NUSBD

A R A Ş T I R M A   M A K A L E S İ   /   R E S E A R C H   A R T I C L E

THE IMPACT OF INNOVATION ON ECONOMIC DEVELOPMENT IN TURKEY

Çağrı ÖZDENER*

* Graduated in Master of Business
Administration from International Balkan
University, Skopje, North Macedonia

e-posta:
cagriozdener@outlook.com
ORCID 0000-0002-5357-3326

ABSTRACT

The main subject of this study is to investigate the impact of innovation on economic development in Turkey. According to the main topic, GDP Growth, unemployment rate and productivity will be used as three main variables. The result obtained using the linear regression analysis show that that innovation has a significant impact on economic development in Turkey. In fact, the analysis implying a significant impact of innovation on employment/unemployment rate as well labor productivity, while due to the statistical insignificance of the results received related to the correlation of the Innovation and GDP growth can be neither rejected nor confirmed. Yet, due to the limited time span of 12 years, covering the period when several global crises have occurred, as well as to the fact that the GDP growth is also a very complex indicator that shows intensive volatility in the crisis period, the lack of significant evidence for such correlation can be understood and accepted. Having in mind that the two other indicators (employments and productivity) are very important factors for economic development, the evidence of the strong and significant impact of innovation on employment and productivity can contribute towards confirming the innovation has a significant impact on economic development in Turkey.

Keywords: Innovation, Gross Domestic Products Growth, Unemployment, Productivity,

İNOVASYONUN TÜRKİYE EKONOMİSİNİN GELİŞİMİ ÜZERİNDEKİ ETKİSİ

ÖZET

Bu çalışmanın ana konusu, inovasyonun Türkiye'deki ekonomik kalkınma üzerindeki etkisinin araştırılmasıdır. Bu bağlamda, inovasyon hakkında teorik bilgiler verilmekte, dünyada inovasyonun nasıl geliştiği ve nasıl ölçüldüğü anlatılmaktadır. Türkiye'de inovasyonun gelişimi, Türkiye'de inovasyonu destekleyen kurumlar ve fonlar açıklanmıştır. Ana başlığa göre, GSYİH büyümesi, işsizlik oranı ve verimlilik, hipotezlerin test edildiği üç ana değişken olarak kullanılmıştır. Doğrusal regresyon analizi kullanılarak elde edilen sonuç, inovasyonun Türkiye'deki ekonomik kalkınma üzerinde önemli bir etkisinin olduğunu göstermektedir. İnovasyonun istihdam / işsizlik oranı ve işgücü verimliliğine önemli bir etkisinin olduğunu belirten analizde inovasyon ve GSYİH büyümesine ilişkin korelasyon ile ilgili olarak elde edilen sonuçların istatistiksel anlamsızlığı nedeniyle özgül hipotez 1 (inovasyon ve GSYİH büyümesine atıfta bulunulur) ne reddedilebilmiş ne de de onaylanmıştır.Ancak bu, 12 yıllık sınırlı bir zaman dilimi nedeniyle, birkaç küresel krizin yaşandığı dönemi ve GSYİH büyümesinin kriz döneminde yoğun bir oynaklık gösteren çok karmaşık bir gösterge olduğu gerçeğini kapsayan bir süreçtir. Böyle bir korelasyon için önemli kanıtların eksikliği anlaşılabilir ve kabul edilebilir. Diğer iki göstergenin (istihdam ve verimlilik) ekonomik kalkınma için çok önemli faktörler olduğunu göz önünde bulundurarak, inovasyonun istihdam ve verimlilik üzerindeki güçlü ve önemli etkisinin kanıtı, ana hipotezi teyit etmeye katkıda bulunabilir: İnovasyonun Türkiye'deki ekonomik kalkınma üzerinde önemli bir etkisi vardır.

Anahtar Kelimeler: İnovasyon, Gayri Safi Yurtiçi Hâsıla Büyümesi, İşsizlik, Verimlilik

94

Nişantaşı Üniversitesi Sosyal Bilimler Dergisi
Year/Yıl 2020, Vol./Cilt 8 Issue/Sayı 2, 94-110.

INTRODUCTION

In the changing world order under the domination of information and technology, the wave of increasing globalization continues to change the many systems in countries and their bodies. Therefore, economic units, social and cultural values and political circles that make up these systems become part of this change. In this age that we live, knowledge is critical and that is increasingly difficult to keep pace with the innovations in technology. This is undoubtedly called an Information and Technology age. Understanding and adapting to new knowledge and technologies is the common goal of every nation that aims to increase economic prosperity.

Understanding the role of information and technology in economic and social life is possible by analyzing the historical process. Increased human needs within pleasure and preferences have made information and technology a necessity. The cumulative increase in the level of knowledge over time and the emerging new technology can be the reason for the continuity of change in human needs. Such a process is accompanied by changes in the production system, spatial structures, culture and behavior norms.

The concepts of knowledge and technology that have changed and evolve in a necessary way during the past centuries have also been the basis of the innovations that are the trends of our time. These innovations are defined as a set of technical, industrial and commercial steps to create a new product or process, from scientific research to discovery, development and commercialization.

Innovation derives from the word "innovatus", which is Latin in origin. In the historical process, it is possible to encounter many definitions for explaining the concept of innovation. The reason for this diversity is due to the renewal and the continuity of change. Innovation is the development and implementation of new ideas, methods, products that will provide economic and social benefits. These applications can encompass new brands and methods and can emerge as new compounds of existing products or production schemes.

Competitiveness at the regional level, the ability to produce goods and services that help to hold on to international markets and at the same time a high and sustained income protection. In other words, guarantee quality and quantity together in employment. In the past three decades, we have been in a period of intense competition in the global marketplace within the context of growing economic growth and increasing producer and consumer mobility without borders. In this context, it is emphasized that a variety of authoritarian, innovation and innovation oriented activities are vital for ensuring long-term sustainable economic growth.

Given the importance of innovations, countries in the world economy ground on science, technology and innovation based on growth strategies can achieve more sustainable economic growth than other countries. The World Economic Forum Global Competitiveness Report (2017) states that countries based on innovation are much more competitive and provide more sustainable growth than other countries. There are twelve factors used to measure the global competitive power index. Each factor are important for the countries that stand out or trying to maintain their leadership in the global competition.

