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THE RELATIONSHIP BETWEEN THE LEVEL OF ECONOMIC DEVELOPMENT AND ECOLOGICAL STATE: AZERBAIJAN

Bachelor Thesis

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Introduction

A lot of research has been devoted to ecology and it shows that, if humanity does not undertake global attempts to change the consumer attitude to nature it will face global catastrophes and changes, that put mankind on the brink of survival. Many studies describe the progress of economic development, as having a direct impact on the environment (Lopez, 1994). Until the era of industrial development air, water and land were cleaner and biological resources on fields, forests and reservoirs were more abundant. Forests, which are hypothetically called the lungs of the planet were not cut down with at the current rate that approaches catastrophic proportions. Air pollution was moderate and did not lead to ozone holes. Rivers, lakes and oceans were not polluted with the industrial wastewater, and lands with solid waste. There was no chemical and radiation contamination. (Beckerman, 1992)

From the above one can conclude, that scientific and technological progress resulted in economically developed countries engaging in activities harming the environment. The so-called third world countries are filled with industrial waste from the developed countries, where all the toxic, chemical and nuclear waste is disposed of. Waste disposal sites in undeveloped countries are purchased for very low prices due to the need to alleviate hunger, unemployment and other disasters in those countries. This situation causes the undeveloped countries prone to be the focus of environmental catastrophes that can expand on a global scale. The lack of the means to be dedicated to cleaning territories, reservoirs and the supply of clean drinking water causes the. An example of such an environmental problem is the use of the sites acquired for a pittance as "dead land" to dispose of the chemical fertilizers. This leaves us to ponder on who is to blame: the economy, politics, monopolies, lobby or even mafia structures? It is a well-known fact that economic gains have historically been traded for a negative environmental impact. To achieve

political goals, countries need economic development and a strong industry. Strong industry needs more raw materials and natural resources. And the circle closes. Ecology is surrounded.

The aim of the research paper is to examine the relationship between the environmental pollution and the economic growth (using the GDP per capita as an estimation) in case of Azerbaijan Republic. Azerbaijan is the authors home country, which makes it easier to get the necessary data and information about the country. Moreover, this country was not examined before by any resarches.

The main research tasks of the paper are the following:

- To construct a theoretical basis on the relationship between the environmental degradation and economic growth,
- Give an overview of previous Environmental Kuznets curve (EKC) theoretical and empirical studies on environmental pollutants,
- Collect data of total emissions or concentrations of pollutants, as well as gross domestic product (GDP) per capita, CO_2 per capita, water consumption in total, total municipal waste and energy use in Azerbaijan,
- Present the historical experience of Azerbaijan in the field of pollutants, as well as the way to a modern ecological state and the future strategic environmental state,
- Check the applicability of the EKC (Environmental Kuznets curve) in the case of Azerbaijan, by analyzing the ratio between gross domestic product (GDP) per capita and total emissions or concentrations of pollutants.

The research paper starts with the theoretical part, where will be described the overall relationship between the environment and the economy, based on the prominent environmental Kuznets curve. Further, the author describes the historical background of the chosen country

Azerbaijan and explains about the affected environmental factors. The author used mainly scientific researches, books and articles for the theoretical part. Gross domestic product per capita (GDP) was used, as an economic indicator, as this indicator was always considered as a component of welfare and based on previous researches, the GDP was used as a main measurement, and for environmental pollutant CO_2 per capita, total municipal waste, water consumption in total, municipal waste in total and energy use. The dependent variables were used in the reason, that they are the most dangerous indicators, which show the contamination of the environment in Azerbaijan. The investigation will be based on the Environmental Kuznets curve (EKC) using regression analysis and time series from 1995 – 2016 years, as this is the available period for the given pollutants.

Key words: environmental Kuznets curve, economics, ecology, emissions, Azerbaijan.

1. Theoretical aspect of the relationship between ecology and economic development

1.1 Economic development and its influence on ecology.

Ecology and the economy are increasingly intertwining with each other, at the local, national, and global levels, forming a complex set of causes and effects. The ecological situation in the world can be described as a state of the environmental crisis, the same as the fight against inflation. One of the main contradictions is the clash between economic growth and the need to limit its environmental intensity.

While the environmental danger is increasing, economists are not asleep. The more attention is being paid in the explaining the economic causes of the environmental problems. One of them some economists consider as an economic growth. Constant development of the economy, increasing production capacity, the growth of GDP, an increase in output is how

economic growth was characterized. And the question arises: Does economic growth actually affects the environment? Opinions of economists of this issue are divided.

Opponents of economic growth are primarily concerned with environmental degradation. They argue that industrialization and economic growth rise such negative phenomens of modern life as pollution, industrial noise and emissions, deterioration of cities, traffic jams, etc. All these costs of economic growth arise because the production process only transforms natural resources, but does not dispose of them completely. Practically everything that is involved in production eventually returns to the environment as a waste. The greater the economic growth and the higher is the standard of living, the more waste will have to absorb or try to absorb the environment. In any sufficiently developed society, further economic growth can only mean meeting the more pressing needs with the growing threat of an environmental crisis. Therefore, some economists believe that economic growth should be purposefully held back.

The “theory of zero growth” is close to this position, based on the study of the relationship between population growth, depletion of natural resources and environmental degradation. According to the theory, the only way out is to stop or, at least, stabilize economic growth at some optimal level that does not threaten natural conditions. However, there is an opposite point of view. Proponents of economic growth believe that the connection with the state of the environment is too exaggerated. In fact, these problems can be separated from each other. If society completely abandons economic growth, while maintaining GDP at a constant level, it will still have to choose between different production structures, and this choice will affect the state of the environment and the quality of life. Society still needs to determine whether to preserve the natural beauty of the forest or cut it down for firewood. And if the forest is cut

down, it is necessary to decide whether to use wood for the construction of houses or to put it on advertising stands. (Meadows, Randers & Bachren, 1972)

According to the advocates of this approach, pollution is not so much a collateral product of economic growth, but rather the result of improper pricing, namely: much of the natural resources (rivers, lakes, oceans and air) are considered as “common property” and have no price. Therefore, these resources are used excessively intensively, which worsens their condition. Environmental pollution is an example of spillover or cost overflow. The solution to this problem is possible with the introduction of legal restrictions or special taxes ("fees for drains"), in order to compensate the defects of the pricing system and prevent the irrational use of natural resources. Proponents of this point of view do not deny the serious problems associated with environmental pollution, but they believe, that limiting their economic growth will not solve them. The essence of their position: "To limit the pollution, it is necessary to limit it, not the economic growth." (Meadows, Randers & Bachren, 1972)

At present, it is obvious that economic growth cannot be stopped, since there is also a inverted tie: one of its sources is the quantity and quality of natural resources themselves.

In the contradiction “the environment is the economic development” it is not so much a dilemma: either economic development or a clean environment, as the need to achieve a common goal: to provide a level of development that would imply not only the creation of material goods needed by society, but and maintaining a clean environment. The principle of ecological development is based on this. (Meadows, Randers & Bachren, 1972)

At the present time, the problems of mankind are aggravated by the fact that the increasing part of resources has to be spent not on the production development, but on saving the environment. Otherwise, the pollution begins to slow down the growth of GDP and the

effectiveness of investments falls. However, only the richest countries in the world can afford large-scale environmental rescue programs. The poorest countries cannot afford it. As a result, humanity was faced with the need to choose one of the economic policy options: either to accelerate economic growth and increase the material well-being of people while reducing the duration and quality of their life due to environmental pollution; or improving the state of the environment and increasing the life expectancy of people while slowing the growth rate of their material condition. Exactly this dilemma in the twenty-first century determines the economic policy of many countries and humanity as a whole. This also applies to the problem of the interaction of man and nature, but on a global scale - economics and ecology. The economy has always been aimed at meeting the material needs of society. In the process of evolution, social needs increased, making it necessary to further develop the technology. As a result, in the 20th century, economic development is no longer conceivable without scientific and technological progress, ensuring and maintaining a constant growth rate of production, which implies an increasing dependence on natural resources. (Michaelova, 2009)

Of course, the available natural and human resources, the level of technical knowledge, the system of institutions determine the conditions for the functioning of the economy. Society has always depended on natural resources, but the problem is that this dependence is not taken into account in the economy. Man tends to consume, not save.

