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**PUBLIC HEALTH, HUMAN CAPITAL,
AND ECONOMIC GROWTH:
THE CASE OF TURKEY**

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The material included in this thesis has not been submitted wholly or in part for any academic award or qualification other than that for which it is now submitted.

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ABSTRACT

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PUBLIC HEALTH, HUMAN CAPITAL AND ECONOMIC GROWTH: THE CASE OF TURKEY

Human factor in the development of countries stands out. Thus investments of human capital and evaluation of these investments are significant policies. Stock of human health capital can be got by measuring preventive care services, cure services and nutritional status in uterus and during their lives.

Health systems include the components of public health departments, hospitals and clinics. The role of public health in economic growth has increasing importance. This is connected with the fact that the role of human factors is expanding in the knowledge-based economy – a type of economy which all advanced and rapidly growing economies like Turkish are moving to. This makes the study of the link public health – economic growth more and more interesting object of the study.

In the recent surveys close relationship is observed between the economic growth and human capital potential to accelerate development. Our study is aimed at seeking the role of human capital and in particular the health capital of Turkey in the economic development for the next decades. Our attention is concentrated on the role of the health public and private (households) investments in Turkey from the macroeconomic and microeconomic perspectives. As at present serious gap between regions is clearly observed. The study is envisaged to outline the future projections about the Turkey's health situation and investment in the next decades.

Key words:

Economic Growth, Public Health, Human Capital

KISA ÖZET

Alperen Mehmet AYDIN

Temmuz, 2009

KAMU SAĞLIĞI, BEŞERİ SERMAYE VE KALKINMA:

TÜRKİYE ÖRNEĞİ

Ülkelerin gelişim sürecinde insan faktörü öne çıkmaktadır. Bundan dolayı beşeri sermaye yatırımları, bu yatırımların verimli kullanılması, ve değerlendirilmesi için kayda değer şekilde politikalar geliştirilmektedir. Sağlık beşeri sermaye stoğu hesabı yapılırken önleyici sağlık hizmetleri, tedaviler ve bireylerin beslenme durumları gözönüne alınır.

Kamu Sağlığı halka açık sağlık kurumları, hastaneler ve klinikleri kapsar. Bu artış Türkiye'nin ekonomisine benzer ekonomilerde de görülen, hızlı büyüme gösteren bilgiye dayalı ekonomilerdeki, insan faktörlerinin etkisiyle bağdaştırılmaktadır. Bu da halk sağlığı ve ekonomik büyüme arasındaki ilişkiyi daha ilginç bir çalışma konusu yapmaktadır.

Yakın zamanda yapılan araştırmalar göz önüne alındığında, ekonomik gelişme ve beşeri sermaye potansiyeli arasında gelişmeyi hızlandırabilecek bir ilişki gözlenmektedir. Bu çalışma, ileriki yıllardaki Türkiye'nin beşeri sermayesinin ve sağlık sermayesinin ekonomik gelişmeler etkisini incelemeyi amaçlamaktadır. Türkiye'deki kamu sağlığı ve özel yatırımların rollerinin makroekonomik ve mikroekonomik perspektiflerden değerlendirilmesi çalışmanın asıl odak noktasıdır. Bölgeler arasındaki ciddi farklılıklar açık bir şekilde gözlenebilir. Bu çalışma ileriki yıllarda Türkiye'deki sağlık durumunun ve yatırımlarının gelecekteki öngörülerini tasarlamak için hazırlanmıştır.

Anahtar Kelimeler

Ekonomik Büyüme, Kamu Sağlığı, Beşeri Sermaye

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LIST OF ABBREVIATIONS

ASR	Adult Survival Rate
BMI	Body Mass Index
GDP	Gross Domestic Product
IMR	Infant Mortality Rate
LDC	Less Developed Countries
LE	Life Expectancy
MoH	Ministry of Health
OECD	Organization of Economic Cooperation and Development
RSHCPSPH	Refik Saydam Hygiene Center Presidency School of Public Health
TUIK	Turkey Institute of Statistics
UNDP	United Nations Development Program
U5MR	Under Five Mortality Rate
UN	United Nations
UNICEF	United Nations Children's Fund
UNR	United Nations Report
THR	Turkish Health Report
WB	World Bank
WHO	World Health Organization

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INTRODUCTION

Within the second half of the 20th century, health gained quite importance. Countries started to invest on health services that generate more healthy generations. Human capital accumulation increased sharply in the western world. So many researches have been done to investigate the link between health human capital and economic progress of the nations. By these two determinants nations develop.

International health statistics institutions publish annual health reports to indicate annual changes in the health conditions of the nations. Moreover, every country has national health statistics institutions to investigate the annual changes and has long run planning according to new conditions. National statistics, like Turkish health statistics, indicate the detailed information about each region's or each province's health data. These statistics include life expectancy changes during years, infant mortality rates, GDP per capita, health workforce density in each of the regions etc.

Economic growth and life expectancy and mortality rates are found to be correlated strongly in many of the researches. The recent literature explains that economic growth fosters the life expectancy and health quality, and some claim that amendment of the health conditions of the citizens has quite contribution to the economic growth. From the beginning of the 90's health has been enunciated as a growth factor more than previous times. In the 90's Barro, Lucas, Romer mentioned health as a growth factor and it has strong impact in the human capital.

Though health was discussed by early researchers Becker, Mincer and Grossman, who are pioneers with establishing the health human capital model; the notion of health human capital takes place in the academic works less than its importance. The human capital as a growth factor is taken as only the education and education investments of the individuals.

Most of the studies are done by Barro, Weil, Lucas, and Kalemli-Ozcan in the different countries. They mostly have surveys in the African countries; the results of the surveys indicate the lag situation caused by low healthy status. Hence, we realized that health is not only a growth factor; countries do have policy implications and fairly distribute the health sources among regions; it is a threshold for start to establish a developed nation. The samples are the European countries and the USA. In these kind of countries, being healthy is not endowment of the state, it is a human right that is mentioned by WHO. Besides these cases, we obviously see that after the membership of the EU, new countries have accelerated rate in the life expectancy and decreases occur in the mortality rates. This case pushes the economic growth since people became more patient to have long run investment and lowers the loss of workdays by increase in the health service quality.

In Turkey MoH is the main body about the public health activities and it has investments in different regions of the country. It establishes hospitals, cottage houses and the other health institutions like research and development institutions. Public health has broad area and main purpose of it is to promote the life quality of the individuals. Hence, the improvement of

the health quality will have some positive impact on the growth of the economy so this case will positively influence the wealth of the nation.

We noticed that, while researching Turkish literature, the researches on the health human capital link to economic growth is too poor. The works done in the recent years doesn't take health as an economic growth factor, they investigate how health investments increase by the economic growth or what are the economic growth contributions in the life expectancy and mortality rates. Here we take the health as a considerable element of the human capital and in the analysis we will seek for how much it contributes to economic growth. Besides this, we will seek if the health improvement and growth have a corresponding relation.

In our work we will have statistical analysis of the distinguished regions of the Turkey with taking into consideration the factors like life expectancy rates, infant mortality rates, health investment of the state, health expenditures and income per capita progress of the each province.

PART I

THEORETICAL BACKGROUND

This study starts with the brief description of human capital, and public health. We will mention about the link between public health, human capital, and economic growth. The recent papers will be discussed and early researches will be taken into consideration, in chapter 1, to grasp the issue more comprehensively. The theoretical background with Grossman health capital model, the aggregate economic growth model with human capital, and stochastic model are introduced in chapter 2.

CHAPTER 1

THE CHAIN BETWEEN HEALTH, HUMAN CAPITAL AND ECONOMIC GROWTH

1.1 Scope and Purpose of the Study

Health is the main capital of the human beings and healthy being are the capital of the nations in the long run period. The physical capital importance in the growth models sometimes are not given to the human capital as well. There are lots of economists whose research areas are capital accumulation, capital flows etc., but not many of them discuss human capital issues in their works. Health is vital for quality of the life with the other human capital issues such as education etc. The health systems and the health impacts on the economy is a broad research area and every year United Nations (UN), World Health Organization (WHO) and countries local health bodies prepare reports for projecting the health status of the households and preparing new precautions for prospective threat that will hurt the public in the near future. In Turkey the main body of the health services provider, Ministry of Health (MoH), prepares annual reports about the regional health statistics, diseases, mortality rates and nutritional status of the households. These reports include the specific health statistics of each provinces. MoH is the responsible body about all of the health services and it manage the health system in Turkey via its different bodies in provinces to

villages. MoH bodies are hospitals, health houses, clinics and the staff of these various institutions.

In the World Health Organization's (WHO, 1990) definition, a health system is "all the activities whose primary purpose is to promote, restore, or maintain health.". Health systems include the components of public health departments, hospitals and clinics. The role of public health in economic growth has increasing importance. This is connected with the fact that the role of human factors is expanding in the knowledge-based economy – a type of economy which all advanced and rapidly growing economies like Turkish are moving to. This makes the study of the link public health – economic growth more and more interesting object of study.

In the recent surveys close relationship is observed between the economic growth and human capital potential to accelerate development. Our study is aimed at seeking the role of human capital and in particular the health capital of Turkey in the economic development for the next decades. Our attention is concentrated on the role of the health public and private (households) investments in Turkey from the macroeconomic and microeconomic perspectives. As at present a serious gap between regions is clearly observed, the study is envisaged to outline the future projections about the regions health situation and investment in the next decades.

Another aspect of the study is to analyze the role of social security system on public health, hospitals, doctors and nurses per thousand of population. It is expected to explain the close relation between public health

and the development as result of the influence of the social security system. Health inputs and the outputs, various health indicators, will be testing for explaining the influence of public health on human capital and thus on the economic growth of Turkey.

Causality tests and the regression analysis are expected to show if they really have impact on the growth or how they influence the growth rates and other aspects of development. Comparative analysis between the European Union (EU) countries and Turkey; and the Organization of Economic Cooperation and Developing (OECD) countries and Turkey will be helpful to present more comprehensive picture of the problems using data from the TUIK Statistic Pages, the UN and the WHO statistics.

We expect to have three contributions to recent literature. Firstly, the findings of the impact of health on economic growth of Turkey and results of the analysis will help us to see Turkey's growth potential for the next decades. Secondly, the results of the analysis are expected to facilitate the future projections and new policies' mechanisms to improve public health in underdeveloped regions of Turkey. Thirdly, the applied econometric models are supposed to present more exact qualitative and quantitative estimations of the link between public health and human development, productivity and the growth of GDP in Turkey.

In summary, the study is planned to prepare a map of Turkey's human capital potential from health stock view and to discuss if this potential is

sufficient for the economic growth of the next decades and would we inherit a capital, health human capital, for next generation.

1.2 A Brief Description of Human Capital

Human capital perceived as the stock of skills of labor force, knowledge capabilities of labors, cognitive and functional capabilities, the health status of labor and analogous indicators related to these indicators. For further classification competency, leadership, social skills and employee motivation can be added to human capital indicators for searching according to human resource management.

Concept, human capital, discussed while mentioning the modern economic theories first, in the work of Adam Smith. He discussed four types of capital: i) machines for production, instruments in use for the trade; ii) buildings for revenue; iii) land for use; and iv) human capital.

"Fourthly, of the acquired and useful abilities of all the inhabitants or members of the society. the acquisition of such talents, by the maintenance of the acquirer during his education, study, or apprenticeship, always costs a real expense, which is a capital fixed and realized, as it were, in his person. Those talents, as they make a part of his fortune, so do they likewise that of the society to which he belongs. The improved dexterity of a workman may be considered in the same light as a machine or instrument of trade which facilitates and abridges labour, and which, though it costs a certain expense, repays that expense with a profit (Smith, 1776: 493)."

Smith mentioned human capital as skills, talent and dexterity. After Smith, in 1900's the term 'Human Capital' was not much more discussed in the papers until it was first discussed by Arthur Cecil Pigou, that he took the human capital as an investment in human beings as well as investment in material capital (Lopez-Casasnovas et al., 2005). He discussed the relationship between economic growth, production function and the productivity of the workforce regard to the per capita monetary returns. His works were all on the employment relation and human capital of the labor. After these attempts Mincer (1958) and Becker (1964) had a pioneering study on the topic. According to Mincer's study, human capital in economics is that human capital has similarity to physical capital, eg. factories and machines, and furthermore, one can invest in human capital via education, training, and medical treatment. Additionally, he discussed about outputs of the human capital investments that they are the rate of return of the investments. Hence, he interpreted that how much one invests in human capital will have higher rate of return. Becker in his early paper proposed that education promote economic growth, moreover the rate of return on the educated people is significantly observed by the high rate of the returns. His issues are about training of the labor power such as on the job training and the general training programs and standart education of the labor in formal education institutions.

Furthermore, knowledge is another component of human capital. Knowledge as the term has specific characteristics. The features of the knowledge based on human capital, that are unlike physical capital and sole labor power, it is improved with time, shareable, expandable and self generating. The accumulation of knowledge can be generated by sharing among individuals and it is transferable among individuals. Moreover, this transfer does not prevent its use by the original generator of the knowledge or the generator of the idea.

Schultz (1997) discusses the human capital in five forms. These types are distinguished and may have impact, most probably increase the life time productivity of an individual. Each of them has specific rate of return depending on the technological progress of the society and income of the households. The first and the main health human capital indicator is childhood nutritional status, which has quite large effects in the future life of the individuals and is cumulatively measured by early physical growth, body mass index of children and development, such as height for age and weight for age. Child nutritional status has strong impact on the adult productivity. Beside the improving adult productivity, childhood nutritional status enhances the school performance of the children. Hence, this paces the expected rate of return in the future. The second form is schooling. Children start school at different ages, i.e 6, and continue for different number of years. The enrollment rate on human capital investigated and it is accepted

that the schooling rate, human capital accumulation and economic growth are exactly correlated. The third one is migration. This kind is discussed in the Schultz papers as the migration of the individuals that have graduated from high schools or more. This manner reveals that individual that have more years enrolled to school migrates to the other places than birth place, this third one reveals that the more educated people migrated cities economic growth and development pace is higher than the others due to the human capital accumulation rate. The human capital accumulation conveyed to these new places by migration. The fourth one is fertility. This manner is related to women. The avoidance of the unwanted fertility will enhance the women productivity in the labor market. Hence the women participation in the workforce will rise. When thought individually, most of the women get out of labor market after the birth for several years. Unless they want to come back, it took a few years. The fifth one is the Body Mass Index (BMI) which is related to individuals current health status. BMI has huge impact on the productivity of the individual. It is shown that BMI contribute to the wage of the individuals (Grossman, 2007).

After 1990's health started to take place more than before in the human capital definitions, and nutrition stronger than before by following the early studies of Becker (1964) and Mincer (1958). 1990's human capital researchers are Barro (1996) and Barro and Sala-i Martin (2004) perceived the human capital term as education, training, and health. Also in their

researches they divided these part into several sub parts such as BMI, length for age, weight for age of the children, menarche age of the girls, fertility rates, mortality rates, the healthy life time and life expectancy in years at the birth.

Health human capital issue mainly focuses on the implication of health status of the individuals and nutrition of them. Chakraborty (2004) suggests that health plays an important role, quite unlike any other human capital, by increasing life spans, it makes individuals effectively more patient and willing to invest since the extended life expectancy, and by reducing mortality risks, it raises the return on investment.

Since health is a component of human capital, by investing in health during the life cycle, the utilization level can be increased by the increase of the gains caused by health, eg. higher wages, higher life expectancy rates, work loss by illness days.

Health capital is inherited from the previous generation, parents, and it depreciates by a reasonable rate during the life cycle. During the life cycle, the depreciation rate increases after some ages, thus people need to have health investment such as medical care activities, cure activities more than previous ages. After some ages the stock of the health capital falls under a certain level so that individuals die. Before death occurs by the depreciation of the health capital stock, people determine the length of their life by having health precaution activities or vice versa. While we take the depreciation rate level of health capital stock, such activities -in other words health inputs of

the individuals -medical care services utilization, mother nutrition, genetic endowments of the parents, nutrition in fetus, childhood nutrition, precautions against infectious illnesses, exercise, smoking, drug consumption, alcohol consumption- accelerate or slow down the depreciation rate of the health capital (Schultz, 1997; Barro, 1996).

1.2.1 Human Capital and Education

Human capital is the attributes of a person that are productive in some economic context and the set of skills which an employee acquires in the formal education, on the job, through training and experience, and which increase that employee's value in the labor market. Mainly refers to formal educational attainment, with the implication that education is investment whose returns are in the form of wage, salary, or other compensation. These are normally measured and conceived of as private returns to the individual but it includes also the public and social returns.

To build a modern nation, the starting point is the investing in the human beings and ensuring the accumulation of the human capital. The developing countries vital suffering point is the lack of the well educated labor force. We just have look to some Asian and African countries. The natural sources and the reserves of the natural sources are not only sufficient for these nations to develop because they have not got well educated labor force, they can not converge the physical capital to value added products therefore the life standards stay low. As can be seen in the annual reports the development indicators are worse such as education

levels, life expectancy rates, infant mortality rates etc., this case indicates that initially start with investing on people to improve economically and socially. The non-physical capital, human capital, has effective role in the growth process of a nation. The human capital of a nation is the wealth of it. For further discussion we see that, the changes in the human capital directly affect the economic growth. And so, as the Solow model indicates, this movement pushes the GDP per capita of the nation upper.

Education is the key factor to create, and spread knowledge and accordingly it is fundamental for providing quality to human life and ensure progress (HDR, 1997).

When human capital is taken into consideration according to business view it is *"an organizational context, human capital refers to the collective value of the organization's intellectual capital (competencies, knowledge, and skills) (www.businessdictionary.com) ."*

1.2.2 Definitions of Public Health

Health of the individuals, or the society, relies on the physical, psychological and mental functions. It has many distinguished meanings varying through situations, time, and regarding to the scope of the field. When thought individually or in the society, there are many intrinsic, extrinsic, cultural, and socio-economic forces have role in the public health. Public health is *"the science and art of preventing disease, prolonging life and promoting health through the organized efforts and*

informed choices of society, organizations, public and private, communities and individuals (Winslow, 1920: 4)."

