Original Article

Economic planning and equilibrium growth of human resources and capital in health-care sector: Case study of Iran

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Abstract:

CONTEXT: During different planning periods, human resources factor has been considerably increased in the health-care sector.

AIMS: The main goal is to determine economic planning conditions and equilibrium growth for services level and specialized workforce resources in health-care sector and also to determine the gap between levels of health-care services and specialized workforce resources in the equilibrium growth conditions and their available levels during the periods of the first to fourth development plansin Iran.

MATERIALS AND METHODS: In the study after data collection, econometric methods and EViews version 8.0 were used for data processing. The used model was based on neoclassical economic growth model.

RESULTS: The results indicated that during the former planning periods, although specialized workforce has been increased significantly in health-care sector, lack of attention to equilibrium growth conditions caused imbalance conditions for product level and specialized workforce in health-care sector.

CONCLUSIONS: In the past development plans for health services, equilibrium conditions based on the full employment in the capital stock, and specialized labor are not considered. The government could act by choosing policies determined by the growth model to achieve equilibrium level in the field of human resources and services during the next planning periods.

Keywords:
Economic planning, equilibrium growth model, health planning, sectoral planning

Introduction

Economic planning in health-care sector makes a relationship between services growth in health-care sector, human resources growth, equipment, and physical capitals. In this sense, services growth should be so much that can be specified by quite employment of human resources and equipment. It is noteworthy that in planning, human resource is one of the most important factors of production in the process of health care and development

services delivery. Financing costs of human resources can be possible based on required human resources' supply policies and planning according to the limitation of financial and equipment limitation.[1]

Human resources status of health-care sector differs in different countries.[2] Some countries are faced with shortage of physicians and health-care specialists. In contrast, some are confronted with suitable or surplus supply of specialist groups.[3] In the sense of surplus specialists, the courtiers are enforced to employ trained and

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specialized human resources in no specialized positions. If such problems proceed, the resulted insufficiency will lead to inefficiency to combine resources with each other. In the countries where shortage of specialized human resources is felt in health-care sector, increase of trained human resources is emphasized in a sector independent of its equilibrium relationship with services level and other equipment factors.[4] For example, Bangladesh, Sri Lanka, India, and Nepal could specify shortage of human resources problem by human resources strategic plans and emphasizing on health development as well as suitable service delivery.[5,6]

Difficulties caused by surplus human resources situation in the UK, the US, Canada, Australia, and Sweden were studied by hiring planning models and emphasizing on proper allocation of resources and the development of effectiveness indicators and efficiency of human resources. However, in such models, no equilibrium relation is seen between human resources amount and services level as well as other equipment factors. The used models in these countries were mostly based on social need analysis, predictions for human resources' supply and demand, human resources to the population ratio, services usage-based approaches and target group-based classifications. Another problem was distribution of human resources which was paid into attention in some countries. This problem gave rise to shortage of human resources in some regions and to surplus of them in other regions.[7-10]

Since the human resources employed in health-care sector as well as available equipment and facilities are two main factors of service delivery in health-care sector, what is an obstacle in health-care sector (like other sectors) for service production in potential level is specified by a productive factor which - in combination with other production factors - is placed in lower level than the required least.[11,12] It seems that this production factor is currently the available capital or equipment and facilities as well as factor of human resources. In the conditions of lack of attention to such a limiting factor, potential level of services can be specified based on medical human resources. Totally, formation of fixed capital in the health-care sector and the annual corresponding financing is faced with some constraints which make difficult to combine it efficiently with other resources including human resources. Sector-based planning can describe a defined relationship between capital resources level (e.g., equipment and human resources of the sector) and annual expected services level. So far, sector-based planning for health care has tried to separately improve such indicators as physician-to-population ratio, the ratio of beds to population and other health-care facilities, and so on, assuming annual flexible resources. The present study tries to evaluate equilibrium growth of health-care sector during some planning periods among total of these resources and annual services level at the framework of a sector-based planning model.

