector assuming the stability of government spending in general, without using the financial space and applying designed financial policies, it leads to a decrease in production and economic prosperity; it seems that the Iranian government should look for ways to increase health financing resources. Considering the increasing growth of health expenses after the implementation of the health reform plan and also the sanctions and the Covid-19, the Iranian government should move toward generating resources for financing the health system, such as earmarking taxes. On the other hand, reviewing government expenditures in all sectors of the economy should help to reduce the budget deficit and increase the executive power of the government in the development of health infrastructure.

Abbreviations

Social Accounting Matrix: SAM
Computable General Equilibrium: CGE
Growth rate compared to the base state: GRC

Acknowledgment

This study was part of a health economics PhD thesis supported by the Iran University of Medical Sciences (grant No: 97-4-37-14300).

What is already known?

Government health expenditures as one of the methods of health financing can affect macroeconomic variables such as growth and social welfare.

What does the study add?

Increasing the share of the health sector in the government budget, while taxes remain unchanged and government expenses are assumed to be constant in real terms, can have a negative impact on economic indicators.

Financial support and sponsorship

This study was financially supported by the Faculty of Medical Information and Management, Iran University of Medical Sciences.

Conflicts of interest

There are no conflicts of interest.

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