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Estimation of causal relationship between gross fixed capital formation in agricultural sector and economic growth in Iraq during 2000-2019

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ABSTRACT

Gross fixed capital formation is considered as the main element in the process of economic growth, however, despite all the capability enjoyed by the Iraqi economy, especially the agricultural sector, we found that its contribution to the gross domestic product (GDP) is very weak, not exceeding at best 5%. This will create an economic problem in providing the internal needs, which is a cause for increasing imports and thus will affect the balance of payments. It was, therefore, necessary to highlight on the study of the causal relationship between the gross fixed capital formation in the Iraqi agricultural sector and the gross domestic product as an indicator of economic growth. Hence the importance of this study is for the period of 2000-2019, as a critical period in the Iraqi economy, since it witnessed many political and economic variables. This study focused on following the analytical and standard methods in finding the relationship between the gross fixed capital formation in the agricultural sector (as an independent variable) and the gross domestic product at fixed prices (as a dependent variable). The results of the statistical analyses indicated that there is no correlation between the growth rates of the gross domestic product and the growth rate of the gross fixed capital formation in the agricultural sector. One of the results of the statistical analysis shows the coefficient of determination (R^2), which reflects the interpretative capacity of the model, exhibiting that 33% of the alterations in the gross domestic product are due to the gross fixed capital formation and it is a weak proportion.

Keywords: Gross fixed capital formation, Economic growth, Gross domestic product.
Article type: Research Article.

INTRODUCTION

Gross domestic product (GDP) is one of the most important macroeconomic indicators that reflect the country's total activity and economic performance during a specific period of time, in addition to the elevated growth rates of this output, which in turn is reflected in the general economic situation of the state in terms of raising the standard of living, the level of employment, increasing exports, capital accumulation, and the flow of investments and others. The changes in the volume of investment also affect many macroeconomic variables, including gross domestic product. The gross fixed capital formation is one of the components of investment, which is divided into three groups for the purposes of national accounting, namely fixed capital formation, change in inventory and real estate investment. The fixed capital formation consists of spending on the acquisition of new capital goods, as well as additions, renovations, improvements to existing capital goods, and the value of construction work in progress. The GDP is affected by the volume of investments, the increased investments and elevating their effectiveness on the upraised GDP. At the same time, the GDP affects the volume of investments (Saumya & Deepika 2021; Elshater *et al.* 2022).

MATERIALS AND METHODS

Research importance

The importance of the study lies in estimating the form and direction of the relationship between the gross fixed agricultural capital formation and the gross domestic product to help the economic decision-maker in the timing

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of the decision and deduce standard models used to influence the size of each of them. This is done by using the time-series analysis method based on auto linear regression vector models.

Research hypothesis
The existence of a significant reciprocal causal relationship between the gross fixed agricultural capital formation as an independent variable and the gross domestic product as a dependent variable, since it reflects a long-term balance relationship.

Research problem
In light of the exacerbation of the Iraqi food security problem and the increased size of the food gap, despite the availability of material and human capabilities and economic resources, however, there is a continuous decline in the contribution of the agricultural sector to the gross domestic product and to the fixed capital formation in its gross and net form, in addition to the deterioration of the reality of the relative importance of some macro indicators in the agricultural sector, such as gross fixed capital formation and gross domestic product.

Research objective
Determining trend, testing, and estimating the relationship between GDP and gross fixed capital formation in the Iraqi agricultural sector.

Research limits
Time limits: The study was determined in terms of time, in the period from 2000 to 2019.

Spatial limits: This study in Iraq is limited to estimating the causal relationship between the gross fixed capital formation in the agricultural sector and the Iraqi economic growth expressed in the gross domestic product.

Research methodology
The research relied on the descriptive approach in the theoretical aspect as well as the analytical approach in the applied aspect, using the statistical method in simple linear regression analysis.

Research structure
The study included the concept and types of investment, economic growth, gross domestic product, the relationship between GDP and investment, and the reality of the Iraqi agricultural sector, as well as the standard analysis of the relationship between the gross fixed capital formation in the Iraqi agricultural sector and the gross domestic product.

