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The impact of qualified industrial zones investments on the environmental deterioration in Jordan

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ABSTRACT

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In literature, several core studies have addressed the effects of industries in general, and the investments in Qualified Industrial Zones (QIZ) on the environment, adding up to the pollution risks resulting from these investments. What distinguish this study is that it dealt with investments in the QIZ in Jordan and its risks on the environment beside some other sectors that participate in polluting the environment such as the production sector represented by the GDP, the population sector, and the number of vehicles used during the study period that covered 1999 to 2017. This study used the ordinary least squares (OLS) method to examine the impact of investments in QIZ on the quality of the environment and its imbalances. It's found that there is a clear negative effect of investments in the QIZ on the environment quality in Jordan in addition to the negative impact that is not less risky on the environment created by the other sectors.

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1. Introduction

It is noticeable that the grow of economic development, particularly to invest in urbanized areas, is a main reason to cause vicious contamination problems in the appearance of discharges for remarkable kinds of gases such as Carbon dioxide emanation curtailing by the blazing of fossil oil which contains carbon dioxide produced throughout the use of types of gas energy and its burning. Several international academic and empirical studies have focused on the impact of foreign investments on environmental deterioration. This paper implemented an analytic statistical approach, by use (OLS) technique, in turn to examine the QIZ investments and the consequence on the environment superiority by investigating Jordan's investments to make sure when there are high levels of QIZ production intensification, guided by massive investment are generating environmental disparities. We may find the impact of every independent construct as represented by QIZ investments, real Gross Domestic Product, population size, and other related variables on the dependent construct, labeled as Carbon dioxide emanations (CO₂), are mainly positive. If it is the result, it should be not strange since it goes with various literature conclusions mainly those related to developing nations. The paper assumes to conclude the problem by coming back with the following main question, Do the high investments in QIZ areas in the country contributed to a drop in environmental prominence, seen as CO₂ productions resulting in Carbon dioxide emission?

This paper is organized as follows. The next section provides a theoretical framework. This is followed by a survey of previous literature on the factors related to the current study. Fourth Section discusses the methodology and data used for this study. Followed by the results, the analysis and discussion of the findings while the last section concludes.

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2. Theoretical framework

2.1 Qualified Industrial Zones

Qualified industrial zones in the Hashemite Kingdom of Jordan offer special importance for investment. Investors in these cities are given incentives and advantages and the advantage of exporting their products to the United States is fully tax free and without a quota limit. Exports of goods produced in these cities are also exempted by 100% of the income tax and social services. In addition, imports of factories and established projects in eligible cities and raw materials, machinery and spare parts are exempt from all tariffs (Jordan Chamber Industry, 2018).

2.2 Qualified Jordanian industrial zones

In Jordan there are currently (10) Qualified Industrial Zones that are distributed in different regions to serve investors and meet their requirements. The public sector manages three of these cities while the private sector manages and owns seven cities:

First: Public Qualified Industrial Cities

There are currently qualified industrial cities in Jordan that are distributed to various regions to serve investors and meet their needs. These cities are managed by the public sector and the private sector as follows (Jordan Chamber Industry, 2018):

- Al Hassan Industrial Estate: It is the first qualified industrial city, which was declared in March 1998. It is located near the city of Irbid, 80 km north of the capital Amman, with a total area of 1.2 million square meters.
- Al-Hussein Ibn Abdullah II Industrial Estate (In Karak): It is the second qualified industrial city; it is located 110 km south of Amman and linked to the port of Aqaba on the Red Sea highway, with a total area of 580000 m².
- Aqaba Industrial Estate is still under implementation.

Second: Private Qualified Industrial Cities

- Ad-Dulayl Industrial Park: It is only 45 km northeast of Amman, with a total area of 345,000 m².
- Al-Tajamouat Industrial Estate: 20 km from Amman city center and 20 km from Queen Alia International Airport, with a total area of 300000 m².
- Gateway QIZ: This project is located in the north of the Kingdom 80 km south of Sheikh Hussein Bridge, 70 km from the capital Amman and 40 km from the city of Irbid. The total area is 50000 m².
- Jordan Cyber City: The project has the status of the Qualified Industrial Zones and Special Free Zones for Export, specialized in the IT industry and light industries. The complex is located in Irbid Governorate in the north of the Kingdom with a total area of 4 km².
- The Hashemite University: The Industrial city of Hashemite University is located near the city of Zarqa with an area of 150,000,000m², which is not yet operational.
- Al-Qastal industrial zone: It is owned by the private sector, located 3 km from Queen Alia International Airport and 22 km south of Amman, with a total area of 4000 km².
- Al Mashatta Qualified Industrial Zone Complex: It is located in Quneitra east of Queen Alia International Airport, covering an area of 4000 km². It is not yet operational.
- El-Zai Ready-Wear Manufacturing Company: It is located in Rusaifa, north of Amman.
- Qualified Industrial Zone: It is located in Al-Daylil, which is still under construction.
- Resources Company: Located in Muwaqqar and is still under implementation.

