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RESEARCH ARTICLE

The Effects of Economic Fluctuations on Health Care Expenditures of Iranian Households Using the DSGE Model

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Abstract: The health sector is a very important field that has attracted policymakers' attention due to its high importance. Such importance is more understandable when we know that health improvement results in human capital enhancement through the accumulation of health capital.

Given existing economic shocks, the effectiveness of the health and Care services sector has led to changes in household expenditures and consumption patterns, especially those on health and care; and this can cause long-term damage to the household, and the economy in general. Considering that health is both a consumer and an investment commodity, any negative economic shock that leads to income and liquidity restrictions can endanger the health of the individual, and society by reducing health and treatment costs from the financial portfolio of the household. Accordingly, economic shock and its effects, will affect the allocation of resources on healthcare goods and services, vis a vis other goods and services, by re-changing healthcare costs. For this reason, the government should pay special attention to the health sector of society and improve the quality of the health care sector by investing extensively in this sector.

Keywords: Economic Fluctuations, Households, shocks, Health Care Expenditures, DSGE Model.

JEL Classification: C11, C24, D10, I10

Introduction

Due to the unpredictable nature of some health system costs, financial access of households to health care is very important. Also, there is a consensus on supporting households against the costs of health services as a desirable and satisfactory goal of the health system's policies. One of the main concerns of the Iranian health system policymakers has always been the increase in the costs of health services caused by the development and evolution of technology; as well as the increase in the level of awareness and health expectations of people, both of which have created problems in the financial provision of healthcare expenses for society.

Households face many problems due to the lack of financial provision to access Care services. In order to provide these costs, they reduce other necessary expenses, which causes their social welfare to decline. In fact, as a result, families give up receiving or pursuing treatment; and this leads to the decline of health and hygiene practices. of families, and society in general.

Statesmen, therefore, recognize the importance of the impact of economic shocks on health and Care expenses. Increase in the price of goods and services in

the healthcare sector leads to increase the household's health expenses; and thus, the composition of its consumer basket needs to be changed to maintain the previous level of its health index. These economic shocks will change consumer and producer price indices in the healthcare sector in the short and long term.

Due to its special characteristics, the health sector has grown higher than the general inflation level of the country; and the price of hospital and medical services will grow faster than the consumer price index. On the other hand, any shock that increases the government's incomes and expenditures can increase investment (in Care facilities and equipment) in the healthcare sector; and thus, it can increase access of households' o such facilities. In other words, when the government invests in the health sector, by providing suitable conditions and facilities, households can spend more on health needs, thereby improving their investment and financial abilities.

Households perform differently under different economic conditions on how to allocate resources on Care goods and services and on other goods and services because economic conditions can affect the employment situation, and thus the income of the household (Goodman & Mance, 2011).

Therefore, undoubtedly, it is necessary to study shocks and their influence channels on household health expenditures, and how to control them. However, despite the significance of this topic, so far, not many studies have been conducted on the impact of economic shocks on household health expenditures in Iran within the framework of Dynamic Stochastic General Equilibrium (DSGE) modelling. Hence, the present study aims to investigate the shock effects of macroeconomic variables on household health expenditures. In the following, the structure of the article is organized as follows. The next section will review the theoretical literature and studies conducted in this regard. Then, in section three, the details of the model will be presented. The model is solved in section four, and the results are analyzed and reviewed. Finally, the last part is devoted to conclusions and the associated suggestions.

A study has investigated the impact of health on the economic growth of several countries. This study shows that if different variables are chosen as health representative variables, their effects on economic growth are completely similar; and it concludes that the economic growth of countries partly can be attributed to their health status (Arora, 2001).

The findings of another study show that hygiene and the state of health of the society both directly and indirectly affect the productivity of the labor because healthier people with a certain amount of capital are more productive (Behrman, 1993).

The findings of some studies show that half of the differences in economic growth between developed and developing countries are related to healthcare costs, indicating a positive correlation between healthcare costs and economic growth. However, instability and shocks of macroeconomic variables can lead to changes in health expenditures. Regarding the effects of economic shocks, there is a view that such shocks have both an income effect and a substitution effect on households. When there is an economic recession, the income effect leads to the worsening of children's education and more infant mortality, and the substitution effect will lead to the improvement of education and health status. The issue as to which of these two effects will prevail is an empirical matter and, according to the nature of the crisis, will vary from country to country (Ferreira & Schady, 2009).