Turkey's rankings are not high on Global Scale. The biggest reason is the failure of Turkey's Research and Development. Compared to other countries, Turkey's share of R & D reserve is very low. This is the reason why the country's economy does not develop. According to the Global Competitiveness Report (2015-2016), with the share of GDP allocated to R & D Turkey rank is 86 between 143 countries.

According to World Bank data, the number of patents in Turkey compared to other countries are low level. This situation shows that Turkey is insufficient for creating innovation. Increasing the number of shares allocated to Research and Development (R&D) will increase the number of patents.

95

Nişantaşı Üniversitesi Sosyal Bilimler Dergisi
Year/Yıl 2020, Vol./Cilt 8 Issue/Sayı 2, 94-110.

Turkey's patent allocates less budget has been the contribution to economic growth. But, policymakers must support science and technology, make institutional arrangements for intellectual property rights and raise the level of education.

In addition to the structural precaution to ensure the development and sustainability of innovation, in order to increase R&D spending, there should be made regulations. In addition to these policies, it is important to encourage new entrepreneurs and to support investments. At this point, companies can do innovation by making their R & D activities easier.

1. Literature Review of Innovation

There are changing needs for companies to improve their products and services in order to increase their competitiveness. Innovation is one of the important tools for this change, renewal and transformation. There are so many studies about innovation both theoretical and empirical in literature.

According to Freeman, the original scientific and technical ideas are related to the quality and number of people who are able to realize successful innovations in the new technological system, but which are able to understand this information, regardless of which countries or institutions have been implemented. This situation depends on the degree of openness of the society's supervision, knowledge, education systems and society. (Freeman, 2004: 552) Mensch (1979), the stagnation in the economy stems from the lack of basic innovations. Mensch divides innovation into three different categories: radical innovation, development innovation, and image innovation.

Innovation is the product of successfully formed technological changes. The economic benefits of innovations can only be demonstrated by the successful introduction of the new product or the successful use of a new process. Therefore, the measure of successful innovations is not only dependent on the quality and quantity of technological inputs, but also the production, marketing and management of that innovation. (Barber and White, 1987: 25)

According to different schools of thought, studies on the relationship between innovation and economic growth are varied. Although these studies largely agree that innovation is important for economic growth, their views are different on the importance of innovation. These ideas are shaped in the following frame: the Neo-Classical view which regards innovation as an external variable; new growth theories that combine innovation as an external variable in the equilibrium model; Schumpeter's view of innovation as an external variable that distorts the balance; Neo-Schumpeterist opinion says that there is a non-linear relationship between the many determinants in the innovation system (Eggink,2013:5).

Özsağır, Çütçü (2015), studied about the long-term relationship between the number of patents the main determinants of innovation and the foreign trade data the determinants of innovation were analyzed in two steps. First, Johansen causality analysis was conducted and the existence of the relationship between the number of patents and the foreign trade was identified. In the next step, it was concluded that there is a bi-directional and positive relationship with the Vector Error Correction Model (VECM).

Güreşçi and Ballı (December,2017) investigate the impact of innovation on economic growth and the direction of causality between innovation and economic growth for high and upper-middle income countries utilizing panel data analysis and Dumitrescu-Hurlin (2012) panel causality test for the period of 1996-2014. Gengenbach (2016) test results reveal that there is a long run equilibrium relationship between variables. Panel causality test results show that there exists a bidirectional relationship between variables.

Özkul and Örün (Journal of Entrepreneurship and Innovation Management, December 2016) have been examined the influence of entrepreneurship and innovation on the economic growth by availing the GEM data between 2002 and 2013 of the 9 OECD countries with full data by panel

96

Nişantaşı Üniversitesi Sosyal Bilimler Dergisi
Year/Yıl 2020, Vol./Cilt 8 Issue/Sayı 2, 94-110.

data analysis. The results were technological innovation intensity has been a positive and meaningful impact on economic growth.

Önder (Journal of Entrepreneurship and Development,2017) the effects of entrepreneurship, productivity, and innovation on the industrial sector were analyzed by time series. As a result of the analysis, it was founded that the effect of productivity and innovation on the industrial sector showed a positive and statistically significant relationship. The results show that the most important variable influencing the industry in a positive direction is entrepreneurship, followed by productivity and innovation, even though they have a low impact level.

Işık, Kılınç (Anadolu University Journal of Social Sciences, Volume 16, 2016) have been examined the relationship between economic growth and innovation in the case of selected countries for the period 1990-2011 were examined. Analysis results show that innovation (positively affects economic growth in line with expectations. In addition, there is a both long and short-term relationship among innovation indicators and economic growth. Accordingly, 1% increase in private sector R&D expenditures and electronic industry export will increase the GDP by approximately 0.46% and 0.16%. In the short run, these coefficients were estimated as 0.19% and 0.03%.

1.1. The Definition of Innovation

There are different understandings about innovation by institutions and scientists who are working on it. Innovation is defined as their perspective and knowledge. However, the differences in definitions do not change the main purpose of innovation.

According to Oslo Manual (OECD, 3rd edition,2005), an innovation is "The perpetration of a new or remarkably ameliorated product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations". The process of renewing science and technology to provide economic and social benefits. That is, combining creativity with commercial skills. Innovation is about creating the future and ensuring sustainable and profitable growth.

The minimum requirement for innovation must be new or remarkably improved to the firm. This includes products, processes and methods that firms are the first to develop and those that have been adopted from other firms or organizations. Innovation activities also include research and development that is not directly related to the development of a particular innovation.

Innovation is an implementation with local and national characteristics. According to their national antecedents, countries have to draw their own innovation strategies. This job is not easy. All elements such as power, brainpower, university, planning, possibilities, industry, technology, industry and market are parts of innovation. The ability to carry out the innovation activity, which should include all the elements of science and technology of almost any country, can be carried out primarily by the adoption and support of all sections of society and the government.

According to Schumpeter, innovation defined in his book (The Theory of Economic Development,1911), "The introduction of a new feature of a product or an existing product that the customer does not know yet; commencement of the implementation of a new production method; the opening of a new market, the finding of a new source of raw or semi-finished goods." Schumpeter also emphasizes that entrepreneurs have transformed the balance in the market with their innovative role and created constant dynamism in the economy.

