

The Impact of Carbon Dioxide Emissions on the Growth of GDP in Iraq and its Implications for Development

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Abstract

The relationship of energy sources to environmental pollution is controversial and the focus of many studies, as climate changes have proven that energy consumption has a clear impact on the changes that have occurred on the environment in general. Others advocate environmental protection and aim to limit growth in order to help the ecosystem regenerate itself.

Economic growth may be incomplete as long as it is based on ideas, and ideas do not admit of depletion, in which case the economy shifts from an economy based on materials to an economy based on information or goods - information, an intangible good, thus keeping the environment safe from pollution.

The research problem comes in the main question: How can carbon dioxide emission affect the gross domestic product in Iraq? The research problem can be identified in light of the main questions addressed, namely:

Q1: What are the philosophical and intellectual foundations for the concept of pollution?

Q2: What effects can environmental pollution have on sustainable development?

Q3: What is the reality of the availability of the foundations for building renewable energy and its sustainable development impact?

The research is divided into three axes that include the first axis theoretical rooting of the concepts, and the second axis measured the relationship between carbon dioxide emissions and growth in the gross domestic product in Iraq (characterization and estimation of the standard model), and the third axis dealt with reality analysis and building a forward-looking vision, and conclusions were reached and recommendations.

Keywords: Pollution, Carbon Dioxide, Gross Domestic Product.

The Theoretical Rooting of Concepts

It is the biosphere that should be sustainable, how to protect biodiversity and genetics, the most contentious issues of whether growth is required from the point of view of environmentalists, many scientists point out that no growth is not an appropriate solution, and part of the growth It can help prevent environmental degradation, so it is required, such as clean technologies such as solar or wind energy, but technologies should be avoided, as well as growth that harms the environment, that economists need to pay more attention to environmental and ethical aspects calling for environmental protection as a first focus and advocates The other to economic priority as a second axis.

1. The Concept of Environmental Pollution

Pollution is defined as a deliberate or spontaneous change in the shape of the environment resulting from human excrement, or as a change in the natural environment that carries with it dangers to living organisms. (El-Baz 2003).

As for the procedural definition of pollution, it is any change in the environment that leads directly or indirectly to harming living and non-living organisms. The basic definition: Pollution is an undesirable negative change in the environment, usually adding something dangerous or harmful. EPA definition: A substance in the environment that, by its chemical composition or quantity, inhibits the conduct of natural processes and produces undesirable environmental and health effects. (Speth 1988) By definition, pollution is harmful (much in the wrong place), but some pollutants are beneficial, phosphates and other plant nutrients are essential for aquatic life, and carbon dioxide in the atmosphere helps keep the Earth warm enough. It is sufficient to be habitable, but the accumulation of large amounts of it as a result of the use of fossil fuels and other sources threatens to change the climate of the planet. Water (liquid waste) and land (solid waste). Pollution is the direct or indirect human introduction of substances or energy into the environment that can cause harm, endanger human health, harm vital resources and ecosystems, constitute an attack on ways of life, or better impede other legitimate uses of the environment road. Pollution is a change in the properties of the natural, chemical, and biological components of the environment around humans, including water, air, and soil, that may cause harm to human life or other living organisms, plants and animals, or cause harm and disturbance to humans. Living conditions in general and the destruction of heritage and valuable cultural assets such as archaeological buildings and facilities.

Pollution is also defined as everything that affects all elements of the living environment from plants, animals and humans, as well as everything that affects the formation of non-living natural elements such as air, soil, lakes and seas. (Mr. 1992).

Degrees of pollution: Due to the importance and nature of pollution, it has been divided into three types: (Al-Rifai 2008).

1. Acceptable Pollution: A degree of environmental pollution that is not affected by the balance of the ecosystem and is not accompanied by environmental risks or problems.
2. Serious Pollution: It is an advanced stage of pollution where the quantity and quantity of pollutants exceed the normal limit, and with it the negative impact on the natural and human environmental elements begins.
3. Destructive Pollution: This pollution represents the stage in which the ecosystem collapses due to a radical level of disruption, such as the Chernobyl accident that occurred in the Ukrainian nuclear reactors in 1986.