During the recent years, each 5-year development plan in Iran has emphasized on increased goods and services level in health-care sector. In these plans, human resources were paid into attention as an important factor at health system and development of health services supply. During different planning periods, human resources factor has been considerably increased in the health-care sector. In the former plans, this issue was not paid into attention that how a planning model in the health-care sector can provide an equilibrium relation between increased services level and increased human resources and capital factors of the sector in full employment conditions. Iranian health-care sector, irrespective of mentioned equilibrium, was permanently faced with a status with surplus human resources in former plans. This surplus leads to unemployment of a part of trained human resources and decreased productivity of staffs and thereby low level of service production-to-potential level. In the 1980s, mean physician staffing growth and growth rate of annual mean hospital bed capital were 5.3% and 3.6%, respectively. After implementation of physician staffing increase policy in Iran, mean physician staffing growth reached to 10.5% while growth rate of hospital bed capital had a decreasing trend with an annual mean of 2.5%. From 2001 through 2007, mean physician staffing growth also reached to 5.2%. Given the status of physician staffing development during two recent decades, health-care sector was faced with some problems to hire and employ human resources. These problems can be caused by lack of planning for equilibrium growth of production factors in health-care sector and surplus medical human resources.[13,14]

In the study performed by "Khanum S and Singh A", their aim was an investigation on countries experience about macroeconomy and health in Southeast Asian countries, aiming to use countries experiences to draw key concepts for planning and policy-making to enhance and develop health system, so they focused on key concepts such as the relationship between poverty and health, the gap between financial resources and costs, evidence-based planning, identification of diseases load, and investment in health-care sector.[15] In other study project, Paalman investigates strategic plan of human resources for health in 2003–2017. He concluded that given the low number if medical human resources in Nepal and the necessity to improve initial health status in this country, strategic planning considered some plans to increase and develop workforce and also develop clinics and health-care departments for more accessibility to primary health care.[6] Based on other study plan performed by Management Sciences

for Health and the World Health Organization, they defined their aim to assessment of some tools for planning and development of human resources for AIDS and other health services in 2006. This model was composed of six sections including general information, service providers, duties, patients' data, results, and a section for the calculations done by MS Excel. According to the results of this research, they found that decision-making about human resources and efficient use of these resources will be possible.[16] In other research done by Eichler *et al*., they defined their aim as a level of costs and impacts which should be obtained by an intervention to be accepted in a health-care system, and they used cost-effectiveness analysis methodology and today their method became a suitable tool for planners and managers in health sector to make decision clearly and reasonably about resources allocation.[9] Bloor and Maynard did human resources planning for health care in Canada with a comparative and economic study between five countries (Australia, the UK, France, Germany, and Sweden). Their study model was control methods of health human resources supply, use of effectiveness, and efficiency indicators in health-care resources planning (surplus/shortage of workforce), fundamental changes in planning, and employment and activities levels. Then, they found systematic and continuous development of workforce planning policies that will be complex in Canada and other countries, but undoubtedly, it will have deep impacts on combination of skill and efficient use of workforce in health-care sector.[10] In other research, Bloom *et al*.'s aim was evaluation of microeconomic variable effect on macroeconomic variables in economic growth, so they use the model assessed efficiency of production factors which were estimated for 1960–90 by total factor production and using panel date method. They concluded that the health has a positive and considerable impact on economic growth so that 1-year life expectancy increases gross domestic product as much as 4%. Health improvement leads to more efficiency of workforce and investment in health care for increases human capital and thereby welfare improvement. In this study, no reason was found in microeconomic studies for higher impact of macro-variables for education and experience relative to impact on such variable.[17]

Given the conducted studies, it can be seen that planning is paid into attention at most of the countries, and it is one of the priorities of experts, policy-makers, and managers in health-care sector. Hence, the plans were implemented based on several approaches and models. As the studies show, the problems related to shortage/surplus and distributions of workforce are paid into attention in different countries which were evaluated and analyzed by different planning models. In the most of introduced models in these studies, the relations of

equilibrium growth between main factors for services delivery and required equipment are less seen to meet social needs.

Comment based on equilibrium growth planning model in the present study, we try to answer two main questions in 5-year plans for growth and development of health-care sector. The questions are as follows:
- Has been increased planning in health-care services level proportional to annual increased human resources in health-care sector?
- During former planning periods, has been any gap between services' potential capacity and services' actual capacity in practice?

In according to describe realities, it is necessary for assess health-care sector planning in the field of equilibrium growth of human resources and capital human based on appropriate methods.

