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Revisiting the Role of Financial Development in Energy-Growth-Environment Nexus in Iraq

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Abstract: While lots of empirical research studies have examined the relationship between energy, economic growth, and the environment, the existing literature has not explored the impact of financial development on the nexus between growth, energy, and the environment. Hence, the current study aims to assess the correlation between financial development, economic growth, and the energy-environment relationship in Iraq. The temporal scope of the study encompasses the period from 2000 to 2022.The study employs three distinct models to estimate the relationships between economic growth, environmental quality, and energy consumption. These models include Fully Modified Ordinary Least Square (FMOLS), Dynamic Ordinary Least Square (DOLS), and Canonical Cointegration Regression (CCR). Based on the findings, it can be observed that all three specifications demonstrate a noteworthy inverse relationship between financial development and both economic growth and energy consumption. There is a significant positive relationship between financial development and environmental degradation. The study concludes that the financial sector in Iraq exhibits insufficient development and efficiency, thereby hindering the promotion of economic growth and environmental quality. The study suggests implementing significant reforms within the financial sector in order to effectively harness its potential benefits in both economic and environmental domains.

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1. Introduction

The continuing rise in global warming has emerged as a significant impediment to the attainment of sustainable development. The phenomenon of global warming can be attributed to various factors, such as the increase in waste and energy consumption resulting from technological advancements, as well as the widespread utilization of natural resources. Energy plays a pivotal role in driving economic activities, serving as a fundamental component. However, it is important to acknowledge that energy also bears responsibility for the degradation of the environment (Chen & Lei, 2018). Over the years, there has been an important surge in industrialization, accompanied by increased demand for labour, raw materials, inputs, and capital. This growth can be attributed to the rise in economic activities (Bekun, Alola, & Sarkodie, 2019). In recent times, there has been a notable escalation in the energy requirements of economies, driven by the pursuit of elevated growth rates. As a result, the endeavour of industries to attain necessary raw materials and exploit natural resources among the human population intensifies, leading to a substantial escalation in carbon dioxide emissions. CO2 emissions persist as the primary contributor to environmental degradation among all greenhouse gas emissions (GHG). The emissions of carbon dioxide (CO2) associated with the energy sector have experienced a notable increase of 45% within the environment over the course of the past thirteen years. The expansion of the industrial sector has led to a discernible increase in the release of greenhouse gas emissions into the Earth's atmosphere. According to a recent report by the Intergovernmental Panel on Climate Change, it is projected that there will be a substantial increase of 40 to 110 percent in energy-related carbon dioxide emissions by the year 2030 (W. Chen & Lei, 2018). Undoubtedly, carbon dioxide (CO2) emissions have a detrimental impact on the environment and serve as a central focus of discourse surrounding issues related to climate change. Consequently, the primary emphasis of affluent nations currently lies in the mitigation of carbon dioxide (CO2) emissions, which constitute approximately 81% of global greenhouse gas (GHG) emissions (Owusu & Asumadu-Sarkodie, 2016). The escalating increase in carbon emissions poses a significant threat to both global technological progress and the environment. It is imperative to assess the factors that contribute to the emission of CO2 in order to attain economic growth that is low in CO2 emissions (Khan et al., 2020).