2. Sources of Pollution

Pollutants are divided according to their origin into natural pollutants that arise from components of the environment, such as gases and dust from volcanoes, nitrogen oxides formed in the air, pollen grains of some flowering plants, and new industrial pollutants that come from humans. Technologies and discoveries such as nuclear waste, transportation exhaust and various industrial wastes. By their nature, pollutants are divided into biological and biological pollutants such as viruses and bacteria, and physical pollutants such as noise, heat and various radiations. Pollution can be divided into two different parts:

- Physical pollution: It includes pollution of air, water, soil and food.
- Intangible pollution: It includes noise, electromagnetic, radioactive and valuable pollution.

Pollution is the spread of energy or matter in the environment in large quantities in the wrong place and time, which harms human health and living organisms and limits the legitimate uses of the environment. In most cases, pollution leads to a change in the chemical, physical or biological properties of the environment. Although there is natural

pollution as a result of volcanic eruptions, forest fires, etc., what nature suffers most is pollution caused by human activity, such as pollution of surface and ground water, soil, air and food. Pollution can be classified in chemical and physical terms as follows:

i. Energy Pollution

The development of human life over the years and as a result of the increasing consumption of all kinds of energy, and due to the increasing possibilities of depletion of traditional energy sources coal, petroleum, natural gas, many countries of the world hastened to take the necessary measures to rationalize the use of traditional sources of energy, with the development of new and non-traditional sources to obtain its growing needs of energy, such as the use of new and renewable energies, which is characterized by low cost and the few pollutants it causes, such as preserving the environment from pollution and the resulting damage to humans, animals, plants and all elements and components of the environment. Energy pollution arises from physical sources, and in the twentieth century, increased. People are exposed to radiation from different sources. The first of these sources was the use of X-rays in the diagnosis and treatment of diseases, and since (1945) until now, the explosion of nuclear weapons led to the leakage of large quantities of radioactive materials into the environment. Recently, accidents of some atomic reactors that are used to generate energy have increased the public's interest in providing an adequate level of safety during the operation and maintenance of these reactors, and we all feel pollution by noise, which is the most type of physical pollutant that causes distress and boredom, as in the areas adjacent to airports and traffic congestion areas. (Saber 2000).

ii. Contamination by Materials

Pollution with materials is one of the most important sources of pollution that harm living organisms. It is known that living organisms feed on a range of nutrients that are found in the environment in quantities that meet their needs. The lack of these elements or their presence in a high concentration leads to damage to living organisms, and the interaction of some of these elements, with each other or with other elements in the environment, leads to the formation of new compounds that may be harmful to living organisms, and this damage varies depending on the quality of the organism and the period of time. Exposure and concentration level of pollutants. Some pollutants have a small harmful effect on living organisms, while others have harmful effects that outweigh their benefits, and many of them cause deadly diseases.

iii. Climate Changes

The phenomenon of climate change is one of the dangerous phenomena that has become a source of concern for the whole world and this is mainly due to the increase in the proportion of greenhouse gas emissions resulting from the increasing human activities, especially the burning of fossil fuels, as well as the removal of tropical forests, and the disintegration of the ozone hole, and carbon dioxide is the main cause of the phenomenon Global warming, as it absorbs the infrared radiation coming from the sun and does not allow it to be bounced back into outer space. This has resulted in an increase in the speed of melting ice in the Arctic, which predicts the disappearance of ice completely before the end of the current century, and this has been attributed by researchers to the causes of disasters that strike the Earth To rapid climatic changes and bad handling of nature.

iv. Water Problem

A UNESCO report confirmed that humanity will face a real water crisis, and one study confirmed that a quarter of the world's population is deprived of clean drinking water, and that diseases transmitted by non-potable water are the number one cause of death in the world before malnutrition, where 22,000 people die daily. Most of them are children under the age of five, due to diseases transmitted by contaminated water, including: (typhoid, cholera, malaria and diarrhea), and that 50% of the developing world's population is exposed to polluted water sources, in which thousands die every day, as a result of what is pumped into rivers, banks and lakes of waste. Different, and in view of the serious social, health and economic repercussions that the water problem may have, at the level of regional and international relations, and on the development movement, some have called the water problem the "sleeping tiger" due to its seriousness in relation to all other environmental problems. (Kaffee 2013).

v. The Problem of Desertification

Desertification is one of the environmental concerns that increasingly haunts the world, and it is a problem that threatens every human on the surface of the earth through changing the characteristics of agricultural soil,

decreasing its productivity, increasing the spread of dust across the globe, polluting water and air, complicating the problem of poverty and hunger, and hampering efforts and efforts to solve it in many countries of the world.