Thus, the main contradiction between economic and environmental development lies in the fact that, on the one hand, the economy must develop, on the other hand, this development produces harmful consequences for the environment. To get a complete picture of the scale of this influence, it seems necessary to make a small digression and turn to realities.

There are many theories that boil down to the fact that significant population growth after the Second World War led to increased human influence on the environment. For the first time this approach was described in the work Erlich and Holden (1971) "Impact of population growth" and subsequently carried out many studies that develop it. The authors Meadows, Randers and Bachren (1972) summed up these works by publishing the book "The limits to growth" in which the authors proposed to reduce the accelerated population growth and limit consumption to prevent an ecological collapse in the near future. As economic development and population growth, pressure on the environment increases and the environmental situation worsens. However, if the economy of the state allows accumulating significant resources for the development of "green" technologies, then it is possible to improve the state of the environment. (Meadows, Randers & Bachren, 1972)

The American economist S. Kuznets, (1955) drew attention to the existence of a link between income inequality and economic development-economic inequality growing over time, and then, passing level, from below, with GDP per capita income growth. This dependence was called the Kuznets curve, or the inverse U-curve. (Kuznets, 1955)

Later, in 1991 the Kuznets curve became a vehicle, where showed a relationship between levels of environmental quality and the levels of GDP in years. As economists were able to put the big samples data for the income and environment, the curve began to show, that as the countries develop, the environmental degenerates and then improves. The main feature was that the curve had the same inverted U-shape, as the original Kuznets curve, which showed the relationship between inequality and GDP per capita. After that, the original Kuznets curve was reformed with the Environmental Kuznets curve (EKC). (Yandle, Vijayaraghavan & Bhattarai, 2002)

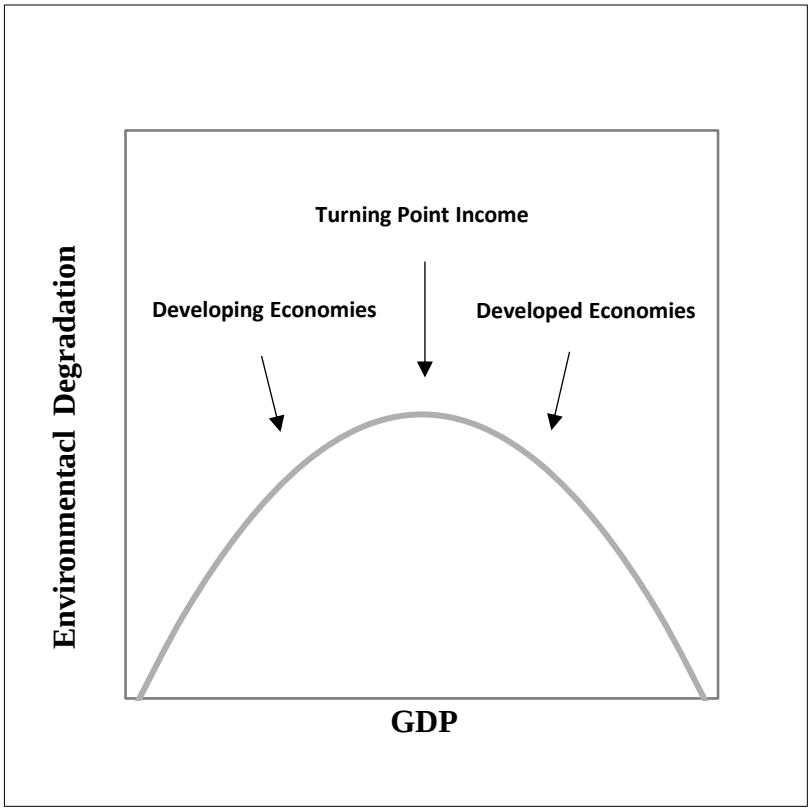

Figure 1. The Environmental Kuznets Curve

Source: Compiled by the author based on Grossman & Kruger 1991

The environmental Kuznets curve (EKC) is a hypothesized dating among numerous signs of environmental degradation and income per capita. At the beginning when the economic growth goes up, the pollution increases and then at certain levels both reach certain stability. The authors Grossman and Kruger (1991) suggested the possibility of the existence of an environmental Kuznets curve (EKC), which asserts that, other things being equal, economic development first leads to an increase in income inequality between population groups to a certain maximum, and then to its reduction. In the works of Beckerman (1992) and Baldwin (1995), it is said that the demand for environmental quality is a luxury goods with income elasticity greater than one (in other words, as income grows, the interest in the environment

grows more), and, therefore, this product in national scale can afford only developed "rich" country. According to Beckerman (1992) he even came to the conclusion that the best, and perhaps the only, way to maintain a decent level of the environment is to become a rich country (Beckerman, 1992).

Summarizing the information mentioned above, the ecology and economy are connected with each other very tight and to measure the environmental degradation, that arise due to an economic growth, can be done by the Environmental Kuznets curve, which firstly was invented for the measuring the relationship between the income growth and inequality.

1.2 Previous work on the study of EKC

There were many investigations and measurements about the environmental degradation and the economic growth, like GDP per capita, which prove the existence of the EKC in one or more countries. By using different variables, many authors were showing various results. According to work Shafik and Bandyyopadhyav (1992) by using the log linear of GDP they obtained the results, which showed the relationship between GDP and pollutants, and explained, that there is a little connection of macroeconomic factors to the environment. In this study for the author the most important are several directions, trying to explain the existence of EKC. One of them is concluded in analysis of such mechanisms as the scale effect, the structural and the technological effect. The essence of this theory, which explains this direction is that the growth of the economy`s structure, shifts first from the beginning to the industrial manufacturing, and then to the postindustrial type of manufacture, decreasing the level of contamination. Besides, high technologies are developing, which are increasing the use of energy efficiency, which also leads to a decrease in the pollution. The results of Panayotou (1993) reached the same conclusion

between the relationship of some pollution indicators an income per capita which was described by U-inverted curve.

In subsequent years, the number of works devoted to the EKC was growing rapidly. In addition, separate studies have led to the conclusion, that the effect of EKC exists for developed countries and is practically absent for developing (Galeotti, Manera & Lanza, 2006). Despite this, several studies refuted this theory, by providing new investigations, as for example EKC worked in China case and it's a developing country, but EKC didn't work for the developed country - Canada. On the other hand, these researches explain that the U-inverted pattern is cause of trade liberalization as many polluting industries are reassigned between countries with low or high level of income. "Trade itself is likely to increase the impacts (of pollution) in developing countries and reduce them in the developed countries and this may be another explanation for the EKC relationship" (Suri & Chapman, 1998).

There is a hypothesis of «pollution haven» by the author Cole (2004), which supports that the developing countries have an advantage in the polluting sphere as their fairly, low income standards cannot cover strong regulations of the environment as their richer trade partners. Indeed, with trade liberalization, the pollution-intensive industries are likely to leave developed countries and move to developing countries, where pollution control is less severe. The author Ekins (1997) states that if the pollution in developed countries is decreased by themselves, this cannot be a potential remedy for todays developed countries. That why the maintenance of the EKC hypothesis may barrier the sustainable development of the developing countries and the world in general (Ekins, 1997).