One of the core aim of the public health is the common attainment of the highest level of physical, mental, and social well-being and longevity consistent with generating knowledge and resources availability at a given time and place (WHO, 1948). This goal is to have contribution to the society and life of the individuals. World Health Organization (WHO) defines health, by extending the scope of it, as a state of ensure physical, mental and social well-being and not merely preventing the only the diffusion diseases. In conformance with the amendments in the medical and the scientific knowledge, public health has expanded from its original context, that Winslow mentioned in 1920, from physical environment and sanitation to individual, social environment, preventive medicine and ensuring comprehensive health services for all citizens (in James, 1984). Public health is typically divided into health services, epidemiology, and statistics of the health activities and statistics of the health status of the community.

As Winslow enunciated in 1920: *"Public Health is the Science and Art of (1) preventing disease, (2) prolonging life, and (3) promoting health and efficiency through organized community effort for*

- a) the sanitation and care of the environment,*
- b) the control of infections*
- c) the aware of the individual in personal hygiene*

d) the medical and nursing services for the early diagnosis and preventive cure activities against diseases

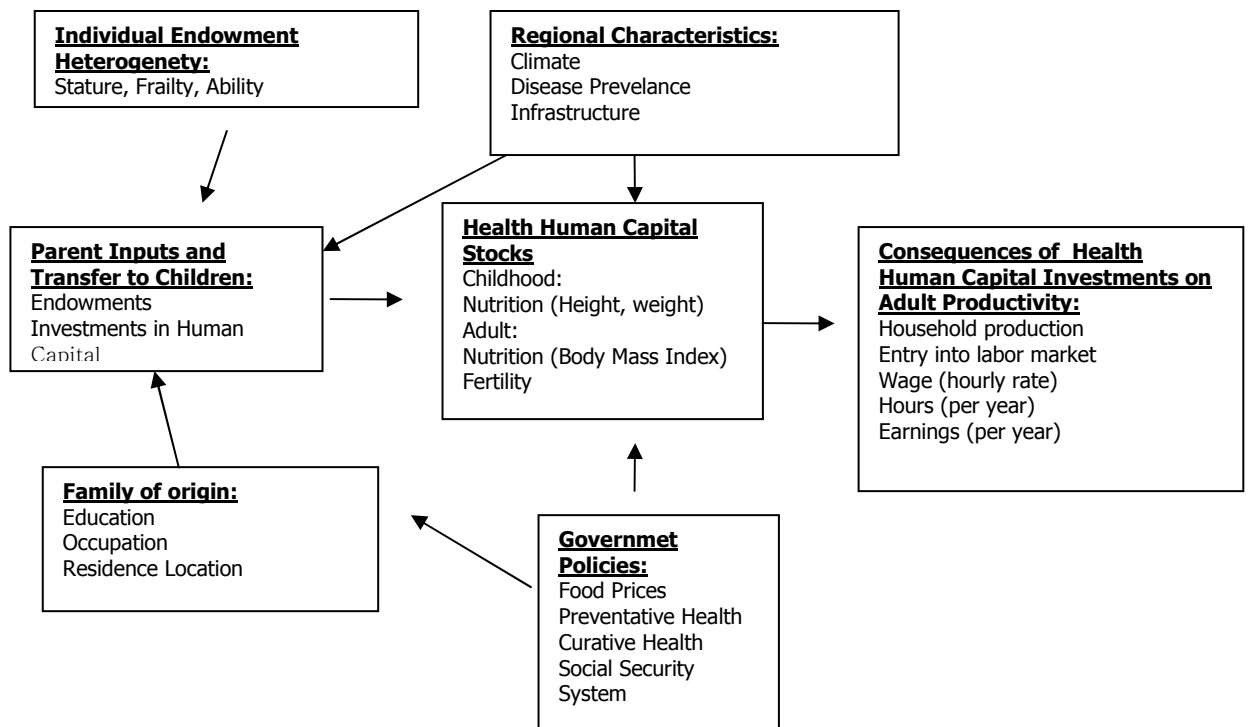
e) the development of people in the community.” (in James, 1984:4).

1.3 The Chain between Health, Human Capital and Economic Growth

As health perceived a one of the main determinant of the human capital, considerably it is thought that it has link to economic growth as taking into consideration the link between human capital accumulation and the growth. Health human capital diagram (Figure 1.1) illustrates the health inputs and consequences of health human capital investments including family factor, regional factors, and government factors. Figure indicates relation between health investments and its effect on adult productivity. It mentions an individual's health status. Initially diagram flow starts with parental inputs and the transfer of these inputs to the children. Endowments, investment of parents on their children health, and some funds for their future utility in the unexpected health problem times are family health investments for children. Here we see the health can be inherited from family, not only the physical possessions. The one kind of parental endowments are stature of them and frailty of them. These determinants transferred to children geneticly and these are inheritance for the children. In

this kind of flow, we can see the overlapping situation, that the parents also procured these endowments from their parents.

FIGURE 1.1 CONSEQUENCES OF HEALTH HUMAN CAPITAL INVESTMENT ON ADULT PRODUCTIVITY.



Source: adopted from Schultz, (1997).

Health insurance funds, education about the health, awareness of health care activities during childhood and nutritional intake of children in perinatal period, infant period, and childhood period have quite impact in the adult ages.

Family of origin is another factor for health. Education level of the parents is important since the highly educated parents are aware of the illnesses and they have precautions before the illnesses. Moreover, they teach to their children about care activities. Occupation of the parents is

about to gain adequate income for nutrition of the family individuals and another important part is to have investment for health fund to use in the unexpected illness times. Residence location is another factor about family. The location is important for the distance of the health service providers. If they live in the rural areas, they have difficulties to access the health services or health institutions. Therefore, one of the immigration from rural areas to urban areas reason is the difficulties in access to the health institutions in the time of illnesses. Or the other alternative is growing the children with lack health services.

Related to residence location of the family, regional characteristics have impact on the health with the factors of climate, disease prevalence and the infrastructure. The climate is about to be so hot and so cold. In the hot places mostly disease prevalence is accelerated by the hot weather and some kind of diseases come into action. For example malaria have high prevalence in these climates. Infrastructure is about the geography and in some areas the government cannot be successful while supplying health services since the hard conditions of the regions.

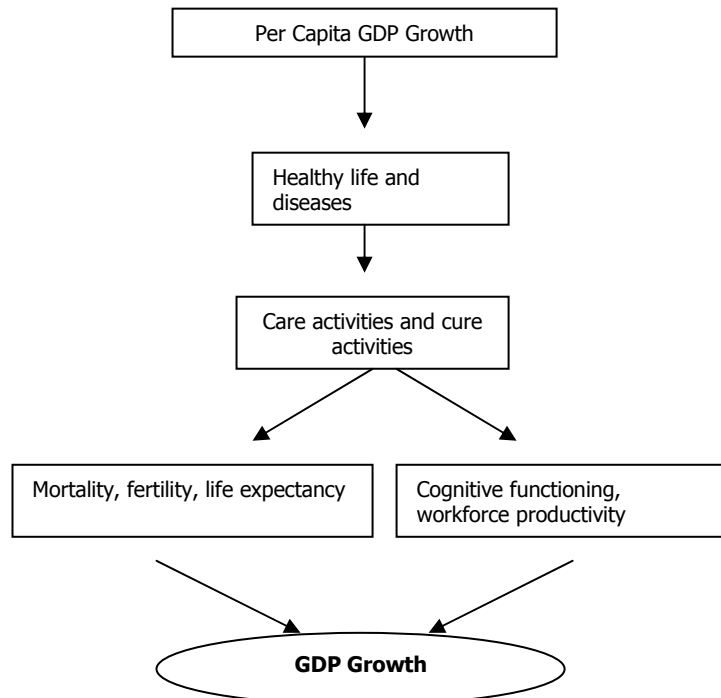
Government policies have impact on the food prices that has impact on the nutritional status; health service provider's preventative health services and curative health services in the institutions such as hospitals, cottage houses, etc. Social security system is controlled by the government and the effective and efficient use of the funds determine the quality of the health

services and the allocation of the collected funds among regions avoid the lag situation of different regions in the country.

As mentioned above, these five factors determine health human capital stock. Accordingly, the health human capital stock is measured by the nutrition of the children, BMI of the adults and children and the fertility of the adults. The economic consequences of health human capital stock are household production, annual earnings. The quality of life is also another non economic consequence of the healthy body.

Within the consequences of the health human capital investments we will look for the link between individual productivity and its effects on the GDP growth. Figure 1.2 illustrates the relation between health and GDP growth from two sides. First proposition is that the GDP level effects on the health status and the second is the health has effect on the GDP growth. In the analysis part we will seek to answer these two propositions via statistical and causality analysis if they have one side relation or correspondingly related.

FIGURE 1.2 GDP GROWTH AND THE HEALTH DIAGRAM.



Source: adopted from Bloom et. al, (2004); Barro, (1996); Kalemli-Ozcan, (2002).

1.4 Recent Papers on the Topic

Human Capital investments have long term effect on the economic growth. By means of the production function we may combine land, labor, capital, and in human capital education, training, skills of people, and health investments. Accordingly, to take into consideration the importance of long term economic growth and human development, they are stimulated by technical progress -itself the product of increased health, education, and training- increased health can have contribution to the growth rate of income through technical innovation (Brempong & Wilson, 2004). Health capital increases the efficiency and productivity with which individuals produce education.

An expanded neoclassical growth model was used by Brempong and Wilson (2003) to seek for the influence of the health human capital on economic growth and they found that human capital is the most important factor determining growth. At micro level, several studies show a strong link between health human capital and labor productivity. Schultz (2003) discussed effect of health on productivity, wage function and any other financial gains generated by the health. Also, he analysis the health human capital in exogenous or endogenous growth models to view the effects in macro level. Historical and contemporary studies in low-income and high-income countries demonstrate that health and nutritional status influence labor productivity per unit time worked, and supply of labor per year to market (Schultz and Tansel, 1997).

Alsan, Bloom, and Canning (2004) suggest that the importance of the health as a consumption good, health can also be viewed as a form of human capital that enhances economic performance, both for individuals and for whole society. In their survey they calculate the effect of population health on gross inflows of foreign direct investment. Between 1980 and 2000, they found that gross inflows of foreign direct investment are strongly and positively influenced by population health in low- income and middle-income countries. After controlling for other relevant variables they suggest that raising life expectancy by one year increases gross foreign direct investment inflows by 9%. These results are the view that health is a strong determinant in the development and growth process.

Alsan et al. (2001), suggest that countries may benefit to different degrees from health. Many evidences have demonstrated that population health is a robust predictor of growth in per capita income. Bhargava et al. (2001) argue that economic growth is resulting from health improvements and the investment in nutrition status of individuals from perinatal period to whole life time.

In World Health Statistics (2007), with the evaluation of 193 member states, the African countries suffer of low healthy conditions and lack of sufficient health investments. The malnutrition of the infant and the malnutrition of the mother in the pregnancy period, the children are under weight born and low height born. In the following years this case proceeds. In their future life time, their body would be less resistant against the diseases and would be fragile. The HIV, aids, malaria viruses are the main cause of the early deaths. The lack of medicine and doctors and health care services cause high rate of child mortality. UNESCO reports indicate the ratios of the life expectancy, under five mortality rate, HIV prevalence and water sanitation of the nations. According to these data, they rank the nations developmental situations. For instance, Norway's life expectancy rate was 79,3 under five mortality rate was 0,4%, HIV prevalence was 0,1%, water sanitation was 100%; in same order number are for Japan: 82, 0,4%, 0,1%, 100%; for Finland: 79, 0,6%, 0,2%, 100%; for Turkey: 69, 0,8%, 0,1%, 96%; for Iran: 70, 0,8%, 0,2%, 96%; for Zimbabwe: 38, 12,9%, 20%, 81% (WHS, 2007). Schultz (2003) found in his surveys that child

mortality rate is the best indicator with considering the health human capital level of the countries since it indicates the health provider quality of the countries, the easy access of health bodies services by the all individuals, and the country-wide public health education programs quality that make the community aware against diseases.

The empirical studies in African countries indicate that the low productivity of the labor force is influenced by the low investments in human capital. One side of this is the lack of vocational education and the other side is the lack of health investments. Brempong and Wilson (2004) studied the effects of health human capital on the growth rate of per capita income in Sub-Saharan African countries and in OECD countries. They suggested that high levels of per capita income expectation of the nations can be available by increasing the stock of health human capital. For long run, sustainable growth, the nations have to balance the capital stock investments by the human capital investments.

In micro level the discussions are concentrated on the investments in labor health and the individual's health contribution to market activities such as productivity. Healthier workers are physically and mentally more energetic and robust; they are more productive and have high rate of returns (Bloom et al., 2004).

The social security system affects the labor force and the employer. The social security systems and the impacts on the labor market is discussed by the Warshawsky (1997). Social security system includes health care services,

accordingly it hedge the risk of high cost of illnesses in unexpected times. By the risk hedging via social security systems the returns of the worker increase and the returns such as wages, salaries became smooth in the life time. Careful statistical methods have indicated that a large part of the effect of health on raising earnings is due to productivity differences (Todaro and Smith, 2006). They investigated that formal public health measures have played a very important role in developing countries. Since health systems performance varies according to countries, the role of it as an accelerator of the growth differs among countries. For instance in welfare states such as Norway, Iceland, Finland and in many European countries the system run appropriately, hence, it stimulate the growth, but in the low-income and middle –income countries it is all opposite due to the poverty.

"A trap that has tragic consequences because poverty cannot be eradicated without dealing with the health issues of the poor, and these health problems, in turn, will not be fully solved until poverty is eradicated. Poverty affects health through many different channels. First, and most obviously, poor people (and poor countries) do not have the material resources, the money necessary to buy health care: they cannot afford prevention before the disease appears and they cannot afford doctors and Moreover poor people are likely to be unhealthy and malnourished (Sala-i-Martin, 2005:95)."

CHAPTER 2

HEALTH AS AN ELEMENT OF HUMAN CAPITAL

2.1 Basic Models of Growth with Human Capital

The production function in the modern economic theories includes two kinds of capital stocks, one is the physical stock and the other is the human capital stock. The human capital entered in the growth theories and into the production function with discussions of the Adam Smith and classical model. Then neoclassical models had discussions on the human capital stock and accumulation of it. Not only human capital is discussed in the economic theories, it is also discussed in the social theories by the various academics but in our dissertation we will focus on the human capital role, especially health side, in the economic growth models.

2.1.1 Economic Growth Theories and Their Relation to Human Capital

The modern economic growth theory has become discipline with the Adam Smith's *Wealth of Nations* that was written in 1776. Elements that construct the pillars of the modern economic growth theory have their origins in the classical economics works. After *Wealth of Nations*, David Ricardo in 1817, and Thomas Malthus in 1789 have works on wealth and economic growth. At the beginning of 1990's, Frank Ramsey, Allyn Young, and Joseph Schumpeter developed new models that explain competitive behaviour and equilibrium dynamics, the role of increasing returns, and economic progress

(Lopez-Casasnovas et al., 2005). The other important contributions came from Solow (1956), and Swan (1956). These works were named neoclassical growth model. But by using the neoclassical model, technological progress was not well explained. Neoclassical model was unsuccessful in explaining the long term growth because they take the technological progress exogenously and diminishing returns to capital has limited the analytical capacity of neoclassical model and its empirical calibrations (Howitt, 2005). The quite gap between welfare states and poor countries inspired the researchers to look for endogenous economic growth theories. These new studies explained the long term growth by taking the technological progress into consideration endogenously.

At the beginning of the 1990's in large number of studies have been done to identify the determinants of economic growth. The economic growth variables tested and revised by new surveys. Economists added new variables to the economic growth factors to well define the trends in the long run and so that they were able to explain long term growth significantly by endogeneity of the variables. The role of human capital discussed in these endogenous models. Human capital was regarded as the educational level of the individuals in the first papers but then by the new analysis it was divided into several categories. Nowadays, human capital is regarded as the combination of health status of individuals, education, training, cognitive functioning, and other personal capabilities. Without taking human capital into consideration, it is impossible to explain long term economic growth.

The recent paper of Ehrlich (2007) is about the United States and its role in the world economy as a super power. He suggests that human capital stock of United States is the engine of its economic growth. Lack of the educated labor force and healthy labor force, countries become incapable of maintaining a state of long term economic growth. Hence, low level of human capital is a strong barrier to economic development. Any country aims to gain competitive advantage, among the others, have to be aware of the human capital formation.

2.2 Public Health in the Economic Models

Till the beginning of the 1990's, mainly human capital was regarded as the components of human training and education. Becker, and Mincer are the earlier researchers of the health human capital in 60's, but they did not wholly explain health as the considerable contributor of the endogenous growth and the supporter of the long run economic growth (in Grossmann, 2007). The health human capital model contains two models: pure investment model and pure consumption model (Grossmann, 1972), including health, and explained the health inputs impact on the individual productivity, wage rentals and the long run rate of returns to community and the depreciation of the health capital in the life time (eg.). Fundamentaly, the discussion of the human capital theory within the analysis and the researches of Mankiv, Romer, and Weil (1992), that the other factors such as health, human skills, and cognitive functioning contribution to human capital, occured. Furthermore, health became a significant issue in the economic

growth models. The other initial researchers that focused on health while they are seeking to explain endogenous economic growth factors are Fogel (1994), and Barro (1996). They were among the first in examining the relationship between economic growth and health, and their research has almost accelerate to work on establishing a chain between wealth and health to explain endogenous factors of economic growth.

Nowadays, it is precisely accepted that health of the nation is the wealth of it. Better health status of the people increases workforce productivity; reduce uncapability, debility, the lost days caused by illness; and pretend the body from pathogenic illnesses; individuals are more patient for long run investments due to the extending life time that we see by the increase in the life expectancy. Moreover healthier workers earn higher wages and healthier children's school attendance is affected positively and improves their performance (Grossman, 2007). Additionally researches are continue on the issue about the health human capital, the health care and cure activities. By the causal relationship, recent studies prove that good health generates economic growth in the macroaspect and high performance, productivity and high income in the microaspect. On the other hand, vice relationship occurs that high income, wealth generate better health. Income is crucial for better health. Improvements in the health technology and health care activities facilitate an increase in the consumption of these health care goods. This is possible by the high level of income. Policy interventions to motivate the families to invest in human capital are

discussed by Schultz (2003). He expressed that the wage opportunities induced the human capital investment of the families both schooling rate increased and the health investment of the families increased. Within the second half of the 20th century, an increase in the income, in the most of the regions in the world, generates higher expenditures on the nutrition of the children and health care activities. Hence, this situation maintains higher life quality.