Types of Environmental Pollution by Source: There are two different types of pollution: (What is pollution, Aquarium of the Pacific, a non-profit institution www.aquariumofpacific.org).

- Pollution is Known (Specific) Source: it is pollution that can be easily tracked and its source can be reached. Examples of this type of pollution are the oil spill from marine oil tankers, factory smoke, and as an applied case for this type of pollution is the one caused by the Exxon Oil Company.
- Pollution is Unknown (Unspecified) Source: This pollution is difficult to reach its source or cause. This pollution occurs daily in our societies, and it comes from multiple sources. Among the applied cases of this type of pollution is the dumping of motor oils into sewage networks, waste, pesticides, and fertilizers.

3. The Role of Environmental Policy in Sustaining Economic Growth

The development of environmental policies is very important in order to reduce the regulatory burden on the economy and achieve the benefits of growth in terms of general improvement of economic efficiency, and in terms of securing long-term growth, if it helps in increasing prosperity and well-being through increasing income and improving health as well as education and quality of life Among these policies are: (Tim Everett 2010).

1. Investing in environmental research and development, public spending and technology programmes, such as infrastructure development for floods, support for low-carbon technologies such as the electric car, and provision of information and other policies to address barriers to behavior change, such as policies to adopt resource efficiency measures that contribute to savings environmental and financial.
2. Orientation to policies that aim to price environmental resources correctly, raising costs in the short term, in exchange for innovation and increased efficiency in the use of resources that can stimulate environmental policy, by providing greater certainty about the future policy environment.
3. Smart and cost-effective policy design can be used to further reduce any policy in the short term through the trade-off between environmental policy and economic growth. This includes considering the best combination of tools to achieve environmental goals, from pricing externalities to investing in technology and infrastructure.

Measuring the Relationship between Carbon Dioxide Emissions and Growth in GDP in Iraq (Characterization and Estimation of the Standard Model)

1. Data

Quarterly data for the period (2007-2018) on carbon dioxide emissions from the official website of the World Bank and quarterly data on the gross domestic product for the same period from the statistical website of the Central Bank of Iraq were relied on. The model was estimated for the above period at (48) Watch. (simple regression model).

2. Drafting the Form

The most acceptable model to explain the impact of GDP on carbon dioxide emissions is the following model:

$$LCO_2 = a + b LGDP + U_1 \quad (1)$$

Where as:

L is the natural logarithm

CO₂: Emission of carbon dioxide

GDP: gross domestic product

b: intrinsic elasticity $b > 1$

U: random variable

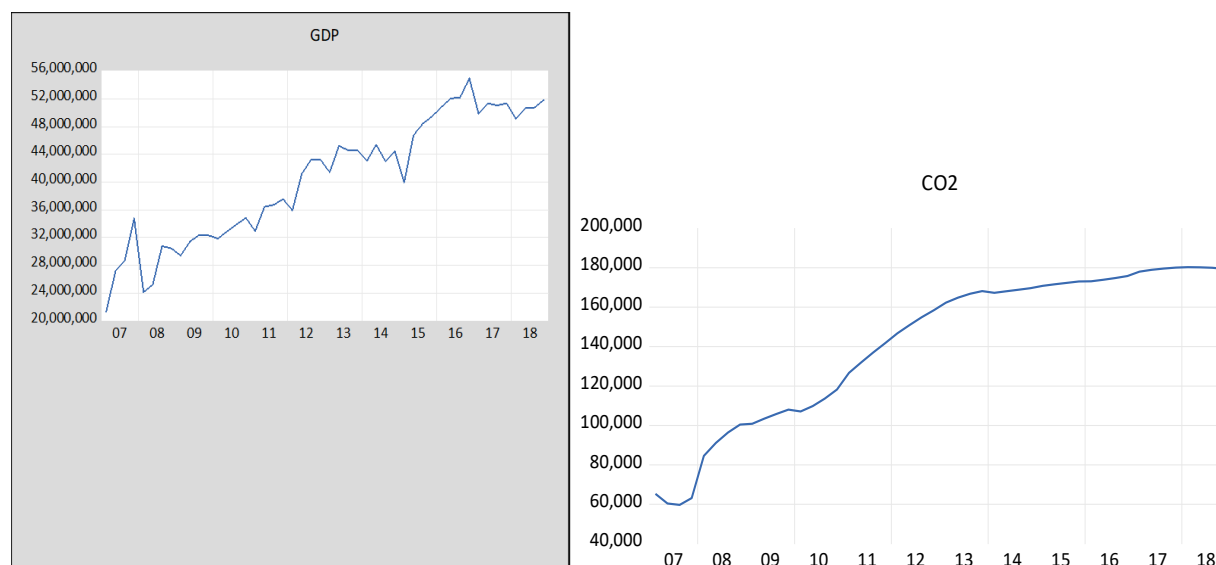


Figure 1: Time Trend of the Research Variables for the Period 2007-2018

Source: From the work of researchers based on the results of the statistical program Eviews.