In theoretical terms, there exists a substantial consensus among researchers regarding the pivotal role of financial development in stimulating economic growth. Currently, the significance of financial development in bolstering economic growth is undeniable. This is primarily due to its role in increasing capital accumulation through the mobilisation and pooling of savings. Additionally, financial development facilitates the availability of crucial information pertaining to various economic activities and investments, thereby enabling the optimal distribution of capital. The financial sector plays a significant role in reducing energy emissions by supporting advancements in the energy supply industry (Salahuddin, Gow, & Ozturk, 2015). This suggests that the advancement of financial systems plays a pivotal and beneficial role in combating environmental degradation by facilitating the reduction of CO2 emissions. Financial sector improvement has the potential to mitigate environmental degradation. Furthermore, the advancement of financial systems also plays a crucial role in promoting investments in environmentally focused green initiatives. This is achieved through the initiation of research and development efforts, the attraction of foreign direct investment, and the subsequent acceleration of economic activities, all of which collectively contribute to a positive impact on environmental quality (Tamazian & Rao, 2010). By improving the level of efficiency within the energy industry, a well-established financial sector is able to reduce borrowing costs, stimulate investment, and effectively mitigate the proliferation of energy emissions (Charfeddine, 2017; Tamazian, Chousa, & Vadlamannati, 2009). On the other hand, it is reasonable that financial development may have a detrimental impact on environmental quality by facilitating industrial growth, thereby increasing pollution levels and contributing to environmental degradation (Charfeddine & Kahia, 2019).

The primary objective of the present study is to assess the impact of financial development on the relationship between energy, economic growth, and the environment in Iraq from 2000 to 2022. Over the course of time, Iraq has emerged as one of the developing nations that are experiencing a simultaneous increase in economic growth, energy consumption, and carbon emissions. Despite possessing significant solar energy potential, the nation predominantly depends on energy sources derived from fossil fuels, which is a prominent contributor to carbon emissions. Furthermore, it is important to note that the Iraq war has made a substantial contribution of approximately 141 million metric tonnes of carbon dioxide (CO2) emissions since its commencement in 2003. On the contrary, the proliferation of transportation systems, air-conditioning units, electricity generation, seaport operations, and industrial manufacturing processes, particularly in the heating, gas, and oil sectors, have been identified as the primary factors contributing to the observed rise in carbon emissions associated with the nation as a whole (Akadiri, Bekun, Taheri, & Akadiri, 2019). Therefore, it is worth noting the significance of examining the interconnections among environmental degradation, economic growth, and energy consumption in Iraq. Figures 1 through 3 depict the patterns of economic growth, energy consumption, and CO2 emissions in Iraq.

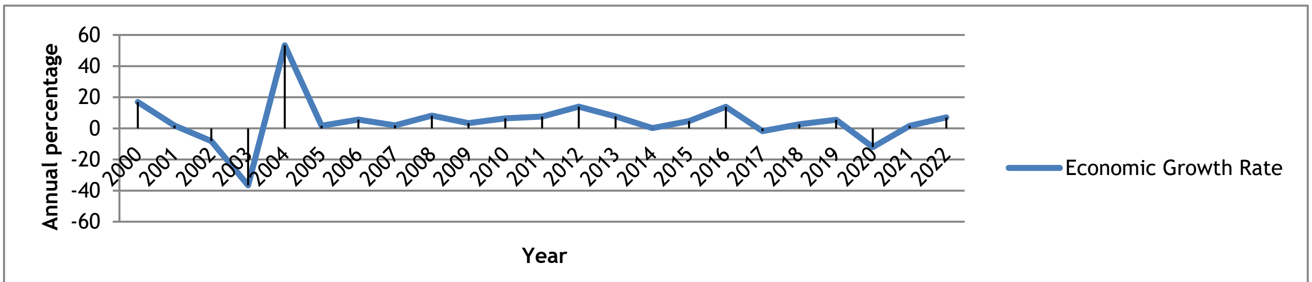

Figure 1: Economic Growth in Iraq (2000-2022)