The modeling of the health human capital via the Cobb-Douglas aggregate production function by Shastry et al. (2002) stressed on the some illnesses those directly affect the life and the outcomes of them. Within the ln value of the health capital, education and physical capital, he found that health variation explains 19 % of the output variation when he puts adult survival rate (ASR) in the ln mode of the per capita equation.

The mortality rate and the fertility rates are the other composition of the health. Kalemli-Ozcan (2002) established a stochastic model with fertility rates and mortality rates that has impact on the economy. She reached the conclusions that by endogenizing mortality in the general equilibrium model, population growth becomes a hump shaped function of income per capita, therefore at low levels of income per capita population growth rises as income per capita rises. This case leads to dilution of the resources, moreover resulted with lower income per capita in Malthusian steady state. At the steady state the fertility rate is high but on the other hand human capital investment is low. In the vice versa situation, high levels of income

per capita results lower fertility and lower population growth but higher investment in human capital. Hence the sustainable growth is achieved in the long run period.

2.2.1 Grossman Model with Health Capital

Grossman (1972) is the pioneer one who constructs a model to explain the demand for health capital. He proposed that if increases in the stock of health occur, the increase in wage rate of individuals occurs. He has two approaches about the health model: pure consumption model and pure investment model.

According to human capital theory, increases in a person's stock of knowledge or human capital raise his productivity in the marketplace and resulted with acceleration of economic progress in the aggregate level, where he gain money earnings, and in the nonmarket or household sector, where he produces commodities that enter his utility function. In particular Grossman argued that a person's stock of knowledge affects his market and non market productivity, while his stock of health determines the total amount of time he can spend producing money earnings and commodities.

In his health model, he defined broadly the model including longevity and non-illness days in a given year. Health is demanded and produced by consumers.

Health is perceived as choice variable because it is a source of utility and because it determines income or wealth levels. In the preference function health takes place in two ways. First as a consumption commodity,

that directly enters their preference functions, or sick days are a source of disutility; second as an investment commodity, that is determined the total amount of time available for market and nonmarket activities. The reduction in the illness days increases utility, satisfaction, the monetary returns and productivity (Grossman, 2007).

Let the intertemporal utility function of a typical consumer be¹

$$U = U(\phi_t H_t, Z_t), \quad t = 0, 1, \dots, n \quad (1)$$

Where H_t is the stock of health at age t or in time period t , ϕ_t is the service flow per unit stock, $h_t = \phi_t H_t$ is total consumption of health services and Z_t is consumption of another commodity. The stock of health in the initial period (H_0) is given; it is notable that health stock at any age other than initial period is endogenous. The length of life of an individual represented by n and it is endogenous same as the health stock except initial period. Particularly death occurs when the stock of health capital at any time t became lower than the treshold point ($H_t < H_{\min}$). That the minimum health capital stock is mentioned about this treshold value of the health conditions and stocks individual should maintain life such as mental activities, physical activities and so on. Thus, the health capital determines the life period and life time to maximize utility subject to constraints. Net investment in the stock of health equals gross investment minus depreciation:

$$H_{t+1} - H_t = I_t - \delta_t H_t \quad (2)$$

¹ The model taken from Grossman, (2007). The Human Capital Model.

Where I_t is gross investment and δ_t is the rate of depreciation during the period of t , $0 < \delta_t < 1$. the rates of depreciation are exogenous but depend on age. Consumers maintain gross investment in health in the utility with the other commodities. The household production functions are:

$$I_t = I_t(M_t, TH_t; E), \quad (3)$$

$$Z_t = Z_t(X_t, T_t; E). \quad (4)$$

M_t is the vector of inputs purchased in the market that contribute to gross investment in health, X_t is a similar vector goods inputs that contribute to the production of Z_t , TH_t and T_t are time inputs, E is the consumer's stock of knowledge or human capital exclusive of health capital.

Grossman (2007) assumes that an increase in knowledge capital have amendments in the efficiency of the production process in nonmarket or household sector, in increase in technology enable improvements in the efficiency of the production process in market sector. Also the other assumption of him according to equation 4, is that all production functions have own time inputs. The sick time and the loss of work by equations:

$$TW_t + TH_t + TL_t + T_t = \Omega \quad (5)$$

$$TL_t = \Omega - h_t \quad (6)$$

Where TL_t is time lost from market and non market activities due to illness and injury. The equation (5) modifies the time budget constraints in allocation of time model. Therefore, the addition of the total sick time to the market and non market time reveals the use of time efficiently. The inverse relation between sick time and health capital stock can be formulated as:

$$\partial TL_t / \partial H_t \leq 0 \quad (7)$$

Here Ω is measured in hours, beside this ϕ_t is defined as the healthy days and time flow per unit of H_t occurs in equation (1). By equation (6), h_t is the total number of healthy hours in year t , so we reach the loss of work time TL_t by subtracting the h_t from total time Ω .

2.2.2 Quality of Life, Schooling and Health

The strong consensus on the sustainable growth and poverty reduction is generated by improvement in child nutrition, adult health, and schooling rate of the population. Hence, countries started to give considerable importance to the human capital investments in the last decades ever than before. "The engine of the growth is the human capital" notion is taken into consideration strongly. Several amendments of health care services and education services done in the western countries initially and the convergence exists in the developing countries. The policies such as social security systems, health insurance systems and the public education established. The aim of these attempts are allocating the resources among individuals equally and avoid any of the disease that hurts the quality of the life and the productivity of the individuals, in other word, avoid threats that has negative impact on the market and non market activities.

One of the negative impacts of the diseases is the non-attendance to school. These health problems have long run negative consequences in the life. The individuals will be low literated and will not gain as much as the

healthy individuals in the market. Moreover non-market activities such as participating in social activities will not be easy due to health problems. On the other side the rate of return will be lower since the lack of full attendance to school.

2.2.3 Growth Model within Health Capital

As mentioned before, previous theoretical human capital models on growth mainly focused on education but have tended to explain the role of health. Barro (1996) described a frame work, especially extending the neoclassical model, to embed health capital in the model. He explored two-way causal relation between health and economy. Better health tends in various ways to enhance economic growth; furthermore, economic advance stimulates further accumulation of health capital. The impact of health on progress proved by him in his model. His model includes a direct impact of health on productivity. That means, within constant quantities of labor hours, physical capital, and worker schooling and experience, an improvement in health raises a worker's productivity. Moreover, a progress in health lowers rates of mortality and disease, slows down the rate of depreciation on human capital (Figure 2.1).

In his model² Barro takes population growth exogenous. This extension allows for an effect of health capital on fertility and, hence, for an additional influence on economic growth. Starting with the production function:

$$Y=A \cdot K^{\alpha} S^{\beta} H^{\gamma} (L e^{x t})^{1-\alpha-\beta-\gamma}, \quad (1)$$

where $\alpha > 0$, $\beta > 0$, $\gamma > 0$, and $0 < \alpha + \gamma + \beta < 1$. The formulation assumes constant returns to scale in the four inputs and diminishing returns with respect to each input individually. The parameter A represents the technology, and $x \geq 0$ is the labor augmenting technological progress. The total labor input, L , is assumed to correspond to population, so that variations in the ratio of work effort to population are not considered.

The equation (1) represents not only inputs -physical capital, raw labor, number of labor, and human capital within the form of educational level- but also incorporates the state of worker health, H . Health capital has precise impact on the worker efficiency, effectivity, effort, dexterity, and so on.

When we divide both sides of the equation by the quantity of labor input, $L e^{xt}$, to find the per capita values of the inputs and output:

$$\hat{y} = A \cdot \hat{k}^\alpha \cdot \hat{s}^\beta \cdot \hat{h}^\gamma, \quad (2)$$

The gross investment flows per unit of effective labor –denoted by \hat{i}_k , \hat{i}_s and \hat{i}_h (3) – determine the evolution of capital stocks as follows:

Where a dot over a variable indicates differentiation with respect to time, $\delta > 0$ is the exogenous depreciation rate for physical capital, not including health. $d > 0$ is the depreciation rate for schooling and health. Thereby, the household budget constraints expected to be:

$$\hat{y} = \hat{c} + \hat{i}_k + \hat{i}_s + \hat{i}_h \quad (4)$$

² The model taken from Barro, (1996). Health, Human Capital and Economic Growth.

Here about the depreciation, the key assumption is that d for human capital is a decreasing function of the stock of health capital per person, h (Barro, 1996):

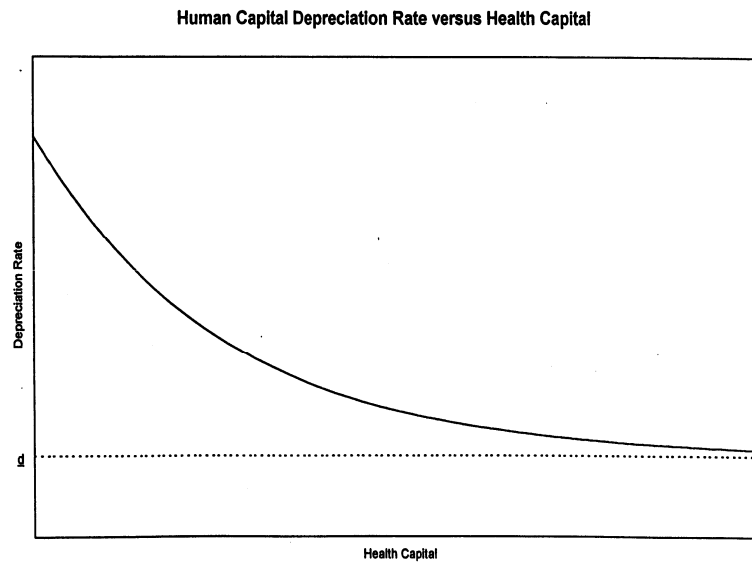
$$d = d(h) \quad (5)$$

(-)

Better health reduces the probability of death, therefore depreciation of the health capital will be slower. Figure 2.1 illustrates the health capital depreciation and health capital stock change during a life cycle of a human being. The assumption according to figure is that the derivative in equation (5) is negative, but the magnitude of the derivative decreases as h rises. Another assumption is that d has a positive lower bound, d_0 , so no amount of health capital can lower the depreciation rate below this value. Physical capital differs from human capital because a person's death or disease does not effect machines or buildings directly. Hence, depreciation rate δ in equation (3) does not depend on the state of health.

Consequently, an interesting point of the Barro model is that the decline in human capital depreciation rate, d , tends to raise the ratios of schooling and invest on health to physical capital. Eventually, s/k and h/k tend to rise as the economy develops; s/y , h/y tend to increase as the economy develops.

FIGURE 2.1. HUMAN CAPITAL DEPRECIATION VERSUS HEALTH CAPITAL



Source: from Barro, (1996).

2.2.4 Stochastic Modeling of Health

For all the periods the individuals are maximizing their utility of consumption, that is maximizing their utility function at any time t

$$U_t = U(C_t e^{\alpha t})$$

C – consumption in period t

α - discount rate

object of the constraint function R

$$R = \psi(x_1, x_2, x_3, \dots, x_n)$$

where $x_1, x_2, x_3, \dots, x_n$ are restriction factors as income, culture, genetic features, etc.

We can formulate next the Lagrangian as

$$L = \int U(C_t e^{\alpha t}) dt + \lambda(x_1, x_2, x_3, \dots, x_n)$$

The next problem of the utility maximization is the change of utility over time. Following the Kahnemann logic we analyze three kinds of utility: experienced and expected (predicted) utilities. Utility maximization is using martingale – a stochastic process in which the expected utility at time $t + 1$ depends only on the experienced utility at time t given the experienced utilities at all time before t , that is $t-1, t-2, \dots, t-n$.

In the most general form the utility of consumption (health) at time t can be expressed as

$$E(U_{t+1} | U_0, U_1, \dots, U_t) = U_t$$

The idea is that the expected utility in time $t+1$, given all previous utilities is equal to the utility at time t .

2.3 The Link between Public Health and Economic Growth – Empirical Studies

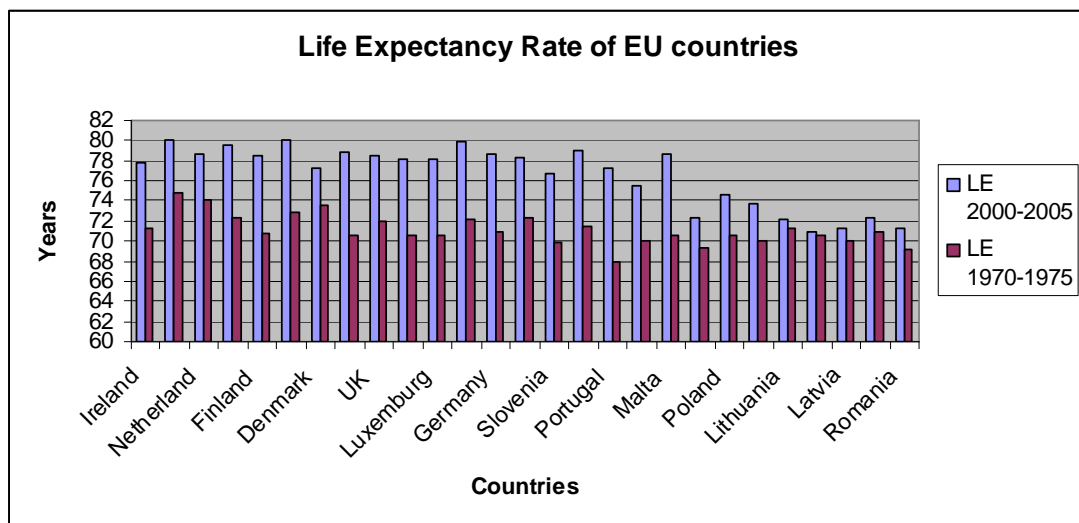
Over the last two decades, after human capital components were started to be discussed deeply in the growth models, literature provided evidence that health has substantial contribution to growth. Some theoretical models developed to support the hypothesis of the health human capital contributions to economic growth and the income level of the households. Cross country researches done to explain the reasons of the lag of some countries. According to macroeconomic researches, cross-country and within country, economic lag is caused by the lack of the sufficient human capital

store. From the microeconomic aspect, these studies seek for the indicators that positively impact on the economic condition of the households. Results of the analysis show some of the health indicators are weight, height, body mass index (BMI), etc. Individuals that suffer from any illness or incapable of having some kind of activities will be limited to work effectively. Hence, this case will avoid him/her from high performance. Moreover, healthier workers are expected to be more susceptible to disease, more energetic, more productive and get higher wages (Grossman, 1972).

Weil (2005) used microeconomic estimates about individuals health to construct macroeconomic estimates to find the effect on the GDP approximately. He used the cross-country data and historical data on the indicators such as height, adult survival rate (ASR), and age at menarche. According to his study, the correlation between ASR and the log of GDP per capita is 0.773; between age of the menarche and log of GDP per capita is -0.494; and between ASR and age of menarche is -0.495. The other upshot is about the countries that started to develop earlier. In this kind of countries, there has been a long, gradual improvement in the health status. For example in Sweden, whose is typically similar to Europe, height increased by 5.5 cm. between 1820 and 1900, and it continued by 6.8 cm between 1900 and 1965. During these periods ASR rose by 0.179 and 0.203 respectively. His work reveals the large effect of health on income. Estimations results indicates that health explains 22.6% of the variance of log GDP per worker, and thereby reducing the health gap among countries will resulted by the

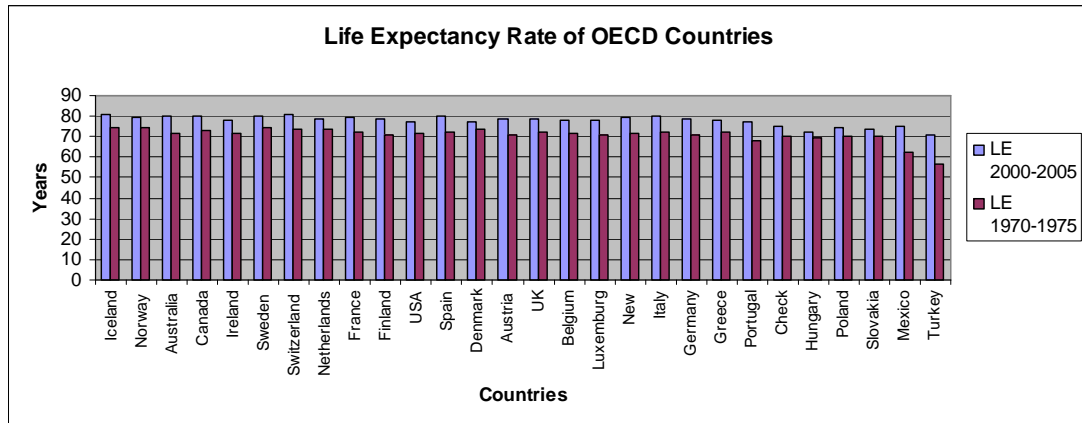
income increase. After the second half of the twentieth century the EU countries life expectancy and OECD countries' increases gradually (Figure 2.2 and Figure 2.3) . Within the economic growth and the increase in the per capita income results in the gradual increase in the quality of the health services and high expenditure on health. As a result of these situations, the life expectancy rates went up. When we compare to the EU countries 70's to 2000's years, the countries life expectancy sharply increase after the EU membership, eg. Portugal, Greece.

FIGURE 2.2 LIFE EXPECTANCY OF EU COUNTRIES



Source: Data taken from WHS, 2007 <http://www.who.int/whosis/whostat/2007/en/index.html>.

FIGURE 2.3 LIFE EXPECTANCY OF OECD COUNTRIES



Source: Data taken from <http://www.who.int/whosis/whostat/2007/en/index.html>.

Bloom et al., (2004) constructed a panel data of countries observed every 10 years over 1960-90. They take into consideration the education level of the population. It is measured by the average total years of schooling the population aged 15 years and older. Life expectancy data in the survey are proxy to indicate the health of the work force. Aggregate work experience for each country by computing and experience measure for each of 22 gender and age group combinations involves 15-19, 20-24,, 60-64, 65+. Experience is perceived the time spent in the labor force, that means the total years subtracted from schooling years. Here there is shortcoming that this measure of experience calculation in years plausible for male, while it does not work well for the females. Since females spent most of their times out of labor force. They tried to investigate the economic growth factors such as technological innovation, technological diffusion, health status. As a result, one year improvement in a population life

expectancy contributes to an increase of 4% output. Increase in the expenditures on health will have positive impact on productivity.