Naturally, shocks and fluctuations in economic variables affect household health expenditures in different countries. Various studies have been conducted on the impact of economic shocks on the health sector. In the field of economic shock, the studies of Miller and Urdinola (2010) in Colombia, Frijters et al. (2005) in Germany, and Brown et al. (2014) in Turkey can be mentioned.

In addition, other studies that have been conducted on the impact of macro-economic shocks on health include Grossman (1972), Tallman and Wang (1994), Chay and Greenstone (2003), Canova and Ciccarelli (2004), Owoeye and Adenuga (2005), Goodman and Mance (2011), and Sanwald and Theurl (2015).

Background and Literature

In a study, Hassan (2021) examined the asymmetric effects of petroleum income on health expenditures using the autoregressive distributed lag (ARDL) model. Regression estimates showed that government health expenditures respond asymmetrically to positive and negative changes in petroleum incomes in the long run, while the responses are symmetric in the short run.

Ahmad et al. (2021) examined the relationship between health expenditures and economic performance. Based on the results of this research, a long-term stable relationship states that the growth of health expenditure has a relationship with the growth of Gross Domestic Product (GDP).

Ndaguba and Hlotywa (2021) examined the costs of public health and economic development in South Africa. Empirical findings show a positive relationship between health expenditure and economic development in South Africa. Also, there is a relationship between the consumer price index and healthcare costs.

Siami-Namini (2018) evaluated the relationship between health care costs, economic growth and inflation. The results showed a strong short-term relationship between economic growth and price index to health care costs; as well as a positive long-term relationship between healthcare spending and economic growth and a negative long-term relationship between health care spending and inflation.

Baulia (2018) investigated the effect of income shocks on household health expenditure. The results of his research indicate that negative income shocks reduce household health expenses and have a negative effect on the health sector.

Doğan (2017) examined the impact of oil prices on health expenditures for ten countries. The results showed that oil price has no effect on health costs in dynamic models. The currency exchange rate and GDP have a positive effect, and the inflation rate has a negative effect on health expenditure.

Fichera and Savage (2015) found evidence of the impact of income shock on the health sector in Tanzania. They found that increasing the amount of rainfall as a factor in increasing income and, in a way, causing an income shock, reduces the number of diseases and increases the number of vaccinations for children under six years of age.

Acemoglu et al. (2013) investigated the effects of increasing income on the health sector. The results show that the increase in income is not the main factor in increasing the share of the health sector in GDP; therefore, changes in income have no effect on health expenses.

Chen et al. (2022) investigated the response of Chinese families to income shocks. The results showed that households sacrifice health and Care expenses to balance food consumption, which will lead to a long-term negative impact on human capital accumulation.

Looking at the above studies, this research examines the effects of shocks on household health care expenditures on the Iranian economy. Examining the effects of shocks on Iran's economy, in general, can provide policymakers with a clear vision to develop policies and programs that are appropriate to the country's conditions.

The Model and Methodology

This paper uses economic studies to build a model for studying the effects of shocks on health expenditures of households. The research considers an open economy with a representative household, a firm, and a government using the DSGE framework. This economy is populated by a large number of identical households that receives income from providing labor and capital and chooses a path of consumption and capital investment to maximize their utility (the utility is in the logarithmic form) given by:

$$E_0 \sum_{t=0}^{\infty} \beta^t U(CO_t, LA_t) \tag{1}$$

$$U_t = U(CO_t, LA_t) = LN(CO_t) + \chi\, LN(1 - LA_t) \tag{2}$$

$$U_t^H = LN(CO_t^H) + \chi\, LN\,(1 - LA_t) \tag{3}$$

$$U_t^O = LN(CO_t^O) + \chi\, LN\,(1 - LA_t) \tag{4}$$

$$CO_t = \theta CO_t^H + (1 - \theta) CO_t^O \tag{5}$$

$$a_t = \rho_a a_{t-1} + \varepsilon_{a,t} \quad (6)$$

$$g_t = \rho_g g_{t-1} + \varepsilon_{g,t} \quad (7)$$

$$CO_t + KA_{t+1} = (1 - T_{LA})W_t(LA_t) + (1 + R_t(1 - T_{KA}) - \delta)KA_t \quad (8)$$