From the Table 1, the case of France, Ang (2007) analyzed the relationship between CO_2 ,energy consumption and economic growth, using different types of tests such as ADF unit

root tests, Phillips-Perron test, Elliot-Rothenberg-Stock, Johansen cointegration tests and Autoregressive distributed the Granger causality test. The results showed that in the long run there is a bi-causal relationship between the CO_2 emission, energy consumption and the output growth and the uni-directional causality from the use of energy growth and output growth in the short run (Ang, 2007). One more investigation from Jalil and Mahmud (2009) showed, that there is an existence of EKC in the long run for the CO_2, energy consumption, foreign trade and the GDP in China, during the period of 1975 – 2005 (Jalil & Mahmud, 2009). The econometric tools used to see the quadratic relationship were: ADF unit root tests, the Granger-causality test, ARDL to measure the long run, the cumulative sum of recursive residual (CUSUM) and the cumulative sum of squares of squares of recursive residual (CUSUMQ). One more study, concluded by Paul and Bhattacharya (2004), that using Indian data for the period 1950-1996 and applying the Engle – Granger cointegration test and approach, there is a bi – directional causality exists between the energy consumption and the economic growth (Paul & Bhattacharya, 2004). Hussain, Javaid, and Drake (2012) examined the climate change, energy consumption and economic growth for the developing country Pakistan, using time series data and various econometric tools, such as ADF Unit Root Johansen Co – integration VECM and Granger causality test, but found no existence of EKC. Moreover, it showed that there is no directional causality between GDP and CO_2, GDP and energy consumption, but there is between CO_2 and energy consumption per capita (Hussain, Javaid & Drake, 2012).

Another explanation of EKC theory is the change in demand for net environment. Thus, according to Lopez (1994), Baldwin (1995) and Beckerman (1992) the role of the elasticity demand for a clean environment by income is role in explaining the existence of EKC. The case with a Turkey, Halicioglu (2009) examined the relationship between CO_2, income, energy

consumption and foreign trade using time-series and Johansen cointegration test, which showed that the cointegration between the variables in his results. Furthermore, the variables follow the N-shape pattern, but the findings do not support the hypothesized data set. Thus, the author suggested that the environmental problems could be resolved automatically without any policy actions (Halicioglu, 2009).

Table 1.

Summarized result for EKC, using time series for 1 country

References	Variables	Time period	Countries/cities	Models	Relation Shape
Ang (2007)	CO_2, GDP, energy consumption	1960 - 2000	France	Quadratic econometric model	Long run relationship $CO_2 - GDP - energy$
Jalil & Mahmud (2009)	CO_2, GDP, energy consumption, foreign trade	1975 - 2005	China	Auto regressive distributed lag (ARDL)	Quadratic relationship $CO_2 - GDP$
Paul & Bhattacharya (2004)	GDP, CO_2	1950 - 1996	India	Linear, cubic, quadratic	Relationship Energy and GDP
Hussain, Javaid and Drake (2012)	Energy consumption, CO_2 and economic gowth	1971 - 2006	Pakistan	ADF Unit Root Johansen Co-integration	No inverted U-shaped EKC
Halicioglu (2009)	CO_2, energy, income, foreign trade	1960 - 2005	Turkey	Johansen cointegration	N-shape curve, no EKC
Vornovytskyy & Boyce (2010)	Income inequality and GDP, CO, SO_2	2000 - 2013	Russia (regions)	Panel data model	No relation between GDP growth and emissions
He & Richard (2010)	GDP, CO_2	1948 - 2004	Canada	Semiparametric and nonlinear parametric model	No existence of EKC

Source: Compiled by the author based on (Ang 2007, Jalil & Mahmud 2009, Paul & Bhattacharya 2004, Hussain, Javaid & Drake 2012, Halicioglu 2009, Vornovytskyy & Boyce 2010 and He & Richard 2010)

In work Shibayama and Fraser (2014) several models of economic growth were considered. The main idea of this approach is that with the growth of the population, demand for maintaining high quality environment is increasing. In this regard, consumers not only start investing more in environmental funds, but also start providing the political pressure on regulators to tighten protection legislation environment. This study could be very beneficial for the developed countries as they already have quite rich economy and seek to increase the environmental quality. (Shibayama & Fraser, 2014)

Looking to the Table 2, it summarizes the panel data for many countries. According to the Vornovytskyy and Boyce (2010) the study examines the inter – regional variation of the economic growth, inequality and the uncontrolled emissions into the atmosphere according to the data from the 2000 – 2005 of the regions of Russia. By the controlling the absolute level of the income, they found that regions with less income comparing to neighborhood regions has more uncontrolled atmosphere pollution. But the difference in the uncontrolled pollution is not connected with the differences between the spending on the environment struggles. The results highly support the hypothesis, that the higher is the income in other regions in one federal district, the more it is connected, with an uncontrolled atmosphere pollution in the given region. These results have to be investigated more, but due to scarcity of data for the regions, it is complicated for now. (Vornovytskyy & Boyce, 2010)

In the work He and Richard (2010) based on the Canadian time data over a period of 1948 - 2004 years, the authors investigated the relationship between the CO_2 and the GDP per

capita. It was found that there is a relationship between the ecological state and economic development, in the period of 1970s when there was an oil shock. The results are quite complex, and even with additional factors, the emission growth in the model is resumed from a certain amount of income. After obtaining the correlation results, by using the parametric cubic model, there was no evidence of a Kuznets curve model. (He & Richard, 2010)

Table 2.

Summarized result for EKC, using panel data for different countries

References	Variables	Time period	Countries/cities	Models	Relation Shape
Shafik and Bandyyopadhyav (1992)	CO_2, GDP	1960-1990	149 countries	Linear, quadratic, cubic	Linear U-inverted
Galeotti et al. (2006)	CO_2, GDP	1960 - 2002	24 OECD countries	Integration and cointegration	Inverted U-shape
Panayotou (1993)	CO_2, SO_2, clean water, deforestation, urban sanitation	N/D	Global	Multivariate causality	Quadratic U - inverted
Koop & Tole (2001)	GDP, deforestation	1961-1992	48 tropical countries	Standard panel data	High inequality, high deforestation
He, Makdissi & Wodon (2007)	GDP, CO_2, SO_2, NO_x	1980 – 2002	Global	Cross- country panel data	CO_2- SO_2 no relation, NO_x adjustment of EKC

Source: Compiled by the author based on (Shafik & Bandyyopadhyav 1992, Galeotti et al. 2006, Panayotou 1993, Koop & Tole 2001 and He, Makdissi & Wodon 2007)

Based on previous researches, the author is more interested in the relationship between GDP and CO_2, which will be represented in the empirical analysis further.

Thus, it can be concluded that, there are many previous studies based on EKC can be found and compared. Most of them show that EKC does follow the inverted U-curve, but that's

not the definitive conclusion. There is a unidirectional causality between the GDP per capita and CO_2. The cases of Turkey, Pakistan, Canada, China and Russia showed that, there an inverted U-shaped EKC is not supported. It shows to be more steadily increasing curve, which means that as GDP per capita increases a linear increase will be found in CO_2 – EKC curve. Firstly, it means that, the high economic growth causes the high environmental degradation, and secondly, policy makers have considerations protecting the environment involves huge amount of money and developing countries cannot afford it. If new policies are introduced for environmental degradation, they will slow down the economic growth of the country. The new standards and networks should be implemented, in order to reduce emissions, which are efficiently duty in the world.

One question arises, is the EKC relevant nowadays? The EKC hypothesis emerged from 90s and brought a huge shift in the policies and structures of the developing and developed countries, which also affects the world development institutions. Due to fast economic growth which creates an enormous amount of costs, put a question mark on the survival of our planet, where arises a need to criticize the strategy called "grow now clean latter" suggested by EKC hypothesis. In the work Gill, Viswanathan and Hassan (2017) was found that empirical literature inappropriate and many types of pollutants were not tested due to not availability of data. Plus, EKC growth strategy is resource immerse and has huge environmental costs, which could lead to planets demolition. (Gill, Viswanathan & Hassan, 2017). One more research named "The environmental Kuznets curve after 25 years" conducted by Stern (2015), concluded that EKC fits better to the pollution concentration data that Grossman and Kruger (1991) applied in their analysis in the earliest time. The author believes that econometric approaches used in those

literatures are naïve and problematic. It is much more important to use convergence and time effect, that EKC effect, when modelling aggregate pollution emission.