Gyimah-Brempong and Wilson (2004) investigate the effects of health human capital on the growth rate per capita income in Sub-Saharan countries and OECD countries. They calibrated the influence of health stock, health investments and other variables on income per capita and growth rate by using expanded Solow model, panel data and a dynamic panel estimator. Their estimated results suggest that the stock of health human capital affects the growth rate of per capita income in a quadratic way. Hence, the growth rate percentage of 22% to 30% can be attributed to health. Besides this, they found that the structure of relationship between health human capital and the growth of income in Sub-Saharan Africa countries is similar to the structure of the relationship in OECD countries. This case reveals that for expected higher income the health human capital should be higher. For the policy implications this case wholly has to be taken into consideration. Another interesting result of this survey is the long run and short run influence of health human capital. For Less Developed Countries' (LDC's) with low stocks of health human capital, that investment in health human capital neither decreases income growth nor physical capital investment in the short term. The implications of these findings are that additional health investments in Sub-Saharan African nations will accelerate economic growth in the short run and the level of income in the long run as health investments become part of the nations' stocks of human capital.

Mayer-Foulkes's (2005) research on the health indicators, human development traps and economic growth is concluded that human capabilities can be improved by the income, technology. With the regression analysis and evidences, nutrition and health improvements contribute both level of economic growth; moreover at lower levels of income, lack of nutrition and health dampen the human development and modern economic growth. Fogel's (1993) work was on the nutritional status of the countries and its relation to economic growth. He was the first who has work on the nutrition, health and its effect on long term economic growth. 19th century data was used in his work involving weight, stature and mortality. He concluded that, by setting up caloric national accounts per capita- including calory and protein availability-, one third of economic growth of Great Britain over two centuries was due to increase in the work delivered by human machine. The challenge is that if nutrition or health of the individuals have amendments this will foster the long term growth.

PART II

THE CASE OF TURKEY

This part includes the case of Turkey, starting with the features of public health and scope of it in Turkey. The main determinant of public health is discussed in chapter 3 according to Turkey case and the earlier public health theories mentioned. The health indicators of Turkey are discussed by providing graphical and numerical illustrations in chapter 3.

Chapter 4 is the empirical study part. It evolves regression analysis, results, and the interpretations. This chapter is prepared to investigate Turkey's economic growth factors and health role on these factors. By chapter 3 illustrations and chapter 4 analysis we also have idea about the future growth potential.

CHAPTER 3

PUBLIC HEALTH IN TURKEY

3.1 The State of Public Health in Turkey

The health care activities, the health development activities, and cure activities are main facilities of the public health. In these issues mother and child health programs, education against the diseases, vaccine control mechanisms, mental health care activities, and care against chronic illnesses gain quite importance (Karagul, 2003). The health providers and the health activities managers imply policies on these issues. And the main body of the health services provider is Ministry of Health (MoH) in Turkey. It has several kinds of divisions regarding to serve different health services in the provinces, districts. Nowadays, Turkey has some problems within the some issues according to public health compared to the other OECD countries or developed countries although it has so many new policy implications to cover all the citizens with health insurance with the General Health Insurance policy. The law and the policy implications will be discussed in the following sections with the processes, with the results of the new policy, and some critics on the issue.

Besides the policy implications, all the health care and cure services have economic consequences. In Turkey the financial part of the health insurance and the funding of the health services became in trouble since it generates bulk of load on budget. The financial side of the health services

and which type of the financial approach could be used will be discussed in the following sections with different approaches.

A critic about Turkey public health services is that the citizens either the state do not give importance to care activities. Instead of health care activities, cure activities are funded mostly, but by care activities and education against illnesses, the financial load would expected to decline.

3.1.1 Public Health and Ministry of Health in Turkey

Winslow, one of the earlier researchers in the public health, characterized public health:

" practice as the science and the art of disease prevention, prolonging life, and promoting health and well-being through organized community effort for the sanitation of the environmennt, the control of communicable infections, the organization of medical and nursing services for the early diagnosis and prevention of disease, the education of the individual in personal health and the development of the social machinery to assure everyone a standard of living adequate for the maintenance or improvement of health (Winslow, 1920:4)."

Health is defined by WHO as an intrinsic human right, and it is a main input to poverty reduction and development of the nation. Chakraborty (2004) defines the public health system such as provision of clinical facilities, sanitation, inoculation, and disease control. Substantial flow of medical technologies like antibiotics and vaccines; and providing the awareness and education to individuals against infections, diseases, and about health care

activities gained quite importance in the public health implications. A health system aims to improve health and life quality of the individuals via institutions, organizations and personnel. Therefore, most of the health systems nations use have public, private, traditional, and informal sectors. The main functions of the health systems are service provision, resource generation, financing and stewardship (WHO, 2007).

Especially, the World Bank and OECD (2009) prepared a report about the effective use of the public health funds and prove that in poor countries health services are not distributed fairly among regions because they by pass rural areas. Cost effective interventions for suspending infectious disease exist, but lack of adequate financial resources hamper the effort to distribution of the health services to the poor regions.

Ministry of Health bodies are the responsible of the all activities about the vaccine control, cure of the infected bodies and the education programs against microbic and infectious illnesses. For these purposes in the modern era most of the countries established centralised Ministry of Health (MoH) to control the public health institutions, such as cottage houses, hospitals, clinics, etc. Before the modern era there were no organized institutions to operate against the diseases and for this case European countries suffer in the disease in the medieval era. Millions of people died because of diarrhea, tyhoid fever, etc.

Turkish public health experience³ with the organized public health activities started with the latest periods of the Ottoman Empire. The health services for the military was operated directly by the government and the other health services were offered by the institutions that were founded by the Sultan, or another statesmen. These institutions were hospitals, small clinics that have cure activities for public. Health personnel was assigned by the Reisul Ettibba (Hekimbasi), there was no other official institution to organize the public health services. In the last periods of the Empire, Public Health Office (Sihhiye) was established to organize the health services centrally.

The Turkish Ministry of Health (MoH) is founded in 1920. In the previous period, it focused on the post war structure of the public health and establishing the regulations of national health. Current public health system pillars rely on 1923-1946 national health reforms. The first Health Minister Dr. Refik Saydam focused on the health care services and besides this he has works on the organization of the Ministry of Health to provide the services effectively. So he organized the vertical structure of the health system.

In these years, the health programs planning and implementation of the health policies took place. The regulations of General Public Health (Umumi Hifzissiha) in 1930 that are perceived as the main law of the health system was became law (THR, 2004). This law is the pillar of the recent health

³ Here we mention the Turkish experience of public health as taking the milestones only, for comprehensive information refer to THR, (2004).

services policies. There were several regulations to clarify the duties and jurisdiction of the ministry of health. The programs established to control the tuberculosis, the thyphoid. The law of Social Aids and Health Ministry came into force in 1936, and the frame work of the health organization structure. In cities and towns, the structure of health involves the diognosis, care and cure activites. Between 1946 and 1960, cottage hospitals were established to operate in the villages and the rural areas for citizens easy get in touch with the health facilities. This activity was a amendment of the health system in favor of the citizens. In the villages, with the trained health workforce, decreases occured in the child birth and some amendments occured in the mother health. During these years, integrated health system was established for blue collar workers. In 1961 Social Health system regulations provide national health services (THR, 2004). According to these regulations, the sustainable public health services were aimed, and the fair distribution of the health work force among the cities and regions was projected. Financial support for these sustainable public health services was gathered from social security fund and from government budget. Mostly deficit was compansated from national budget.

By new regulations, integrated public health system was aimed and besides this all the individuals' utilization of the free health services was aimed. One of the main purposes of the health regulations was the easy and quick reach of the health facilities of the citizens. As the prompt intervention is vital role in the case of an illness. Cottage hospitals are the primary

institutions in the health sector that provide these services in the villages and rural areas. By the cottage hospitals, the people who live in villages and in the rural areas became more aware about the health and became more wise to care about their health. Here not only the awareness of the public is adequate for gaining health but its role cannot be ignored. In the following sections, the other factor that is important for gaining health, economic facilities, will be discussed.

Till 1963, health system investments were not involved in the five year development plans. In the 1963 five year plan several maners discussed and some policies are determined to implement about the health system (World Bank and OECD, 2009). They were, *"i) focusing on the health care activities. These were four precautions before illness and make the people aware of the patogens and diseases. ii) Providing the public health services by the Ministry of Health, this to make the system more integrated and well managed. iii) Fair allocation of the health force among different regions of the country. iv) supporting the national medical sector. v) Supporting the establishment of the private hospitals and clinics to serve public health facilities. vi) Establishing the General Health Insurance, but this was not a succesful attempt (WB and OECD, 2009:12)".*

Socialised Health Facilities implementation period existed till 1984 and in this process the focus point was the role of the cottage houses that are quick to reach by the public. These institutions were the primary institution of the health organization according to the law of health. The

implementation of the cottage house system had not succeeded after several years from the implementation started. Unfortunately the cause of the fail did not seek by the governors and too much source passed away.

During 1970's several times new legislative attempts occurred to enrich the health system and to accept the General Health System Law, unfortunately, the political volatility and the huge amount of the budget deficit suspend this attempts. The malfunctions in the Integrated Health System were amended by new laws in 1980's. Between 1986 and 89, the Basic Law of Health Facilities and social security law for Bag-Kur came into force. According to the Basic Law, the focus was on the fair distribution of the public health facilities and besides this the financial source of the services. Unfortunately, the success of the new Basic Law was limited, neither systematic reforms were supported not a comprehensive health policies were internalised.

Between 1988 and 93, the Ministry of Health and State Planning Agency had cooperated work on the health reform. The National Health Policy prepared, involving the General Health Insurance and Family Medicine System was discussed in this new policies. Primary goals of the policies were the amendment of mother-child health status and the extending the health facilities utilization in the favor of all citizens (THR, 2004). Since the unfair distribution of the health work force additional to lack of adequate financial sources, the child mortality was higher in comparison to other OECD or developing countries that can be counterpart of Turkey. The attempts to

distribute the work force fairly among regions in 1990's were not successful as the expected although the work force operated in Eastern part of Turkey were paid more wages. The main reasons were the terrorist attacks in the region that so many cottage houses were destroyed and nurses-doctors were attacked, social facilities in these cities, and the climate of the region. Moreover central government could not have health investment since these problems and the health status of the people in these regions were much more worse than the western parts, taking into consideration of child mortality, life expectancy rates, body mass index (Table 3.3, Table 3.5, Table 3.6).

During 1990's Green Card given to the citizens, who had no social security, and are poor, for free utilisation of the health services of the state. However, this policy was a zealot for the poor citizens, some abuse this and Green Card given to the people who did not meet the conditions. By the way, the burden of the Green Card became a really huge burden on the health system budget. On the other hand, with the economic crises of 2001, 3.2 million new application occurred and the burden of the state increased catastrophically. New regulations delayed and till beginning of the 2000's no amendment in the health system was done effectively in favor of General Health System.

After 1980 till 2002, constitutional laws were accepted by the Turkish Great National assembly for all citizens to have right to utilize the health facilities and have social security and health security. In the new regulations

focus was on the fair distribution of the health facilities among individuals, and besides this the government was impressed to supply health facilities without any price. The General Health Security Law came into force in recent years and implementation of the law includes health security of all citizens since born. However the malfunction of the last decades was corrected by amending the new health facilities in favor of the citizens, the deficit of the budget was generated by the health expenditures.

3.1.2 The Main Issues and the Goals of the Public Health Services

Turkey has the National Health Policy 21 that includes the issues of improving health statistics of Turkey; increasing life expectancy; improving the quality of life; and eliminating the the gap among regions health status. The main activities to amend the health status country-wide, Pekcan (2006) suggests about the various factors such as: to control, eliminate and eradicate important infectious diseases in Turkey; to increase the quality of life by reducing non-infectious disease such as disability, disability for work and early death; to reduce deaths and injuries cause by accidents, diseasters and provide continuity; to provide healthy born and survival of the infants, babies and preschool children; to reduce health problems related to sexual life such as HIV prevelance; to reduce the use of drugs and addictive substances such as tobacco, alcoho; to eliminate the factors of effecting health negatively like malnutrition and inadequate physical activity to

minimum level; to increase the health quality of all citizens and especially of the handicapped persons and to provide them more active role in society; to provide special care for mentally ill patients; to provide more health living conditions at any place such as home, school, at work ; to ensure the easy access of the health service, to eliminate social and regional differences via fair distribution of the health services and the health funds, and to reach sustainable public health plans for society.

Besides, public health system has immediate objectives to ensure these long-term objectives. Public health organizations have activities to provide basic education about the health care activities to society; to eliminate the starvation and poverty; to improve the life quality of mother to suspent the child mortality rates; to struggle against infectious disease, and malaria; to ensure the sustainability of the environmental reources health by make the society aware of it.

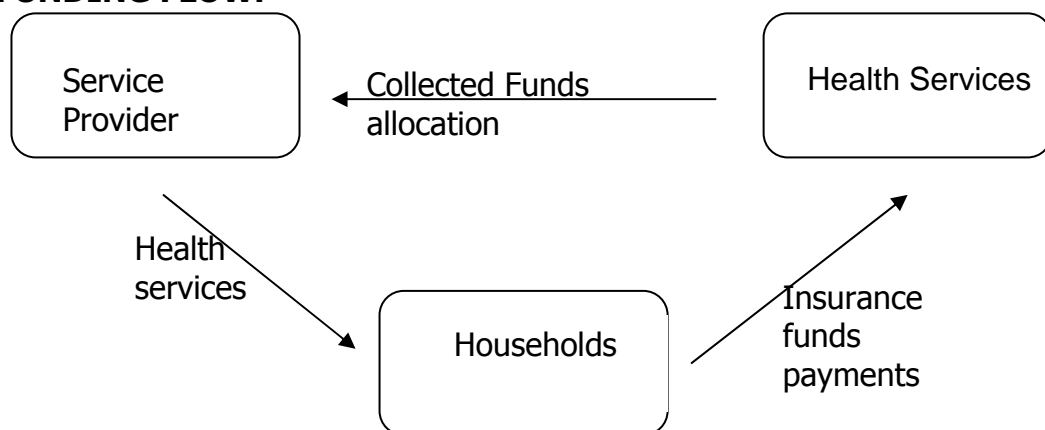
3.2 Structure of Public Health

The Ministry of Health (MoH) is the main public health policy maker, supplier of the health related services, and MoH is officially responsible for the planning, developing, implementing and evaluating the health policies in Turkey. MoH is organized and serves in basis of public health approach and public health policy, and the health priorities. Since health services are percieved as health care activities, improvements of the quality of life, and the cure activities, MoH is the main actor who is the important conductor of the research programs about the problems, service quality, and he has

bodies to evaluate the implemented policies to have amendments on the inaccuracies. MoH conducts an intervention to prevent iron deficiency, vitamin deficiency and iodine deficiency among children. On the other hand, with the researches, MoH has collaboration with several agencies in the field studies such as the UNDP, the TUBITAK, the UNESCO etc. (THR, 2004).

The states' four core activities related to health policies are health insurance of all households, access of the health services and fair distribution of the health services, efficiency in the health finance and the sustainability of the health services funding (Yaşar, 2007). Health Activities triangle involved from three actors, with three activities. Figure 3.1, below illustrates the triangle and the activities relation to other factors.

FIGURE 3.1. TRIANGLE OF THE HEALTH SERVICES AND FUNDING FLOW.



Source: adopted from Mossalos and Dixon, (2002).

The ministry provides the primary care supplements and is the main body that is responsible to provide the health force to cottage houses, hospitals, clinics and other official health institutions. There are several

institution that are operating in the public health area country-wide. Health centers and cottage houses are the primary institutions that have contact with the people. Health centers scope is to have service 5000 to 10000 people in rural areas and 10000 to 50000 people in urban areas. The health care staffs in these institutions are general practitioners, dentists, nurses, midwives, sanitarians. Table 3.1 illustrates the number of the population/health force country-wide in time series beginning with the establishment of the Republic. The health workforce number grow in total and in density gradually. In the first years the population / physician was above 12000 unlike approximately 600 now. In the cottage houses, that are the most common health institution and easy to reach, midwives serve.

TABLE 3.1 NUMBER OF PERSONS PER HEALTHCARE PROVIDER

Year	Population/ Physician	Year	Population/ Physician
1928	12.841	1970	2.228
1930	12.217	1975	1.843
1935	12.909	1980	1.631
1940	11.819	1985	1.381
1945	9.629	1990	1.109
1950	6.890	1995	890
1955	3.371	2000	792
1960	2.799	2005	675
1965	2.859	2006	637

Source: TUIK Statistics available at http://www.tuik.gov.tr/VeriBilgi.do?tb_id=6&ust_id.

The administrative unit of the public health structure starts with the province governor. Turkey has 81 provinces and provincial health directors on behalf of governors of the provinces direct health services. The sub parts of the provinces are districts and villages. Turkey has 849 districts and 36699

villages (TUIK, 2008). The other bodies related to health services are the municipalities. The responsibility of the municipalities about the public health is the control of the health of the food and beverages industries, providing safety water, waste control and care of the public areas from the vaccines.

The Refik Saydam Hygiene Center Presidency School of Public Health (RSHCPSPH) is the other body in health system and he is the branch of MoH. The RSHCPSPH is a research center and till now MoH had conducted huge number of studies via collaboration with national and international partners. The other institutions are the Medical Faculties, that have their own hospitals and own research departments, operate in different provinces and they are approximately 45 medical faculties country-wide.

The other institutions are hospitals, the main bodies of the public health suppliers. Table 3.2 illustrates the number of the distinguished types of the inpatient and outpatient health institutions according to 5 years period since 1970. The numbers of the Social Insurance hospitals are not attendance after 2005 since the merge with the MoH hospitals in accordance with the Health Reform Laws of the government. The number of the health institutions increased approximately three times since 1970 and the outpatient ones approximately four times.

TABLE 3.2 THE NUMBER OF THE INPATIENT AND OUTPATIENT HEALTH INSTITUTIONS

Year	General Total	Inpatient Health Institutions							Outpatient Institutions
		Total	Attached to the Ministry of Health	Attached to other ministries and other institutions	University	Municipality	Social Insurance	Private	
1970	5 507	743	570	26	4	8	56	79	4 764
1975	6 959	798	593	34	5	6	68	92	6 161
1980	10 471	827	604	33	17	10	73	90	9 644
1985	12 355	722	481	19	23	7	77	115	11 633
1990	16 110	857	593	18	23	5	93	125	15 253
1995	18 677	1 009	677	13	33	5	115	166	17 668
2000	19 522	1 184	744	10	42	9	118	261	18 338
2005	14 446	1.156	795	30	53	9	-	269	13 290
2007	15 904	1.276	849	1	56	5	-	365	13 352

Source: Inpatient and outpatient medical institutions 1967-2007, http://www.tuik.gov.tr/VeriBilgi.do?tb_id=6&ust_id=1.