Materials and Methods

The present work is a retrospective study conducted by descriptive-analytical and statistical methods. The required data were collected through statistical documents (annual calendars of Statistical Center of Iran as well as time series information of Iranian Central Bank) and the data existing in the National Health Accounts by direct referring to Ministry of Health for 1981–2007. After data collection, econometric methods and EViews version 8.0 (1994–2013 IHS Global Inc.) were used for data processing. The statistical population here is composed of health-care sector and total specialized workforce (physician and dentist) in health-care sectors along with total fixed capital including health-care facilities and their equipment in macro-level of health-care sector. Due to statistical limitation for 5-year-development plan periods and the former years, the total number of physicians and dentists per year was considered as specialized workforce in health-care sector. The used model in the tudy is based on neoclassical economic growth model.[18]

Neoclassical growth model
Neoclassical growth model or Solow model is a production function with such features as constant productivity return to the scale, the succession of capital and labor with each other, and diminishing marginal productivity of production factors. It is shown as follows:

$$Y = f(K, L) \qquad (1)$$

In Equation 1, capital production and human resource are depicted by K and L, respectively. This production function can be generally explained by Cobb–Douglas production function. Production function 1 is shown as follows in health-care sector in terms of capita variables:

$$\frac{Y_H}{L_H} = f\left(\frac{K_H}{L_H}, 1\right)$$

$$Y_H = f(K_H) \tag{2}$$

In Equation 2, Y_H is the product value in health-care sector, K_H is the value of capital stock in health-care sector, L_H is the number of workforce in health-care sector, Y_H is product per capita of each workforce unit in health-care sector, and K_H is capital to workforce or capita capital per workforce in health-care sector. Equation 2 is shown as follows:

$$Y_H = A \overset{\beta}{K_H} \tag{3}$$

Equation 3 was estimated logarithmically.

Given Equation 3, it will be possible to calculate mean production per capita per capital unit in the health-care sector.

To determine marginal propensity for savings, the result of consumption function estimation and marginal propensity for consumption was used, and it was calculated for annual and long-term periods. Saving rate for the long-term period of 1971–2007 was considered as 0.155.[19]

Equilibrium condition in neoclassical growth model in steady state for growth period

In neoclassical growth model, changes in capital stock per capita, ΔK_H, are equal to net investment per capita which can be shown by a growth rate equal to subtracting the growth rate of capital stock, $\frac{\Delta K_H}{K_H}$ from human resources growth rate, $\frac{\Delta L_H}{L_H}$ that is:

$$\frac{\Delta K_H}{K_H} = \frac{\Delta K_H}{K_H} - \frac{\Delta L_H}{L_H}$$

$$\dot{K}_H = \dot{K}_H - \dot{L}_H \tag{4}$$

In Equation 4, K_H is the growth rate of capital stock per capita in health-care sector, $\dot{K}_H$ is the growth rate of capital stock in health-care sector as $\frac{\Delta K_H}{K_H}$, and $\dot{L}_H$ is human resources growth rate in health-care sector as $\frac{\Delta L_H}{L_H}$. Hereinafter, human resources growth rate in health-care sector, is depicted by g_H.

Using the result of Equation $_H$ $(S \times Y_H)$ (d_H) based on the model, which was obtained through equilibrium condition in demand sector for product per

capita of health-care services, Equation 4 can be shown as follows:

$$\dot{K}_H = \frac{(S \times Y_H) - (d \times K_H)}{K_H} - g_H \tag{5}$$

In terms of demand for product, it is assumed in neoclassical growth model that economy in growth period is concurrent with growth of workforce growth in steady-state growth conditions where capital per capita, K_H, is kept unchanged. That is:

$$\dot{K} = 0$$

Therefore, in steady-state growth conditions, Equation 5 is shown as following:

$$0 = \left(\frac{S}{K_H}\right) \times Y_H - d - g_H$$

$$\left(\frac{S}{K_H}\right) \times Y_H = d + g_H$$

$$(S \times Y_H) = (d \times K_H) + (g_H \times K_H) \tag{6}$$

By placing Y_H from the production function in Equation 2, Equation 6 can be considered as the equilibrium relation between supply and demand for product per capita of health-care service in steady-state growth conditions.

Next, based on neoclassical growth model and equilibrium condition for steady-state growth, it is shown in Equation 6 - by placing estimation results of production function in Equation 3 - that capital stock per capita can be determined endogenously in the current state as follows:

$$(S \times Y_H) = (d + g_H) + K_H$$

$$\frac{(S \times Y_H)}{K_H} = d + g_H$$

$$\frac{Y_H}{K_H} = \frac{d + g_H}{S} \tag{7}$$

In steady-state growth conditions and while planning, capital stock per capita, K_H, is considered steady. Based on this assumption during the growth period, capital stock per capita, K_H, should be defined clearly during the plan at a given and steady level. Now, if mean capital stock per capita during K_H is determined as the planned $\dot{K}_H$, then equilibrium growth rate of specialized human resources will be obtained based on the final rate of long-term savings, $S = 0.155$, and using Equation 7.