2.3 The GDP and Economic Sectors

The performance of the Jordanian economy during the year 2017 has stabilized, despite the continuing uncertainty resulting from the continued political turmoil in some neighboring countries. Real GDP grew 2%, the same as in 2016. The economic growth was driven by the growth of most economic sectors, especially "financial and insurance services", "transport, storage and communications", "extractive industries" and "manufacturing industries". These sectors contributed 1.2 percentage points (or 60%) of growth rate achieved during 2017. In light of the population growth rate of 2.6%, the real per capita GDP declined by 0.6% to reach JD1,181million (CBJ, annual report 2017).

GDP grew at constant market prices by 2.0% to reach 11872.3 million, maintaining the same growth rate recorded in 2016. However, by excluding net taxes on products, GDP at fixed base prices grew by 2.1% against 2.2% growth in 2016. Meanwhile, excluding net taxes on products, GDP at fixed base prices grew by 2.1% against 2.2% growth in 2016. The growth in gross domestic product (GDP) at fixed base prices was due to the disparity of the performance of the various economic sectors. While the sectors of extractive industries, agriculture, wholesale and retail, restaurants and hotels grew at

an accelerated pace, other sectors witnessed a slowdown in their performance, notably transportation, communications, financial services, insurance, manufacturing, electricity, and water, while, the construction sector declined in performance (CBJ, annual report 2017).

Most of the major economic sectors contributing to the formation of GDP at constant market prices during 2017 witnessed positive growth rates ranging from 13.0% for the extractive industries sector and 0.1% for the domestic services sector. While the construction sector fell by 1.1%. Net taxes on products grew by 1.2% (CBJ, annual report 2017).

The commodity production sectors improved their performance in 2017 to grow by 1.8% against a 1.3% growth in 2016 while service production slowed down by 2.3% compared to 2.6% growth in 2016. However, the commodity and service sectors maintained almost their relative importance in the gross domestic product at constant fixed prices recorded in 2016 and by 33.4% for the service production sectors (CBJ, annual report 2017).

Thus, the service production sectors still account for the largest share of GDP growth at fixed base prices, contributing by 1.5 percentage points from the 2.1% growth rate while the commodity production sectors contributed by 0.6 percentage points (CBJ, annual report 2017).

2.4 Population

The results of the recent census showed that the population growth rate in Jordan increased to 5.3% during the period 2012-2020. The population according to the results of the latest census was 10,203,712 people. The Jordanian population was about 6.6 million, or about 69% of the total population of the Kingdom, compared to 31% of non-Jordanians, about half of whom were Syrians 1.3 million (Department of Statistics, Annual Report, 2017). The estimated population of 2016 was 9,554,000 people. The main reason for the high rate of population growth is forced migration entering the Kingdom as a result of the political situation in the region that has led to the influx of hundreds of thousands of Syrian refugees since the beginning of 2011 (Department of Statistics, Annual Report, 2017). According to the Population Projections for the Kingdom's Residents during the Period 2015-2050, Jordan was ranked 92th among countries in terms of population. The population is expected to reach about 12 million by 2030 and reach 13.4 million in 2050, (Department of Statistics, 2016). It is obvious that the presence of population density in urban areas is a major cause of economic development and sustainability. Increased industrial activity and higher incomes are encouraging migration to large cities. Increasing population density and skilled labor in large cities are known to generate basic services and requirements, especially education and healthcare, and higher living standards. The high population density in cities and their consumer patterns also create various environmental problems such as accumulation of waste and the emission of smoke from vehicles and other pollution problems (Basem Hamouri, 2014). Clearly, as in Fig. 1, the population of Jordan has increased from 8.089,000 in 2012 to 10.203.000 in 2020.