3.2.1 Scope of Public Health

During recent years, the scope of public health activities and services have been expanding rapidly. Whereas not long ago many of the researchers articulated public health matters as general sanitation and the control of infectious disease, but today all aspects of Winslow's (1920) famous definition is extended with several others. Nowadays, personal health services, and health agencies are already deeply involved to ensure adequate comprehensive health care for all citizens, besides providing fair distribution and quality of health personel and facilities among citizens.

Nowadays, as James identifies public health is concerned with three broad areas: health service system, health behaviour and environmental hazards, and the seven sub categories (James, 2007:7):

" 1) *Activities that must be conducted on a community basis: a) supervision of community food, water, and milk supplies as well as medications, household products, toys and recreational equipment; b) insect, rodent and other vector control; c) environmental pollution control, including atmospheric, soil and aquatic pollution control; prevention of radiation hazards; and noise abatement*

2) *Activities designed for prevention of illness, disability, or premature death from: a) communicable diseases, including parasitic infestations; b) dietary deficiencies or excesses; c) behavioral disorders, including alcoholism, drug habituation, narcotic addiction, certain aspects of delinquency, and suicide; d) mental illness, including mental retardation; e) allergic manifestations and their community sources; f) acute and chronic noncommunicable respiratory diseases; g) neoplastic diseases; h) cardiac and cerebrovascular diseases; i) metabolic diseases; j) certain hereditary or genetic conditions; k) occupational diseases; l) home, vehicular, and industrial accidents; m) dental disorders, including dental caries and periodontal disease; n) certain risks of maternity, growth, and development.*

3) *Activities related to comprehensive health care: a) promotion of development, availability and quality of health, personnel, facilities, and*

services in the broadest sense; b) operation of programs for early detection of disease; c) promotion and sometimes operation of emergency medical systems; d) promotion and sometimes operation of treatment centers, varying from disease-specialty clinics to comprehensive health centers; e) facilitation of and participation in pregraduate and continuing health professional and para professional education.

4) Activities concerned with collection, preservation, analysis, and use of vital records.

5) Public education and motivation in personal and community health.

6) Comprehensive health planning and evaluation.

7) Research-scientific, technical, and administrative.”

3.2.2 Health and Government

In the modern period, the role of the states in the health services increased. Many of the states compensate health expenditures from their general budget that is generated by the taxes, i.e. Finland, Denmark and some developing Asian, African countries; some compensate it from the pooled funds and from taxes i.e. Turkey; and some use private funding in priority and state funds, i.e. the USA. Since the health is a human right (WHO, 1948), states are impressed to supply the health services to their citizens in the most appropriate ways, and fairly distribute the health sources among the regions-citizens. Also, health taken as the basic

human right notion is analogous to the suggestions of the Haynes (2002). He claims that the states have to be respectful to the citizens and they have to increase the life quality of the individuals by increasing life expectancy at birth, adult literacy rate and GDP per capita.

All the times till now, public health services had the priority impact on the progress of the human beings, and besides this situation the progress of all nations are related to the health conditions of the citizens. For instance in the middle era European countries all suffered from the infectious diseases. The life expectancy of the people were the in lowest level, i.e 35 years in some countries. In this point states have role to ensure the minimum health requirements with long-term health policies for all people and educate them against diseases. Health economics is the main science who exactly related to the economic consequences of the health policies, and economic side of the all health related services, activities. The definition of health economics is perceived as the application of the economic framework to the study of medicines use and effective use of the funds. The effective use of the health expenditures and the fair allocation of the sources are all involved by this science. The health economics science observes the cause and effect relation of the health input and the out comes, the financial expenditures impacts on the health's of the citizens etc.

States are, like Turkey, the main supplier of the health services. The state pools the health insurance fund and then allocates them to the

related institution according to their service capacity. As the deficit of the health budget, the state compensates this financial burden from the general budget of the state. Table 3.3 indicates the annual states' health expenditures ratio to state budget and the trend in the years.

TABLE 3.3 ANNUAL STATE MoH HEALTH EXPENDITURES RATIO TO STATE BUDGET.

Years	MoH Budget/State Budget (%)	Years	MoH Budget/State Budget (%)	Years	MoH Budget/State Budget (%)	Years	MoH Budget/State Budget (%)
1923	2,21	1970	3,08	1988	2,73	1998	2,65
1925	2,64	1975	3,54	1989	2,74	1999	2,81
1930	2,02	1980	4,21	1990	4,12	2000	2,26
1935	2,54	1981	3,59	1991	4,21	2001	2,66
1940	3,05	1982	2,81	1992	4,71	2002	2,4
1945	3,12	1983	2,93	1993	4,56	2003	2,43
1950	4,08	1984	3,11	1994	3,72	2004	3,19
1955	5,18	1985	2,53	1995	3,9	2005	3,8
1960	5,27	1986	2,71	1996	2,76	2006	4,3
1965	4,1	1987	2,8	1997	3,22	2007	5,2

Source: Turkey Health Statistics, (2006).

The common ratio of the GDP to health expenditure is 5 % and above this in the western countries with several exceptions (WB and OECD, 2009). These countries health systems are well structured and public funding of the health services are highly quality. Within the establishment of the Turkish Republic, the state budget was limited for health activities though they are vital for people. In the following years the ratio of the MoH budget increased. Within 1950's the ratio became 4% and 5% (Table 3.3). Also, the new law for health and social security insurances came into force. In 1980's the ratio dropped since the high budget deficit of the government and the defence expenditures of the

state. The situation continued in 1990's but after the start of the evaluation of the EU membership chapters, some amendments took place. So many laws came into force in favor of the citizens. The funds of the MoH increased and the health services access became easier within the investments such as new hospitals, hiring new health personnel.

3.2.3 Financial Sources of Health Activities

Finance of the health system is one of the main determinants of the public health and ensures the sustainability of the health services in the future. Health financial system has three main activities (that is also mentioned in figure 3.1, Mossalos and Dixon, 2002): collection of the funds, pooling the funds, and paying the service providers from the collected funds. Health funds are paid by households or by the employers of them. Health insurance companies privately collect the funds, government as an employer pay the funds, or the private employers pay the funds to the health private insurance companies or the states health insurance institutions. The funds are pooled in the institutions and they are directed to service providers after the health services activities are got by the insured individuals by the related institution. In Turkey, there were three state insurance institution were operating before the General Health Security Law got into force and the establishment of the Social Security Institution. Besides the states' institutions, there are several private health funding institutions that collect fund by the individuals. These private funds are voluntary ones. On the other

hand some charity organizations provide health funds without fund collection by the related people; they operate only with the donors financial supports.

The examples from all over the world approve this proposition, funding without precollection. In the poorest regions of the world, i.e African continent, the spending is still insufficient to pay for access of the health when needed, so that this situation push many people into unhealthy life. Besides this, the price of the health care activities such a this kind of countries is too expensive to pay compared to developed European countries according to purchasing power parity and many people is driven into poverty by paying high amounts of their income to the health services access. Governments in the richer countries use some economic tools and economic systems to compensate the health payment of the population by establishing some health security systems and by compensating the health cost of the citizens from the treasury resources and from taxes. All of the countries have to take into consideration how they can supply health services to the population sustainably and fairly among people. Moreover they have to determine how they can arrange the resources to health costs and which system is best to fit to their case.

Effective, efficient and equitably use of the financial resources gained great importance. Thus, countries make different decisions for determining the resource utilization. Some use resources like insurance and taxes, some use private and public funding for the health service costs.

Health financing system includes prepayment and risk sharing mechanisms to avoid catastrophic expenditures and to cover the unexpected cost without budget deficits. Here the main issue is “how much state have spend” and “which approach he has to use”. Four different approach is identified by Savedoff (2003), compared to other countries and different systems of health service funding.

First approach is “the peer pressure approach”; here the country is compared to the other countries according to its development raking, income level, culture or socioeconomic conditions. These systems rely on observations and comparative statistics. This approach only focuses on the inputs, not the results and not the other special conditions of the countries’. Hence, this point is the main critic of this approach.

Second approach is “the political economy approach”. This approach’s focus is on the allocation of the resources, the current situation of the country is criticized to make optimal spending on health. Health spending diverges from this optimum point because of any other prior political decisions and any other priorities of the economic institutions. The lobby groups have quiet influence on the allocation of the health fund utilization. For instance unions, medical associations, pharmaceutical associations, and medical companies are main actors to influence the health funds utilization decisions.

Third approach is “the production function approach”. This approach use cross-country and panel data estimations to view the consequences of

the health expenditures by taking into considerations the demographic, socioeconomic changes in years, factors that have influences in society's life quality. The results can be interpreted to calculate the spendings's effects on the society, on health conditions and on the other related factors. The inputs in this model is for the desired goals and the observation after the spendings are done to find the correlation between the amount of the expenditures, allocation type of the funds and the output, the desired results like improvement in the life quality, easy access of the services and the increase in the life expectancy etc.

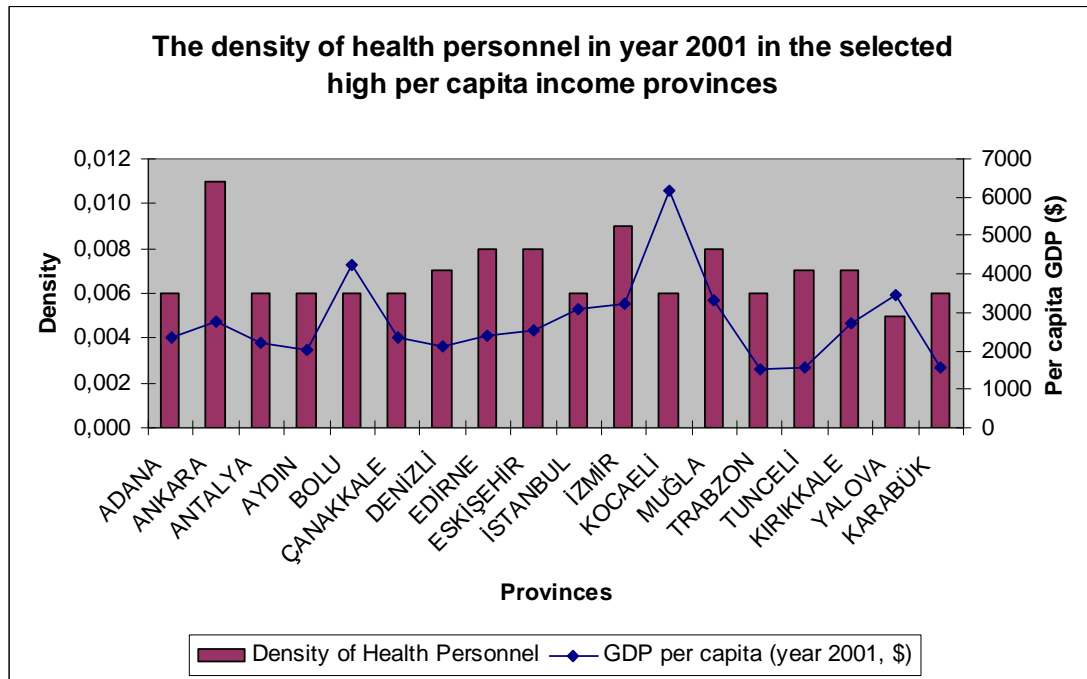
This model is better and preferable than peer pressure approach since it is focus on the input and output coincidely.

The fourth approach is the "budget approach". The most practical and complete approach is this one and it identifies the desired health status changes and determine what are the needs to purchase any of the health related factors such as inputs of health and health services. There is pricing system to achieve to reach the expected level. The estimation methods are the tools to determine how much health services to buy subject to budget constraints. The budget constraint exactly taken into consideration in the policy decision period and in the implication period. The combined version of this approach is the biggest strength. The combined version of the third and the fourth approach is plausible for Turkey.

3.2.4 Health Personnel Density among Regions

There are some problems with the fair distribution of the health personnel among regions. The personnel are not reluctant to work in the eastern part of the Turkey due to the lack of some social facilities, the climate and the geography. Besides these factors in 1980's and 1990's the terrorist attacks occurred in the region. The health personnel density high in the big cities and the western cities like Ankara, İzmir, Muğla, Antalya; in oppose to this situation the density is low in Agri, Iğdir, Şırnak, Batman, and Sanliurfa. The health personnel density and the GDP per capita trend is vice versa in the provinces. The high per capita provinces health personnel density is quite high and the in eastern provinces it is opposite. Figure 3.2 and Figure 3.3 illustrates the health personnel density in the selected provinces in year 2001. We use the data of 2001 since the TÜİK or any other statistic institutions had per capita income of the each province. In the industrialised provinces such as Adana, Denizli, Bolu the high income bring some advantages and some extra facilities in the cities so mostly these attract the health personnel and they want to work in these cities. This causes the unfair distribution of the health work force as indicated in the Figure 3.3. The low income eastern cities has insufficient health workforce though they need more due to the harsh conditions of the climate and geography. The Turkey average density is 0,006 but in the eastern regions like Southeastern Anatolia and Eastern Anatolia, it is 0,003.

FIGURE 3.2 THE DENSITY OF HEALTH PERSONNEL IN YEAR 2001 IN THE PROVINCES THAT HAS HIGHER PER CAPITA INCOME THAN THE TURKEY AVERAGE.

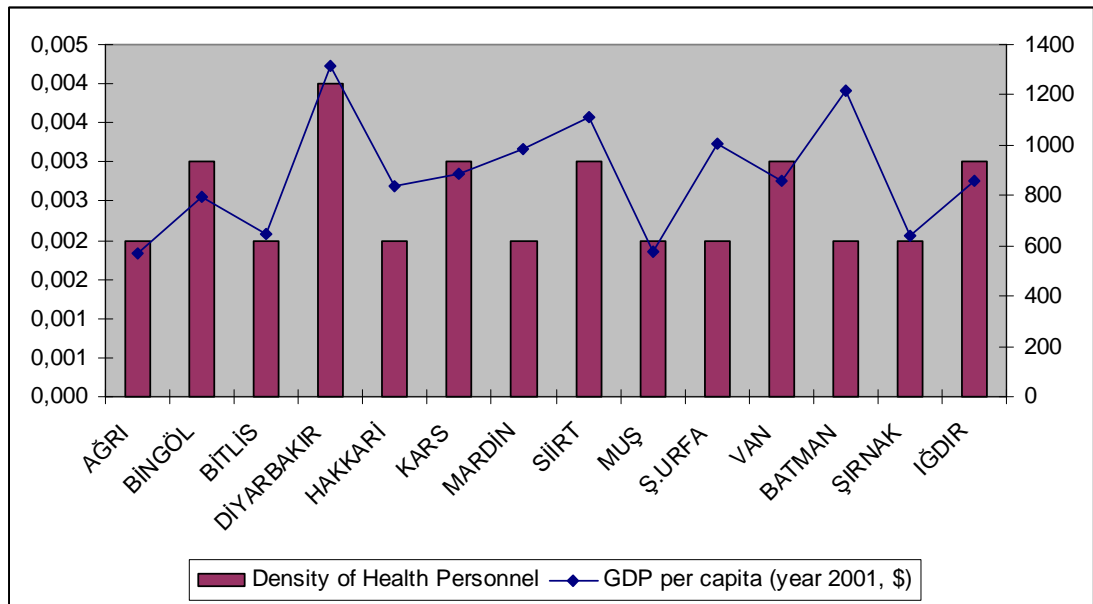


Source: GDP per capita is taken from Turkey Health Statistics, 2006. Health Statistics, Ministry of Health, 2003. The personnel density ratios are counted by the author by dividing the province 2001 population to the total health personnel number.. The population data of the each provinces is taken from TUIK Statistics web page in April 2009 http://report.tuik.gov.tr/reports/rwservlet?adnksdb2=&report=turkiye_il_koy_sehir.RDF&p_kod=1&p_yil=2008&des_format=html&ENVID=adnksdb2Env.

Ankara has density of 0,010 with the GDP per capita \$2752; Izmir has density of 0,009 with the GDP per capita \$3215; Denizli 0,007 with the GDP per capita \$ 2133. Only Tunceli is a bit confuse us because it has per capita income of 1584 but have density of health work force 0,007, that is 25 percent higher than Turkey average. Moreover the eastern provinces, Agri has per capita GDP \$584 with density of 0,002; Bitlis has per capita income \$

646 with density of 0,002; Sırnak has per capita income \$ 638 with density of 0,002.

FIGURE 3.3 THE DENSITY OF HEALTH PERSONNEL IN YEAR 2001 IN THE PROVINCES THAT HAS LOWER PER CAPITA INCOME THAN THE TURKEY AVERAGE.



Source: GDP per capita is taken from Turkey Health Statistics, 2006.
 Health Statistics, Ministry of Health, 2003.
 The personnel density ratios are counted by the author by dividing the province 2001 population to the total health personnel number.
 The population data of the each provinces is taken from TUIK Statistics web page in April 2009, http://report.tuik.gov.tr/reports/rwservlet?adnksdb2=&report=turkiye_il_koy_sehir.RDF&p_kod=1&p_yil=2008&des_format=html&ENVID=adnksdb2Env

3.3 Basic Health Indicators

Health indicators are the variables that indicate the health status of the individuals, some of them are input and some of them are the consequences of these health inputs. Health inputs are: nutritional status, pathogens and infectious illnesses, and health care activities and health expenditures; health

outputs are: height for age and BMI, infant mortality rates, and life expectancy rates.

3.3.1 Health Inputs

Health inputs are the intakes of the individuals to survive and to enable their bodies have certain routine activities, and the health related activities for life long healthy life.

3.3.1.1 Nutritional Status and Health

Nutrients are the essential intakes needed by human beings, plants and animals for growth. Nutritionists often group nutrients into two categories: they are macronutrients and micronutrients. Macronutrients are the nutrients that form the major portion of your consumption and have energetic contributions to the body. Macronutrients are basically carbohydrates, fats, and proteins. Sometimes water is also categorized as a macronutrient. All other nutrients are micronutrients that are consumed by human beings.