2. Empirical analysis of Kuznets environmental curve in the case of Azerbaijan

2.1 Historical background of economy in Azerbaijan

The Republic of Azerbaijan is the largest of the South Caucasus republics and has a large variety of raw materials, as well as numerous of environmental problems. The nature of Azerbaijan is remarkable for its exceptional diversity, uniqueness and rich resources. Like all countries of the world, Azerbaijan faces various environmental problems. Preservation of ecological balance on the planet, rational use of reserves, protection of water, air, soil from pollution is a global problem. Undoubtedly, the solution of these problems is one of the strategic tasks facing Azerbaijan, which requires programs of planned and long-term activities, large state investments. It should be noted that in the Soviet era, the preservation of the ecological balance in Azerbaijan was not a priority. Also, during the restoration of independence, the problems faced by the republic did not allow us to pay special attention to environmental problems, allocate investments for their resolution. As a result, a difficult situation has developed in Baku, on the coast of the Caspian Sea, Sumgait and other regions. But the economic development of Azerbaijan in recent years has made it possible to transform the solution of environmental problems and protect the environment into one of the priorities of state policy. Over the past 7-8 years, large-scale state programs have been implemented in Azerbaijan, aimed at improving the ecological situation, as well as large projects requiring billions of investments. Such a scale is being carried out in Azerbaijan for the first time in the last several decades, and they are beginning to bear fruit.

The whole world is concerned about the problems of the destruction of the ozone layer of the atmosphere, global warming, the spread of the desertification process to more extensive areas, a significant decrease in biodiversity, the spread of various diseases associated with environmental pollution.

Today, Azerbaijan is attached to all international conventions on environmental protection relevant for the republic. Violation of the ecological environment in Azerbaijan, reduction of forests, pastures, land suitable for agriculture, and sometimes even their complete unsuitability, atmospheric pollution in large cities, pollution of the Kura, Araks and other rivers, environmental problems of the Caspian, soil, disturbance or reduction of biodiversity intensifies the need to take immediate action to resolve environmental problems.

GDP growth after the Soviet Union

The economic development that exists in the country, from the period of independence to today can be divided into two main stages. The first period covers 1991-1995 and is a period of chaos or decay. The second period began in 1996 and continues till the present and this is a period of macroeconomic stability and dynamic economic development.

At the first stage of economic development (until 1995), the process of liberalization was accompanied by a sharp increase in prices in the country. In 1991, the gross domestic product (GDP) was 2.7 billion manat, and the GDP in 1991-1995 decreased every year by 13-20%. The monetary income of the population, which is a generalized measure of the standard of living of the population, has decreased in real terms by 3.6 times, and per capita incomes by an average of 1.4 times. As the result of the failure of production industries, the unemployment rate has increased significantly, so during the 1991-1995-ies there was a decrease in the number of employed people among the economically active population.

Starting from the 1996, the inflation rate in Azerbaijan did not rise above 2-3%, and only in 2004 it was 6.7%, the practice of financing the budget deficit was stopped and the budget deficit decreased to 1-2% of GDP. (The State Statistical Committee of the Republic of Azerbaijan, n.d.)

Thus, in 1996, in a country that was in an economic crisis, macroeconomic stability was established. Since 1997, it became possible to ensure dynamic economic development, since the GDP growth rate in 1996 was 1.3%, in 1997 was 5.8%.

In a short historical period, Azerbaijan has become a developed country of the world community with a stable economy, taking the leading positions and having a significant impact on the political processes in the region. By the beginning of the 21st century.

Azerbaijan's economy accounts for 2/3 of the GDP of all the countries of the South Caucasus. In the period from 2005 to 2008 the growth of the real GDP of the Republic of Azerbaijan has reached the highest values since the independence of the republic, which averaged 24.2% per year. This period is characterized as a "period of economic boom," when Azerbaijan was the absolute world leader in terms of economic growth. (The State Statistical Committee of the Republic of Azerbaijan, n.d.)

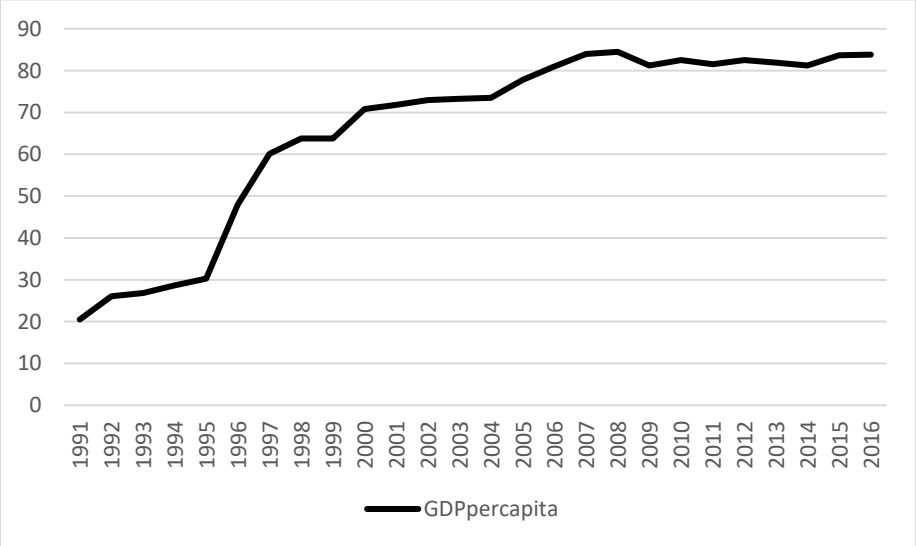

Figure 2. GDP per capita (%)

Source: Compiled by the author based on the State Statistical Committee

As seen from the Figure 2, the economy in Azerbaijan was reflects the low development starting from the 1991 till 1995, and after the 2000 till the present days it started to grow reaching the GDP level at 84,5%.

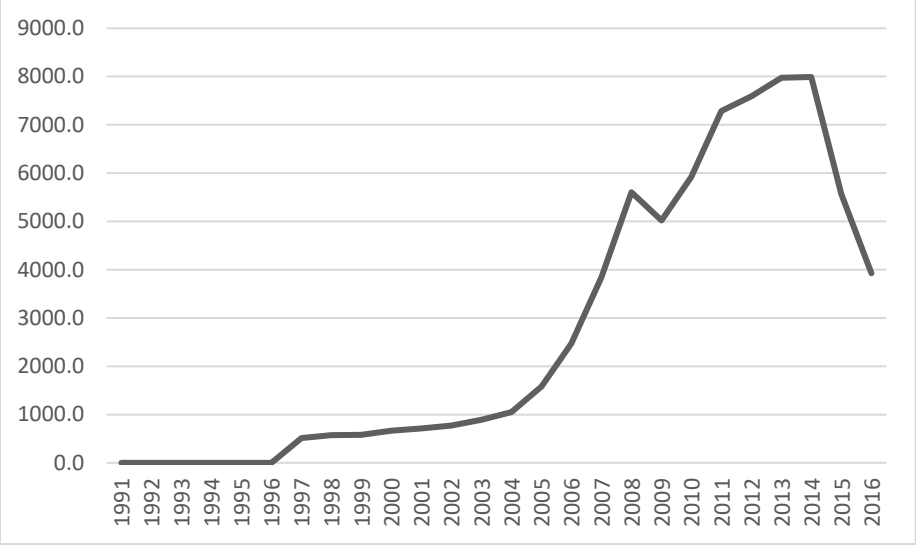

Figure 3. GDP per capita in USD

Source: Compiled by the author based on the State Statistical Committee

Bases on the figure 3, its seen that Azerbaijan economy was growing impressively fast and the highest amount of GDP per capita, reaching its peak at 7990,8 USD.