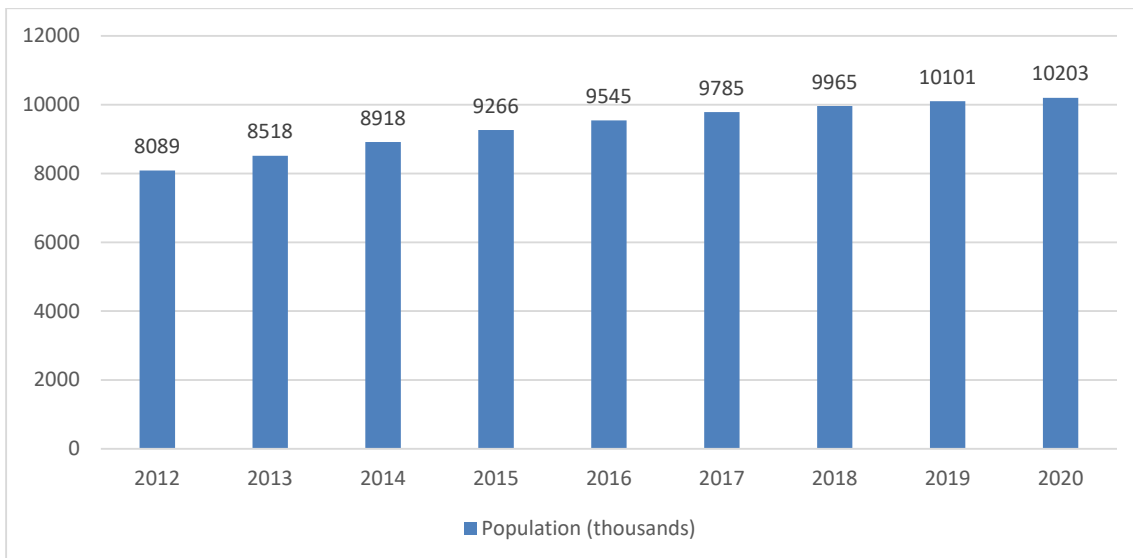


Fig. 1. Population Density 2012-2020

Source: Department of Statistics, Annual Report, 2017.

2.5 Vehicles and pollution

In the nation's biggest cities, air pollution is a serious issue. Demand for consumer goods has grown during the past 20 years, which has in turn fueled significant expansion in the industrial and service sectors. For instance, the automotive industry has had remarkable growth during the last ten years (see Fig. 2). These boosted emissions of several gases, particularly carbon dioxide (CO₂) and particulates, which have negative environmental effects (Basem Hamouri, 2014).

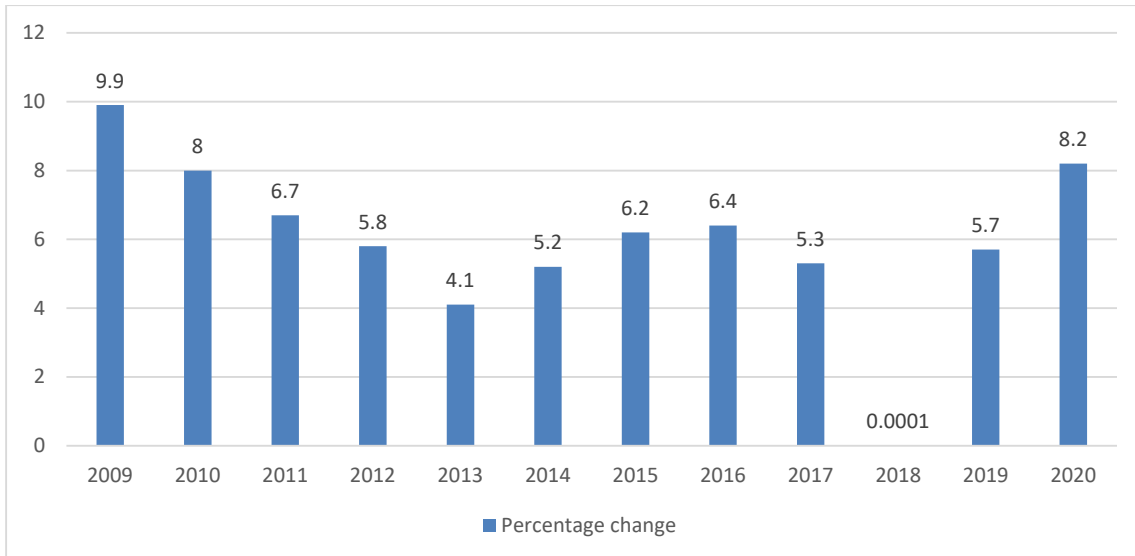


Fig. 2. Number of Vehicles and Its Percentage Change 2009-2020 (Thousands)

Source: Department of Statistics, Annual Report, 2017.