Sutton (1992), explains that "Mainstream or neoclassical economics views innovation in terms of asset creation as well as market experiments". In this view, innovation is an aspect of business strategy, or part of the set of investment decisions to create capacity for product development or to ameliorate efficiency. Recent developments have focused on the idea of "sunk costs",

irrecoverable commitments of resources to enter new markets or to create competitive advantages by repositioning production or output in the value chain.

Peter Durcker (Innovation and Entrepreneurship,1985) says that "Innovation is a special tool that entrepreneurs possess. By means of this tool, entrepreneurs can use opportunity exchange for a different job or a different service. According to him, businesses and societies that learn to be entrepreneurs get rich and innovation is presentation as a discipline, learning and implementation".

Innovations in the literature have been subjected to many different classifications according to their grades, areas, characteristics. According to the degree of change and diversity, innovation is generally classified as radical and incremental (Ettlie, 1984).

In the literature, administrative and technical innovations are also distinguished. Technical innovations occur in the technical system of the organization and Innovations in priority business activities, while management innovation is innovations in the organization's social system. (Damanpour, 1984).

1.2. The Importance of Innovation

As the world economy evolves, so, does the process of innovation. Globalization has led to dramatic increases in access to information and new markets for firms. It has also resulted in greater international competition and in new organisational forms. In the current day economic scenario, innovativeness has become a major factor in influencing strategic planning. It has been acknowledged that innovation leads to wealth creation. Even though efficiency is essential for business success, in the long run, it cannot sustain business growth.

Most often planned and measured combination of ideas, objects and people leads to innovation resulting in new business ideas and technological revolutions. In order to be termed valuable innovations, new products and services need to be strong enough to progress through rigorous commercialization processes and into the marketplace.

Many organizations are adopting measures to strengthen their ability to innovate. Such companies are creating a dependable operating system for innovation, an important indicator of corporate sustainability. Research has indicated that competition combined with strong demand is a major driver of innovation. The intensity of competition is the determinant of innovation and productivity. Innovation, besides products and services, also includes new processes, new business systems and new methods of management, which have a remarkable impact on productivity and growth.

Today, we need innovators more than at any time before. Every organization and business are feeling the impact of globalization, migration, technological and knowledge revolutions, and climate change issues. Innovation will bring added value and widen the employment base. Innovation is imperative if the quality of life in these trying circumstances is to ameliorate.

1.3. The Benefits of Innovation

There are some standing about the benefits of innovation. They show the benefits of innovation in turn. Thus, a better understanding of innovation is aimed at those standings.

Increasing productivity and decreasing costs, a lot of process innovation is about decreasing unit costs. This might be achieved by ameliorating the production capacity or flexibility in the business to enable it to take advantage economies of scale.

Better quality; from the definition, better quality products and services are probable to meet customer requirements. Given that they are effectively marketed, that should end up with higher sales and profits. A new product or process can be a source of market advantage for the

98

Nişantaşı Üniversitesi Sosyal Bilimler Dergisi
Year/Yıl 2020, Vol./Cilt 8 Issue/Sayı 2, 94-110.

innovator. In the case of productivity-enhancing process innovations, the firm gains a cost advantage over its competitors, allowing a higher mark-up at the prevailing market price or, depending on the elasticity of demand, the use of a combination of lower price and higher markup than its competitors to gain market share and increase profits.

In the case of product innovation, the firm can gain a competitive advantage by introducing a new product, which allows it to increase demand and markups. A business with a single product or limited product aline could almost surely benefit from making innovation. A more extensive product aline provides an opportunity for advantage sales and profits, also decrease the risk for shareholders.

To handle legal and environmental issues; innovation can enable the business to decrease its carbon emissions, produce low waste or may be submitted with changing product laws. Changes in laws often force enterprises to be innovative.

Improved staff retention, motivation and easier recruitment; it's not an apparent benefit, but often meaningful. Potential good and quality recruits are often ruled to a business with standing for innovation. Innovative businesses have a standing for being inspiring places in which to work.

Innovation can also ameliorate performance by increasing the firm's ability to innovate. For example, ameliorating the capabilities of production processes can make it possible to develop a new range of products, and new organizational practices can improve the firm's ability to gain and create new knowledge that can be used to develop other innovations. Firms innovate to defend their existing competitive position as well as to seek new competitive advantages. A firm may take a reactive approach and innovate to avoid losing market share to an innovative competitor.

2. Innovation Indicators In Turkey

According to WEF Global Competitiveness Report, Turkish economy global competitiveness is ranked at the 55th position among 139 countries achieving Global competitiveness index of 4,4 , while according to innovation pillar index it is positioned at the 69th place ,achieving the same value of its innovative pillar here years in row (3,3) .

The indicators for the Innovation pillar component for Turkey in 2017 are as follows :

Table 1. Innovation Pillar Indicators –Turkey

Innovation pillar components	Indicator	Rank/139
Capacity for innovation	4.1	74
Quality of scientific research institutions	3.3	100
University-industry collaboration in R&D	3,5	66
Company spending on R&D	3.3	69
Gov.procurement of advanced technology products	3.4	64
Availability of scientists and engineers	4.3	49
PCT patents applications/million pop.	10.9	39

Source: WEF Global Competitiveness Report 2017-2018

Out of the above presented indicators it can be concluded that the innovation aspect in Turkey is lagging much behind its global competitiveness, but some of the innovation pillar components

are showing even worse result. Namely, although it capacity fo innovation has reached the value of 4,1 (positioning Turkey as 74th out of 139 countries) , the " quality for scientific research institutions " are assessed very low (3,3) putting the Turkey at the 100th place out of 139. One of the best scores in the innovation pillar components are related to its "Availability of scientists and engineers" (index 4.3 with rank 49 out of 139) and patent application which ranked Turkey at 39th place as almost 11 patents application are realized on every million of population in Turkey . The other three components' scores : "company spending on R&D", "university-industry collaboration in R&D" and " Government procurement of advanced technology products" are ranking the country in the middle of the the table having the position between 64th and 69th place out of 139 countries .

The insufficient attention on innovation aspect of the economy is noted as a reason why Turkey as one of the emerging economy having a great potential in the earlyc 2000s, has now lost much of the ground they gained before 2013.

Analyzing the trend of development of the innovation pillar index and its components in the period 2006-2017 (Table 2) similar conclusions can be made.