Nutrition is one of the key factors for a healthy human being and as it is emphasized in many papers has extensive value for productivity and economic growth. A concern has been strongly accepted that sustained growth, total factor productivity and reduced poverty are associated with improvements in a population's child nutrition, adult health, and schooling (Barro, 1996). Microeconomic analysis indicates direct link between

nutritional status of the individuals and productivity which influences the macroeconomic situation, economic growth.

We perceive that microeconomic analysis is more informative about the causal effects of nutrition, malnutrition in productivity. Especially nutritional status of the individuals has strong influence on the cognitive development and physical development of the individuals. In this chapter we first focus on the regional nutritional gap of Turkey, especially nutritional status of the children and infant and its influence on the individual health; and second, we seek how the policy implications can ameliorate malnutrition. While viewing the nutritional status of the children, we would utilize the health reports to analyse the nutritional status by proxies of health, like BMI, weight for age, and height for age.

As nutritional status indicators mentioned are especially used. This nutritional status has outcomes that are caused by the actions of individuals, preferences, income constraints, and any other social or geographic restrictions. These constraints are strongly linked to the income level of the families and the individuals. The exact constraint for the adequate nutrition is income. This constraint has great role on the nutrient intakes, the physical consumption of macro nutrients (calorie and proteins) and micronutrients (minerals and vitamins), as well as time devoted to the nutrition, the individuals genetic situation and education (or knowledge) and skill regarding the combination of these inputs to produce nutritional status (Alderman et al., 2005).

During their growing period the children have to take adequate food and vitamins. This care determines the future body size, and body mass index. Thus the children that grow in the welfare states or developed countries have less constraints about the intake of the food and vitamins in their growing period. Schultz (2003) discusses which factors are relevant in the future productivity of a human being. He suggests that the availability of calories, proteins, and certain micronutrients maintain a child to grow and be resistant against infections and diseases. Birth weight and gestational age at birth, height for age and weight for age (BMI) are all indicators and related to the nutritional status of the body that proxy health because they predict future survival period. Moreover they seem to be correlated with later school and labor market performance. According to this case, we can discuss that this lag occurs among different regions of the country and it is the reason for the low level of economic growth (the low income of the families) and reduced schooling rate.

Mayer-Foulkes (2005) and Fogel (1991) set up caloric national and regional accounts that include data on caloric and protein availability per capita. Focusing on the Great Britain for over two centuries, he seek to see how the increase of of caloric intakes and protein intakes influence the efficiency of labor in work.

Concerning Turkey, the gap is larger in the eastern, than the western parts. It means that the childrens in the eastern parts are not as well nourished as in the western parts. This malnutrition case has so many

outcomes like high infant mortality rates, low life expectancy, low work performance and low productivity. Malnourished individuals have less resistance to the disease and other health problems. This situation causes loss of working hours and low efficiency in the work. Additionally low birth weight can be an indicator of poor socioeconomic status and malnourished individuals have higher infant mortality. The probability of infant mortality is estimated to be much higher for low birth weight (LBW) infants than for non-LBW infants. In the neonatal period if the children could not take sufficient proteins and vitamins, they most probably die before five. LBW cause the loss of cognitive skills of the children and would influence the future school success of the children. According to the Ashwort (1998), Alderman and Behrman (2004) surveys on Indian and Guetamalian babies the probability of an infant death drops by about 0.078 for each birth in the 2,500-2,999 gram range compared to the 2,000-2,499 gram. Table 3.4, Table 3.5, and Table 3.6 illustrate the gap of child nutrition among regions in Turkey and its outcomes as the weight for age, height for age and BMI according to age in years 1993, 1998, and 2003-04. The nutrition of the children is bounded with the socioeconomic condition of the families. From the tables, weight for age, and height for age values are all worse in eastern part though the gap started to broaden from 1993 to 1998 to 2003-04.

The other main problem of malnutrition is that it increases the risk of illness that hurts the body and hurts the life quality. People use the health care services more than the healthy ones and hospital stay days increase.

Thus malnutrition has effect on school and work attendance. Mayer-Foulkes (2005) looks the topic from the human capabilities aspect, that with the increase in the nutrition status of the people their capabilities have increased substantially in the last two centuries. This has role on the stagnation of the modern economic growth.

3.3.1.2 Pathogens and Infectious Diseases

Pathogens are defined as *“the microscobic organisms that can cause disease in the other bodies, in humans, animals and plants (e.g., bacteria, viruses, or parasites) found in crowded areas, in runoff from farms or rural areas populated with domestic and wild animals, and in water used for swimming, etc. (www.medterms.com). ”* Pathology is the study field and in the pathology centers examine the cause of the illnesses and provide care activities against pathogens.

The pathogenic illnesses are one of the main health problems. They cause low birth weight, low height in the child hood and the loss of the working days, therefore life expectancy rate would be lower due to pathogenic illnesses. Besides, these kind of situations sometimes have large effects on the economy directly. As an example like SARS viruses that appeared in China and conveyed to the other countries, or in the recent years bird flu became a threat for economic activities. The precautions before the pathogenic illnesses diffusion to large areas are important, moreover by the time its harm on economy gets bigger. Nowadays, the H1N1 (swine flu) virus is a serious problem that appeared firstly in Mexico

and conveyed one to another with communicable ways. It is easy to diffuse and so many precautions are taken country-wide. In the short run the economic consequences of the illness would be the decrease in the tourism revenues since the tourist all over the world will be reluctant to travel for holidays as before. Here we see that the virus hasn't large effect on our citizens but it has negative effects on economy.

The other infectious disease is the HIV virus. All over the world so many human get the viruses and in some countries, like African, it hits the economy by huge level of expenditures to avoid the viruses and provide cure activities. Though the WHO and UN transfer health personnel and financial aid, they couldn't prevent the diffusion of the viruses from one to other bodies. For Turkey HIV prevalence is not a serious threat since the HIV prevalence rate is in confident level. The HIV prevalence of Turkish citizens is less than 1 per thousand (HDR, 2008), therefore it has no large impact on the economy.

3.3.1.3 Medical Care and Health Expenditures

Medical care actions are initial actions those aim to avoid or remove the causes of the health problems before it hurts the body or the community and before a serious threat for the society. Medical care actions include health protection services. By health care training actions or education in the schools or center, the citizens became aware of the seasonal disease and avoiding chronic illnesses. These types of health care actions have great importance. These precautions will affect positively the future health status

of the people and it has really great impact in the growing era of the children to be in the optimum weight-height in the related ages. The life expectancy and the quality of the life is related to care activities. Therefore, being aware of the illnesses and have precautionary approaches provide better life for the human.

Second actions are detecting a health problem at an early stage. This provides to prevent the future bigger harms of the diseases. Hence, the early detection prevents the disease to have large destruction in the body. Both cure and care activities are bounded with the economic situation of the family, the education level of the individuals and the most important is the health infrastructure of the state. Health care services are not only the using the drugs or any other medical tools, it includes knowledge about illnesses and be aware of the healthy life actions by keeping your body energetic. Hence, the diseases couldn't be threat for the body easily.

Cure activities are one step further, and they are more comprehensive, since the medical tools used like drugs and surgery actions. The economic burden of the cure activities is heavier than the care activities. Though this case Turkish institutions invest much lower sources on care activities. But if more importance is given to the care activities the health expenditures of the state will decrease, moreover the load of the health institutions will decrease. Within the fund generated by the saving from cure activities would be new investment to the regions that are lag in health services.

The health expenditures is seriously influenced from the economic conditions, for example in the 2001 economic crisis of Turkey the per capita health expenditure dropped drastically. While health is a core issue in the human life, in the crisis conditions individuals spend less on health than before. While they spent \$189, \$205 in years 1999 and 2000 respectively (THS, 2006), it fell to \$161 in 2001. After the drop, it gradually increased within the amendments in the income of the citizens in the following years and with start of \$259 in 2003, it is more than \$550 per capita annually (OECD, 2008).

The critic about health expenditures is the per capita spending on health. Among OECD countries our health spending is much lower than the average and the effective use of the health fund is criticised. Although the new laws that facilitate people to access the health services and enable them all be secured by the state to utilise from the health services, abuse of the health funds occurs. The new health actions are really costly and the biggest part of the state budget deficit is caused by state health spendings with social security deficits, and it is actually more than 20 billion TL in 2008.

3.3.2 Health Outcomes

The health inputs have some consequences in the future and these are effective in the life cycle of the individuals. For the quality of the life, high life expectancy and high rate of financial returns, these health related factors gained importance.

3.3.2.1 Body Mass Index (BMI), Height for Age, Weight for Age

One of the key indexes for healthy body is weight height ratio in different ages in the life span. The body mass index (BMI) is a person's weight in kilograms (kg) divided by their height in meters (m) squared. According to this calculation the results is interpreted to three categories: normal weight, overweight, and obesity. The international BMI chart indicates the optimum values. Since the BMI describes the body weight relative to height, it correlates strongly with the total body fat content. Overweight is defined for women when BMI is 27.3 % or more and 27.8 % or more for men. Obesity is defined as a BMI of 30 % or more than this value (www.medterms.com). The normal BMI for adults is between 18.5 and 24.9.

The other indicator is adult height, it is a good indicator of health status of the individuals. This indicator is related to grew up period of the children. Factors such as malnutrition and illness during the childhood has negative impacts on the adulth height. Besides, this the nutritional status during the uterus period of the children has remarkable impact on the adult height. The health status of individuals according to the adult height is determined by the averages of the whole population. Thereby the change in average height of the population over time provides a good indicator of the change in the health environment, while the genetic situation of the

population doesn't change (Weil, 2005). Additionally, wherever per capita income are unavailable, researchers look for the average height of the population to have some information about the standart living of the society. However this is a method used mostly, it has some shortcomings, where the health environment is changing rapidly, the adult height indicator is a bit problematic indicator, Barro (1996) has serious survey about height and economic growth relation for the Pan American Health Organization.

In microeconomic studies, most frequently used health indicator is adulth height. Additionally, Body Mass Index (BMI) estimates are used in the surveys, but there is not consistent data for comparison of the countries. So that less survey had done on BMI and economic growth. Accordingly, there is no serious survey in Turkey that seeks for the BMI and height relation to economic growth by searching regional data. The study is done by WHO in each 5 years and published with the name of "Global Database on Child Growth and Malnutrition" to seek for the health outcomes of the children in different regions (WHO, 2004). The plausible proposition about the topic is that the highly income families children BMI would approach the standards, but we could seek for that if the BMI and height for age values approach the standart values, is it possible to this situation foster the individual productivity and within the chain, accelerate the economic growth.

As BMI, weight for age, and height for age are proxies of health, thus, they view the health status of the citizens, especially children, they give us idea about all regions of Turkey. Beginning from 1993 to 2004, each five

year this survey (WHO, 2004) is done and 2008-09 will be published in the following months. When we take into consideration year 1993, refer table 3.4, we see that the Eastern region of Turkey's children health indicators indicates us the lag situation. When Turkey average 32.9 % for children who are below SD of height for specific age, the number is 59,4 % in Eastern regions. It is huge gap, and shows that more than half of the children health aren't in the expected situation. The gap has narrowed down in the following years as we observe in the following reports (Table 3.5, Table3.6), but still eastern parts health situation is worse while every time western regions, Eagean, Mediterranean and Marmara Regions, are better.

TABLE 3.4 THE HEALTH STATUS OF THE CHILDREN ACCORDING TO HEALTH INDICATORS AMONG DIFFERENT LOCATIONS OF TURKEY IN 1993

Year 1993									
Location	Weight/Age		Height/Age		BMI/Age				
	Below 3SD	Below 2SD	Below 3SD	Below 2SD	Below 3SD	Below 3SD	Above 1SD	Above 2SD	Above 3SD
Turkey Average	2,4	8,7	8,8	24,1	0,9	3,8	26,5	6,1	1,6
Residence									
Urban	1,8	6,7	5,9	19,2	0,9	2,9	20,6	2,7	0,6
Rural	3,4	11,8	13,3	31,5	0,7	3,7	25,1	5,6	1,2
Region									
Central	1,8	5,9	7,7	23,7	0,6	2,5	32,6	8,1	2,3
East	5,9	19,5	17,9	41,5	2,1	7,1	21,7	5,2	1,3
North	1	5,6	8,1	16,3	0,6	1	32,6	8	2,2
South	1,4	5,7	6,3	20	0,3	2,3	22,7	5,6	1,4
West	0,9	3,8	3	13,2	0,6	3,6	26,1	4,9	1

Source: WHO, (2004). www.who.int/entity/nutgrowthdb/database/countries/.../tur_ref.pdf . (May 2009)

In 2003-2004 survey, height for age ratio of Southeastern Anatolia is 36 % below SD, it is an amendment when compare to 1993 59.4 % value, while the average is 20,5 % for Turkey. For future projection, this condition will be resulted with low performance in education, and in work life. The rate of return of the individuals will be lower than their western counterparts.

TABLE 3.5 THE HEALTH STATUS OF THE CHILDREN ACCORDING TO HEALTH INDICATORS AMONG DIFFERENT LOCATIONS OF TURKEY IN 1998.

Year 1998									
Location	Weight/Age		Height/Age		BMI/Age				
	Below 3SD	Below 2SD	Below 3SD	Below 2SD	Below 3SD	Below 3SD	Above 1SD	Above 2SD	Above 3SD
Turkey Average	2	7	7,5	19,1	0,9	2,5	26	5,4	0,5
Residence									
Urban	1,4	5,2	5,9	14,9	0,9	2,3	25,1	5,1	0,4
Rural	3	10,1	10,3	26,5	0,9	2,7	27,5	5,8	0,7
Region									
Central	1,5	4,3	4,7	14,3	0,5	1,7	29,5	6	1,1
East	4,6	14,7	16,3	35	1,6	4,1	23,7	5,5	0,2
North	0,6	4,4	4,7	15	0,8	2,4	35,4	8,4	0,5
South	1,7	7,4	5,5	17,8	0,8	2,3	18	3	3
West	0,8	3,3	4,1	11,7	0,7	1,8	26,8	5,1	0,4

Source: WHO, (2004). www.who.int/entity/nutgrowthdb/database/countries/.../tur_ref.pdf . (May 2009)

**TABLE 3.6 THE HEALTH STATUS OF THE CHILDREN
ACCORDING TO HEALTH INDICATORS (2003-04)**

Year 2003-04									
Location	Weight/Age		Height/Age		BMI/Age				
	Below 3SD	Below 2SD	Below 3SD	Below 2SD	Below 3SD	Below 3SD	Above 1SD	Above 2SD	Above 3SD
Turkey Average	0,8	3,5	4,9	15,6	0,4	0,9	40	10,7	1,8
Residence									
Urban	0,8	2,5	3,5	11,8	0,4	0,8	40,2	10,8	1,9
Rural	0,9	5,4	7,6	22,9	0,3	0,9	39,5	10,4	1,6
Region									
Aegean	0	2,2	1,6	11	0	0,8	34,2	10	1,1
Central Anatolia	0,8	1,3	4,3	12	0,4	0,8	40,9	12,4	1,9
Central East Anatolia	2,4	8,3	13,2	31,6	0	0,6	34,1	5,7	0,9
East Marmara	1,1	2,9	1	6,4	1,2	1,6	31	7,7	1,4
East Black Sea	0	1,3	5,7	18,8	0,3	0,3	44,8	14,7	0,3
Istanbul	0,6	1,6	1,4	7,8	0,5	0,9	44,8	11,5	2,7
Mediterranean	0	2,1	4	14,2	0,4	0,4	41	11,3	1,4
Northeastern Anatolia	0,8	6,5	7,7	23,3	0,4	0,8	43,1	10,8	2,2
Southeastern Anatolia	1,7	6,8	9,6	27	0,4	1,7	43,1	10,7	1,6
West Marmara	1,7	3,7	2	9,3	0	0	39,4	13,6	2
West Anatolia	0,4	1,6	4	11,4	0,4	0,4	39,9	11,9	3,4
West Black Sea	0	2,6	3,8	11	0,3	0,6	39,5	11	1,4
Central	0,4	2,5	4,3	12,2	0,3	0,9	39,2	11,1	2
East	1,8	7,1	10,3	27,6	0,3	1,2	40,6	9,4	1,5
North	0	1,4	4,8	14,6	0,4	0,7	42,6	14,1	1,4
South	0	2,1	4	14,2	0,4	0,4	41	11,3	1,4
West	0,7	1,9	1	7,9	0,5	0,7	39	10,6	2,2

Source: WHO, (2004). www.who.int/entity/nutgrowthdb/database/countries/.../tur_ref.pdf . (May 2009)

3.3.2.2 Infant Mortality Rates

Infant mortality rate (IMR) is found by number of death bodies after birth divided to one thousand live births in the first year. The most common causes of infant mortality are diarrhea, infections and malformation. In the developed countries, IMR approach to 0. IMR is a good indicator for having idea about the development level of the countries. IMR could be decreased by establishing rural health institutions and having training programs for mother. Mostly infant mortality occurs in the rural areas in Turkey. In the long run period we see that the IMR decreased seriously by health investments in the rural areas and by the increased awareness of the mother about child health. The IMR was considerable high before 80's. The amendments in the health services of the state and the with the improvements in the medical technology and the transfer of this technology to the rural areas, although some lag occurs, have consequences of declining infant mortality rates.

In the literature there are several terms used to define the mortality of the children: perinatal mortality only includes deaths between the foetal viability (22 weeks gestation) and the end of the 7th day after delivery; neonatal mortality only includes deaths in the first 28 days of life; post-neonatal mortality only includes death after 28 days of life but before one year; child mortality includes deaths within 5 years after birth and under five mortality is the total of child and infant rates (www.medterms.com) .

In the recent years, within the new laws that came into force about the health system according to be convenient with the EU laws, the regional lag about the service quality and the work force lowered. Besides the EU effect, the high economic growth performance of the country enabled state to invest more in the health. In the eastern part of the Turkey, the mothers started to be conveyed to the hospitals in the winter time before several days of their children born and this case is too important attempt for both infant health and the mother health. Before in these parts of the country, infant mortality rate was too high and Turkey's infant mortality rate was 150 per thousand in 1970, while European average was 27 per thousand and OECD average was 26 per thousand (HDR, 2008). According to 2005 and 2007 data Turkey has showed quite progress about the infant health and the mother health, respectively in 2005 the number is 26 per thousand and in 2007 the number is 21 per thousand (HDR, 2008). Table 3.7 illustrates the IMR and under five mortality rate between 1970 and 2005. Within the economic growth and the rise of the per capita income the life expectancy rates rised and infant mortality rate declined. When we ignore some of the years the health indices are plausible develop. The exceptional cases occurred sometimes lack of the relevant health personnel in the rural areas or the shortage of the MoH budget to serve health activities effectively.