3. Literature Review

This part briefly reviews the literature as regards to the factors which may develop the hypotheses tested in the study. All of these factors will be taken in detail. Moreover, the studies related directly to the study will be reviewed, such as the study of Acar and Tekce (2014) and Commoner (1972), also a research carried out by Lave and Seskin (2013) and Grossman and Krueger (1992), be the founders to clear the correlation among the environment deterioration and investment progression in industrial sector by adopting the time series analysis modeling as acknowledged by “Environment Kuznets Curve (EKC)”. In this context, the objective of Acar and Tekce (2014) was to analyze the determinants of industrial pollution in many selected Mediterranean countries. The study utilizes data from the World Development Indicators for 40 years. And as the CO₂ is the main pollutant in the industrial sector, CO₂ emissions from manufacturing and construction were taken as a proxy of industrial pollution. The results of the study show that there is an inverse U-shape relationship between GDP per capita and industrial pollution in the sample countries, which confirms the validity of the Kuznets curve assumptions. In addition, the development of the industrial sector, energy consumption, population density and urbanization are all important factors in industrial emissions in the selected countries. Zeng (2015) summarizes the development experiences of China's special economic zones, as well as the main results of China's investment in special economic zones in African countries. The study provides some recommendations on how to invest in the Special Economic Zones and Industrial Zones in African countries and countries around the world by making great use of the experiences of China. The study mentioned the success factors of China's special economic zones, which were the most important of which was the government's strong and long-term commitment to developing these areas, creating an appropriate working environment, strategic locations to be built, and the use of advanced technology and training. In addition to the above, there must be strong coordination between the outputs of these investments and the local economy. However, China's investment in the private industrial zones has raised some problems that must be avoided and minimized. The most important of these problems are the deterioration of the environment and the consequent high economic and social costs.

The World Bank Group paper in 2008 followed the comprehensive descriptive approach. The study relied on 30 years of experience in QIZs and reviewed the economic and environmental impacts of these zones around the world. Experience shows that these development areas have been effective and positive in addressing economic growth and development goals in some countries. They have not been successful in East Asia, Latin America, and Africa. In addition, since the beginning of the development of regions in some developing countries, concerns have been raised about the impact of qualifying areas on employment (gender, wage levels, benefits, workers' rights and working conditions), the environment and the resulting environmental pollution. The paper recommends that maximizing the benefits of QIZs depends on the degree of coordination and integration with their host economies, trade and investment reform and reduction of negative impacts, particularly environmental pollution. In 1977, Barry Commoner examined the environmental costs of economic growth, which linked economic growth with environmental pollution. He reviewed the USA position on the environmental situation since 1946 and attributed the environmental degradation to an increase in the amount of smoke emissions and the production of toxic substances harmful to humans such as nitrogen oxide that comes out of vehicles. Commoner reported that water and soil pollution was caused by the use of unnatural fertilizers in agricultural land, with pollution increasing to 648% during the period 1949-1968. The Commoner study concluded that the poor environmental situation in the United States of America is due to several reasons, including population density and high rates of production and consumption of goods, as well as a change in the patterns of technology used in production.

A study conducted in 1995 by Grossman and Krueger was a pioneering study on the correlation between environmental risks and economic growth using time series models (Environment Kuznets Curve (EKC).) On this subject, Kolstad and Krautkraemer concluded in 1993 that there was a strong correlation between environmental pollution and economic growth. This study confirms that the use of energy sources always achieves economic return, and lead to an immediate negative impact on the environment. In the same context, Lise and Van Montfort (2007) analyzed the correlation between energy and GDP in Turkey for the period 1970-2003. The study shows that energy consumption and GDP are complementary and have a bi-directional causal relationship. In the same subject, Soytaş and Sari (2009) analyzed the long-run Granger causality correlation between GDP, CO₂ emissions and energy consumption in Turkey. The results of the study are like those of previous studies, namely that energy consumption is the main cause of carbon emissions in different areas.