1- The investment
The concept of investment: Multiple definitions of investment have emerged due to the multiplicity of angles through which the investment process can be viewed. Thus, some see "that investment means sacrificing a current benefit that can be achieved from the satisfaction of a current consumer in order to obtain a future benefit that can be derived from greater future consumption". Others define investment as "giving up the use of current funds for a certain period of time in order to obtain more cash flows in the future as compensation for the present value of the invested money" (Han & Yi 2022). The investment of any money may take many forms and in general, it is possible to distinguish between several types of investment as follows:

Real and financial investments
Real investment means investment in real assets, such as investment in buildings, projects, machinery, and land. This type of investment is the basis for increasing the national income. Furthermore, it is considered the basis for feasibility studies and project evaluation. While financial investment is the type that relates to investing in securities such as stocks, bonds, and deposit certificates.

Long-term and short-term investments
A distinction can be made between two types of investments, which are short-term and long-term investments. Short-term investment is represented by investing in securities that take the form of treasury bills, bank acceptances, or deposit certificates. The long-term investment is a capital one (since its components are included in the formation of capital). This means that the financial investment may become a real one. Therefore, there are

no boundaries between real and financial investments, since the relationship between them is complementary rather than competitive.

Independent and catalytic investments

Independent investment is considered as the basis for the elevated income and national output, coming from outside the current income cycle, whether by the government business sector or in the form of foreign investment. Catalytic investment is the type that comes as a result of an upraised income, meaning that this type of investment depends on income (there is a positive relationship between them). So, the elevated income is a prerequisite for savings and part of it should go to saving, thus the upraised investment is based on the income equation (Liu *et al.* 2021).

Physical and human investments

The physical investment represents "the traditional form of investment, which is a real one". In the case of human investment, it is not less important than physical one. If we proceed from a basic idea, believing that the human being is the goal and means of development, this is represented by investment in education, health, culture, and also the fields of training and rehabilitation (A'muhammad & Muhammad 2015).

Investing in research and development

This investment is important in developed countries at the level of importance of real one, exhibiting in large industrial companies in the fields of research and development (Khaled 2014).

Investment determinants

The size of investment depends on two main factors, i.e., the interest rate and the rate of return on investment (capital marginal sufficiency) in addition to some other factors. Thus, the interest rate is one of the most important determinants of the investment decision, whether the investor has the necessary capital or will resort to borrowing. The volume of investment has an inverse relationship with the interest rate, since the interest rate expresses the cost of obtaining funds for investment purposes (Adjman 2015). Whereas, the marginal sufficiency of capital (the rate of return on investment) varies from one period to another and from one sector to another within the same economy, depending on the ability of the producer to increase revenues and control costs. In addition, there are other determinants of investment including the level of scientific and technological progress, the degree of risk, the degree of economic and political stability, the investment environment, investors' expectations, and the level of optimism for the future.

2- Economic growth

The concept of economic growth means the elevation in the flow of economic productivity in a particular country through the upraised production of goods and services in a specific period of time, excluding the effects of economic inflation (Stiker 2019). Furthermore, economic growth aims at (Helena & Pierre 2022):

- to increase investment in capital.
- develop production.
- optimum use of available economic resources by enhancing production processes.
- work to achieve the optimal use of available economic resources by enhancing production processes.
- creating ideas to increase growth and income level.
-

Role of agriculture and investment in economic growth

The importance of the impact of general economic growth on agriculture was one of the main reasons behind the ability of agriculture to benefit from general economic growth. This is a result of the availability of modern technology and inputs and it is available from the industrial sector, which may raise agricultural productivity. Moreover, it states that broader technological change is a critical factor in the further development of the agricultural sector, due to the small potential for increased production when using traditional inputs. The agricultural sector can stop the rise in the price level by increasing agricultural production and improving the level of income (Abdel-Ghani 2021). Experience has shown that there are multiplier effects for agriculture, since the size of this effect depends on the structure of the economy, where weak economies suffer from low growth rates while the opposite is found for strong economies (Ekanem & Josephine 2021).

The relationship between agricultural development and overall economic growth is not only characterized by the causal relationship of increasing agricultural productivity and its impact on economic growth, but also this relationship is determined by the interdependence and complementarity between other sectors of the economy and agriculture (Thweeny 2016). Economic growth is mostly expressed in the change in the gross domestic product. Economists have differed in analyzing the relationship between investment and economic growth, as some believe that economic growth leads to the flow of more investment and that higher economic growth helps the flow of most of it to the state. Thus, the economic growth rate was considered as an external variable. Furthermore, there is another point of view that believe the economic growth rate as an internal variable, as the flow of more investment may encourage the achievement of a high growth rate (Ibrahim 2016).

3- Gross domestic product

Gross domestic product "is the market value of all locally recognized final goods and services produced in a country during a specified period of time". GDP per capita is often considered as an indicator of the standard of living in a country, and is not a measure of per capita income. On the other hand, GDP is related to national accounts and should not be confused with the gross national product (GNP), which allocates production by ownership (Abdul Hadi 2014).