Table 2. Innovation Pillar Indicators And Its Components

Innovation pillar and its components	2006	2008	2009	2010	2012	2013	2014	2015	2016	2017
Innovation pillar indicator	3.3	3.2	3.1	3.1	3.3	3.5	3.4	3.4	3.3	3.3
Capacity for innovation	3.5	3.3	3.3	3.1	3.4	3.8	3.7	3.8	4.1	4.1
Quality of scientific research institutions	3.9	4.1	3.6	3.3	3.4	3.7	3.9	3.6	3.3	3.3
Company spending on R&D	3.2	3	2.9	3	3.2	3.1	2.9	3.1	3.3	3.3
University-industry collaboration in R&D	3.4	3.4	3.4	3.4	3.6	3.9	3.7	3.7	3.5	3.5
Gov't procurement of advanced tech products	3.8	3.1	3.3	3.7	4.0	4.1	4.2	3.7	3.4	3.4
Availability of scientists and engineers	4.8	4.3	4.4	4.5	4.5	4.4	4.2	4.2	4.3	4.3

Source: WEF Global Competitiveness Index database , created by the author

Namely , over the observed period the General Innovation index marks very flat, stabile, trend , and reaching its pick in 2013 , it started slightly to decrease , so that at the end of the observed period achieved the same score as its beginning.

The biggest improvement is marked related to "capacity for innovation" aspect as it has been increased from 3,5 in 2006 to 4,1 in 2017. The worst state and trend development is observed in one very important aspects of innovation: "Quality of scientific research institutions" , which was much more developed ten years ago reaching the indicator of 4,1 in 2008 , with continuous downwards trend from 2009 till the end of the observed period when the indicator dropped at the level of 3,3. The strongest aspect of innovation is the "Availability of scientists and engineers" component keeping the value of its index above 4 throughout all observed period. However, the trend of development of this component has shown significant worsening, starting from 4,8 in 2006 till 4,3 in 2017. This is probably due to the "drain brain "trend which is

100

Nişantaşı Üniversitesi Sosyal Bilimler Dergisi
Year/Yıl 2020, Vol./Cilt 8 Issue/Sayı 2, 94-110.

characteristic for Turkey in recent years. Government is not seen as a initiator of innovation in Turkey in the last several years, since its purchases are in advanced tech products are decreasing in years, while the private initiative and company spending on Research and development as well as University-industry collaboration in research and development is stable over the observed period with slight increase in the recent year.

3. Economic Development Indicators In Turkey

In the literature and practice , Gross Domestic Product and Gross Domestic Product Growth (GDP Growth), Employment and Unemployment Rate , as well as Productivity are the most frequently used indicators for determining economic development of the countries. Thus, with data presentations of these indicators, within the period 2006-2017, it is aimed to show how Turkey's economy is developing and which indicator is more effective in economic development in Turkey.

3.1. Gross Domestic Product GDP and Gross Domestic Product Growth (GDP Growth) in Turkey

Turkey has the world's 17th-largest nominal GDP and the G-20 major economies .Different institution classifies Turkey as a developed country (CIA) , Merrill Lynch and The Economist describe Turkey as an emerging market economy , while the World Bank classifies Turkey as an upper-middle income country in terms of the country's per capita GDP.

GDP per capita (constant 2010 US$) which represent gross domestic product divided by midyear population expressed in US$ converted from domestic currencies using 2010 official exchange rates and GDP growth (annual %) which represent annual percentage growth rate of GDP at market prices based on constant local currency based on constant 2010 U.S. dollars.

Both indicators are presented at the Table 3 for the period 2006-2017

Table 3. GDP per capita and GDP Growth in Turkey 2006-2017

	GDP per capita (constant 2010 US$)	GDP growth (annual %)
2006	10251.37718	7.109703381
2007	10638.06334	5.030457776
2008	10599.63117	0.845251442
2009	9973.6633	-4.704465981
2010	10672.40016	8.487372187
2011	11683.60448	11.11349555
2012	12052.72008	4.789940207
2013	12866.09535	8.491309393
2014	13312.4552	5.166690703
2015	13898.74884	6.085886632
2016	14117.43687	3.183831543
2017	14933.26521	7.418643975

Source: World Bank Database, created by author

From the table 6 can be concluded that the GDP per capita (constant 2010 US$) has marked constant and continuous growth rising from 10 thousand to almost 15 thousand US$ per citizen , which present 50% cumulative growth for the observed period. The only exception is the GDP

101

Nişantaşı Üniversitesi Sosyal Bilimler Dergisi
Year/Yıl 2020, Vol./Cilt 8 Issue/Sayı 2, 94-110.

per capita realized in 2009 , due to the world crisis , when the respective indicator was even bellow 10 thousand US$. While the GDP per capita indicator has more stable and upward trend , the Gross domestic Product growth, measured as a GDP annual percentage change is violating in the whole observed period , with the minimum level of -4, 7% in 2009 to over 11 % for 2011, succeeding to surpass the average annual growth level of 5% .

3.2. Employment and Unemployment in Turkey

An important indicator of the level of economic development and social development of a country is the size of its employment structure and unemployment. Employment means using resources those the factors of production, labor, capital, entrepreneurial and natural to participate in the production process in an optimal way.

Unemployment is the most important social problems faced by all developed and developing countries. While countries are technologically developed, production systems are changing and it is becoming difficult for the labor force to keep pace with these developments. Unemployment causes market imbalances, individual and social traumatic consequences.
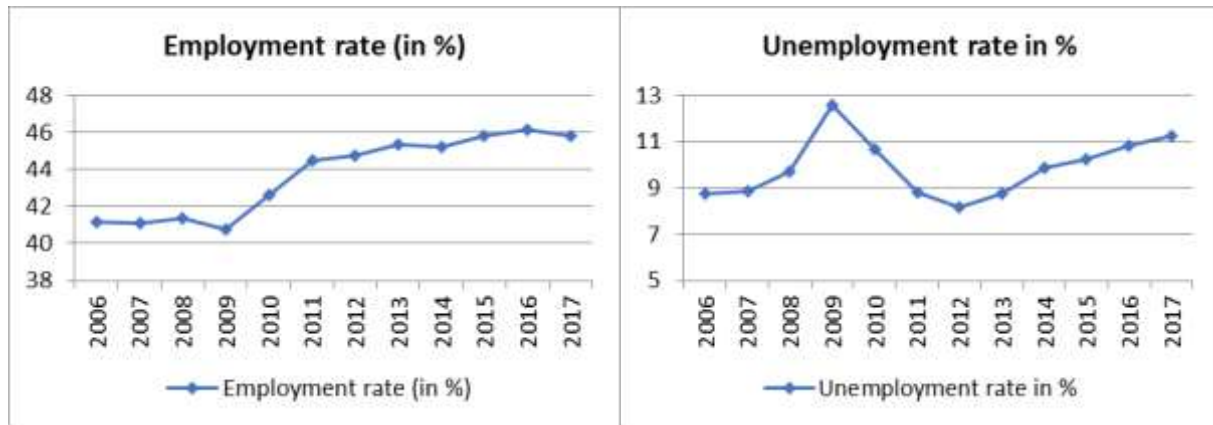