A study conducted in 1998 by Galli addresses energy and pollution. Found that there were several reasons that led to the reduction of increased use of fuel and energy. These factors have led to increased efficiency and reduction of pollution resulting from energy use, as well as the use of less polluting and more efficient fuels and the adjustment of the overall demand structure for these types of energy. In his study, Kadnar (1998) emphasized the correlation between energy consumption on the one hand and population and GDP growth on the other to predict demand for future energy in the short term. These studies point to the need to use more efficient energy types to reduce environmental risks. Many studies show that environmental pollution is caused by emissions due to energy consumption in all sectors, especially in the production sector, and it seems that the good management of energy consumption and the use of renewable energy and modern technology is the best way to get rid of this problem. In any case, energy must be used to enhance economic growth and prosperity. To accomplish the goals of the research, many hypotheses should be accomplished:

H₁: *There is a direct substantial valid influence of QIZ investments on the environment deterioration.*

H₂: *There is a direct substantial valid influence of the population on the environment deterioration.*

H₃: *There is a direct substantial valid influence of the number of automobiles on the environment deterioration.*

H₄: *There is a direct substantial valid influence of real GDP growth on the environment deterioration.*

4. Methodology

Analytical technique is applied in the research. The paper begins with the proper literature and covers a time period approximately as of 2015 to 2022, which enclosed accessible data that should be collected for the dependent construct (CO₂) and the independent variables as pointed in the literature, specifically QIZ investments, number of automobiles, population density, and the GDP. Every one of these variables is assumed to impact the proposed dependent variable. So, the complete data is collected from the official institutions reports issued in Jordan and from other international foundations. Finally, the required data is analyzed statistically using the (OLS) technique.

5. Study model

$$CO2_{it} = \beta_0 + \beta_1 QIZ_{it} + \beta_2 Pop_{it} + \beta_3 Veh_{it} + \beta_4 GDP_{it} + u$$

CO₂: Environment Deterioration

QIZ: QIZ investments

Pop: Population

Veh: Number of Vehicles

GDP: GDP growth

u : Error limit

6. Statistical analysis

6.1 Time series static test

Many criterion studies as Stock and Watson (1988) have emphasized that time series associated with financial variables are characterized by instability, which is resulting in the problem of Spurious Regression. Therefore, it was necessary to verify the study variables' stability using the Augmented Dickey-Fuller (ADF) for the Unit Root Test to ensure the strength of stability of the time series or whether it does not contain the unit root. The null hypothesis was arguing that the series which includes the unit root of the variable is unstable, where this hypothesis is arbitrated, i.e., acceptance or rejection, by estimating the probability value of ADF. Hence, If the probability value of ADF is less than (0.01), this means that the statistics value of the ADF is more significant than its tabular value. Accordingly, the imposition of the basis will be rejected, as it refers to the presence of the unit root and the judgment of the stability of the time series of the variable under study.

6.2 Time series stability tests for the study variables

The QIZ investments, Gross Domestic Product, population size, and vehicles used in the study were all found to be stable when the ADF and PP tests were run, as seen by the results provided in Table 1. After taking the initial difference, all variables stabilized at a significant level of 1%. The absolute metrics of the statistic were higher than the essential metrics for all levels of statistical significance and suggestive of the presence of unit roots.

Table 1

Time series static test

Variables	Prob.Diff. 1(P) in ADF	Prob. Diff. 1 (P) in PP
QIZ	0.0000 (0.0000)	0.0000 (0.0000)
Pop	0.0000 (0.0005)	0.0000 (0.0005)
Veh	0.0002 (0.0000)	0.0000 (0.0040)
GDP	0.0000 (0.0167)	0.0000 (0.0290)

6.3 Estimating the study model

The fixed effects model, the random effects model, and the Hausmann test were evaluated. The Generalized least squares was conducted, which considers the heterogeneity and autocorrelation of the error limit (Green, 2008). Table 2, Table 3 and Table 2 show the results.