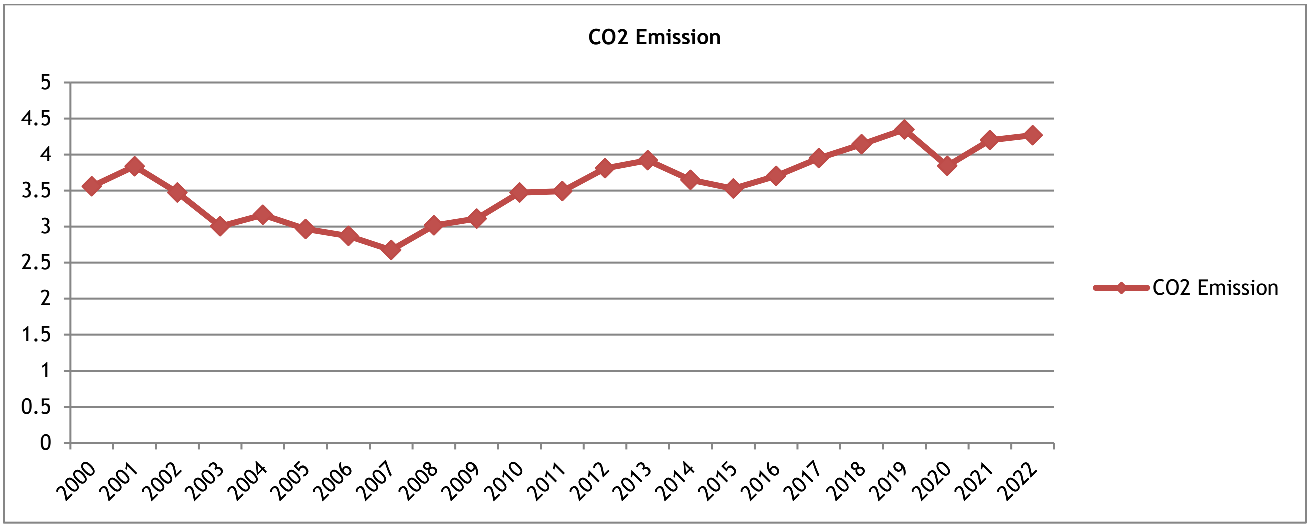

Figure 2: CO_2 Emissions in Iraq (2000-2022)

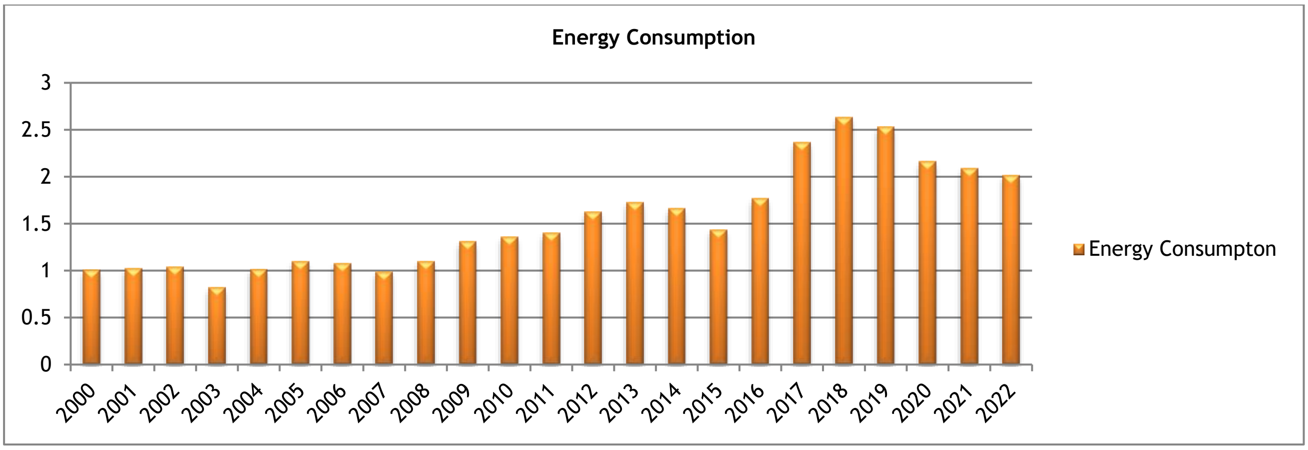

Figure 3: Energy Consumption in Iraq (2000-2022)