Figure 1. Employment and Unemployment Rate of Turkey (2006-2017)

Source: World Bank, created by the author

The employment and unemployment rate for the period 2006 - 2017 in Turkey are presented in the figure 1. The global financial and economic crisis in2007- 2008 negatively affected the labor markets as well as the financial structures of the countries. However, the effects of the crises on employment have been postponed for one year more, when in 2009 unemployment rate has increased from 9% to 12%.

 After the economic crisis, recovery in the economy shown results and in 2010, unemployment rate declined to 10,6 % .The unemployment rate fell to a single-digit and it became 8.8% thanks to the high growth figures in 2011.Turkey, during the crisis was followed by active labor market policies. Turkey has achieved success in combating unemployment with community work programs and workforce training programs; it has succeeded in lowering the unemployment rate to below pre-crisis levels.

However; the soft landing period in the economy during the year of 2012 has stopped the tendency to fall in unemployment and the high increases in employment despite the falling growth have led to a horizontal trend close to 9 %.The steady rise in the economy also allowed unemployment to remain in single digits in 2013.After the 2013 global economic crisis in the world that Turkey experienced significant political events has brought to unemployment close to 10 3%, while after the 2015 coup attempt, the economy was adversely affected and

unemployment marked unemployment rate of over 10 % , with further increasing trend in 2017 reaching the unemployment rate of 11,2%.

3.3. Productivity in Turkey

Business strategy and production strategy enabling organizations to become more competitive on the market. All production activities are in an effort to supply customer needs with minimum cost while maintaining performance criteria such as flexibility, time, and quality. In order to measure the success of production activities; the most common indicator is productivity. Productivity is generally defined the ratio of input to output that used to produce it. Outputs may be goods or services, while inputs are labor, raw materials, energy and other sources. If an organization more efficiently use their resources, productivity will be so high.
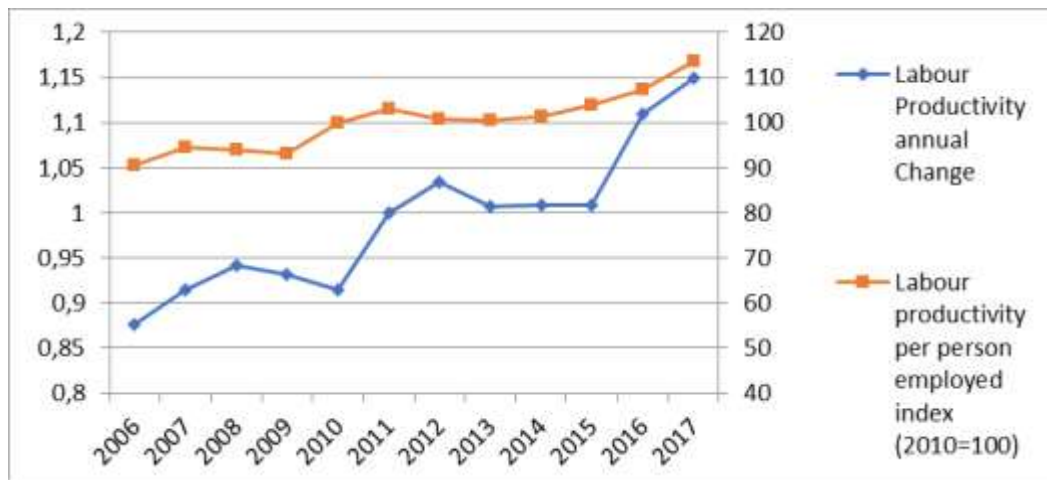

Figure 2. Labor Productivity Indicators of Turkey (2006-2017)

Source: OECD data base and Ministry of Industry and Technology database, created by the author

The data which are shown in the figure 2 are taken from the OECD countries' labor productivity indices and annual average labor productivity change rates. Turkey's rank 17th out of 24 OECD countries with over 1% annual average rate of labor productivity over the observed period.

The productivity of the labor force which rises with the recovery in the economy since 2009 is continuously improving especially in the recent years , marking 13% more productivity of employed person related to baseline 2010 and as of 2011 above 1% of annual growth of the productivity in continuous row.

Although there are small and continuous increases in labor productivity, the labour productivity needs to be further improved for Turkish goods and services to be more competitive at the world's market. Therefore, Turkey need to increase investments in innovative technology and increase labour productivity in more intensive way.

4. Empirical Analysis and Hypothesis Testing

The main purpose of the research is to estimate the impact that the Innovation has on economic development in Turkey. In this respect, its aimed to research and analyze how innovation affect economic growth, employment and productivity of the Turkish economy.

Therefore, the research will be based on testing the main as well specific hypothesis as follows

103

Nişantaşı Üniversitesi Sosyal Bilimler Dergisi
Year/Yıl 2020, Vol./Cilt 8 Issue/Sayı 2, 94-110.

Main Hypothesis: The innovation has significant impact on economic development in Turkey.

The Specific Hypothesis are;

1- There is a positive and significant impact of innovation and GDP growth".

2- The level of innovation significantly affects unemployment rate

3- The Innovation positively and significantly affects productivity of the country

For estimating these relationships, it has been used the trend analysis as well as quantitative research strategy, concretely the simple regression analysis. When estimating regression models using time series data, STATA 12 software package is used for data analysis and performing the regression results.