Due to the fact, that after gaining its independency the Azerbaijan Republic`s economy started to growth, it led to various environmental problems. There are 6 major ecological pollutions in Azerbaijan Republic, like atmosphere, waste, water and energy, which will be analyzed by the author in the next sub-chapter, to see if there is a real economic degradation, that was affected by the economic growth.

Atmosphere pollution

The state of air atmosphere in the largest cities of Azerbaijan is characterized by a high level of pollution. Annually more than 850 thousand tons of harmful substances are discharged into the atmosphere in the republic, including more than 450 thousand tons of motor vehicles. Emission includes substances such as soot, dust, formaldehyde, sulfur dioxide, nitrogen oxides, carbon oxides and metals. In a connection with the collapse of the Soviet Union, the destruction of economic ties, most enterprises located in cities operate less of the designed capacity, which reduced the number of emissions, but the number of ingredients, that threats life remains at the same level. (Azerbaijan Economy, 2007)

The causes of pollution in the air basin in the cities were depreciation of equipment and outdated technology, that did not change over the past 40-50 years, a sharp decrease in the use of natural gas as fuel and using instead of high-sulfur fuel oil, chronic non- protected activities and lack of sufficient capital investments for nature protection. Moreover, the main sources of air pollution are industrial facilities, power plants and transport. According to official sources The State Statistical Committee of the Republic of Azerbaijan (n.d.), the air pollution in 1995 amounted to 1 325 thousand tons, of which 879 00 tons from stationary sources, and the rest from mobile sources. Stationary sources dumped 730,000 tons of carbon monoxide into the atmosphere. The majority of industrial emissions in Azerbaijan are concentrated in Baku, Sumgayit, Ganja and Mingechaur. The primary source of atmospheric pollution is the oil industry, which is particularly affected by the shortage of booster compressor stations, which leads to significant emissions to the atmosphere of gas produced along with oil. One of the most serious sources of air pollution are torch structures. (Major facts about Azerbaijan economy, 2010)

The congestion of the roads became a serious problem in Baku. Moreover, after the event Formula- 1, the problem became more significant. According to official figures, since the flow of petrodollars flowed into the country at the beginning of the millennium, the number of personal vehicles in Azerbaijan increased in 3.3 times and exceeded 1 million of cars. Moreover, over 57% of these cars are concentrated in Baku. As a result, the Azerbaijani capital with a population of 2.2 million people faced traffic congestion and air pollution. According to local and international researchers, despite the efforts of the authorities, pollution of the atmosphere has become one of the most acute environmental problems of the republic.

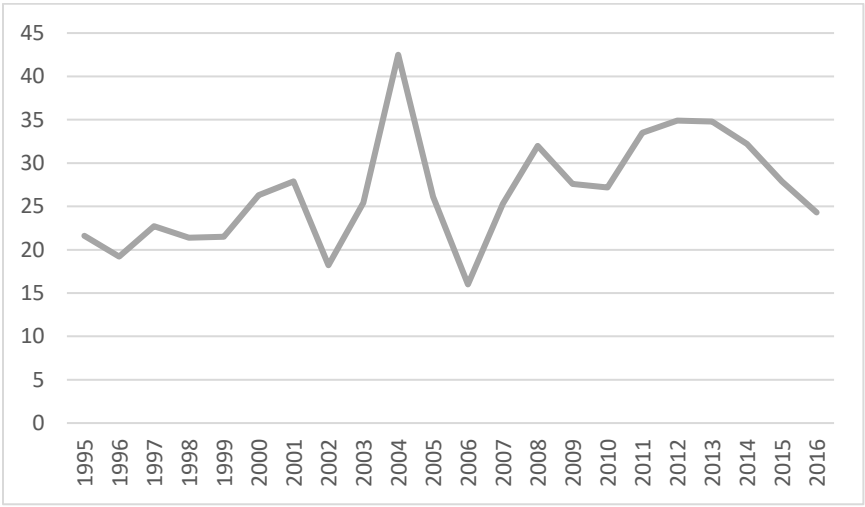

Figure 4. CO_2 emission from the period 1995-2016 (thousands of tons)

Source: Compiled by the author based on the State Statistical Committee

Waste

In the non-industrial zone, 60% of emissions are in the cities of Baku, Sumgayit, Ganja, Ali-Bayramli. Exemplary calculations based on stat.gov.az showed, that in the republic there are over 1.5-2.0 million tons of solid domestic waste. For the liquidation of solid household waste, the construction of a garbage processing plant is necessary. The main causes of air, water and soil pollution are obsolete technology, malfunctioning, lack of equipment to reduce pollution and

the use of lower quality raw materials with a high content of pollutants. Taking into account, that the state of the environment has improved markedly with the decrease in the output of industrial products, the author can say that the main sources of pollution are old enterprises. So, finding in a distressed state of production equipment using a mercury process for the production of chlorine-alkaline leads to a loss of mercury. These losses reached the maximum level. The mercury lost, as a result of this process is discharged into the atmosphere, discharged with sewage and part of it accumulates in the solid waste of the plant. (Azerbaijan Economy, 2007)

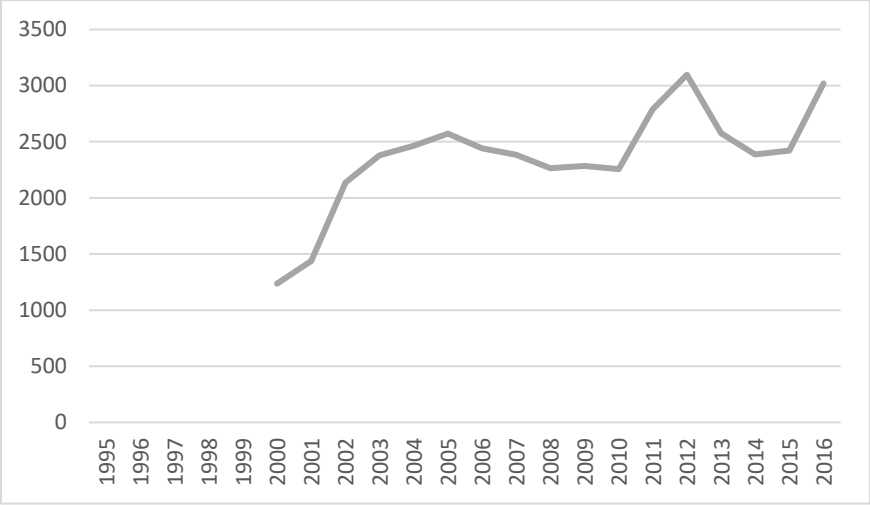

Figure 5. Total waste from the period 1999-2016 (thousands of tons)

Source: Compiled by the author based on the State Statistical Committee

Water

Water is necessary to sustain life and its availability in quantities and quality that are sufficient to meet basic human needs is one of the prerequisites for both improving people's health and sustainable development. Water resources in Azerbaijan are insignificant, their distribution and consumption is inefficient. The losses of this valuable natural resource are very high. Tap water supplies the needs of almost the entire population, but in many areas its acute

shortage is felt. The water used for water supply of the population is taken from sources, mainly located locally throughout the territory of the republic.