Therefore, the objective of this study is to assess the relationship between these two variables, with a specific focus on the influence of financial development. The financial system in Iraq underwent significant political and economic changes and fluctuations during the 1980s. The government has experienced various fluctuations and transformations that have been influenced by factors such as oil shocks, the financial system, economic sanctions, wars, decline in economic growth, and the adverse consequences resulting from the USA attack starting in 2003. Even though these factors have a big impact on Iraq's financial system, the country's financial sector is still growing and could play a key role in the country's energy use, environmental sustainability, and economic expansion nexus (Hamad Khalaf, 2019).
This study differentiates itself from previous research on the subject in the following ways: 1) The study has incorporated financial development as the primary predictor in three underlying models: namely, economic growth, energy consumption, and environmental degradation. 2) In contrast to prior research, the current study examines three distinct models for analysing the interrelationship between financial development and economic growth, energy consumption, and the carbon emissions nexus. 3) The study employs FMOLS, DOLS, and CCR regressions for empirical analysis, a novel approach that, to the best of our knowledge, has not been previously utilised to estimate this relationship, particularly within the Iraqi context. The study will provide significant insights into mitigating energy consumption and CO2 emissions in tandem with Iraq's economic development.
The research process is structured in the following sequence: Section 2 provides a comprehensive overview and analysis of the current body of literature on the subject matter. Section 3 provides the data and applied estimation approach. In Section 4, we present a comprehensive analysis of empirical findings and engage in scholarly discussions. Section 5 of the report focuses on the conclusion and policy recommendations.

2. Existing Literature

In order to conduct a comprehensive review of the existing literature, we have categorised it into three distinct subsections. The initial subsection provides an overview of the relationship between financial development and economic growth. The second subsection examines the relationship between financial development and energy consumption, while the third subsection explores the relationship between financial development and the environment nexus.

2.1 Financial Development and Economic Growth

Extensive research has been undertaken to explore the relationship between financial development and economic growth. Certain researchers have observed a positive correlation between them, whereas others have discovered a negative correlation. Nguyen and PHAM (2021) conducted a study examining the correlation between financial development and economic growth in both transition and Asian countries from 1998 to 2020. The authors employed the GMM estimation approach to investigate the relationship between financial development and economic growth, revealing a curvilinear pattern characterised by an inverted U shape. In their study, Tsitsi Musakwa and Mbaya Odhiambo (2022) examined the relationship between the financial sector and economic growth in Botswana. The authors utilised data spanning the period from 1980 to 2020. The empirical estimation employed the ARDL Bound test to examine the impact of financial development on economic growth. The findings revealed that there was no statistically significant effect of financial development on economic growth. In a study conducted by Chen et al. (2020), the authors examined the relationship between economic growth and financial development nexus in Kenya from 1972 to 2017. The application of the NARDL estimation approach yielded findings that suggest a positive relationship between positive shocks and economic growth, while negative shocks in financial development were found to have a detrimental effect on economic growth. The impact of financial development on economic growth for the period of 1993 to 2014 was estimated by Guru and Yadav (2019) using data from BRICS economies. The results obtained through the application of the system GMM estimation approach indicate a statistically significant and positive association between financial development and economic growth. Purewal and Haini (2021) conducted a study that examined the interrelationship among financial institutions, financial markets, and economic growth. The study utilised data from 24 OECD economies spanning the period from 1980 to 2017. The study used GMM estimation to ascertain the favourable influence of financial markets and institutions on economic growth. The study conducted by Siddikee and Rahman (2021) examined the relationship between financial sector development and economic growth in Bangladesh from 1990 to 2018. The authors utilised the Vector Error Correction Model (VECM) approach to analyse the relationship between financial development and economic growth. Their findings indicate a positive impact of financial development on economic growth in the short run, but a negative impact in the long run. Abdullah and Abbas (2022) conducted an analysis utilising data from Iraq to estimate the relationship between financial development and economic growth during the period spanning from 2004 to 2020. The study used the NARDL estimation approach and discovered a statistically significant association between financial development and economic growth. The application of the causality approach yielded results indicating the absence of a causal association between the two variables.