$$(1 - T_{LA})W_t = \chi\left(\frac{CO_t}{1 - LA_t}\right) \quad (9)$$

$$\frac{1}{CO_t} = \beta E\left[(1 + (1 - T_{KA})R_t - \delta)\frac{1}{CO_{t+1}}\right] \quad (10)$$

$$Y_t = F(LA_t, K_t) = (e^{a_t}LA_t)^{\alpha}KA_t^{1-\alpha} \quad (11)$$

$$R_t = (1 - \alpha)(e^{a_t})^{\alpha}\left(\frac{LA_t}{KA_t}\right)^{\alpha} \quad (12)$$

$$W_t = \alpha(e^{a_t})^{\alpha}\left(\frac{LA_t}{KA_t}\right)^{\alpha-1} \quad (13)$$

$$KA_{t+1} = IN_t + (1 - \delta)KA_t \quad (14)$$

$$e^{g_t}(GO_t) = T_H W_t(LA_t) + T_K R_t(KA_t) \quad (15)$$

$$Y_t = CO_t + IN_t + e^{g_t}(GO_t) \quad (16)$$

Where U_t, the utility function, E, expectations operator, θ, Share of health care expenditures in total consumption expenditures, T_{LA} and T_{KA} taxes on labor and capital income, R_T, the interest rate, Y_T, output, IN_T, gross investment, LA_t, labor of households, KA_t, accumulate physical capital, δ, the depreciation rate of physical capital, CO_t, total consumption expenditures, CO_t^H, health care expenditures, CO_t^O, other consumption expenditures, GO_t, Government spending, a_t, the productivity shock and g_t is Government expenditure shock.

Calibration, Simulation and Discussion

Health and hygiene have always been considered by economists necessary for achieving sustainable economic growth and development and improving the standard of living and well-being of people in society, because improving health improves human capital and economic growth and development. However, it should be mentioned that the existence of several fluctuations and shocks in the country's economy can lead to changes in household health expenses and cause long-term adverse effects for the country. Information on how the shocks spread and how they affect the economic variables, in addition to enabling economic planners and policymakers to make desirable decisions when shocks occur, can be used as a clear path for better decisions by economic agents.

The research model used the parameter values listed in Table 1 Based on the literature on models for economies to solve and simulate the pattern.

Table 1. *Calibrated Parameters*

Parameters	Description	Value	Source
θ	Share of health care expenditures in total consumption expenditures	0.5	Izadi (2018)
ρ_a	Technology Shock Persistence	0.599	Izadi and Marzban (2019)
ρ_g	Government Spending Shock Persistence	0.929	Izadi and Marzban (2016)
δ	Depreciation rate	0.0139	Izadi (2021)
χ	risk aversion	2	Marzban et al. (2018)
α	Capital share	0.44	Izadi (2022)
β	Discount factor	0.9952	Izadi and Sayareh (2019)
τ^k	Tax on Capital	0.356	Marzban et al. (2016)
τ^h	Tax on Labor	0.047	Marzban et al. (2016)
G/y	Government Spending	0.125	Izadi (2022)

Table 2. *Effect of Changing of Government Spending Shock Standard Deviation on Moments of Simulated Variables*

Variable		C_t	C_t^H	C_t^O	U_t	U_t^H	U_t^O
Mean	$\varepsilon_{g,t} = 0.01$	17.8685	0.5892	0.5628	0.0006	0.0167	0.0175
	$\varepsilon_{g,t} = 0.05$	17.8686	0.5893	0.5629	0.0006	0.0168	0.0177
	$\varepsilon_{g,t} = 0.09$	17.8688	0.5893	0.5629	0.0007	0.0170	0.0178
Std. Dev.	$\varepsilon_{g,t} = 0.01$	0.0141	0.0070	0.0070	0.0030	0.0133	0.0175
	$\varepsilon_{g,t} = 0.05$	0.0189	0.0094	0.0094	0.0030	0.0171	0.0178
	$\varepsilon_{g,t} = 0.09$	0.0258	0.0129	0.0129	0.0031	0.0227	0.0238