Starting from 1970, except 1975-79 period, infant mortality rates declined in the Turkey, averagely. While it was 150 in 1970-75 period, it is less than 30 in 2009. It is not as low as the OECD and the EU countries but

the progress continues. The U5MR decline is much more impressive than IMR, while it was 210 in 1970-75 period, it is 28 nowadays. The parents awareness and their spending for their child health have large impact on the amendments of these cases within the states attempts to allocate fund fairly among regions to avoid infant and child mortality.

TABLE 3.7 LIFE EXPECTANCY AND INFANT MORTALITY RATES WITHIN THE ECONOMIC INDICATORS BETWEEN 1950-2009.

Years	Average GDP per capita in \$	% growth of GDP per capita	LE from birth (years)	IMR (per thousand live births)	Child Mortality (per thousand live births)	U5MR (per thousand live births)
1950-54	1858,51	4,5	42,8			
1955-59	2224,6	3,3	44,68			
1960-64	2376,6	2,4	49,93			
1965-69	2773,6	3,4	53,12			
1970-74	3198	2,1	55,09	150	60	210
1975-79	3752,1	1,1	57,01	158	65	223
1980-84	3716,6	2,3	59,04	126	47	173
1985-89	4334,9	2,1	66,4	109	37	146
1990-94	4896,5	0,3	67,1	67	16	83
1995-99	5459,4	1,4	67,8	51	11	62
2000-04	5609,85	0,1	68,7	43	7	50
2005-09	8653	5,3	69	25	3	28

Source: GDP per capita values are with the constant prices of the years 2000 and taken from PWT 6.2 country statistic tables, available at http://pwt.econ.upenn.edu/php_site/pwt62/pwt62_retrieve.php. Life expectancy rates and infant mortality rates are taken from <http://www.tuik.gov.tr/Beslenme/temelGostergeler.htm>.

3.3.2.3 Life Expectancy and Mortality Rates

Life expectancy (LE) is the total years a person survives. It has different categories like LE after 5, at birth etc. Also the term is called expectation of life. LE describes the average life span of the individuals.

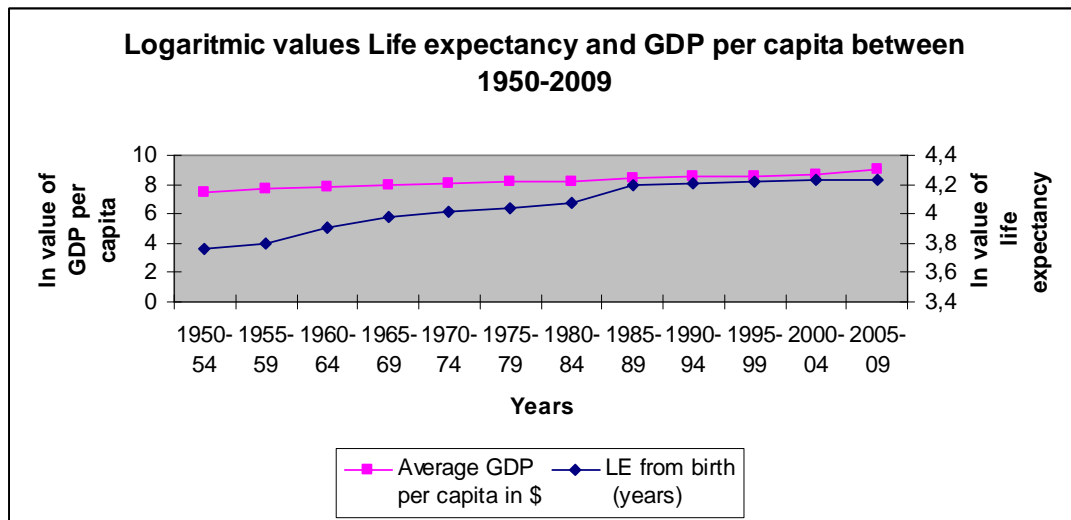
Mortality rate is the portion of the individuals that die during a specified period.

The third outcome of the health status is the Life Expectancy and the Mortality Rates. The LE has the advantage of measuring survival during working years, and thus it seems to be a good indicator for determining the level of output per worker. Weil (2005) found that the relation between adult mortality in 1999 and output per worker in 1996 by using the cross-country data. By increase in the adult survival rates (ASR) resulted by the increase of the per capita income. For instance, ASR is approximately 0.4 in 1999 in Rwanda while the GDP per capita is approximately \$1400 per year. In opposite to this situation ASR is approximately 0.9 and GDP per capita is \$750. Mainly the high mortality occurs in poor countries because of the low nutrition and the lack of the public health services or the inefficient use of the services. These situations occur under the situation of poverty and inadequate living conditions. As a consequence of this situation saving rates and investment rates are low in high mortality societies since low expectancy raises impatience of the individuals and decreases the rate of returns of investments.

Within the second half of the twentieth century life expectancy rates increased gradually in the western countries. Table 3.7 indicates the life expectancy rates, and the income increases. Turkey life expectancy also increased but not as the western countries. Due to the some health service and funding problems people couldn't access the health services as easy as the western citizens. The income rates are the other main determinant of the health expenditures. Turkish citizens' per capita health expenditures are averagely one sixth of the EU countries and one tenth of the USA (HDR, 2006).

When we look in the life expectancy improvement in Turkey (Figure 3.4), by the raise in the per capita income LE raises or correspondingly within the LE increases the long run investment of the individuals raise and the capital accumulation in the long run period contributes to the economy more than low LE rate period. These two propositions are possible and we leave the result to the data analysis part in the following chapter. The Figure illustrates that all two LE and GDP per capita growth in quennial periods from 1950 to 2009. Also there is some shortcomings of the economy like crises but when looked in the 5 year periods, 1950's, 1965-70 and the recent years, after 2001 crise, the upward sloping of the GDP per capita is impressive than the other periods. From health side these periods are also the periods of the amendments in the health system and social security system to enable all citizens to access the health services easier. Therefore within the easy access life of the individuals be longer and the healthy life time extends.

FIGURE 3.4 LOGARITMIC VALUES OF LIFE EXPECTANCY AND GDP PER CAPITA BETWEEN 1950-2009.



Source: GDP per capita values are with the constant prices of the years 2000 and taken from PWT 6.2 country statistic tables, available at http://pwt.econ.upenn.edu/php_site/pwt62/pwt62_retrieve.php. Life expectancy rates are taken from <http://www.tuik.gov.tr/Beslenme/temelGosterger.htm>.

In this case we cannot mention that the high value of the health expenditures are whole the indicator of the life quality, due to the discussion of the fund effective and efficient utility problem but it can give us some idea that Turkish people do not intent to expend on health as their EU counterparts due to budget constraints. The average incomes of the EU countries' citizens are more than thirty thousand US dollars according to PPP of year 2008 but Turkey is newly approaching to ten thousand US dollars.

While concluding the chapter 3, we met two aims of our study. We viewed the map of regionsi provinces and the whole Turkey picture according to health related issues. We have observed that low health workforce density provinces income is lower than the others. For future projection, the gap would narrow down but health investments of the state

have to go on to ensure to provide more effective and efficient health services. The other problem of unfair distribution of health funds and health workforce has to be solved to utilize from health capital of the citizens for sustainable progress.

CHAPTER 4

HEALTH ROLE IN THE ECONOMIC GROWTH: THE CASE OF TURKEY

4.1 Methodology

Initially, we construct a model of growth, starting with the aggregate growth function representing output (Y) as the function of labor, capital and technological variables. We represent two kinds of capital in the model: one is human capital and the other is physical capital. Then we solve it to reach the Cobb-Douglas per capita equations and ln value of the variables via regression analysis. The data are obtained from statistical year books and web page of the related institutions. Also some are calculated by the author via dividing population to the number of the each province health workforce number in the specified years. For regression analysis 57 years data of Turkey used for LE rates, GDP per capita values and per capita capital stock values, that are between years 1950-2007; to regress the schooling ratio and the MoH budget ratio to state budget data are available from year 1987 and therefore we use 20 years data while regressing these variables.

The dependent variable: GDP per workforce is in US Dollars within the constant prices of year 2000; the independent variables: LE is in years, schooling ratio is the formal education ratio of Turkey, per capita capital stock is in US Dollars, and health expenditures are the ratio of the MoH budget to state budget in the related years.

The regression results are tested according to their level of significance. The correlation level test between independent and dependent variables occurred in the empirical study. The results noted in tables representing the coefficients, standart deviations and interval values. Four different tests occurs in the regression of the per capita production function, that exists by changing the independent variables in each of the regression (Table 4.3) and two correlation level analysis to investigate the relation between the variables (Table 4.2 and 4.3)

4.2 Data

We construct a time series data of Turkey for 5 years periods between 1950-1985 and beginning from 1987 to 2007 annual data exist in the survey. Output data, GDP per capita and GDP per workforce, are obtained from PWT 6.2. The independent variables data, such as LE, are obtained from TUIK statistical pages and THR, 2006. LE is used as the proxy of the health status of the workforce. Capital stock is calculated by the investment ratio of each period that is obtained from PWT 6.2. Between 1950-1985 values of the GDP per capita are the average rates of related five years period. Beginning with 1987 to 2004 values are annual values obtained from same source and the values after 2005 to 2007 are estimated and calculated by taking into consideration the growth rate of Turkey. All GDP values used in the econometric analysis are referenced to constant prices of the 2000 and PPP in US dollars.

Health statistics, about MoH, are obtained from MoH statistical pages and from THR, 2006. The health densities of the provinces are calculated by dividing active health workforce to related years population for each province. Population data and health workforce data are obtained from TUIK pages and MoH pages. The GDP level of each province in 2001 data is obtained from TUIK page and unfortunately we could not reach actual data like for years 2007-2009, since TUIK give up offering GDP per capita of each province in 2001 and soon this year in October he will start again.

4.3 The Model

We initially use the production function approach. The proxy of health commonly used is the life expectancy statistics. In most of the model it is included in the logarithmic component, not directly to labor. We construct the model in the form of ln with starting with the production function.

$$Y_t = K^\alpha H^\varphi (AL)^{1-\alpha-\varphi}, \quad 0 \leq \alpha \leq 1, \quad 0 \leq \varphi \leq 1, \quad \alpha + \varphi \leq 1 \quad (1)$$

Where A, the technological variable; K, capital stock; H, health human capital stock and education human capital stock. Hiring one more unit of labor will increase the human capital stock and also n, population. Labor augmenting model is used in our formula. The marginal product of labor is calculated by using the per labor human capital. The extended solution of the model can be seen in Appendix C⁴ and ln values of the available data is

⁴ The Formula is taken from Todaro and Smith, 2006. For extended definitions and information please refer to the source.

in the Appendix A. After the solution of the formula via Cobb-Douglas per capita equations we reach a model like

$$\ln \text{GDPPC} = a_1 + a_2 \ln k + a_3 \ln l + a_4 \text{LE} \quad (2)$$

where GDPPC is per capita GDP, k – capital stock per capita (labor force), l – employed labor (it is 1 since it is per capita equation) force, LE – life expectancy rate at birth of each labor force. Finally, we find

$$\ln \text{GDPPC} = a_1 + a_2 \ln k + a_3 \text{LE} \quad (3)$$

When we want to extend the per capita equations (2) and (3), we can add schooling ratio and the health expenditures of the state, since they are related to human capital. It is notable that we don't use ln value of LE and SR since the change of them isn't much and when we take them in ln form the results may not show us the exact results.

$$\ln \text{GDPPC} = a_1 + a_2 \ln k + a_3 \text{LE} + a_4 \text{SR} \quad (4)$$

$$\ln \text{GDPPC} = a_1 + a_2 \ln k + a_3 \text{LE} + a_4 \text{MoH} \quad (5)$$

Equation (4) illustrates the GDP per capita is a function of workforce per capita capital stock, life expectancy at birth and the schooling ratio; moreover in the equation (5) the health expenditures taken as the MoH budget ratio are embedded instead of schooling ratio.

4.4 In Search of Relationships

When we take into consideration the provinces health workforce density, and the GDP per capita correlation, we could construct a model to test the causal relationship between two variables (GDP per capita of the provinces, and health workforce density).

H₁: The health workforce density, the health providers number per thousand people have impact on the GDP per capita.

$$F(X_1) = X_2,$$

where X₁ is the dependent variable and it is present the GDP per capita income in US dollars, and X₂ is the independent variable that have consequences on GDP.

The test have the correlation of 0,57 and indicates that the relation is significant. Table below illustrates the standart deviations and standart error of the variables. Therefore, we accept H₁. In appendices the provinces and the health personel density exist. Appendix A illustrates the healthworkforce number per thousand people and per capita income in US dollars with the 1987 constant prices.

TABLE 4.1 TEST RESULTS OF GDP PER CAPITA AND HEALTH PERSONNEL DENSITY

	Std. Deviation	Std. Error Mean
GDP per capita (X ₁ , dependent)	0,001820	0,000202
Health personnel density (X ₂ , independent)	912,440	101,382

(t₍₈₀₎ = -17,44, p ≤ 0,01)

When we investigate the life expectancy and GDP per capita correlation via paired samples test, we construct a model as GDP per capita in US dollars is dependent variable and life expectancy at birth is independent variable.

$$F(X_1) = X_2,$$

H₂: Increase in the life expectancy has positive influence on the GDP per capita

TABLE 4.2 TEST RESULTS OF GDP PER CAPITA AND LIFE EXPECTANCY

	Std. Deviation	Std. Error Mean
GDP per capita (X ₁ , dependent)	0,44550	0,12861
Life expectancy rate at the birth (X ₂ , independent)	0,16953	0,04894

(t₍₁₁₎= 49,488, p≤ 0,01)

Life expectancy and GDP per capita is calculated as 5 years period from 1950 to 2008. The extended table is in Appendix B. The test results presents the life expectancy rate at the birth have effect on the GDP per capita in US dollars with the significance level of 0,94. Hence, we accept H₂.

4.5 Empirical Results

We have 8 regression analysis for searching relationships between the distinguished variables. The results are presented in Table 4.3. In the first regression, we tried to regress GDP per workforce to capital stock of per workforce. Logic of the model is that GDP per workforce raise by technology, and capital stock as the discussion of the recent studies. As we observed the high R squared ratio, we seek for the multicollinearity tests between per capita and LE; between per capital stock and LE; then the results of R squared values respectively retrieved 0,297; and 0,390 for Turkey. We reach a conclusion that there is no multicollinearity between variables, nonlinearity occurs between variables.

TABLE 4.3 RESULTS OF REGRESSION ANALYSIS

	1	2	3	4
Right-hand side variables	$\ln\text{GDPPC} = a_1 + a_2 \ln k + a_3 \text{LE}$	$\ln\text{GDPPC} = a_1 + a_2 \ln k + a_3 \text{SR}$	$\ln\text{GDPPC} = a_1 + a_2 \ln k + a_3 \text{LE} + a_4 \text{SR}$	$\ln\text{GDPPC} = a_1 + a_2 \text{LE} + a_3 \text{SR}$
Constant value	6,166 (0,131)	9,244 (0,101)	4,377 (3,846)	4,451 (3,845)
Capital per worker	0,002 (0,018)	-0,013 (0,014)	-0,013 (0,013)	
Life expectancy	0,048 (0,03)		0,075 (0,059)	0,73 (0,059)
Schooling ratio		0,014 (0,002)	0,002 (0,001)	0,002 (0,010)
MoH Budget Ratio				
R Squared	0,957	0,735	0,758	0,743
Adj. R Squared	0,953	0,705	0,715	0,715
Level	at %1 level	at %1 level	at %1 level	at % 1 level
F value	276,321	24,927	17,709	26,069
Sample years	1950-2007	1950-2007	1950-2007	1987-2007
	5	6	7	8
Right-hand side variables	$\ln\text{GDPPC} = a + a_1 \text{LE}$	$\ln\text{GDPPC} = a_1 + a_2 \ln k + a_3 \text{LE}$	$\ln\text{GDPPC} = a_1 + a_2 \ln k + a_3 \text{LE} + a_4 \text{SR} + a_5 \text{MoH}$	$\ln\text{GDPPC} = a_1 + a_2 \text{LE} + a_3 \text{SR} + a_4 \text{MoH}$
Constant value	-4,500(0,944)	-4,828 (0,930)	8,057 (3,001)	8,172 (2,933)
Capital per worker		-0,01 (0,001)	0,006 (0,011)	
Life expectancy	5,490 (0,923)	5,817 (0,910)	0,016 (0,046)	0,013 (0,045)
Schooling ratio			0,011 (0,007)	0,011 (0,007)
MoH Budget Ratio			0,038 (0,003)	0,039 (0,013)
R Squared	0,663	0,706	0,838	0,835
Adj. R Squared	0,644	0,672	0,798	0,806
Significant	at %1 level	at %1 level	at %1 level	at %1 level
F value	35,37	20,437	20,740	28,696
Sample years	1987-2007	1987-2007	1987-2007	1987-2007

Test 2 and Test 3 reveal that with a negative coefficient of per work force capital stock, it is not significant for Turkey case. Same problem occurs within the test 6 though R squared values are plausible with the band of 0,70 – 0,85. Most appropriate and comprehensive test in the existing is the number 7. We construct the function including LE, capital per worker, schooling ratio and MoH budget. The results are plausible at the 5 % level.

As the consequence of the regression tests, for Turkey case, LE as the proxy of the health status of the public has contribution to the economic progress in the long run. The results are analogously to the early surveys of the economists and researches that take place in different regions and countries. For Turkey case, life expectancy has not treshold role in the economy as the surveys reveal in the African countries, but not less as the European countries or any other welfare states. Since the health gap narrowed in the EU and in welfare states, the health role as one of the economic growth factors is seen has low influence, but the largest gap occurs in the African and in some Asian countries (chapter two, empirical studies) and as a treshold life expectancy has huge impact on growth.