4- The relationship between domestic product and investment

The monopoly and control over the assets of the national wealth, and draining the state's resources receiving investments by transferring its profits abroad, are considered as the negative effects. Also, direct investments may affect the competitiveness of local industries, which may cause a recession or collapse in emerging or small-sized national industries. Moreover, direct investment leads to an elevation in the influence of multinational companies on the map of the economies of the host country, accompanied by the penetration of many vital sectors. Many direct investment literature in developing countries indicate that this type of investment weakens national control over the economy (Ibrahim 2016).

RESULTS AND DISCUSSION

The agricultural sector in Iraq

Characterization of the gross fixed capital formation

The gross fixed capital formation in the agricultural sector has been taken into consideration at fixed prices for the base year 2007. It shows that the value at constant prices and in general fluctuates between rising and falling in the period of 2000-2019, as it was 97318 Iraqi million dinars (IQMD) in 2000, to reach 214248.2 IQMD in 2015. Then it decreased to 11603.9 IQMD in 2009, which is the lowest decline within the study period, affecting the rate (%) of its contribution to the gross domestic product in Iraq (Table 1; Fig. 1). This was reflected in the relative importance of the gross fixed capital formation in the agricultural sector in relation to the gross fixed capital formation for all sectors of the Iraqi economy, as it reached 0% in 2007, 2008, and 2009, respectively, and also in 2015.

Characterization of fixed capital formation in Iraq

It expresses the gross fixed capital formation by investment, as it reflects the policy of the state to encourage or limit investment. Thus, two methods are adopted in estimating the gross fixed capital formation, which are the production method (flow of goods) and the expenditure method. However, the National Accounts Directorate in Iraq uses the second method in the accounts (expenditure method), on the basis that the state contributes to most aspects of economic activity, which helps in obtaining the most accurate and detailed data and information. The expenditure method is represented by the actual expenditure by the final spenders on the acquisition of the capital goods, and this includes the trade margins and customs duties. Data sources have been relied on estimation according to the method of expenditure, including the general commercial and investment budget law, and the final accounts of public and private sector companies, in addition to the results of construction and industrial statistics for the private sector, investment projects, regional development programs, and others. The gross fixed capital formation in Iraq witnessed many developments during the study period, as it witnessed fluctuation between rising and decline. This is a result of the alterations in the financial policy that the Iraqi economy has been exposed to, as it rose from 1465252.6 IQMD in 2000 to 23239198.3 IQMD in 2008, however, dropped in 2009. It initiated to rise in 2010 (26252776.7 IQMD) until reached its maximum in 2015 (50650572.7 IQMD).

However, it declined again to reach 31676654.4 IQMD in 2019 (Table 1; Fig. 3). This drop may be due to the fluctuation in oil prices, which Iraq relies on for preparing the budget mainly, that negatively affected revenues and then on investment allocations in general, as well as bias in favor of other economic sectors.

Characterization of the Iraqi agricultural gross domestic product

The gross domestic product in the agricultural sector at fixed prices for the base year 2007 witnessed an increase for the period from 2000 to 2002, attaining 5635053.8 IQMD in 2000 and 6665386.3 IQMD in 2002, while then dropped in 2003, which may be due to the American invasion to Iraq. It rose again to reach 7597524.8 IQMD in 2006, however, began to decline in 2007, reaching 4730388.9 IQMD in 2008. It may be due to the events that Iraq witnessed from the creation and control of terrorist organizations, the weakness of financial allocations, and weak government support for the agricultural sector. On the other hand, we noticed the weak relative importance of the agricultural sector output in contributing to the gross domestic product, as it did not exceed 7% in the best conditions. The average year for the study period did not exceed 5%, exhibiting the weakness of the agricultural sector. According to Fig. 2, the agricultural sector in Iraq during the study period was exposed to fluctuation in its production activity between rising and decreasing as a result of political changes and investment allocations, in addition to the weak government support, the climatic conditions that Iraq was exposed to, and the economic crises, in particular the financial.

Characterization of the gross domestic product in Iraq

Gross domestic product (GDP) is one of the indicators reflecting the level of economic performance in the country, while the analysis of the growth of the output is one of the main points for knowing and addressing the defect and treating it. Iraq's GDP at fixed prices in 2000 was 11,2208,511.5 IQMD and continued to rise to 2019 to 211,789,774.7 IQMD (Table 1), which may be due to the rise in the price of the oil barrel, the elevated quantities of exporting oil, and the exploration of new oilfields that helped to raise GDP. According to Fig. 1, overall GDP is on the rise, especially after 2004, due to the higher oil prices, as well as the upraised quantities of production and export.