Table 2

Fixed effect model results

Dependent Variable:	CO2		
Sample:	2009-2020		
Cross-sections included:	40		
Total panel (balanced) observations:	640		
Variables	Coefficient(P-value)	S.E.	t-value
Constant	-0.308166 (0.2740)	0.281425	-1.095019
QIZ	-6.23E-06(0.3375)	7.58E-06	-0.822258
Pop	-0.700156 (0.0000)	0.080361	-8.712634
Veh	-6.30E-09 (0.0021)	3.34E-09	-1.885486
GDP	0.885782 (0.0210)	0.391389	2.263175
R ²	0.557135	F-Stat.	20.13352
R ² Adj.	0.430687	P(F-Stat.)	0.000000

Table 3

The results of the random effect model

Dependent Variable:	CO2		
Sample:	2009-2020		
Total panel (balanced) observations:	640		
Variables	Coefficient (P-value)	S.E.	t-value
Constant	-0.223427 (0.2999)	0.215333	-1.037592
QIZ	-8.20E-06(0.4533)	8.82E-06	-0.927170
Pop	-0.511435 (0.0000)	0.068762	-7.437756
Veh	-7.90E-09 (0.0024)	3.02E-09	-2.628334
GDP	0.682469 (0.0060)	0.189953	3.592830
R ²	0.557135	F-Stat.	18.55360
R ² Adj.	0.430687	P(F-Stat.)	0.000000

Based on the results presented on the tables above, the hypothesis is accepted. Which claims that the environmental Deterioration determinants can be estimated using the random effect model.

Table 4

Hausmann test results

Correlated Random Effects - Hausman Test				
Least Squares				
Test cross-section random effects				
Test Summary				
Chi-Square Statistic	13.744304			
Chi-Square d.f.	7			
Chi-Square Probability	0.1344			
Cross-section random effects test comparisons:				
Variables	Fixed	Random	Difference	P-value
QIZ	1.133423	1.156611	0.023188	0.7739
Pop	-0.005311	-0.005303	0.000008	0.0022
Veh	-0.000000	-0.000000	0.000000	0.3528
GDP	-0.822352	-0.822066	0.000286	0.0065
S.D.	-0.000000	-0.000000	0.000000	0.4223
Cross-section fixed (dummy variables)				
R ²	0.557135	Mean (DV)		0.320156
R ² Adj.	0.430687	S.D. (DV)		0.224571
Regression S.E.	0.162806	AIC		-0.726452
SSR	15.43785	BIC		-0.416428
Log likelihood	285.4652	HQC		-0.611625
F-Stat.	20.13352	DWS		-0.954328
P(F-Stat.)	0.000000			

Note: SSR: Sum Squared Residuals, AIC: Akaike info criterion, BIC: Bayesian Information Criterion, HQC: Hannan-Quinn criteria, DWS: Durbin Watson Statistic

When all data were subjected to the statistical analysis, the result of an analysis in Table 4 found an effect of all independent variables on the dependent variable (environmental degradation), where R^2 was equal to 0.596. From the previous statistical analysis, the effect of the independent variables of QIZ investments, population density, number of vehicles and real GDP on the dependent variable was positive. It is not surprising that these results were consistent with the literature findings, which dealt with developing countries. It should be noted here that the experience of investment in qualifying areas is still at an upwardly high level and is rapidly witnessing a high growth rate through the use of technological means of production. It is worth mentioning that all the independent variables in the study had approximately similar significant impact on the dependent variable.

7. Conclusion and Recommendations

In literature, a number of core studies have addressed the effects of industries in general, and the investments in QIZ on the environment, adding up to the pollution risks resulting from these investments. What distinguishes this study is that it dealt with investments in the QIZ in Jordan and its risks on the environment beside some other sectors that participate in polluting the environment such as the production sector represented by the GDP, the population sector, and the number of vehicles used during the studied period. This study adopted an analytical method to study the impact of investments in QIZ on the quality of the environment and its imbalances. It's found that there is a clear negative effect of investments in the QIZ on the environment quality in Jordan in addition to the negative impact that is not less risky on the environment which is created by the other sectors mentioned above.

The results of this study show that investments in the QIZ and other sectors combined contribute risky and serious damage to the environment during the past 20 years.

In this context, it is necessary to take the necessary action to reduce these risks through the use of modern technology in production means, especially in the QIZ investments, in addition to focus on the low-pollution industries of the environment and the establishment of these QIZ investments in areas far from the population concentration. As for the other of the sectors, such as vehicles, the study recommends the gradual shift of the use of hybrid and electric vehicles instead of vehicles that use the fuel produced CO₂, which at the end has a positive impact on the environment. As for the population sector, the reason for the exacerbation of the problem is due to the high rate of population growth compared to developed countries in addition to population migration from neighboring countries such as Syria, Iraq and Palestine. This, of course, requires immediate solutions such as reducing natural growth rates, by awareness and education, as well as participating in solving the problem of population migration from neighboring countries

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