3. Unit Root Sleep Test

Relying on the expanded Dickey-Fuller test (ADF), the quiescence of the two search variables was tested and it was found that they were static at the level as shown in Table (2).

Table 2: Results of the Unit Root Test for the Studied Variables for the Period (2007-2017)

Variable	Level P-VALUE		
	Intercept	Trend and intercept	Non
GDP	0.02	0.001	-0.96
CO₂	0.01	0.04	0.85

Source: The work of researchers based on the results of the statistical program Eviews

4. Estimation of the Model

The model was estimated and the results were as shown in equation (2), from which it is clear that there is a direct relationship between the increase in GDP in Iraq during the period 2007-2018 and the increase in carbon dioxide emissions, as an increase in this output by 1% leads to an increase in these emissions by 1.22 %, i.e. a greater percentage than the increase in output, which poses a clear danger to the environment, especially since the growth of GDP in Iraq depends largely on the production of crude oil, which in turn is not subject to environmental controls regulating the pollution process and the emission of gases that accompany the extraction process.

$$CO_2 = -9.56 + 1.22 \text{ GDP} \quad (2)$$

P-value 0.0005 0.00001

R-squared 0.83

Prob (F-statistic) 0.000

The results of the estimation show a statistically significant effect of the GDP parameter on carbon dioxide emissions, as evidenced by the value of the p-value test, which was less than 5%. It is also clear that the GDP explains 83% of the carbon dioxide emissions in Iraq, as evidenced by the value of the R-squared coefficient of determination, which amounted to 0.83, as indicated by the significant value of Prob (F-statistic) for the model as a whole, as its value was less than 5%.

The tests of the second degree, which are both the test of self-correlation and the difference in variance between the residuals, showed that the model was free of these problems.

Analyzing the Reality and Building a Forward-looking Vision

The problem of environmental pollution was an inevitable result of human tampering with nature and its resources, with the expansion of the ozone area and the shortage of fresh water, this led to the decay of forests and other environmental problems that resulted due to human extravagance in exploiting what God has blessed him with, and therefore for fear of a polluted future Environmental, the countries of the world, led by the United Nations, hastened to hold conferences, form committees, and establish treaties in order to restore the environment to its purity and balance because the Earth's environment is one, and therefore any negative effects of its pollution will be transcontinental and everyone suffers from it, and it should be noted that the major industrial countries cause the part The largest of this environmental corruption, we find that the United States of America participates in the largest share in this pollution by 25%, followed by the countries of Europe with 13%.

As for the second problem of the environment, it is represented in the depletion of resources, and we may point out here that the same countries that cause the largest percentage of environmental pollution are the same ones that cause the depletion of resources, as we find that in America and the European Union countries represent 80% and the rest of the world's population consumes Only 20% of the resources, and this continuous depletion of resources has led to increased pressure on the environment and the destruction of a large part of the natural capital.

1. The Reality of Pollution in Iraq

The per capita per capita electricity consumption is estimated at 1,300 kWh by less than nearby countries. The per capita energy consumption in Iraq is approximately 1437 kg and this is high compared to other countries in the region and by 2018, second emissions rose Carbon dioxide has increased by 69% compared to its levels recorded in 2009, the year in which the Law for the Protection and Improvement of the Environment entered into force (International Energy Agency 2020, IEA, and electricity, electricity, production, and needs sectors).

In 2018, the total CO₂ emissions from the electricity and heat generation sectors amounted to 9.85 metric tons. While the oil sector accounts for 73% of emissions, and the natural gas sector constitutes the source of the remaining percentage, most of the air pollution results from the leakage of industrial waste and fumes resulting from traffic. The environment in Iraq is considered to be very fragile. Iraq ranked 152 out of 180 countries in 2018, according to the Environmental Sustainability Index, and Iraq has not ratified the Paris climate agreement, which is an indication of the reduction in emissions. (IEA, 2020).