Average annual growth rate of total workforce of medicine and dentistry during 1981–2007 was obtained through the following compound growth rate equation.

$$L_{H,t} = L_{H,0} \times (1 + g_H)^n \qquad (8)$$

In Equation 8, $L_{H,t}$ is specialized workforce (physician–dentist) in the health-care sector at the last desired year, $L_{H,0}$ is specialized workforce (physician–dentist) in the health-care sector at the base desired year, g_H is specialized workforce (physician–dentist) in desired period, and n is the period duration.

Furthermore, in the health-care sector, to keep specialized workforce (physician–dentist) population in growth period duration ratio steady, specialized workforce growth rate should be equal to population growth rate in the growth periods. In this regard, Iranian population growth rate was calculated here using population statistics in 1981, 1986, 1996, 2006, and 2011 for long-term periods.

Evaluation of planned increase at health-care service level proportional to annual increase of human resources

Based on neoclassical growth model, planned increase at health-care services and equilibrium increase at health-care sector during development plans in health-care sector is determined based on a specific level of equilibrium capital per capita or planned K_H^* and long-term equilibrium saving rate.

A comparison on equilibrium growth rate of specialized workforce and annual growth rate in the current status during planning periods specifies state of imbalance in the employment of specialized workforce in each planning period. Considering equilibrium capital per capita equal to average capital stock per capita over the growth planning period as the planned $\dot{K}_H$ and equilibrium savings rate equal to the rate of long-term savings ($S^* = 0.155$), equilibrium workforce growth rate during development plans period in the health-care sector is obtained using Equation 7. Annual growth rate of specialized workforce in planning periods is also determined annual capita per capita, K_H, and annual saving rate, s, in the health-care sector.

The policy to change capital stock per capita ratio

In the conditions where we are faced with shortage/surplus of specialized workforce in the health-care sector, full employment conditions can be provided for specialized workforce by changing capital stock per capita ratio, K_H^*. In neoclassical growth model, capital stock per capita ratio is an exogenous variable for policy-making. That is, for policy-making for planning period in the future, capital stock per capita ratio should be changed according to workforce growth rate conditions. To explain changing policy in capital stock per capita ratio in health-care section, equilibrium condition was considered as follows:

$$(g_H^* + d) \times K_H^* = \left(S^* \times Y_H^* \right) \qquad (9)$$

In this equation, g_H^* is average equilibrium growth of workforce in the planning period, K_H^* is equilibrium capital stock per capita in the growth period, S^* is the mean long-term saving rate, and Y_H^* is equilibrium product per capita. Changing policy in capital stock per capita was considered into two following modes:
A. Changing capital stock per capita ratio based on mean growth rate of specialized workforce in each period
B. Changing capital stock per capita ratio based on mean growth rate of specialized workforce to stabilize physician–population ratio in each period.

In former, mean equilibrium growth of specialized workforce and mean annual stock capital per capita in the current status are considered for three long-term periods of 1981–2007, 1989–2007, and 2000–2007. Then, based on long-term saving rate status, S^*, and equilibrium growth rate of specialized workforce in health-care sector at three mentioned periods, the result is obtained for the policy to determine equilibrium capital stock per capita ratio, Y_H^* through Equation 9. A comparison on equilibrium capital stock per capita and capital stock per capita shows that for full employment of specialized workforce and prevention of capital stock per capita status in full unemployment conditions, what we shall do for future planning period (e.g., 5-year period of 2008–2012)? In the latter mode, mean equilibrium growth of specialized workforce and mean annual stock capital per capita in the current status are considered by stabilizing physician–population ratio in mentioned periods. And then, based on Equation 9, mean equilibrium capital stock per capita, K_H^* was calculated for each of periods including 1981–2007, 1989–2007, and 2000–2007. The comparison of such ratios as equilibrium capital stock and capital stock per capita shows that to stabilize physician–population ratio in each period, what we shall do for future planning period (e.g., 5-year period of 2008–2012).