4.1 Model Specification

In order to estimate the impact of Innovation on selected indicators which represents economic development of Turkey it has been specified the linear regression models with the general formula as following:

$$lnY_t = \beta_0 + \beta_1 lnX + \varepsilon_t$$

- Where *Y* is the dependent variable, (i.e GDP % annual growth -GDPGr, Unemployment rate –UNEMP and Labour Productivity growth-**LabPR**)

- *X* is the independent variable i.e WEF Innovation pillar index -**INNOV**

- β_0-is the constant that represents the level of dependent variable for zero Innovation

- t- is the slope that estimates the change in the variables for one percentage point change of Innovation Index for each time period.

- 'ε' - is the error term, or stochastic factor that is supposed to be with zero conditional mean and constant variance, ie $E(\varepsilon_i) = 0$ for each period

Thus, for testing the Specific *Hypothesis 1: **There is a positive and significant impact of innovation and GDP growth*** " the following model will be applied:

$$ln\ GDPGr_t = \beta_0 + \beta_1 ln\ INNOV + \varepsilon_t$$

Where **GDPGr** is the dependent variable and represent the GDP annual percentage change , while and **INNOV** is the independent variable i.e WEF Innovation pillar Index. All other elements from the equation are already above explained within the general formula explanation.

For testing the *Specific Hypothesis 2: "**The level of innovation significantly affects unemployment "*** the following model will be applied:

$$ln\ UNEMP_t = \beta_0 + \beta_1 ln\ INNOV + \varepsilon_t$$

Where **UNEMP** is the dependent variable and represent the percentage of unemployed labore forec in Turkey over the observed years and INNOV is the independent variable i.e WEF Innovation pillar Index. All other elements from the equation are already above explained within the general formula explanation.

For testing the *Specific Hypothesis 3: **The Innovation positively and significantly affects productivity of the country*** " the following model will be applied:

$$ln\ LabPR_t = \beta_0 + \beta_1 ln\ INNOV + \varepsilon_t$$

104

Nişantaşı Üniversitesi Sosyal Bilimler Dergisi
Year/Yıl 2020, Vol./Cilt 8 Issue/Sayı 2, 94-110.

Where **LabPR** is the dependent variable and represents the labour productivity percentage annual hangover the observed period , while INNOV is the independent variable i.e WEF Innovation pillar Index. All other elements from the equation are already above explained within the general formula explanation.

4.2. Hypothesis Testing

This section gives the empirical results of the regression models. To test the Specific Hypothesis 1 "***There is a positive and significant impact of innovation and GDP growth***" it should be determined the relationship between innovation and Real GDP percentage annual change and to analyze whether the correlation is positive or negative. It is aimed to understand, how the correlation between two variables affect economic development. For that purpose Innovation and GDP Growth data between 2006 and 2017 are taken from Turkstat and the World Bank database.

The first model which represents the testing of Specific Hypothesis 1 is presented on the Table 4, According to the results received, it can be noticed that there is positive but not sufficiently strong correlation between Innovation and GDP growth, (as the t statistics value of 1.05 is below the critical value of 2) , with low statistical significance (0,324) .

Table 4. Empirical results of regression model 1 (Innovation vs. GDP Growth)

```
Ln reg  GDP Innov,

Linear regression                     Number of obs =     12

                          F( 1,   8) =   1.10

                          Prob > F    = 0.3244

                          R-squared   = 0.1856

                          Root MSE    = 4.1017

-----------------------------------------------------------------

      |          Robust
   GDP |   Coef.  Std. Err.   t   P>|t|   [95% Conf. Interval]
-------------+---------------------------------------------------

  Innov |  14.34712  13.66329   1.05  0.324   -17.16049   45.85473

  _cons | -41.46373   45.9404   -0.90  0.393   -147.4025   64.47503
-----------------------------------------------------------------
```

Source: Author's calculation

Also, in this case the R-squared coefficient representing the goodness of fit of data with the regression line, is not sufficiently strong. This means that Specific Hypothesis 1: There is a positive and significant impact of innovation and GDP growth can't be neither rejected nor confirmed as only 18% of variations of the changes in GDP growth can be explained by the variations of the level of innovation. Having in mind the complexity of the factors for GDP growth, as well as the turbulences of economic crisis which made strong impact ion GDP growth and very moderate on competitiveness, such statistical insignificance can be understood and accepted. This also can be confirmed by examining the trends of Innovation and GDP growth in Turkey for the last decade represented graphically, using secondary data below. (Figure 3)
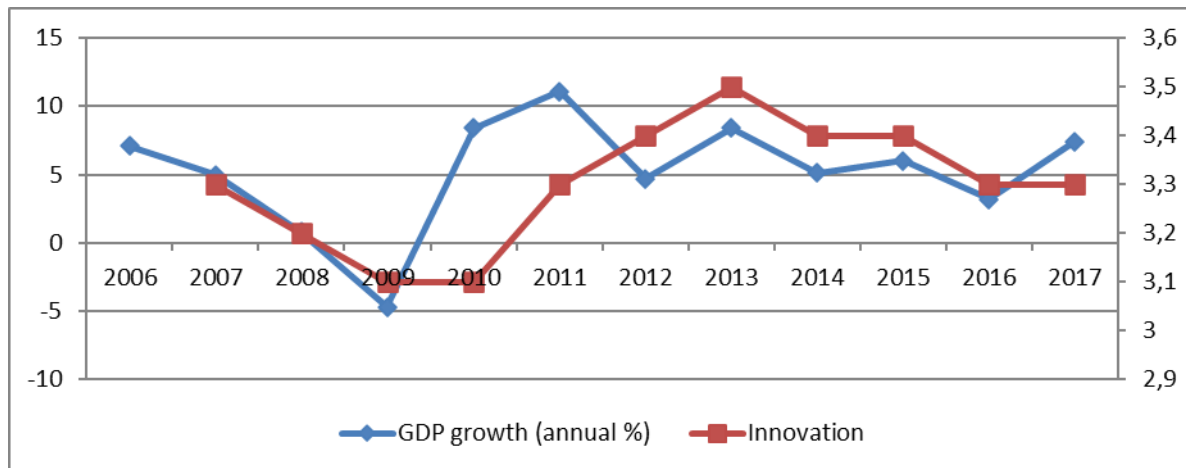
Figure 3. Graphical presentation of the Innovation and GDP Growth data- (2006-2017)

Source: Created by the author

It is clearly seen that the GDP growth doesn't follow the pattern of Innovation index in the some time periods, indicating an unclear relationship between two indicators. However, although the fluctuation of the GDP growth are marking higher deviation in years comparing to competitiveness index, the both indicators share the similar shape of development especially after 2012 when the effects of the financial and sovereign debt crisis period were overcome.