Source: Researcher Calculations

Table 3. *Effect of Changing of Technology Shock Standard Deviation on Moments of Simulated Variables*

Variable		C_t	C_t^H	C_t^O	U_t	U_t^H	U_t^O
Mean	$\varepsilon_{g,t} = 0.01$	17.8685	0.5892	0.5628	0.0006	0.0167	0.0175
	$\varepsilon_{g,t} = 0.05$	17.9482	0.6290	0.6026	0.029	0.0834	0.0875
	$\varepsilon_{g,t} = 0.09$	18.0280	0.6689	0.6425	0.0053	0.1501	0.1575
Std. Dev.	$\varepsilon_{g,t} = 0.01$	0.0141	0.0070	0.0070	0.0030	0.0133	0.0139
	$\varepsilon_{g,t} = 0.05$	0.0685	0.0342	0.0342	0.0151	0.0648	0.0675
	$\varepsilon_{g,t} = 0.09$	0.1229	0.0614	0.0614	0.0272	0.1163	0.1213

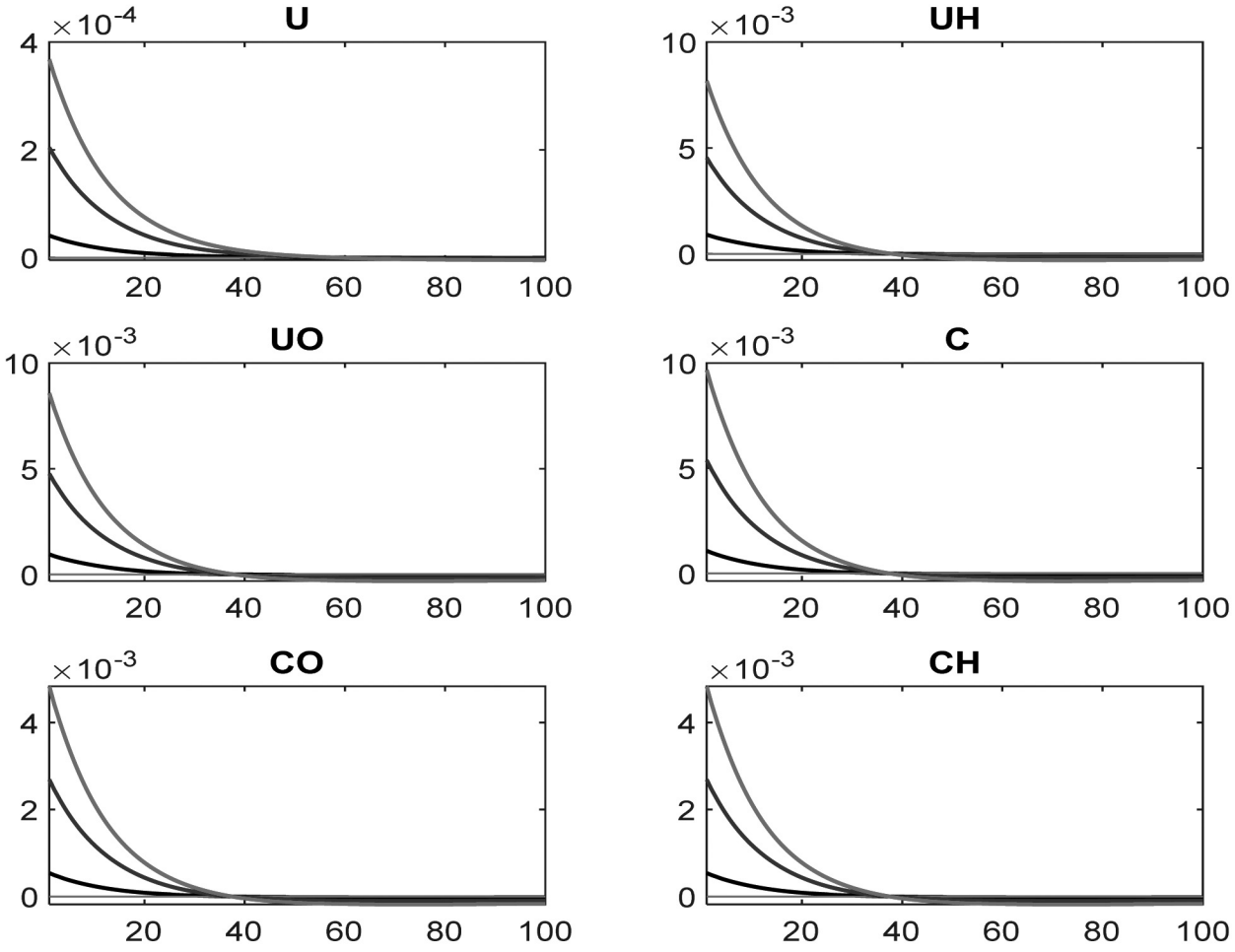
Source: Researcher Calculations

Tables 2 and 3 present the effects of changes in Government Spending Shock Standard Deviation and the technology Shock Standard Deviation with different values, and then report the magnitude of the mean and standard deviation of the variables. As can be seen from Table 2, the increase in two shocks has increased the mean amount and standard deviation of the consumption expenditure; as a result, the household's utility will be increased. Because society's income has increased, the household prefers to consume more goods and services.