The evaluation of the gap between annual product of health-care services and services product based on potential capacity in planning periods

Based on neoclassical growth model, the result of production function is considered for the relation between production level and production factor of capital stock per capita in health-care sector. The shown production function in Equation 3 specifies product level of health-care service by K_H^* factor, product level of services based on potential capacity, and annual product level of services in planning periods by K_H production factor. Potential product level of services is a product level which is determined by hiring specialized workforce and capital stock in health-care sector with full employment status. In contrast for the

plan years, product level of services in the sector is determined for the conditions without full employment of production factors. These conditions are specified by the difference between equilibrium capital stock per capita and annual capital stock per capita. The comparison on potential product level of services and annual product level of health-care services indicates the gap caused by annual imbalance in health-care sector.

Results

Table 1 presents estimation result of Equation 3.

In this formula, virtual variable Dum_1 was set one up to 1992 and since then it was set zero. This virtual variable was considered to show change of specialized workforce growth trend in the health-care sector since 1992.

Unit root test
To check the stationary of variables and also to avoid spurious regression, we used Kwiatkowski–Phillips–Schmidt–Shin (KPSS) unit root test [Table 2]. In the KPSS test, the null hypothesis is the stationary of variable, if the absolute value of the KPSS statistic is smaller than the absolute critical value, intended the null hypothesis will be accepted. The result of this test shows that the logarithm of per capita, Y_H, and the logarithm of per

capita, K_H - level are stationary and we do not need difference making.

In neoclassical growth model, status of imbalance in specialized workforce (whether surplus or shortage) was specified in each planning period by comparing equilibrium growth rate of specialized workforce in full employment condition and annual growth rate in the current status during the planning periods. Table 3 presents surplus/shortage status of specialized workforce during the development plans 1–4 in 1989–2007 based on neoclassical growth model.

In Table 3, in the years where the difference between equilibrium growth rate of specialized workforce and annual growth rate of specialized workforce was negative and thereby health-care sector was faced with shortage of specialized workforce based on equilibrium relation in neoclassical growth model. In contrast, in the years in which such a difference was positive, the sector was faced with surplus of workforce.

The result of change policy in capital stock per capita is obtained based on the equilibrium relation between investment per capita and growth of capital stock per capita in neoclassical growth model. The result of such equilibrium relation along with mean equilibrium capital stock K_H^* and mean total of growth rates of equilibrium workforce (g_H^*) as well as depreciation (d) is shown in $(g_H^*)+d$ neoclassical growth model in Table 4, for each three periods including 1981–2007, 1989–2007, and 2000–2007.

Now, if growth rate of specialized workforce is to be decreased to stabilize physician–population ratio, then it will be possible to change ratio of equilibrium capital stock per capita in each period as policy-making variable. The result of this policy is presented in Table 5.

In neoclassical growth model, based on the result of production function and annual capital stock per capita ratio and mean capital stock per capita ratio during each planning period (equilibrium capital stock per capita), annual product level per capita and product equilibrium level of product for health-care services were calculated, respectively. By specifying the difference between these two levels of health-care services in each year, the gap caused by annual imbalance in health care was obtained.

Table 6 presents the imbalance gap for the product of health-care services and full employment/unemployment for capital stock per capita and specialized workforce in the sector during 1–4 development plans. In full employment years, due to higher level of health-care services product compared to equilibrium product level,

Table 1: Estimation result of Equation 3

$$\text{Ln}\,Y_H = \text{Ln}A + \beta_1\,\text{Ln}K_H + \beta_2\,dum_1$$

Variable	Coefficient	*t*-statistic
LnA	1.687	1.890*
LnK_H	0.702	4.242***
Dum_1	0.201	1.675*

R^2=0.94, Durbin–Watson=1.86, *F*-statistic=125,98 (0.000). The R^2 value of 0.94 means that 94% of the variation in dependent variable is explained by independent variables, a fairly high value considering that the maximum value of R^2 can at most be 1. According to the model parameters based on test *F*, the model is estimated to have a significant meaning. To explore existence of autocorrelation in residuals, the LM test with two lags was used that results from test demonstrated the lack of correlation between the residuals of the fitted regression line

Breusch–Godfrey serial correlation LM test			
F-statistic	0.053507	Probability *F* (2,20)	0.9480
Observations×R^2	0.138377	Probability χ^2 (2)	0.9332

LM = Lagrange multiplier, ***Significant at the 1 percent level. **Significant at the 5 percent level.*Significant at the 10 percent level

Table 2: Static evaluation on changes in equations' volume variables and changes in the efficiency variables using Kwiatkowski–Phillips–Schmidt–Shin test