Iraq has huge potential in the field of renewable energy, but it lags behind its regional peers in terms of using renewable energy technology. The Iraqi electricity sector has suffered from the proper exploitation of its renewable resources, as war and violence have created very difficult conditions compared to some other countries in the Middle East and North Africa. While the integrated national energy strategy is an attempt to develop a short-term vision, it needs to be amended to better focus on existing realities. Consequently, Iraq does not currently have a clear and defined strategy, nor is there a clear approach to the transition to renewable energy. The dominant role played by fossil fuels in the economy and state, inadequate legislation, and the shortage of population on efficiency and political factors, all barriers hinder the path of energy in Iraq, especially after the Covid 19 pandemic is needed and a new or new energy strategy emphasizes the need for technologies Renewable energy and renewable resources are part of the short-term stimulus and recovery plans (IAEA 2020, in this context, Iraq's vision for sustainable development 2030, which is determined in its content is a new social contract between the state and the citizen, will enhance confidence in the government, Self-development opportunities and earning income are available and a sophisticated strategy is an appropriate national strategy, and requires the construction of a long-term vision for energy. The ease of renewable energy potential for contributing to these aspects will be a substantial preliminary step, policy and citizens should realize the benefits of renewable resources provide by stakeholders and citizens. While the need to secure energy supplies is a major catalyst for renewable resources.

On a larger scale, environmental factors are not currently important driving forces in Iraq's energy transition. But this reality may change in the long term, since Iraq will affect the increasing consequences of environmental concerns at the global level, specifically the need to reduce greenhouse gas emissions. In a long term on the Iraqi oil and gas sector and therefore the economy of Iraq, therefore, move forward to the production of fuel from renewable energy sources is capable of providing new development for the economic sector and future export opportunities and may encourage Iraq's vision to adopt an environmentally sound vision or Especially since the construction of traditional power stations, new production facilities and new transportation infrastructure may result in a new dependence on the existing paths within the energy system, and this increasing dependence may lead to a shift in dependence to an exclusive source. This is supposed to give priority to the steps that achieve a significant quality jump in the field of energy rather than investments in carbon dense techniques, and despite the difficulty of

overcoming the political, institutional and cultural resistance of renewable energy in Iraq, may be to move to renewable energy at the levels Economic and environmental, it may provide job opportunities along the energy value chain, reduce air and environment pollution and thus reduce health risks, and raise energy security levels, which is a prerequisite for the transition to energy. Research and development work is necessary to create local value chains, including the provision of financial support, perhaps in the form of an oil sector tax to finance tangible transitions, including a tangible range of transitions. Development in order to set a realistic time frame for the transition process. In addition, the infrastructure must be established, and society must also be an integral part of the overall process, with the need to establish an appropriate framework and an appropriate legal context in the renewable energies of consumers to adopt or produce their own electricity, and this would introduce tools and channels The best to participate in the process of turning the energy to enhance acceptance and contribute to the justice of strength dynamics and energy policies. This can be achieved through the establishment of operations by stakeholders and citizens to work together to develop broader scenarios, in the design of awareness projects suitable for the local context, in the light of the above, There is a need for a long-term, integrative approach that takes into account the entire energy system and the long-term goals of the transition process to an energy system based entirely on renewable resources. Policy makers must realize that renewable energy systems offer multiple benefits in the short term through enhanced security of supply as an opportunity for economic development.

2. Future Vision

The clear understanding and vision of the organization of fundamental requirements for the promotion and guidance of moving towards a fully renewable resource energy system. The progress model of the Middle East and North Africa region has been adapted to the situation of Iraq to provide information to support the transmission of energy system towards sustainability and is indicated that this model is based To the context through visions for managing the process and the basis for the transition, then it was modified to show the differences between the general basic assumptions, the characteristics of the Middle East and North Africa region, and the specific Iraqi context. The model includes four stages:

- Unleashing Renewable Energy
- System Integration
- Energy converted to fuel/gas
- Towards 100% renewable sources

It was applied to determine and analyze Iraq's status on the path to transition to energy based on renewable resources. The application of the model also provides a roadmap that details the desired steps to move forward in this path. The factors that push Iraq to shift towards a sustainable energy system are:

- The need to secure a reliable and affordable supply of electrical energy.
- Potential cost savings and opportunities for long-term economic development.
- Other external imperatives, such as structural changes from global decarbonization efforts that are expected to reduce demand for fossil fuels, could become more important drivers for change. However, despite the decline in renewable technology costs last decade and the increasing use of renewable resources in the Middle East and North Africa, Iraq seems to be about renewable energies is currently hard. Rebuilding the energy system after war and subsequent violent conflicts is supposed to provide an opportunity for a transitional process that will benefit Iraq in the short term and at the same time provide a sustainable long-term perspective.