2.2 Financial Development and Environmental Quality Nexus:

Similar to the concept of economic growth, there exists a lack of consensus among scholars regarding the precise impact of financial development on carbon emissions. Charfeddine and Kahia (2019) conducted a comprehensive analysis of the data from the MENA region spanning from 1980 to 2015. The purpose of their study was to examine the relationship between financial development and CO2 emissions, employing the Panel ARDL estimation approach. The results of the study indicate that there is a limited impact of financial development on carbon dioxide emissions. In their study, Jiang et al. (2022) examined a total of 57 economies participating in the Belt and Road Initiative over the period of 1995 to 2018. The objective of their analysis was to investigate the association between financial development and CO2 emissions. The authors utilised the Driscoll and Kraay Standard error estimation method to examine the relationship between financial development and CO2 emissions in the chosen countries. Their findings revealed a positive nexus between these two variables. Al-Silefanee et al. (2022) conducted a study to examine the relationship between financial development and CO2 emission nexus in a panel of 36 Islamic countries during the period of 2013 to 2018. Using the Fixed-Effects Model, the researchers found no statistically significant association between financial development and CO2 emissions. Petrović and Lobanov (2022) conducted an estimation of the association between financial development and CO2 emissions in a sample of 24 economies spanning the period from 1970 to 2014. The results obtained from the CCEMG estimation approach revealed a positive correlation between financial development and CO2 emissions. In their study, Shoaib, Rafique, Nadeem, and Huang (2020) conducted an estimation of the relationship between financial development and CO2 emissions in both D8 and G8 countries during the period spanning from 1999 to 2013. Based on the application of the PMG-ARDL panel model, the authors have arrived at the conclusion that there exists a positive correlation between financial development and CO2 emissions.

2.3 Financial Development and Energy Consumption

Many empirical investigations have been conducted to examine the association between financial development and energy consumption. Financial development plays a pivotal role in facilitating firms' access to capital from both the stock market and banking sector, thereby promoting investments in energy-efficient technologies and advanced production methods. In this context, the influence of financial development on energy consumption can be both advantageous and detrimental. Chiu and Lee (2020) conducted an estimation of the relationship between financial development and energy consumption in a sample of 79 countries, including both OECD and non-OECD nations, for the period spanning from 1985 to 2014. The study's findings revealed a negative correlation between financial development and energy consumption. In a similar vein, Sadorsky (2010) conducted an analysis on the correlation between energy consumption and financial development in developing nations during the period spanning from 1990 to 2006. The results obtained from the Fixed Effects estimation revealed a positive correlation between financial development and energy consumption. In their study conducted in 2018, Mukhtarov, Mikayilov, Mammadov, and Mammadov examined the relationship between financial development and energy consumption nexus in Kazakhstan from 1993 to 2014. The study utilised the VECM estimation approach to investigate the relationship between financial development and energy consumption. The findings revealed a statistically significant positive association between these two variables. Ma and Fu (2020) conducted a study on the relationship between financial development and energy consumption using a comprehensive panel dataset comprising 120 countries, both developed and developing. By employing GMM estimation, the results of the study indicate that financial development has a positive impact on energy use in both global panel and developing countries. However, no significant relationship was found between financial development and energy consumption in developed economies. Rafindadi and Ozturk (2017) conducted a study in South Africa to investigate the relationship between financial development and energy use. The study covered the time period from 1970 to 2011. The application of the Granger Causality method led to the determination that there exists a causal relationship between financial development and energy consumption in South Africa.

2.4 Literature Gaps

The examination of previous studies has revealed significant deficiencies in the existing body of literature, which necessitate further investigation by researchers. First and foremost, there is a lack of prior research examining the relationship between energy, economic growth, and the environment nexus in Iraq, specifically in the context of financial development. Second, a number of studies have been conducted to estimate the relationship between financial sector development and economic growth in Iraq. However, no previous study has specifically examined the connection between financial development and energy consumption in Iraq. In contrast to prior research, which predominantly employed the ARDL or NARDL approach for empirical estimation, the present study employs the FMOLS, DOLS, and CCR methods to conduct empirical estimation.