Variable	Trend	Result of stationary test
Y_H	0.1176	*I* (0)
K_H	0.1081	*I* (0)
Asymptotic critical values*	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

Table 3: A comparison on equilibrium growth rate of specialized workforce in full employment conditions and annual growth rate of specialized workforce in development plan period in the health-care sector

First plan g_H-g_H^*			Second plan g_H-g_H^*			Third plan g_H-g_H^*			Fourth plan g_H-g_H^*		
1989	−0.019*	Shortage	1995	0.020	Surplus	2000	0.002	Surplus	2005	−0.011	Shortage
1990	−0.027	Shortage	1996	−0.006	Shortage	2001	0.023	Surplus	2006	−0.017	Shortage
1991	0.003**	Surplus	1997	−0.014	Shortage	2002	0.014	Surplus	2007	−0.019	Shortage
1992	0.106	Surplus	1998	−0.032	Shortage	2003	−0.022	Shortage			
1993*	0.051	Surplus	1999	−0.049	Shortage	2004	0.007	Surplus			

*Negative (shortage of specialized workforce), **Positive (surplus of specialized workforce) *1994 This year has seen the gap between 5-year development plan were in the country

Table 4: The total average growth rates of specialized human resources as equilibrium and depreciation as well as mean capital stock per capita

Growth period	Annual mean total of growth rates for specialized human resources as equilibrium and depreciation (g_H^* + d) (Million rial)	Mean equilibrium capital stock (K_H^*) (Million rial)	Mean capital stock per capita at the current situation (K_H) (Million rial)	Mean change in investment per capita to equilibrium (K_H-K_H^*) (Million rial)
1981-2007	0.077+0.085	247.188	470.835	223.647
1989-2007	0.082+0.085	223.786	319.313	95.527
2000-2007	0.054+0.085	414.274	416.904	2.730

Table 5: The total average growth rates of specialized workforce as equilibrium to stabilize physician-population ratio and depreciation and equilibrium capital stock per capita

Growth period	The total average growth rates of specialized workforce as equilibrium to stabilize physician-population ratio and depreciation (g_H^* + d)	Mean equilibrium capital stock (K_H^*) (Million rial)	Mean capital stock per capita at the current situation (K_H) (Million rial)	Mean change in investment per capita to equilibrium (K_H-K_H^*) (Million rial)
1981-2007	0.022+0.085	1209.769	1225.637	15.868
1989-2007	0.017+0.085	1170.426	1448.803	278.377
2000-2007	0.016+0.085	996.782	1312.69	315.904

Table 6: Imbalance gap in the health-care sector during 1–4 development plans

First plan Y_H-Y_H* (Million rial)		Second plan Y_H-Y_H* (Million rial)		Third plan Y_H-Y_H* (Million rial)		Fourth plan Y_H-Y_H* (Million rial)	
1989	−20.056*	1995	21.674	2000	−67.161	2005	260.965
1990	276.844**	1996	−30.026	2001	55.510	2006	−111814
1991	298.170	1997	−18.192	2002	59.218	2007	79.767
1992	−170.742	1998	−37.852	2003	−127.910		
1993	1.145	1999	89.907	2004	−79.173		

*Negative (product shortages and lack of full employment of factors of production), **Positive (product surplus and excessive use of the factors of production)

we are faced with surplus of product and excess use of production factors.

In Table 6, during the years with negative imbalance gap in health-care sector, potential capacity level of services was higher than services' product level based on potential capacity. In these years, level of equilibrium capital stock per year K_H^* was higher than that of annual capital stock per capita (K_H). In these years, annual investment was lower than required level to make balance between annual capital stock per capita and equilibrium capital stock per capita. In contrast in other years, annual investment was higher than specific

amount to maintain annual capital stock in determined level for equilibrium capital stock per capita.

Discussion

The study was conducted to evaluate economic planning conditions and equilibrium growth in health-care sector with full employment conditions of capital stock and specialized workforce. The main goal here was to determine economic planning conditions and equilibrium growth for services level and specialized human resources in health-care sector and also to determine the gap between levels of health-care services and specialized human resources in the equilibrium growth conditions and their available levels in the first to fourth development plan ' periods . For this purpose, determination of health-care services' levels and medical human resources are taken into account in equilibrium growth conditions and current status during development plan periods as the subsidiary goals.