The water intake from sources of water supply rivers, reservoirs, lakes, groundwater, is carried out depending on the type of source and its capacity. It is often used the waters of the Kahriz, left over from the last century. In addition, at present, there is a tendency to renew these people's sources of water supply. Not having a high flow rate, Ganja city contain good quality water and until recently even connected to the centralized water supply system. The large cities as Julfa, Kazakh, Shamkir and Nakhichevan use the riverbed water of Alindinchay, Akstafachay, Jagirchay and Nakhichevanchay rivers, respectively (Wikipedia, 2018). The centralized water supply mainly is the privilege of Absheron peninsula. The waterways that feed this region are the Kurinsky water pipeline, Jeyranbatan and, of course, Baku water pipelines. (Azerbaijan Republic, n.d.)

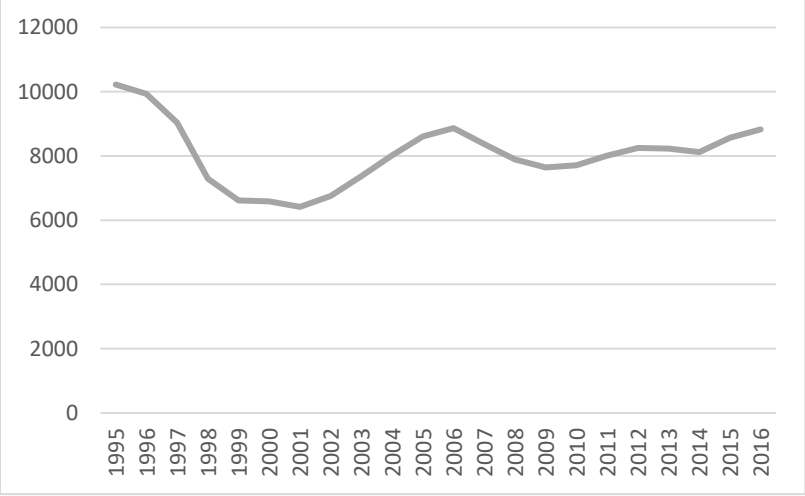

Figure 6. Water consumption from the period 1995-2016 (m^3 million)

Source: Compiled by the author based on the State Statistical Committee

Energy

The use of traditional energy sources is accompanied by environmental pollution. The reserves of hydrocarbons, which are a traditional source of energy, are not infinite. Considering all the above, the country's leadership has determined the use of alternative energy sources as a strategic task for the future. Azerbaijan, due to its favorable natural conditions, has sufficient potential of alternative and renewable energy. In 2011, the first wind power station was launched in Gobustan in Azerbaijan Republic. (Azerbaijan Republic, n.d.)

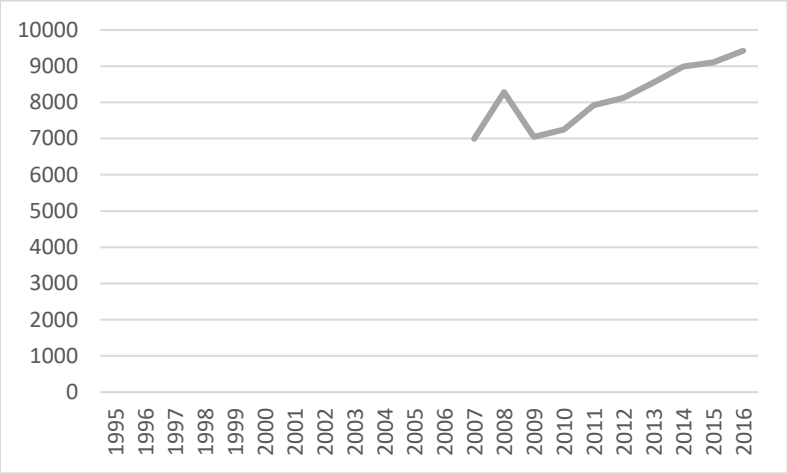

Figure 7. Use of energy from the period 2007-2016 (thousands of TOE)

Source: Compiled by the author based on the State Statistical Committee

2.2 Methodological overview and the results of the analysis

2.2.1 Description of data and methodology

Previous empirical studies for other countries of the economic growth and the environment were carried out with the common independent variable as income per capita (GDP) using different types of econometric estimations like cross-sections, panel data, time series and etc. The author will use the regression model analysis, using time series for the period 1995 – 2016 years.

The aim of this research is to examine the relationship between the environmental factors, mainly CO_2, water and municipal total waste and economic growth (GDP) and apply the EKC to the Azerbaijan Republic. Here are exact titles used for the independent and the dependent variables: GDP per capita – «GDPpercapita» (USD), CO_2 (thousands of tons), fresh water consumption – «WaterCons» (m^3 million), energy use – «Energy» (thousands of TOE (tone of oil equivalent) and the total municipal waste – «Wastetotal» (thousands of tons), collected from the State Statistical Committee of the Azerbaijan Republic. The first and the second parts will be devoted to the analysis of descriptive statistics, and the correlation analysis, to have a general understanding of the behavior of these variables over time starting from 1995 till 2016 years, which includes the scatter plot graph, between the independent and dependent variables. The third part will be to test, whether Azerbaijan` economy is following the Kuznets Curve by conducting the regression models to see the significance between the variables from SPSS software.

The classical regression model for testing the EKC hypothesis has the following form:

$$Y_{It} = a_i + B_1 X_{it} + B_2 X^2{}_{it} + B_2 X^3{}_{it} + B_3 Z_{it} + e_{it} ,$$

$$CO_{2_t} = a_i + B_1 GDP_t + B_2 GDP^2{}_t + B_3 GDP^3{}_t + e_{it},$$

where i = 1, ..., t = 1, ..., T of the year. In the equation, Y is the dependent variable describing the degradation of the environment as CO_2 (measured in thousands of tons), X is the independent variable responsible for the GDP (measure in USD), a_{it}, the constant and $B_{k\ (k=1.2.3)}$ are the coefficient matrices with explanatory variables. Depending on the significance and signs with the coefficients B_k the relationship between the economic growth and the quality of the environment can be defined by the following way (Dinda, 2004):

1) If $B_1 = B_2 = B_3 = 0$, then there is no relationship between Y and X;

2) If B_1> 0, and B_2= B_3= 0, then a linearly increasing relationship is observed;

3) If B_1<0, and B_2= B_3= 0, then a linearly decreasing relationship is observed

4) If B_1> 0, and B_2<0 and B_3= 0, then an inverted U-shaped relationship is observed;

5) If B_1<0, and B_2> 0 and B_3= 0, then a U-shaped relationship is observed

6) If B_1> 0, and B_2 <0 and B_3> 0, then an N-shaped relationship is observed;

7) If B_1 <0, and B_2> 0 and B_3 <0, then there is an inverted N-shaped relationship between Y and X.

To prove the conjecture about the existence of EKC, it is necessary that the symbols and the significance of the coefficients correspond to case 4. In cases 6 and 7, there is still a change in the quality of the environment and the certain areas of the economic growth that corresponds to the EKC theory. (Dinda, 2004) The author will use CO_2 as the dependent variable and GDP as the independent, to see if the EKC model fit in the case of Azerbaijan.

2.2.2 Correlation analysis

Firstly, the author conducted the correlation analysis in order to clarify: whether there is a statistically significant relation between the dependent variable (GDP) and the explanatory variables, and whether the explanatory variables are statistically significantly correlated with each other.

Table 3.

Correlation between the variables

	CO_2	Energy	Waste total	Water
GDP	0,563**	0,215	0,537*	0,074
CO_2		0,144	0,223	-0,124
Energy			0,403	0,672
Waste				0,796**

Notes. ** correlation is significant at the 0.01 level
*correlation is significant at the 0.05 level

Source: Compiled by author based on the data from the State Statistical Committee

From the Table 3 Pearson linear correlation, it visible that correlation between variables is statistically significant, as they are more than 0, which mean that they have positive correlation. It seems, that our dependent variable GDP has a positive relationship between the Waste of total and the CO_2, by the r values 0,563 for the CO_2 and 0,537 for the Waste total, which means that the larger GDP, the larger get those independent variables. For the GDP and Energy consumption there is a weak correlation with r value 0,215 and for the GDP and Water consumption the r value is 0,074, which also shows the weak correlation between the variables. Except for the water consumption that has -0,124 of correlation with the CO_2, shows that with the increase of CO_2 the water consumption will decrease in 0,124. Plus, it shows that in Pearson correlation for water and waste there is a multicollinearity with 0,796, which is closer to 1 and means that there is a high correlation between the variables.