Challenges facing investment in Iraq's agricultural sector

Although areas of private investment in the agricultural sector have often been mostly confined to livestock projects (poultry and fish husbandry), i.e., in areas that achieve a quick return, where the capital cycle in these activities is faster than in the agricultural and vegetable sector. After the legislation of Law (No. 35) of 1983, production activities in the field of vegetation have emerged in relatively large areas, along with the abandonment of agricultural production projects by the State, and the State's farms in 1987. Privatization took place and private ownership of agricultural holdings increased to about 64%, however, the role of the private sector in agriculture has been limited and influenced by the Government's policies to support the production requirements without a serious attempt to develop the agricultural sector, in addition to the elevated efficiency of performance and productivity of animal farms, stations, and poultry fields. However, the checks and conditions of the economic blockade on Iraq and the change in 2003 did not give the opportunity for these projects to develop normally. Therefore, each sector has its own problems, no matter how pioneering or successful. However, Iraq's agricultural sector has experienced problems that are not caused by the sector itself but have been the base in which most of the realities and consequences of political change have been reflected since the establishment of the Iraqi State. The most important challenges limiting the private sector's role in agricultural activity are as follows:

Manpower

After 2003, manpower with an agricultural background was attracted to other activities, such as the police, the army, and other jobs for financial returns and wages in such activities, which, along with other factors, affected the deterioration of the agricultural sector over the past years.

Capital

Notably, however, the capital needed for real development in the agricultural sector has been in the hands of the State for decades. The private sector has the limited size of capital which affects real agricultural development. One reason for the private sector's reluctance to invest in agricultural development projects is the lack of adequate capital and confidence between it and the government sector. Therefore, the country is currently required to create

and mature a legal environment conducive to contributing to the creation of capital-intensive enterprises in cooperation with the private sector and those already working in the sector (Al-Qaisi 2018).

Table 1. Gross domestic product and total fixed public and agricultural capital formation at constant prices, the base year 2007 (million dinars).

Year	GDP at constant prices (1)	Agricultural GDP (2)	Relative importance of agricultural sector (3) 1:2	Gross fixed capital formation (4)	Gross agricultural fixed capital formation (5)	Relative importance of fixed capital formation in agricultural sector for public capital formation (6) 5:4
2000	112208511.5	5635053.8	5%	1465252.6	97318	7%
2001	114190796.9	5692833.0	5%	2531440.9	186146.5	7%
2002	104822921.0	6665386.3	6%	2199076.7	193455.8	9%
2003	66398213.0	4718909.9	7%	4442671.7	153029.7	3%
2004	101845262.4	5546198.2	5%	2857807.0	18268.3	1%
2005	103973180.4	7286558.3	7%	10182362.2	214248.2	2%
2006	109843735.3	7597524.8	7%	16911154.5	115944.0	1%
2007	111455813.4	5494212.4	5%	75304044.0	17600.0	0%
2008	120626517.1	4730388.9	4%	23239198.3	50219.7	0%
2009	124702848.0	4898773.2	4%	14950241.9	11603.9	0%
2010	132687029.6	5560828.4	4%	26252776.7	392032.9	1%
2011	142700217.0	6465656.3	5%	28234992.6	570488.8	2%
2012	162587533.1	6019561.4	4%	38139871.0	1307364	3%
2013	174990175.0	7459173.9	4%	55036676.1	728751.1	1%
2014	175335400.0	7309016.0	4%	55837402.9	421693	1%
2015	182051373.0	3707519.2	2%	50650572.7	213445	0%
2016	193744445.6	5916172.8	3%	28703209.2	328507.8	1%
2017	201528216.0	5916172.8	3%	32330275.7	732790.2	2%
2018	202776669.0	6033548.3	3%	31944571.6	641312.5	2%
2019	211789774.7	6048361.4	3%	31676654.4	674556.4	2%

Reference: 3rd and 6th Columns are the researcher conclude; it based on the statistical data of the statistical group of the Iraqi Central Statistical Organization for different years (2000-2019).