Figure (1) below shows the impulse response function of government spending shock in the presence of changes in the parameter . An increase in government spending leads to more investment in the health sector. This increase in investment is realized through the establishment of Care centers, laboratories, clinics, pharmacies and hospitals, provision of medical and health equipment and importing modern medical knowledge. As a result, by increasing the access of households to health and medical facilities and treatment, their health expenses will also increase.

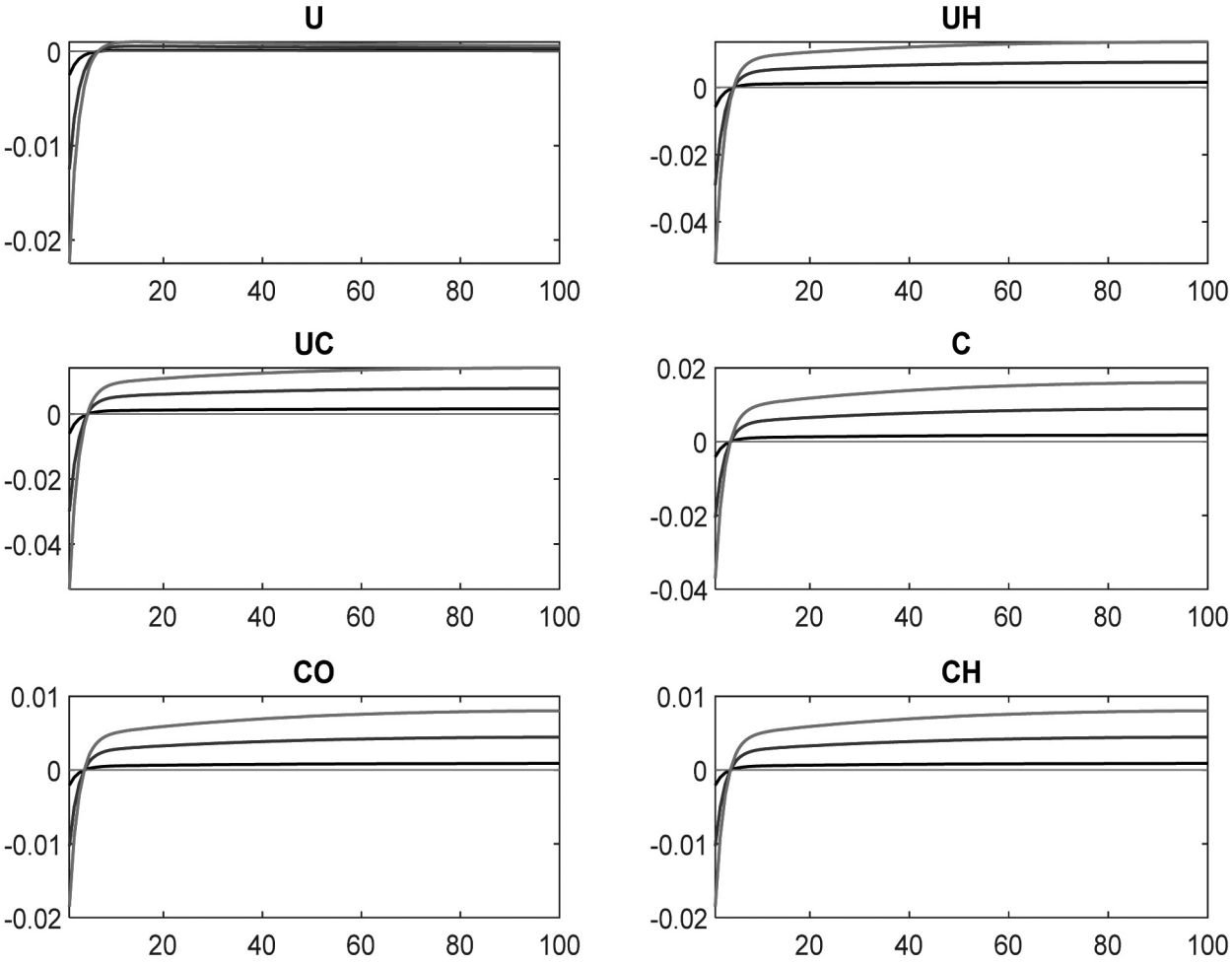
Given all these, households are enabled to obtain better health and wellness. Together with necessary and timely government policies in support of health and Care services, the resulting health promotion, which also increases life expectancy, contributes significantly to faster economic growth. The results of these functions show that the higher the parameter's value , the stronger the impact of this shock on the utility (U, UH, UO) and consumption (C, CH, CO) functions.