3. Data and Empirical Methodology

The primary objective of contemporary research is to assess the interrelationship between the environment, economic growth, and energy consumption in Iraq, with a particular focus on the influence of financial development. In order to achieve the stated objective, data pertaining to variables spanning the years 2000 to 2022 has been collected from secondary sources. Three distinct models of study are formulated based on the objective as outlined below:

Model 1:

$$EC_t = \alpha_o + \beta_1 GDP_t + \beta_2 CO_{2t} + \beta_3 HDI_t + \beta_4 URB_t + \beta_5 IND_t + e_t \quad (1)$$

Model 2:

$$GDP_t = \alpha_o + \beta_1 CO_{2t} + \beta_2 EC_t + \beta_3 FD_t + \beta_4 URB_t + \beta_5 IND_t + e_t \quad (2)$$

Model 3:

$$CO_{2t} = \alpha_o + \beta_1 GDP_t + \beta_2 EC_t + \beta_3 FD_t + \beta_4 URB_t + \beta_5 IND_t + e_t \quad (3)$$

Where, GDP = Economic growth,
CO_2= CO_2 emission
EC= Energy consumption
FD= Financial Development
URB= Urbanization
IND= Industrialization

Table 1: Variables of Study and Sources of Data

Series	Proxy	Source of data
Economic Growth	Per capita GDP (2015 US$ constant)	WDI
Carbon Dioxide Emission	CO2 emission (metric ton per capita)	WDI
Energy Consumption	Energy Use (Quadrillionbtu)	EIA
Financial Development	Broad money (as percent of GDP)	WDI
Urbanization	Urban population growth (annual %)	WDI
Industrialization	Industrial value added (as percent of GDP)	WDI

EIA shows Energy Information Agency, WDI shows World Development Indicator.

Estimation Methods

In order to conduct a comprehensive analysis over an extended period of time, this study employs three distinct empirical estimation methodologies, specifically the Fully Modified Ordinary Least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS) approaches as proposed by Pedroni (2001) , as well as the Common Correlated Effects (CCR) approach proposed by Park (1992). Both parametric and non-parametric techniques are utilised by these approaches. These approaches possess the capacity to address endogeneity and serial correlation, rendering them the most dependable and effective among all-time series approaches. The conventional ordinary least squares (OLS) estimation approach has undergone several corrections in order to develop the fully modified ordinary least squares (FMOLS) approach, which allows for the examination of long-run cointegration relationships. The aforementioned approach also effectively addresses the concerns of serial correlation and endogeneity, which are typically overlooked by the traditional ordinary least squares (OLS) method. Therefore, the Full-Modified Ordinary Least Squares (FMOLS) method exhibits superiority over alternative approaches due to its ability to effectively tackle unresolved concerns associated with Ordinary Least Squares (OLS) and accurately estimate long-term cointegration and coefficient values. In a similar vein, the DOLS technique is deemed a suitable method for analysis due to its capacity to address the challenge of non-stationarity. The inclusion of lagged values in the DOLS method is also associated with addressing the issue of autocorrelation. The DOLS method demonstrates its superiority over the FMOLS approach by offering the following advantages: (a) exhibits superior performance when the sample size is limited, and (b) encompasses dynamic factors. The variable (c) possesses the capability to effectively address and resolve instances of static regression refractions. (d) This is applicable in the context of diverse series (You, Khattak, & Ahmad, 2022).