To test the Specific Hypothesis 2 ***"The level of innovation significantly affects unemployment rate"*** the correlation between two variables which are innovation and unemployment should be analyzed .An important indicator such as innovation is expected to have an impact on employment or decrease the unemployment rate in the country which is an important aspect in one's economy development . The results of the second model testing which is presented in the Table 5, indicate that there is a moderate but inverse correlation between innovation and unemployment rate achieving t statistics value of -1,96, with statistical significance over 90% .

Table 5. Empirical results of regression model 2 (Innovation and Unemployment)

```
reg  unemp Innov, robust

Linear regression                        Number of obs =     12

                              F( 1,  10) =   3.84

                              Prob > F    = 0.0857

                              R-squared   = 0.7579

                              Root MSE    = 1.7893

    -----------------------------------------------------------------------

        |          Robust

   unemp |    Coef.  Std. Err.    t   P>|t|   [95% Conf. Interval]

-------------+----------------------------------------------------------

   Innov | -5.137382   2.62174   -1.96   0.086   -11.18312   .9083607

   _cons |  26.95729  8.812042    3.06   0.016    6.63668   47.27789
```

Source: Author's calculation

106

Nişantaşı Üniversitesi Sosyal Bilimler Dergisi
Year/Yıl 2020, Vol./Cilt 8 Issue/Sayı 2, 94-110.

This means that the higher level of innovation decrease the level of unemployment . No matter of the negative correlation between the dependent and independent variable the decreasing of unemployment can be seen as a positive impact of innovation on the employment in the Turkish economy.

This imply that the Specific Hypothesis 2 :" "The level of innovation significantly affects unemployment rate" can be confirmed . Even the R-squared coefficient that represents the goodness of fit of data with the regression line, is sufficiently high. This indicates that 75% of variations of the unemployment rate can be explained by the variations of the level of innovation in inverse direction. This conclusion also can be confirmed by examining the trends of Innovation and Unemployment rate in Turkey for the last decade represented graphically, using secondary data below. (Figure 4)
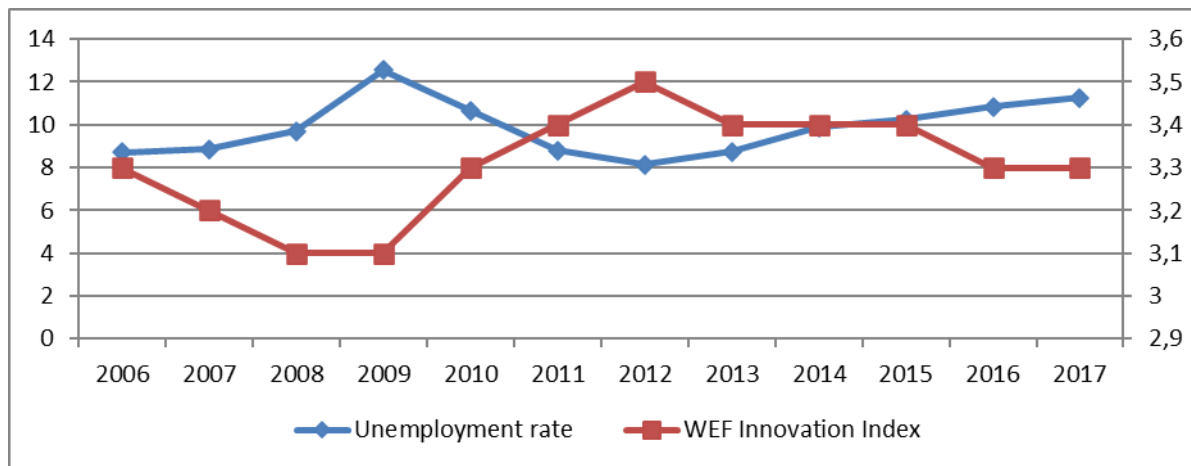

Figure 4. Graphical presentation of the Innovation and Unemployment rate (2006-2017)

Source: Created by the author.

Namely, it is obvious that the trend of innovation index is following the inverse trend of unemployment over the observed period. The higher level of innovation decreases the level of unemployment. The negative correlation between the dependent and independent variable the decreasing of unemployment can be seen as a positive impact of innovation on the employment in the Turkish economy.

To test the Specific Hypothesis 3 **"The Innovation positively and significantly affects productivity of the country** " the correlation between the WEF Innovation index and Labor Productivity annual percentage change is analyzed as presented in the table 6. The results from the Model 3 show that the level of innovation strongly correlates with the labor productivity annual change with high statistical significance.

Table 6. Empirical results of regression model 3 (Innovation and Labor Productivity)

```
--------------------------------------------------------------------------------

reg  labprod Innov, robust


Linear regression                     Number of obs =     12

                        F( 1,    10) =   41.49

                        Prob > F     = 0.0002
```

107

Nişantaşı Üniversitesi Sosyal Bilimler Dergisi
Year/Yıl 2020, Vol./Cilt 8 Issue/Sayı 2, 94-110.

```
              R-squared    = 0.8160
              Root MSE     = .08255


-----------------------------------------------------------------------
       |           Robust
 labprod |   Coef.  Std. Err.    t   P>|t|   [95% Conf. Interval]
------------+----------------------------------------------------------
   Innov |  .2631542 .0408525   6.44  0.000   .1689482  .3573602
   _cons |  .1023228 .1329561   0.77  0.464  -.2042745  .4089202
-----------------------------------------------------------------------
```