2.2.3 Scatter plot

Now the author wants to check, if the independent variable GDP is related to other dependent variables. For this case, the author uses fitted quadratic line plot, which shows the strength and direction of the relationship between two variables.

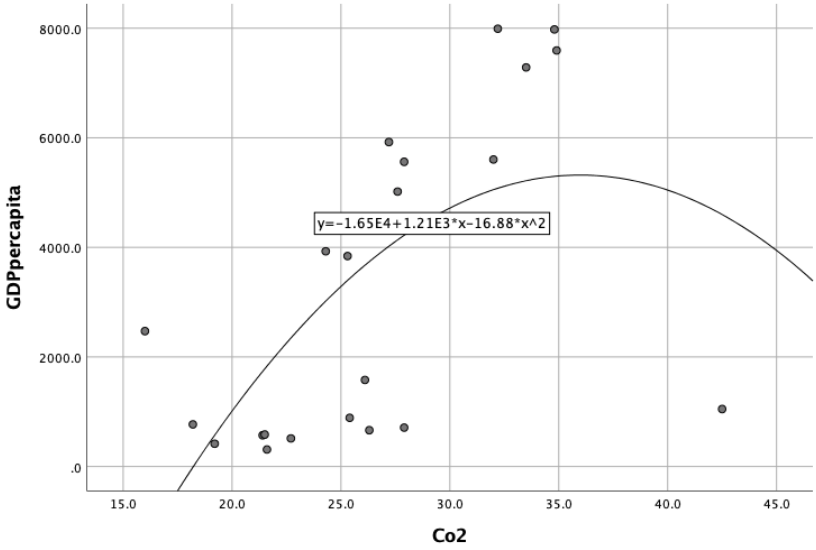

Figure 8. Relationship between the CO_2 and GDP per capita

Source: Compiled by author based on the data from the State Statistical Committee

The first scatter shows the relationship between the GDP per capita and the CO_2 thousands of tons emission. From the Figure 8, the data was used for GDP per capita, which is expressed in unit of US dollars for the period of 1995 to 2016. The quadratic fitted plot shows that points sufficiently do not cover the range of density values and there are many outliers. As there is no correlation, the author can conclude that, the value of CO_2 can vary not depending on the value of GDP.

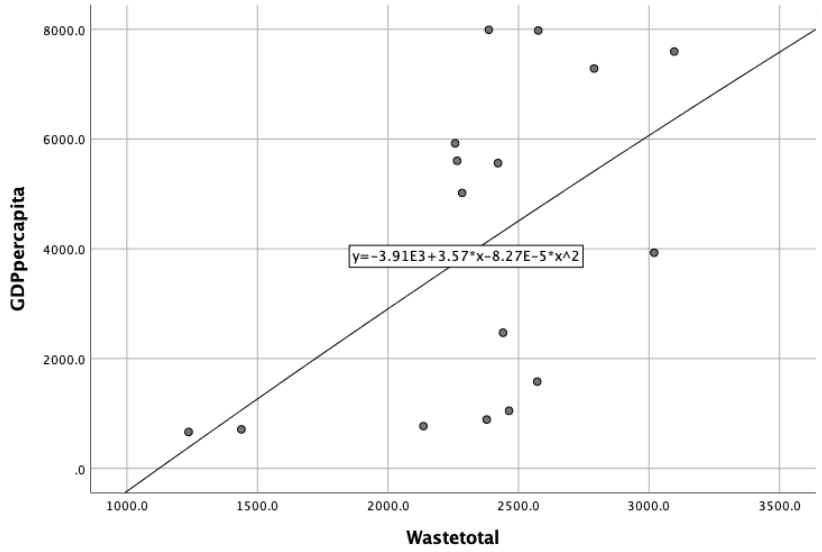

Figure 9. Relationship between the total municipal waste and GDP per capita

Source: Compiled by author base on the data from the State Statistical Committee

From the Figure 9, the data for the total generation waste is expressed in thousands of tons from the period of 1995-2016. On the quadratic fitted plot, it seems that the total waste is positively correlated with GDP, which shows the positive relationship between the total waste and GDP and indicates, that as the values of GDP increase the waste tend to increase.

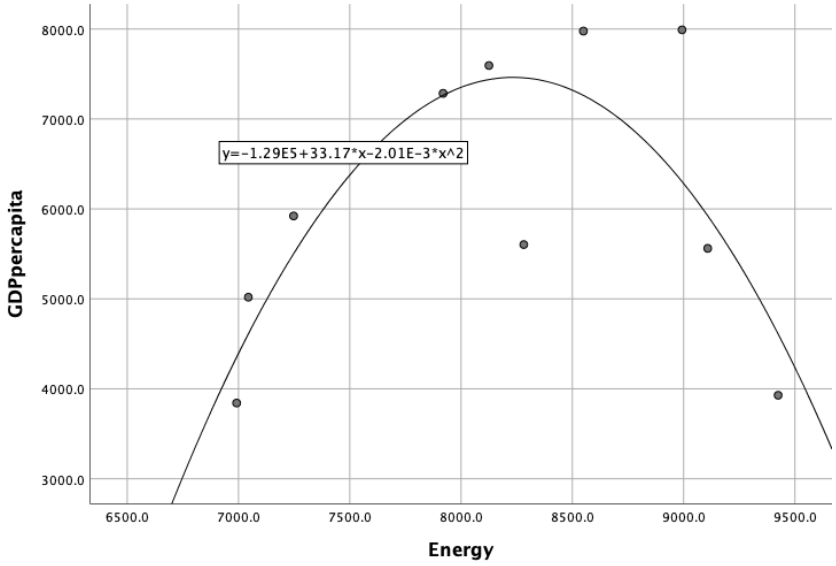

Figure 10. Relationship between the energy consumption and GDP per capita

Source: Compiled by author base on the data from the State Statistical Committee

From the Figure 10, shows the relationship between 2 variables the GDP and the energy consumption, which is measured in thousands of TOE (tons of oil equivalent).It appears that the energy data is following the quadratic plot, which can identify a positive relationship between the GDP and energy use.

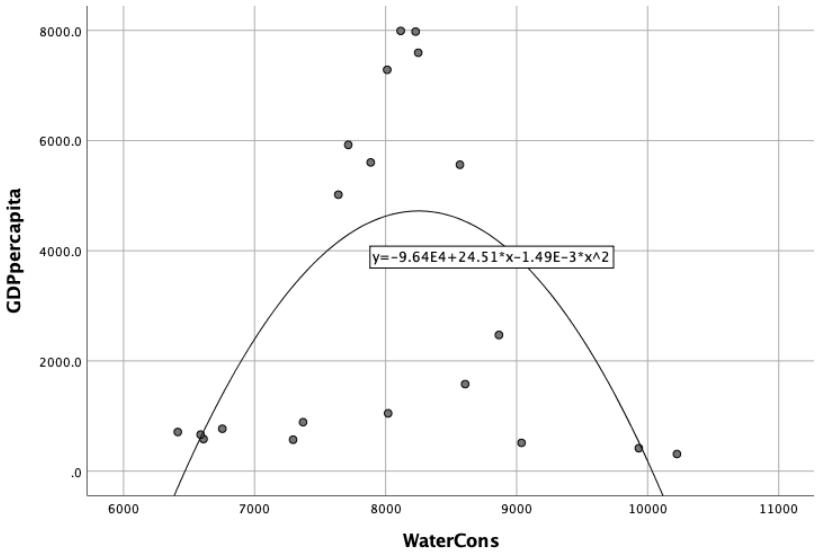

Figure 11. Relationship between the water consumption and GDP per capita

Source: Compiled by author base on the data from the State Statistical Committee

From the table 11, we can see the relationship between the water consumption variable, which is presented in the millions of $m^3$and the GDP per capita. The data shows the no correlation between the variables and the author can conclude that there is no relationship between the GDP per capita and the water consumption in the country.