FMOLS and DOLS estimation are represented in equation 4 and 5 respectively

$$\widehat{\emptyset} = \left[\frac{\beta}{\hat{\gamma}}\right] = \left(\sum_{t=2}^{T} Z_t Z_t'\right)\left(\sum_{t=2}^{T} Z_t y_t^{+} - T\left[\frac{\lambda_{12}}{0}+\right]\right) \quad (4)$$

Where (X'_t, D'_t) is represented by Z_t Primarily, the study of FMOLS estimate depends on the long-term covariance matrices.

$$y_t = x_t'\beta + D_{it'\gamma 1} + \sum_{j=q}^{r} \Delta X_{t+j} + v_{it} \quad (5)$$

The DOLS estimation method improves the analysis of cointegration by incorporating both lagged and leading effects through the inclusion of an orthogonal cointegration error term equation.

In contrast to the FMOLS estimation method, the CCR approach employs a stationary adaptation strategy to address the issue of the long-term relationship between the cointegration equation and stochastic errors. The method provides estimates that follow a normal distribution in the asymptotic limit. The estimation procedure employed in this study accounts for the asymptotic bias resulting from the synchronous relationship between the variables and mitigates the issue of endogeneity as well (You, Khattak, & Ahmad, 2022). Moreover, the use of the CCR approach is both effective and indispensable in regression analysis. Equation (6) presents the fundamental structure of the CCR.:

$$y_t^* = \beta'_{pq} z_{pqt}^* + \mu_{pqt}^* \quad (6)$$

Where, y^*_t and z^*_{pqt} represent the stationary transformation of y_t and z_{pqt}.

4. Results and Discussion

Table 2 presents the results of the summary statistics. The provided statistics encompass fundamental data characteristics, such as the mean or average value, standard deviation, data range, and a normality test. Based on the findings, it can be observed that GDP exhibits the highest mean and standard error values, while energy consumption demonstrates the lowest mean and standard error values when compared to all other variables. Among all the series, it can be observed that GDP exhibits the highest range of data, while urbanisation displays the lowest range of data. The Jarque-Bera test was conducted to assess the normality of the variables, indicating that certain variables exhibited a normal distribution while others did not.

Table 2: Summary Statistics

Series	Mean/Average value	Stand.deviation	Min value	Max value	JB stat
CO2	3.564	0.476	2.674	4.347	0.989
GDP	1417.2	615.06	2227.96	4903.82	4.722***
EC	1.532	0.5432	0.818	2.630	2.095
FD	33.819	10.163	20.246	55.599	1.486
URB	2.897	1.155	-0.771	4.899	15.952***
IND	59.45	10.411	39.902	84.759	1.1100

Determining the integration order is a crucial step in selecting the appropriate empirical analysis approach. The Philips-Perron and Augmented Dickey Fuller (ADF and PP) tests are widely employed unit root tests in the field of time series analysis. The current study also utilises these tests. The results of both tests, as presented in Table 3, indicate that all of the series exhibit a level unit root but achieve stationarity after differencing.

Table 3: Unit Root Results

Series	ADF		PP- Test		
	At Level	At 1st Difference	At Level	At1st Difference	Decision
CO2	-0.8869	-4.789***	-2.137	-5.1669***	I(1)
GDP	1.728	-5.042***	1.728	-5.524***	I(1)
EC	-0.757	-4.085***	-1.065	-2.758***	I(1)
FD	-1.004	-3.930***	-0.614	-7.220***	I(1)
IND	-2.314	-4.408***	-1.530	-7.372***	I(1)
URB	-2.819	-4.598***	-2.209	-4.365***	

The test results suggest that all of the series exhibit I (1) characteristics, indicating a potential long-term cointegrating relationship between the variables. Hence, prior to conducting long-term empirical estimation, it is imperative to employ the Johansen Juselius Cointegration approach in order to evaluate the existence of long-term cointegration among the series. The results are presented in Table 4 for all three models. The null hypothesis, which posits the absence of cointegration, is firmly rejected for all three models based on both the trace and maximum eigen statistics. Based on the results of the tests conducted, it has been observed that there are a total of five cointegrating equations, as evidenced by the trace statistics and maximum eigen value statistics in all three models.