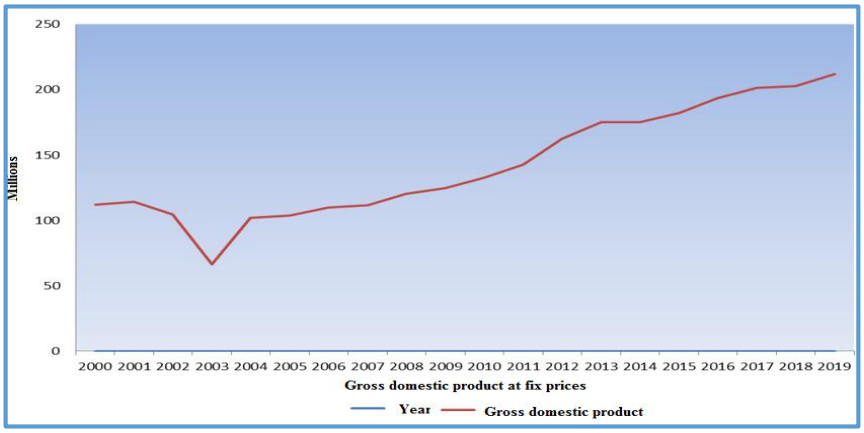

Fig. 1. Evolution of Iraq's GDP at fixed prices for the period (2000-2019);
Reference: The researcher concludes based on the data in Table 1.

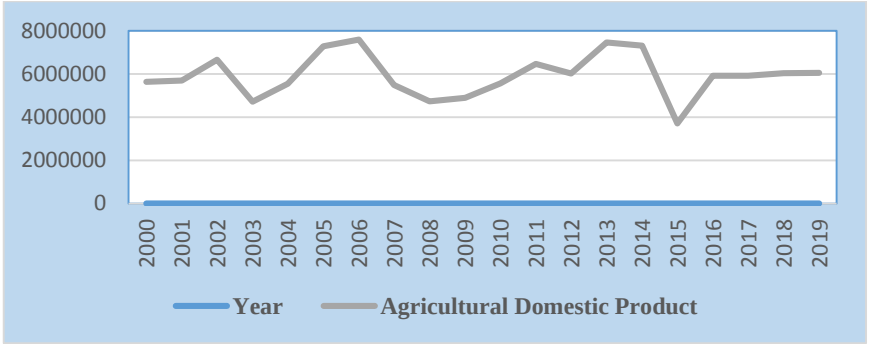

Fig. 2. Agricultural Gross Domestic Product in Iraq;
Reference: The researcher concludes based on the data in Table 1.

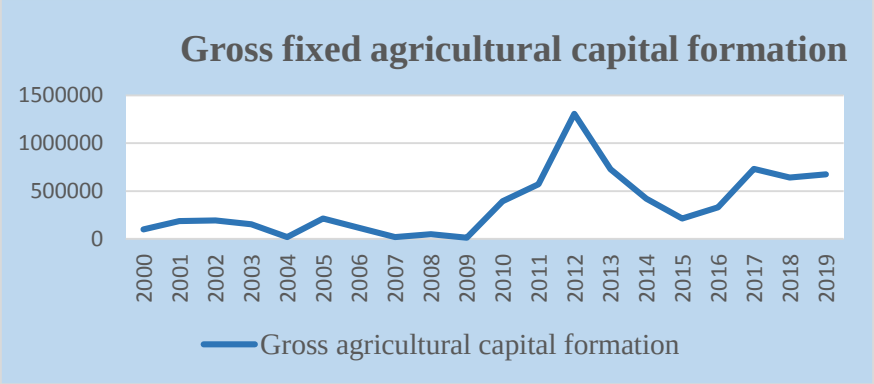

Fig. 3. Total fixed capital formation in the Iraqi agricultural sector;
Reference: The researcher concluded based on the data in Table 1.

Standard analysis of the relationship between the total fixed capital formation in Iraq's agricultural sector and the gross domestic product

The economic theory assumes that there is a correlation between GDP growth rates and fixed capital formation rates in Iraq's agricultural sector since a certain increase in GDP will lead to an elevation in the fixed capital formation in the agricultural sector. Moreover, any rise in the formation of the fixed capital in the Iraqi agricultural sector will lead to the growth of the gross domestic product. There is an interconnected correlation between them and this relationship is governed by the nature of the country's economic policy under consideration. To estimate the parameters of the standard model and analyze them, the SPSS program was used to process the data and follow the simple linear regression method. The growth rate of the total agricultural fixed capital formation was adopted as an independent variable and the growth rate of GDP as a dependent variable. The functions were subjected to many tests in order to ascertain the degree of their significance, the most important tests are as follows:

- R^2 test where the effect ability is shown between the independent variables and the dependent variable.
- T-test: reveals the significance of the parameters used in the model.
- F-test: reveals the significance of the model in general.
- (DW) test: reveals the self-association between random variables.

where:

Gross fixed capital formation in the Iraqi agricultural sector .....(X)

Iraqi gross domestic product…….....(Y)

The linear regression function between the growth rate of GDP and fixed capital formation in the agricultural sector assumes the following:

1. The null hypothesis (H_0): There is no significant effect of the growth rate of the total fixed capital formation in the agricultural sector on the yearly growth rate of the Iraqi GDP.
2. The alternative hypothesis (H_1): There is a significant effect between the growth of total fixed capital formation in the agricultural sector and the annual growth rate of the Iraqi GDP.

Through the statistical program SPSS, a simple linear regression equation was extracted (Table 3), as follows:

$Y= 4.914 – 0.015 X$

Sig. 0.000 = 0.789

The results of the statistical analysis indicate that there is no correlation between Iraq's GDP growth rate and the growth rate of the total fixed capital formation in the Iraqi agricultural sector. The Pearson correlation coefficient reached 5%, while the significance level for the observations of the values of the constant (B) in the linear regression equation was sig. 0.000 at the level of significance of 1%. However, the slope level (b) was not significant, as it reached 0.789, which is greater than 5%, and then we accept the null hypothesis (H_0), and the alternative hypothesis (H_1) was rejected. From the results of the statistical analysis, the coefficient of determination (R^2) indicated that 0.33 of the changes in the gross domestic product are due to the total agricultural fixed capital formation, turning out that it is very weak. The calculated t value was greater than the tabular t value

at the significant level of 5%, indicating the existence of a functional relationship between the dependent variable and the independent variable, while the DW value reached 1.670 confirming that there is no self-association between random errors.

Table 2. GDP growth rates and total fixed capital formation in the Iraqi agricultural sector in the period of 2000-2019.

year	GDP at constant prices (million dinars)	GDP growth rate (%)	Gross agricultural fixed capital formation (million dinars)	Growth rate of total agricultural capital formation (%)
2000	112208511.5	2	97318	91
2001	114190796.9	-8	186146.5	4
2002	104822921.0	-37	193455.8	-21
2003	66398213.0	53	153029.7	-88
2004	101845262.4	2	18268.3	1073
2005	103973180.4	6	214248.2	-46
2006	109843735.3	1	115944.0	-85
2007	111455813.4	8	17600.0	185
2008	120626517.1	3	50219.7	-77
2009	124702848.0	6	11603.9	3278
2010	132687029.6	8	392032.9	46
2011	142700217.0	14	570488.8	129
2012	162587533.1	8	1307364	-44
2013	174990175.0	0	728751.1	-42
2014	175335400.0	4	421693	-49
2015	182051373.0	6	213445	54
2016	193744445.6	4	328507.8	123
2017	201528216.0	1	732790.2	-12
2018	202776669.0	4	641312.5	5
2019	211789774.7	1	674556.4	5

Reference: 2nd and 4th columns is the researchers concludes based on the statistical data of the statistical group of the Iraqi Central Statistical Organization for different years (2000-2019).

Table 3. Results of simple linear regression.

Parameters	B	X	T	F	R^2	D.W	Sig B	Sig X
Value	4.914	-0.015	(1.271)	4.74	0. 33	1.670	0.000	0.789

Reference: The values were extracted by the researcher based on data from Tables 1-2.

CONCLUSION

There is a weakening relationship between Iraq's total fixed capital formation in the agricultural sector and Iraq's gross domestic product (GDP), since it is one of the factors that deter investment. Furthermore, the volatility of Iraq's economic policy and political conditions that Iraq passed through after 2003, have affected investment in the Iraqi agricultural sector, following by the lack of a clear vision of the fate and future of agricultural investment, in addition to the inadequacy of agricultural banks in supporting Iraq's agricultural production (vegetable-animal), along with the weakness of government support, as well as weak financial and investment allocations in total fixed capital formation in the agricultural sector.

RECOMMENDATIONS

We need to reformulate laws to strengthen the role of investment in the agricultural sector and to consider it as the second source of GDP growth after oil, as well as developing a vision and future policy for the agricultural sector, especially when Iraq enters the market economy after 2003, followed by protecting the national product from external competition. We need to monitor and support agricultural banks in granting loans and confronting administrative corruption, increasing the proportion of investment allocations in the country's general budget for the agricultural sector and supporting Iraqi production, especially main commodities.

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