In general, to reach goals of the first and second development programs to increase physician–population ratio, available statistical evidences show that in the first program, physician - 1000 people of population ratio reached from 0.36 at the beginning of the program

to 0.61 at the end. This ratio reached to 0.96 at the end of the second program. In programs third and fourth, while physician-population ratio goal is not seen at the end of these two programs such a ratio increased to 1.24 and 1.45.[13,14] The obtained success in programs first and second goals' achievement can be considerably due to ratification of act of the Ministry of Health and Medical Education in 1985. By ratification of this act, medical science colleges and universities were expanded, and by training human resources, the supply of such workforce was increased according to the demand level. With increased number of graduated students, health-care network could be expanded and rural and underserved areas got considerably under medical coverage. Furthermore, during three recent decades, with the expansion of urban and rural physical spaces of health-care centers and health houses as well as increased number of hospitalization beds and generally increased installations and equipment capital in health-care sector, employment opportunities were increases for physicians, and in parallel, services level of health-care sector has been also increases.[20,21] In the first development program, equitable distribution of health facilities and medical workforce in the country was emphasized. However, in the next programs, nothing is seen from preceding such a goal. According to the importance of suitable distribution of equipment and medical human resources to increase services level for the society, lack of medical services in small towns and lack of adequate access to health care in spite of the relatively good access to major cities are of the problems which are seen due to improper distribution of medical human resources in health-care sector.[22] An assessment on trend of 5-year development programs shows that the objective for these programs was specified temporarily, and some objectives were focused in just one or two periods. This issue can be one of the reasons that formerly in development plan' periods, we were faced with sudden changes in growth rate of medical human resources and imbalance conditions, according to the level of planned services.

Based on regression estimation results of Equation 4 which are shown in Table 1, variable elasticity of product per capita or product of each human resource unit is 0.702 relative to capital per capita in health-care section. This elasticity shows that per 10% of increased capital per capita in health-care sector, product per capita, or product of each human resources in health-care sector is increased as much as 7.02%. The research findings show that, according to results of Table 3, and based on full employment condition of capital stock in steady-state growth conditions, planned ratio for capital stock per capita, production function with the possibility of substitution of capital production factors and human resources, and long-term saving rate, annual investment per capita in health-care sector and growth

of capital stock per capita as decreasing had to be paid into attention on the years with shortage of specialized human resources. In contrast, in the years with surplus of specialized human resources, annual investment per capita and growth of capital stock per capita had to be done with a rate higher than what seen to make full employment of human resources. As previously mentioned, these findings were yielded based on growth conditions in steady state and full employment of capital stock per capita and specialized workforce according to equilibrium relation between supply and demand for product per capita as well as variable and planned ratio for capital stock per capita. For extra investment and increasing capital stock per capita, planned ratio for capital stock per capita during the planning period should be considered with more resources for product per capita.

Based on Table 4 and according to mean annual growth rates of human resources in existing status at three mentioned periods, the equilibrium conditions for full employment of specialized human resources can be met by additional investment per capita (whether negative or positive) which is obtained through the difference of mean annual capital stock per capita in the current status and this mean in equilibrium status. Given Table 5 and based on mean annual growth rates of human resources relative to population growth rate in three mentioned periods, the equilibrium conditions for full employment of specialized human resources can be met by additional investment per capita (whether negative or positive) which is obtained through the difference of mean annual capital stock per capita equal to population growth rate and this mean in equilibrium status.

Conclusions

These findings in neoclassical growth model show that it will be possible to provide equilibrium condition of human resources' full employment in the health-care sector for a planning period in the future through changing the policy toward ratio of capital stock per capita into two modes: (a) maintaining annual growth rate of specialized workforce levels and also in the current status and (b) reduction of this rate at a level equal to growth rate of population. In neoclassical growth model, Cobb–Douglas production function with the ability to substitute production factors and equilibrium capital stock per capita is considered based on desired mean for policy-making. Furthermore, in this model, product level in balance or imbalance modes and difference of these two product levels are calculated as per capita. According to features of neoclassical growth model, the yielded results can be recognized proper for evaluation of shortage/surplus of human resources and shortage/surplus of health-care services' product.