Figure (2) shows the impulse response function



Source: Researcher Calculations

Figure 1. *Impulse Response to A Unit Government Spending Shock in Model. Note. Black Line:* $\varepsilon_{(g,t)}$ *=0.01, Blue Line:* $\varepsilon_{(g,t)}$*=0.05 And Red Line:* $\varepsilon_{(g,t)}$ *=0.09.*



Source: Researcher Calculations

Figure 2. *Impulse Response to A Unit Technology Shock in Model. Note. Black Line:* $\varepsilon_{(g,t)}$ *=0.01, Blue Line:* $\varepsilon_{(g,t)}$*=0.05 And Red Line:* $\varepsilon_{(g,t)}$ *=0.09.*

of Technology Shock in the presence of changes in the parameter . The increase and improvement of technology will enhance the government's income, leading to higher investment in the healthcare sector. When the government increases the amount of consumption in this sector through extensive investment in the health sector and increasing people's access to medical facilities and services, the amount of spending in this sector will certainly increase. The results of these functions show that the higher the parameter's value , the stronger the impact of this shock on the utility (U, UH, UO) and consumption (C, CH, CO) functions.

According to the obtained results, it can be said that the aforementioned shocks have increased household expenses. The healthcare sector is a key and determining component of human capital and a driver of the economic development of any country. This sector is known as a public commodity, and its cost should be paid by the government; however, a large part of these expenses in the country is provided by the household. Therefore, in this regard, the government should increase the subsidies of the healthcare sector through the public budget and government support and avoid hasty policies toward the realization of extensive privatization.

Conclusions

Due to the importance of the effects of macroeconomic shocks on the healthcare expenditures of any country, this study was also conducted as a domestic study on Iran. Our investigation showed that the government expenditure shock and the technology shock had increased the health expenditure of households. Considering the positive impact of these shocks in increasing household health and Care expenses, as well as the high importance of these shocks in economic growth and development, it is necessary for the authorities and planners to consider the appropriate policies and programs to manage the effects of these shocks on vulnerable households and the economy. Being aware of how shocks spread and how powerful they are in affecting economic variables, economic planners and policymakers are enabled to make favorable decisions when these occur, thereby controlling destructive consequences. These positive shocks cause an increase in household health expenses, which mainly can be due to the expansionary fiscal policy created after the increase in government revenues and expenditures. Therefore, governments should move towards increasing the subsidies of the healthcare sector through the public budget, continuing their support in such sectors as health insurance, paying subsidies, optimizing service tariffs and improving the quality of access to healthcare services.

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