Basing on the interpretation from this sub – chapter, it can be concluded, that the quadratic fitted scatter plot showed relationships between the variables. There is a positive quadratic correlation between the GDP and total waste, and the GDP- energy use, but no

relationship between the GDP - CO_2, and the GDP and water consumption. This means that by increase of GDP, only total waste and energy use increase, which means that when the economy growth the environment pollutions total waste and energy degrades. Potentially, the small samples do not provide a precise estimate of the strength of the relationship between the response and predictors, however the author could identify the results and make conclusions.

2.2.4 Environmental Kuznets curve in case of Azerbaijan

The classical regression model for testing the EKC hypothesis has the following form:

$$Y_{It} = a_i + B_1 X_{it} + B_2 X^2{}_{it} + B_2 X^3{}_{it} + B_3 Z_{it} + e_{it},$$

$$CO_{2_t} = a_i + B_1 GDP_t + B_2 GDP^2{}_t + B_3 GDP^3{}_t + e_{it},$$

where i = 1, ..., t = 1, ..., T of the year. In the equation, Y is the dependent variable describing the degradation of the environment as CO_2 (measured in thousands of tons), X is the independent variable responsible for the GDP (measure in USD), a_{it}, the constant and $B_{k\ (k=1.2.3)}$ are the coefficient matrices with explanatory variables. Depending on the significance and signs with the coefficients B_k the relationship between the economic growth and the quality of the environment can be defined by the following way (Dinda, 2004):

1) If $B_1 = B_2 = B_3 = 0$, then there is no relationship between Y and X;

2) If $B_1 > 0$, and $B_2 = B_3 = 0$, then a linearly increasing relationship is observed;

3) If $B_1 < 0$, and $B_2 = B_3 = 0$, then a linearly decreasing relationship is observed

4) If $B_1 > 0$, and $B_2 < 0$ and $B_3 = 0$, then an inverted U-shaped relationship is observed;

5) If $B_1 < 0$, and $B_2 > 0$ and $B_3 = 0$, then a U-shaped relationship is observed

6) If $B_1 > 0$, and $B_2 < 0$ and $B_3 > 0$, then an N-shaped relationship is observed;

7) If $B_1 < 0$, and $B_2 > 0$ and $B_3 < 0$, then there is an inverted N-shaped relationship between Y and X.

The author used CO_2 as the dependent variable and GDP as the independent, to see if the EKC model fit in the case of Azerbaijan. The water consumption and total waste does not affect CO_2 in no other ways, so those variables were removed from our analysis. Moreover, the energy consumption can have some effect on the CO_2 emission, but because of the scarcity of data, the author excluded that variable to avoid confusions in the regression model.

Table 4.

Regression model for EKC variables

Model Summary					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,594	,353	,245	5,4990	1,848

Source: Compiled by author using SPSS

The appropriate econometric test for the autocorrelation was conducted. The table 4 points the Durbin Watson is 1,848, which shows, that there is a positive autocorrelation (1,5 >2,5), which means that the increase in one time series, leads to proportionate increase in other time series. It indicates the common results in time series, so the author can continue with further analysis.

Table 5.

Coefficients for EKC variables

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	23,348	3,967		5,885	,000
	GDP	,001	,006	,524	,194	,848
	GDP Squared	-2,754E-7	,000	-1,003	-,159	,875

GDP Cubic	3,901E-11	,000	1,096	,290	,775

a. Dependent Variable: CO_2

Source: Compiled by author using SPSS

The three linear regression models have different GDP measures in terms of an independent variable: GDP, GDP square and GDP cubic. From the table 5 the coefficients are insignificant and it`s impossible to proceed with the further analysis. This means that the regression analysis indicates that the Environmental Kuznets curve does not exist in case of Azerbaijan Republic.

With the regard to the comparison with previous studies, the present study showed somewhat similar results with Hussain, Javaid & Drake (2012), Halicioglu (2009). In other words, the EKC does not work for the developing countries, when applying the classical regression model, using the CO_2 as the dependent variable.

2.2.5 Results of the analysis

- Based on our empirical results taken from SPSS, the correlation table between the variables shows that, there is a correlation between the GDP per capita and the CO_2 which, means that by the growth of the GDP, the CO_2 also increases. The same conclusion goes to the relation between the waste of total, which means, that by the increase of GDP per capita the level of wastes increases.
- However, looking to the quadratic fitted relationship from the scatter plots the author can conclude that the correlation exists only for the GDP, energy and the total waste. The CO_2 and water consumption data did not show a fitted line, so it means that the slope equals to 0 and has no correlation between variables.

- Using the classical regression model of EKC, the B coefficients showed the insignificant results, and the author can decline the existence of EKC, which means that the curve does not follow any of our curve patterns and does not work in case of Azerbaijan.

Conclusion

The relationship between environmental degradation and economic development has been studied before many times over the past few decades. In the previous decade, the subject of hot debate was the existence and practical application of the environmental Kuznets curve (EKC). It is logically quite simple to explain - in the process of economic development of any nation (i.e., a constant increase in the GDP per capita), the environment deteriorates, but it will eventually improve if there is a desire to maintain a clean environment and there are available the necessary funds. According to previous scientific researches, if an EKC exists, the solution of environmental problems does not affect economic development.

The theoretical model developed earlier for obtaining an EKC has been expanded and is used to determine the validity of the EKC hypothesis. The revised model shows that the EKC resembles a polynomial relationship in the third degree and is not a concave curve or an inverted U-shaped curve, which reflects the relationship between environmental degradation and real GDP per capita. Based on the previous researches, it was found a steady increased curve, where, as GDP per capita increases a linear increase will be found in CO_2 – EKC curve.

This research also explores the same relationship between environmental pollutions, energy consumption and economic growth in case of Azerbaijan Republic. The aim of this paper was to apply the validity of the environmental Kuznets curve in Azerbaijan from the period of 1995 – 2016. The results of the correlation analysis indicate that there is an econometric evidence in the time series data for both dependent and independent variables. To test the EKC evidence a linear, quadratic and cubic model was constructed using GDP per capita, which did not show any positive results as the B coefficients were insignificant and showing no evidence of the Environmental Kuznets curve.

The problem of pollution is more sensitive generally for developing countries and particularly for Asia due to its industry and warm weather. The results obtained may be indicative of the fact that, despite the non - existence of an EKC for emissions of the most common pollutant CO_2 in the atmosphere, departing from stationary sources, economic development Azerbaijan cannot be fully defined as sustainable in a long-term term period and contributing to a reduction in the pressure exerted on the environment. The most likely reason for this may be the raw material dependence on the Azerbaijan economy. In addition, the underdevelopment of social and economic institutions also contributes, to the fact that the growth of factors that are in developing countries promote economic development and reduce environmental degradation, behave quite differently. In view of the foregoing, it is necessary to understand that if we want to reduce to sew the level of pollution in Azerbaijan, it is necessary, first of all to increase GDP per capita, at the same time it needs to be realized through diversification economy and the introduction of more efficient and "clean" technologies in extractive and manufacturing industries.

Taking into account the optimum of Pareto in comparison with the control of environmental safety, there are discussions about the improvement of the state of the environment and continuous economic development, which are possible only thanks to policies based on the principles of wealth, justice and real investment. However, environmental problems accumulated over a long period cannot be solved within short time frame given the limited capability of the economy of the Republic of Azerbaijan which is currently in transition.

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