Source: Author's calculation

More precisely the evidence of the t statistics value of 9.97 is much above the critical value of 2 , with the high statistical significance at the level of 1%. Also, in this case the R-squared coefficient representing the goodness of fit of data with the regression line, is significantly high . This means that the higher level of innovation affects labor productivity or more precisely 81% of variations of the labor productivity can be explained by the variations of the level of innovation. The correlation of the two indicators can be also confirmed form the figure 5.
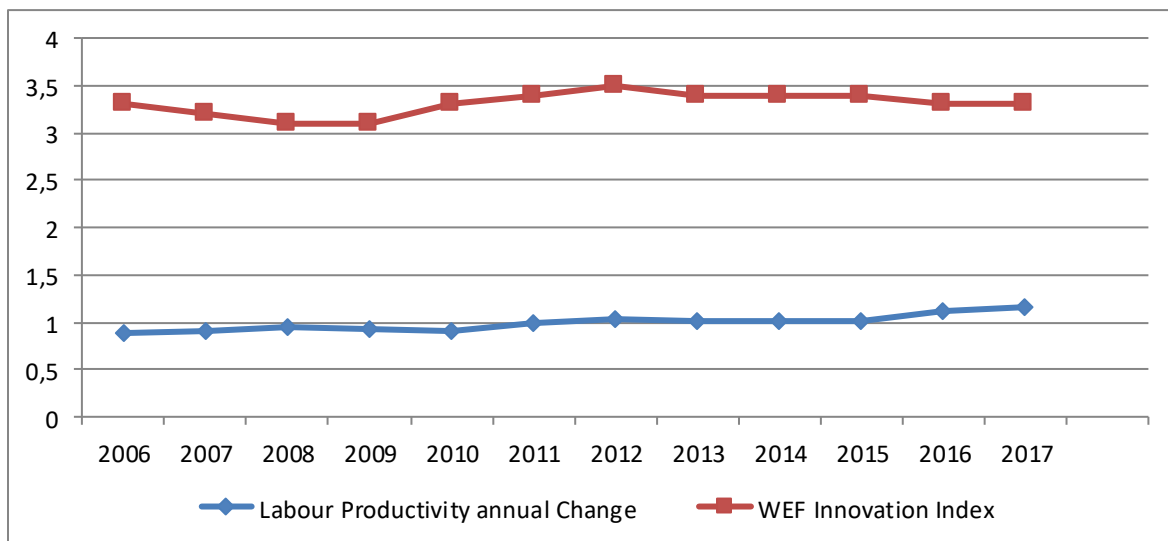

Figure5. Graphical presentation of the Innovation and Labor Productivity growth rate (2006-2017)

Source: Created by the author.

From the graph it can be noted that both variables are following the same pattern over the observed period and thus the Specific Hypothesis 3 :"The Innovation positively and significantly affects productivity of the country " can be accepted .

At the end it can be conclude that while there is positive but not sufficiently strong correlation between Innovation and GDP growth with moderate to low statistical significance and therefore Specific Hypothesis 1 can't be neither rejected nor confirmed, the other two specific Hypothesis implying significant correlation between innovation and employment and productivity can be accepted and conformed.

As the GDP growth is also very complex indicator that shows intensive volatility in the period of crisis as the observed period is, while the two other aspects (employments and productivity) are very important factor as of economic development of the country it can be also concluded that the Main Hypothesis: The innovation has significant impact on economic development in Turkey " can be also accepted and confirmed.

Conclusion

This study aimed to describe the impact of innovation on economic development in Turkey. In this study utilized data taken from several databases in order to analyze the correlation between innovation and GDP growth, the correlation between innovation and unemployment rate as well as the correlation between innovation and productivity have been analyzed.

It is understood from the results that there is a significant correlation between the variables. There is a low positive correlation between innovation and GDP Growth and moderate to strong correlation between innovation and unemployment rate and even stronger one with labor productivity, with high significance in both cases.

Based on these results, we can say that innovation impacts Turkey's economic development. Yet, Turkey has to work on those areas to improve moderate results. Reforms Turkey need to be done in order to improve the condition and quality of the research institution, motivate the scientist and engineers and stimulate investments in research and development by both Government and business sector. Policymakers must support science and technology, make institutional arrangements for intellectual property rights and raise the level of education. In addition to the structural precaution to ensure the development and sustainability of innovation, in order to increase R&D spending, there should be made regulations.

References

Ballı, E, Güreşçi, G., (2017). "İnovasyon ve Ekonomik Büyüme: Üst Ve Üst-Orta Gelirli Ülkeler Örneği". *Yönetim ve Ekonomi Araştırmaları Dergisi*, 99-112.

Burmaoğlu, S, Şeşen, H. (2011). "A Research on the Determinants of the Organizational Innovation of Turkish Firms". *Ankara Üniversitesi SBF Dergisi*, 66(4), 1-20.

EIU (2008). *A Time for New Ideas Innovation in Central Eastern Europe and Turkey*, London, United Kingdom.

European Comission (2013). *Innovation Union A Pocket Guide on a Europe 2020 Initiative*, Luxembourg: Publications Office of the European Union,

OECD and Eurostat (2005). *The Measurement of Scientific and Technological Activities. Guidelines for Collecting and Interpreting Technological Innovation Data: Oslo Manual* (3rd Edition), Paris, France.

OECD (2007). *Innovatıon And Growth Ratıonale For An Innovatıon Strategy*, OECD Publications, Paris, France.

OECD (2010). OECD Measuring Innovation: A New Perspective, OECD Publications, Paris, France.

OECD ve Eurostat (2005). *Oslo Kılavuzu, Yenilik Verilerinin Toplanması ve Yorumlanması icin İlkeler,* 3.Baskı, Ankara: TÜBİTAK,

ÖZKUL, G, ÖRÜN, E. (2016). "Girişimcilik ve İnovasyonun Ekonomik Büyüme Üzerindeki Etkisi: Ampirik Bir Araştırma". *Journal of Entrepreneurship and Innovation Management* , 5 (2) , 17-51.

INSEAD, (2011). *Measuring Innovation Potential and Reuslts: The Best Performing Economies*, Soumitia Dutta and Daniela Benavante, France.

109

Nişantaşı Üniversitesi Sosyal Bilimler Dergisi
Year/Yıl 2020, Vol./Cilt 8 Issue/Sayı 2, 94-110.

Turkish Statistical Institute (2015). Innovation Survey, Product or Process Innovative Enterprises by Specific Type of Innovation, 2012-2014.

Turkish Statistical Institute (2015). *Innovation Survey, Innovative Enterprises by Economic Activity and Size*, 2010-2014.

Turkish Statistical Institute (2016). *Small and Medium Sized Enterprises Statistics*, November 2016.

Turkish Statistical Institute (2017). *Labour Force Statistics,* February 2018.

WEF (2018). Global Competitveness Index Annual Reports 2006-2017, Switzerland.

110

Nişantaşı Üniversitesi Sosyal Bilimler Dergisi
Year/Yıl 2020, Vol./Cilt 8 Issue/Sayı 2, 94-110.