TABLE 4.4 RESULTS OF REGRESSION ANALYSIS OF LE

Right-hand side variables	$LE = a_1 + a_2 \ln GDPPC + a_3 SR + a_4 MoH$	$LE = a_1 + a_2 \ln GDPPC$
Constant value	61,286 (11,648)	4,915 (5,631)
lnGDPPC	0,375 (1,291)	7,287 (0,655)
Schooling ratio	0,153 (0,19)	
MoH Budget Ratio	0,071 (0,82)	
R Squared	0,955	0,867
Adj. R Squared	0,947	0,86
Level	at % 1 level	at % 1 level
F value	119,09	123,601
Sample years	1987-2007	1987-2007

When life expectancy is taken into consideration, the role of GDPPC is obviously seen ith the coeffient of 7,278 taken GDPPC sole factor of life expectancy. Besides, the factors formal education as the value of schooling

ratio and MoH Budget ratio as the health expenditures impact on the LE is seen with analysing the coefficients 0,0375; 0,153; 0,071 respectively. The values are significant at the 0,01 level and includes 20 years data of Turkey. It is expected for the next decades that via raising of the GDPPC, life expectancy will increase.

As we compare Turkey case to the recent surveys (Bloom et al., 2003), our results are analogous to them with LE coefficient between 0,019 (0,012) and 0,073 (0,013).

In our work we proved health and growth have corresponding effect in different levels while taking into consideration different factors of growth in the model and also the other human capital factor, formal education ratio that include only the high school graduate has not got expected contribution to growth according to Turkey case.

4.6 Stochastic Model for Further Research

Human capital is very complex notion object of incessant extension. New and new components are added to it. At present the human capital models in increasing degree include beside the traditional years of schooling, experience and other aspects of acquired knowledge during the life span of individuals such components as health status, value systems, etc.

This complexity of human capital notion is multidimensional: it is a question of the proxies measuring human capital, their life span, distribution over generations, etc. Strongly emphasized are the intertemporal dimensions

of human capital, probably result of the increasing influence of sustainable development imperative.

In the presented below study we follow this imperative. The life span of individuals is divided into three basic periods – the birth and youth, active working time and retirement. It is obvious that health capital has various dimensions in each of these periods. For simplicity (unavoidable problem) we concentrate on the period of active working time as it is expected to be the most productive period of human life, which is denoted by t , the youth period correspondingly we denote as $t-1$ and the retirement period as $t+1$.

For all the periods the individuals are maximizing their utility of consumption, that is maximizing their utility function at any time t

$$U_t = \int U(C_t e^{\alpha t}) dt$$

C – consumption in period t

α - discount rate

object of the constraint function R

$$R = \psi(x_1, x_2, x_3, \dots, x_n)$$

where $x_1, x_2, x_3, \dots, x_n$ are restriction factors as income, culture, genetic features, etc.

We can formulate next the Lagrangian as

$$L = \int U(C_t e^{\alpha t}) dt + \lambda(x_1, x_2, x_3, \dots, x_n)$$

The next problem of the utility maximization is the change of utility over time. Following the Kahnemann logic we analyze three kinds of utility: experienced and expected (predicted) utilities. Utility maximization is using

martingale – a stochastic process in which the expected utility at time $t + 1$ depends only on the experienced utility at time t given the experienced utilities at all time before t , that is $t-1, t-2, \dots, t-n$.

In the most general form the utility of consumption (health) at time t can be expressed as

$$E(U_{t+1} | U_0, U_1, \dots, U_t) = U_t$$

The idea is that the expected utility in time $t+1$, given all previous utilities is equal to the utility at time t . The utility however can be filtrated over time by various factors. Health for example can be traded off for smoking for some period of time, which means that on the language of the martingale the utility can be filtrated with respect to another sequence, or $E(U_{t+1} | X_0, X_1, \dots, X_t) = U_t$ where the sequence X_0, X_1, \dots, X_t is called filtration.

In continuous time this can be expressed as

$$E(U_{t+1} | X_\tau, \tau < s) = U_s, \text{ for all } s \leq \tau.$$

Related to health, where the stochastic factors play very important role, it has many aspects and we are to decide which one to choose: children's survival, life expectancy under various conditions, etc.

Probability of the child to survive = number of survived children / total amount of children

We can next use maximum likelihood techniques to estimate the model.

CONCLUSION

As health gained quite importance in the last decades, it is perceived for particular group of scientists as a basic human right. Accordingly, it became one of the core element of human capital. From the beginning, we mentioned about the human capital scope and especially we emphasized the role of health in the human capital function by investigating distinguished papers and surveys. As it is a core determinant, it has some features to have contributions to quality of life socially and moreover to growth and income of the individuals economically.

In the empirical studies, the health influence on the human capital is quite great and proxy to the human capital; it has impact on the economic growth of the country. As another word, it is a threshold for development. If lag occurs among individuals or among regions, the aggregate development does not exist. Initially, the health problems have to be chosen and public investments have to be done in the lag regions. Moreover, lack of health will have negative impacts on the progress.

The other issue about is the financial burden of the health services, the efficient and effective use of them. Countries like Turkey, health expenditures of the state rise since the establishment of new hospitals and various health institutions, but unfortunately the ineffective use of the sources and abuse of them dampens the success.

In Turkey, we have seen that a gap between regions occurs about health workforce density and about the nutritional status of the children. Whilst

taking into consideration the annual health reports in a time series order, we observe that eastern part has some lags caused by the low income of the families and the low rate of the state investments. Accordingly, one of the main reason is the lack of social facilities as the western parts, and resulted with unreluctandness of health workforce to move to these provinces to work. One another point is the imigration to the western provinces like Istanbul, Ankara, Izmir, Bursa since the hard conditions that make people unable to access to health services.

The improvement in the health status of the individuals can be measured by the LE, IMR and the healthy life time of the one's. The quality of the health services improvement could be measured by the fair distribution of the health workforce fairly among regions and the following the medical care improvement by embedding the new technology in the health services. Health programs could cover more health care activities investments to make the public aware of the illnesses. This case have two consequences: 1) the healthy days of the individuals will rise and life quality will rise, 2) the state will save financial resources since the cure activities are much more expensive and generate burden on the budget.

In the emprical study we seek for the life expectancy, by taking it as a proxy of health, impact on the economic progress by using annual data from year 1950 to 2007. The regression results indicate that increase in the life expectancy is resulted with a plausable increase in per capita. Here we claim a correlation between life expectancy and economic growth with vector

direction from LE to growth. To my knowledge, the recent papers in Turkey were investigating that economic growth have positive impact on LE, our contribution is that we accept the latter but added to it the former. Though schooling is another core element of human capital, the regression results revealed (according to Turkey's data) that it has less impact than our expectations.

For further research, the stochastic health model could be established to calculate the utility maximization of health, taking into consideration the utility level change during life span of the individuals, and its impacts on economy.

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APPENDICES

APPENDIX A HEALTH WORKFORCE DENSITY OF EACH PROVINCE

Provinces	Population/ Active health workforce	GDP per capita with constant prices of 1987 in year 2001 (\$)	Provinces	Population/ Active health workforce	GDP per capita with constant prices of 1987 in year 2001 (\$)
ADANA	0,006	2339	KOCAELİ	0,006	6165
ADYAMAN	0,003	918	KONYA	0,004	1554
AFYON	0,004	1263	KÜTAHYA	0,004	1805
AĞRI	0,002	568	MALATYA	0,006	1417
AMASYA	0,005	1439	MANİSA	0,006	2459
ANKARA	0,011	2752	K.MARAŞ	0,004	1584
ANTALYA	0,006	2193	MARDİN	0,002	983
ARTVİN	0,006	2137	MUĞLA	0,008	3308
AYDIN	0,006	2017	MUŞ	0,002	578
BALIKESİR	0,006	2005	NEVŞEHİR	0,005	2117
BİLECİK	0,004	2584	NİĞDE	0,005	1781
BİNGÖL	0,003	795	ORDU	0,004	1064
BİTLİS	0,002	646	RİZE	0,004	1897
BOLU	0,006	4216	SAKARYA	0,004	2108
BURDUR	0,007	1951	SAMSUN	0,007	1680
BURSA	0,006	2507	SİİRT	0,003	1111
ÇANAKKALE	0,006	2335	SİNOP	0,006	1459
ÇANKIRI	0,004	1136	SİVAS	0,005	1399
ÇORUM	0,004	1654	TEKİRDAĞ	0,005	2498
DENİZLİ	0,007	2133	TOKAT	0,004	1370
DİYARBAKIR	0,004	1313	TRABZON	0,006	1506
EDİRNE	0,008	2403	TUNCELİ	0,007	1584
ELAZIĞ	0,007	1704	ŞURFA	0,002	1008
ERZİNCAN	0,004	1158	UŞAK	0,006	1436
ERZURUM	0,005	1061	VAN	0,003	859
ESKİŞEHİR	0,008	2513	YOZGAT	0,003	852
GAZİANTEP	0,004	1593	ZONGULDAK	0,006	2969
GİRESUN	0,005	1443	AKSARAY	0,004	966
GÜMÜŞHANE	0,004	1075	BAYBURT	0,004	1017
HAKKARİ	0,002	836	KARAMAN	0,005	2012
HATAY	0,003	1757	KIRIKKALE	0,007	2725
ISPARTA	0,008	1510	BATMAN	0,002	1216
İÇEL	0,005	2452	ŞIRNAK	0,002	638
İSTANBUL	0,006	3063	BARTIN	0,005	1061
İZMİR	0,009	3215	ARDAHAN	0,003	842
KARS	0,003	886	İĞDIR	0,003	855
KASTAMONU	0,005	1718	YALOVA	0,005	3463
KAYSERİ	0,006	1806	KARABÜK	0,006	1587
KIRKLARELİ	0,005	3590	KİLİS	0,004	1817
KİRŞEHİR	0,006	1488	OSMANİYE	0,005	1157
KOCAELİ	0,006	6165	DÜZCE	0,006	1168

Source: The GDP per capita is taken from TUIK page.

Health workforce density is calculated by dividing the population to the active workforce in the specified year for each province.

http://www.tuik.gov.tr/VeriBilgi.do?tb_id=6&ust_id

APPENDIX B LN VALUES OF THE VARIABLES

Years	ln GDPPC	ln GDPPC(per workforce)	ln K (per capita)	ln K (perworkforce)	lnLE
1950-54	7,527255919	8,106816039	4,703794867	5,283354986	3,756538
1955-59	7,707062655	8,34877454	5,181334011	5,823045895	3,799526
1960-64	7,77317368	8,473241304	5,319765698	6,019833321	3,910622
1965-69	7,927685046	8,682199026	5,599782145	6,354296125	3,972554
1970-74	8,070280893	8,873468055	5,96490597	6,768093132	4,008968
1975-79	8,23004431	9,072686207	6,197486354	7,040128251	4,043227
1980-84	8,2204031	9,080801001	5,824605625	6,685003526	4,078215
1987	8,41294317	9,258844781	6,570942484	7,416844095	4,188138
1988	8,411165787	9,254261559	6,448617997	7,291713769	4,18662
1989	8,395477433	9,235715678	6,538218981	7,378457227	4,189655
1990	8,469472455	9,306740866	6,712114413	7,549382824	4,195697
1991	8,464214267	9,293117798	6,543484416	7,372387948	4,197202
1992	8,49943647	9,320091236	6,700652386	7,521307152	4,200205
1993	8,559869466	9,372204087	6,962360124	7,774694745	4,201703
1994	8,485083137	9,28924397	6,519684312	7,323845144	4,204693
1995	8,533656917	9,329810872	6,854868927	7,651022881	4,206184
1996	8,58876939	9,377379072	6,888859574	7,677469256	4,20916
1997	8,639764744	9,42084438	6,983759196	7,764838831	4,210645
1998	8,653296274	9,426902312	6,954480551	7,728086588	4,213608
1999	8,605020902	9,371268036	6,8447601	7,611007234	4,216562
2000	8,650674583	9,409600983	7,008713479	7,767639879	4,219508
2001	8,565792861	9,318566777	6,448026205	7,200800121	4,220977
2002	8,607399459	9,354094336	11,34630212	12,092997	4,22391
2003	8,636397439	9,376871243	6,91267038	7,653144184	4,226834
2004	8,695841343	9,437157169	7,140418019	7,881733845	4,229749
2005	8,78201597	9,523324627	7,285906743	8,0272154	4,231204
2006	8,844912951	9,586308009	7,383895044	8,125290102	4,234107
2007	8,893709978	9,639847475	7,466593622	8,212731119	4,242765

Note: Values are the ln mode of the data of Table 3.3 and Table 3.7.

APPENDIX C FORMULA FOR CALCULATING THE PER CAPITA HEALTH HUMAN CAPITAL IN EMPIRICAL STUDIES

Production function with human capital is assumed to be (Todaro and Smith, 2006):

$$Y_t = K^\alpha H^\varphi (AL)^{1-\alpha-\varphi}, \quad 0 \leq \alpha \leq 1, \quad 0 \leq \varphi \leq 1, \quad \alpha + \varphi \leq 1 \quad (1)$$

where A, the technological variable; K, capital stock; H, health human capital stock and education human capital stock. Hiring one more unit of labor will increase the human capital stock and also n, population. Labor augmenting model is used in our formula. The marginal product of labor is calculated by using the per labor human capital:

$$Y_t = K^\alpha h^\varphi A^{1-\alpha-\varphi} L^{1-\alpha}, \quad (2)$$

where we find the $h_t = H_t / L_t$, then we have to find the output per capita by finding y_t . $y_t = Y_t / L_t$, dividing both sides by L_t gives us the per capita production function:

$$y_t = k^\alpha h^\varphi A^{1-\alpha-\varphi}, \quad (3)$$

The investment rate of the physical capital and the human capital is related to the per capita consumption of the households. $S_t = Y_t - C_t$, after the calculation of the saving rate per capita, we have to find the distribution of the saving rate among physical capital and the human capital.

$$K_{t+1} - K_t = I_t^K - \delta K_t, \quad (4)$$

In equation (4), we have substruct capital stock in time t+1 than in time t. Thus we find the change in the capital stock. Investment of capital stock is calculated after the capital stock depreciation.

$$H_{t+1} - H_t = I_t^H - \delta H_t \quad (5)$$

In equation (5), we have substruct human capital stock in time t+1 than in time t. Thus we find change in the human capital stock. Investment of human capital stock is calculated after the human capital stock deprecation.

$$I_t^K + I_t^H = Y_t - C_t = S_t \quad (6)$$

$$I_t^K = s_K Y_t, \quad 0 \leq s_K \leq 1 \quad (7)$$

$$I_t^H = s_H Y_t, \quad 0 \leq s_H \leq 1 \quad (8)$$

Equation (6) and (7) represents the ratio of the capital stock investments and the ratio of human capital investments to GDP.

$$L_{t+1} = (1+n) L_t \quad (9)$$

Here in equation (9), n represents the growth rate of the population.

$$A_{t+1} = (1+g) A_t \quad (10)$$

Writing equation (4) and (5), as $K_{t+1} = s_K Y_t + (1 - \delta) K_t$ and $H_{t+1} = s_H Y_t + (1 - \delta) H_t$, then divide both sides by $A_{t+1} L_{t+1}$.

$$k_{t+1} = [1/(1+n)(1+g)] [s_K y_t + (1 - \delta) k_t], \quad (11)$$

$$h_{t+1} = [1/(1+n)(1+g)] [s_H y_t + (1 - \delta) h_t], \quad (12)$$

The steady state and comparative statics analysis, we write (11) and (12) and then subtract k_t from both sides to find the change between time $t+1$ and time t .

$$k_{t+1} - k_t = [1/(1+n)(1+g)] [s_K k_t h_t - (n+g+\delta+ng) k_t], \quad (13)$$

$$h_{t+1} - h_t = [1/(1+n)(1+g)] [s_H k_t h_t - (n+g+\delta+ng) h_t], \quad (14)$$

At steady state these two equations are equal to 0.

$$s_K k_t h_t - (n+g+\delta+ng) k_t = 0, \quad (15)$$

$$s_H k_t h_t - (n+g+\delta+ng) h_t = 0. \quad (16)$$

From (15) and (16), we find k and h to construct the aggregate production function per capita.

$$k_t = [s_K^{1-\varphi} s_H^\varphi / (n+g+\delta+ng)]^{1/1-\alpha-\varphi} \quad (17)$$

$$h_t = [s_K^\alpha s_H^{1-\alpha} / (n+g+\delta+ng)]^{1/1-\alpha-\varphi} \quad (18)$$

then put the variables in the equation, $y_t = A_t k_t h_t$,

$$y_t = A_t [s_K^{1-\varphi} s_H^\varphi / (n+g+\delta+ng)]^{1/1-\alpha-\varphi} [s_K^\alpha s_H^{1-\alpha} / (n+g+\delta+ng)]^{1/1-\alpha-\varphi} \quad (19)$$

By taking the ln of both sides, we find:

$$\ln y_t = \ln A_t + (\alpha/1-\alpha-\varphi) [\ln s_K - \ln(n+g+\delta)] + (\varphi/1-\alpha-\varphi) [\ln s_H - \ln(n+g+\delta)] \quad (20)$$

where s_K is capital investment rate calculated by the saving rate and investment rate, s_H is rate of LE and rate of formal schooling. For more basic indication we reach:

$$\ln \text{GDPPC} = a_1 + a_2 \ln k + a_3 \ln l + a_4 \text{LE} + a_5 \text{SR} \quad (21)$$

where k is capital stock per capita, l is labor force, LE is life expectancy and SR is schooling ratio.

**APPENDIX D LN VALUE OF VARIABLES INCLUDING MoH BUDGET
and SCHOOLING RATIOS**

Years	ln GDPPC (per workforce)	ln K (perworkforce)	Schooling Rate (%)	MoH B/ StateBudget (%)
1987	9,258845	7,416844	8,4	2,8
1988	9,254262	7,291714	8,6	2,73
1989	9,235716	7,378457	8,8	2,74
1990	9,306741	7,549383	9,4	4,12
1991	9,293118	7,372388	9,9	4,21
1992	9,320091	7,521307	10,2	4,71
1993	9,372204	7,774695	10,8	4,56
1994	9,289244	7,323845	12,7	3,72
1995	9,329811	7,651023	12,6	3,9
1996	9,377379	7,677469	13,5	2,76
1997	9,420844	7,764839	14,4	3,22
1998	9,426902	7,728087	16,1	2,65
1999	9,371268	7,611007	18,2	2,81
2000	9,409601	7,76764	18,7	2,26
2001	9,318567	7,2008	18,4	2,66
2002	9,354094	12,093	21,1	2,4
2003	9,376871	7,653144	23,4	2,43
2004	9,437157	7,881734	24,5	3,19
2005	9,523325	8,027215	25	3,8
2006	9,586308	8,12529	27,5	4,3
2007	9,639847	8,212731	28,1	5,2

Note: Values are the ln mode of the data of Table 3.3 and Table 3.7.