Therefore, it requires that Iraq raise its level of ambition if it is to seize this opportunity. The first step is to improve the framework conditions for renewable energy and raise awareness of its benefits. The government must also invest in developing a comprehensive strategy for the energy sector and a sound institutional framework to support and develop local value chains.

The electricity sector should also be dismantled to enhance efficiency and allow for increased competition and transparency. At the same time, the population must be educated about the benefits of renewable energies through the development of capacities and expertise to the workforce to ensure the success of strategies at the wider level. By investing in rebuilding fossil-based energy supply structures, it is better for Iraq to establish a more sustainable energy system that will benefit the country in the short and long term. It stimulates and supports the debate about the future energy system in Iraq by providing a comprehensive guiding vision for the process of transitioning into the energy system and developing appropriate policy strategies. (Al-Bayan Center for Planning 2021).

Conclusions

1. There is a direct relationship between the increase in GDP in Iraq during the period 2007-2018 and the increase in carbon dioxide emissions, as an increase in this output by 1% leads to an increase in these emissions by 1.22%, i.e. a greater percentage than the increase in output, which constitutes a clear danger to The environment, especially that the growth of the gross domestic product in Iraq depends largely on the production of crude oil, which in turn is not subject to environmental controls that regulate the process of pollution and the emission of gases that accompany the extraction process.
2. The tests of the second degree, which are both the test of self-correlation and the difference in variance between the residuals, showed that the model was free of these problems.
3. The development of environmental policies is very important in order to reduce the regulatory burden on the economy and achieve the benefits of growth in terms of general improvement of economic efficiency, and in terms of securing long-term growth, if it helps in increasing prosperity and well-being through increasing income and improving health as well as education and quality of life.
4. Investing in environmental research and development, public spending and technology programmes, such as infrastructure development for floods, support for low-carbon technologies such as the electric car, and provision of information and other policies to address barriers to behavior change, such as policies to adopt resource efficiency measures that contribute to savings environmental and financial.
5. Orientation to policies aimed at pricing environmental resources correctly, raising costs in the short term, in exchange for innovation and increased efficiency in the use of resources that can stimulate environmental policy, by providing greater certainty about the future policy environment.
6. Smart and cost-effective policy design can be used to further reduce any policy in the short term through the trade-off between environmental policy and economic growth. This includes considering the best combination of tools to achieve environmental goals, from pricing externalities to investing in technology and infrastructure.

Recommendations

1. Activating legislation and laws to encourage investment in the green economy.
2. Increasing the level of awareness in knowing the environmental impact (environmental footprint) and its relationship to the disruption of ecological balance systems.
3. Providing incentives to encourage green activities.
4. Advocating rationality in consumption by encouraging lifestyles with a low environmental footprint for the purposes of sustainability.
5. The process of analyzing the environmental footprint provides policy makers and decision makers with the necessary tools to measure the efficiency of consumption of natural resources and services.

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Form Data

Year	Gross Domestic Product at Current Prices (Million Dollars)	CO ₂ emissions (thousand tons)
1990	5592	47693.002
1991	2131	45643.149
1992	27054	59112.04
1993	18988	63362.093
1994	15367	71334.151
1995	13454	74348.425
1996	21848	69500.651
1997	22345	68308.876
1998	28725	72371.912
1999	34254	72283.904
2000	40941	72445.252
2001	51161	85342.091
2002	50646	87259.932
2003	17415	91117.616
2004	36628	114084.037
2005	49955	113522.986
2006	65140	98770.645
2007	88840	62155.65
2008	131614	93149.134
2009	111661	104546.17
2010	138517	112195.532
2011	185750	134384.549
2012	217969	152723.216
2013	232500	165506.378
2014	223500	168443.645
2015	153741	171952.418
2016	159921	174389.619
2017	179650	179149.372
2018	199879	179987.334
2019	199920	189900.22