The results here indicated that during the former planning periods, although specialized workforce has been increased significantly in health-care sector, lack of attention to equilibrium growth conditions caused imbalance conditions for product level and specialized workforce in health-care sector. Theses imbalances are permanently a fundamental issue in countries studies to determine and describe product level of health-care services and specialized workforce in health-care sector (e.g., in Southeast Asian countries including Indonesia, India, Sri Lanka, and Nepal by an emphasis on increased services product level and its relation with macroeconomic status of the countries as well as development constraints and also increased specialized workforce in health-care sector in some frameworks other than economic model of equilibrium growth in the health-care sector).[6,8] Furthermore, studies of Eichler *et al*., 2004; Bloor and Maynard, 2003; and Birch *et al*., 2009, could not provide a proper method to describe equilibrium growth in health-care sector.[7,9,10]

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Conflicts of interest

There are no conflicts of interest.

References

1. World Health Organization. Models and tools for health workforce planning and projections. Geneva: World Health Organization; 2010.
2. Zandian H, Ghiyasvand H, Nasimidost R. Measuring inequality in health resource distribution: A case study. Payesh J 2012;11:799-805.
3. Zheng X, Wang J, Li X, Yu Y. On the supply of China's healthcare resources in a decentralized healthcare system. Soc Sci J 2015;52:449-58.
4. Kazemian M, Mahboobi Ardakan P, Meskarpour Amiri M. Assessment of physician human resources in Iran based on the goals of 1st-4th development plans. Daneshvar Med 2014;21:1-11.
5. World Health Organization. Everybody's business – Strengthening health systems to improve health outcomes: WHO's framework for action. Geneva: World Health Organization; 2007.
6. Paalman M. Macroeconomics and Health Nepal Situational Analysis. Geneva: World Health Organization; 2004.
7. Birch S, Kephart G, Murphy GT, O'Brien-Pallas L, Alder R, MacKenzie A. Health human resources planning and the production of health: Development of an extended analytical framework for needs-based health human resources planning. J Public Health Manag Pract 2009;15 6 Suppl:S56-61.
8. Fooks C, Duvalko K, Baranek P, Lamothe L, Rondeau K. Health Human Resource Planning in Canada: Physician and Nursing Work Force Issues. Ottawa, ON: Commission on the Future of Health Care in Canada; 2002.
9. Eichler HG, Kong SX, Gerth WC, Mavros P, Jönsson B. Use of cost-effectiveness analysis in health-care resource allocation decision-making: How are cost-effectiveness thresholds expected to emerge? Value Health 2004;7:518-28.
10. Bloor K, Maynard A, Hall J. Planning Human Resources in Health Care: Towards an Economic Approach: An International Comparative Review. Ottawa, Ontario: Canadian Health Services Research Foundation; 2003.
11. Kazemian M. Economic policies and financing in health sector. Tamin J 2007;16:17-25.
12. Farzadi F, Aeenparast A, Maftoon F, Mohammad K, Montazeri A. Waiting time to visit an endocornologist in Iran: Shortage of workforce or inappropriate distribution of patients?. Payesh Journal. 2013;12(1):17-23.
13. Health Ministry of Iran. Health sector development's national document in the programs of economic, social and cultural development. In: Iran HMO, Tehran: Health Policy Council, Ministry of Health and Medical Education; 2011.
14. Central Bank of Islamic Republic of Iran. Central bank of Islamic Republic of Iran, economic time series data. 2010. Available from: http://tsd.cbi.ir/Display/Content.aspx. [Last accessed 2017 Mar].
15. Khanum S, Singh A, (World Health Organization). Integrated health systems strengthening: An operational framework. Geneva: World Health Organization; 2006.
16. World Health Organization. Tools for Planning and Developing Human Resources for HIV/AIDS and Other Health Services. Geneva: World Health OrganizationManagement Sciences for Health; 2006.
17. Bloom DE, Canning D, Sevilla J. The effect of health on economic growth: A production function approach. World Dev 2004;32:1-13.
18. Branson WH. Macroeconomic Theory and Policy.Tehran: Nashre ney; 1998. p. 1-808.
19. Mahboobi-Ardakan P, Mehraban S, Kazemian M. Estimation of aggregate consumption function of healthcare services in Iran in 1981-2011. J Manage Train Ind 2016;3:30-40.
20. Marandi A, Azizi F.Health in islamic republic of Iran. Tehran: WHO Publication; 1997.
21. Barati A, Ghaderi H, Hajhasani Z. Study of household's basket of consumer's consumption of health care services in Kerman. Payesh J 2006;5:105-11.
22. Taghvaei M, Shahivand A. Distribution of health care in Iran cities. Soc Welf J 2010;10:33-54.