Table 4: Johansen Juselius Cointegration Results

	Trace	Max eigen values	Trace	Max eigen values	Trace	Max eigen values
None	200.90***(0.002)	78.131***(0.000)	200.90***(0.000)	78.131***(0.000)	200.90***(0.002)	78.131***(0.000)
At most 1	122.77***(0.000)	46.747***(0.000)	69.818***(0.000)	33.876***(0.000)	122.77***(0.000)	46.747***(0.000)
At most 2	76.026***(0.000)	37.410***(0.002)	47.856***(0.000)	27.584***(0.002)	76.026***(0.000)	37.410***(0.002)
At most 3	38.610***(0.0038)	19.860***(0.0745)	29.797***(0.003)	21.131**(0.0745)	38.610***(0.0038)	19.860***(0.0745)
At most 4	18.749***(0.0156)	13.188***(0.0734)	15.494***(0.015)	14.264**(0.0734)	18.749***(0.0156)	13.188***(0.0734)
At most 5	5.560***(0.0184)	5.560***(0.0814)	3.8414**(0.0814)	3.8414***(0.0814)	5.560***(0.0184)	5.560***(0.0814)

Findings of DOLS, FMOLS and CCR

In the following section, we undertake the estimation of long-term coefficients for all three models employing the FMOLS, DOLS, and CCR regression techniques. We shall commence by examining the outcomes of Model 1, as presented in Table 5. Notably, the significance and direction of the coefficients remain consistent across the FMOLS, DOLS, and CCR regressions, albeit with variations in their magnitudes. Primarily, the results indicate a negative association between financial development and energy consumption across all model specifications. The three models indicate a decrease in energy consumption by 0.02, 0.03, and 0.02 units, correspondingly, with a 1-unit increase in financial development. The lack of surprise associated with this finding can be attributed to the fact that financial development plays a crucial role in facilitating the availability of funds for the implementation of energy-efficient technologies. The discovery supports the notion that financial development contributes to a decrease in energy consumption by facilitating the advancement of renewable energy sources and enabling more affordable and accessible environmentally sustainable investments and green technological innovations (Tamazian, Chousa, & Vadlamannati, 2009). In the majority of cases, projects aimed at enhancing energy efficiency require access to financing options that extend over an extended period of time. Financial institutions that have undergone significant development play a crucial role in reducing the costs associated with financing and effectively allocating capital towards the support of novel endeavours, such as energy-efficient projects. Consequently, this has a direct impact on nature and quantities of energy consumption. The present finding is consistent with previous scholarly investigations conducted by Islam, Shahbaz, Ahmed, and Alam (2013) and Farhani and Solarin (2017). However, it diverges from the findings of Sadorsky (2010), Mukhtarov, Mikayilov, Mammadov, and Mammadov (2018), and Rafindadi and Ozturk (2017), as their research indicated a positive relationship between financial development and energy consumption.

Table 5: Model 1 (EC)

Variables	FMOLS		DOLS		CCR	
	Beta	Prob	Beta	Prob	Beta	Prob
FD	-0.0236***	0.007	-0.0310***	0.032	-0.0218**	0.070
CO_2	1.267***	0.000	1.275***	0.000	1.199***	0.0000
GDP	0.00012	0.298	0.0062	0.644	0.0068	0.5535
URB	-0.1146***	0.003	-0.0980***	0.035	-0.105***	0.0092
IND	0.0423***	0.000	0.0452***	0.003	0.0368***	0.0001
C	1.139***	0.072	1.2661**	0.092	-0.740	0.2008
R^2 value	0.91		0.94		0.91	
Adjusted R^2 value	0.88		0.90		0.88	

When considering the influence of GDP and the environment on energy usage, it is evident that there is a positive correlation between CO2 emissions and energy consumption across all estimations. In our study, it was observed that there is a positive relationship between CO2 emissions and energy consumption. Specifically, a unit increase in CO2 emissions resulted in corresponding increases of 1.26, 1.27, and 1.19 units in energy consumption. Consistent with the research conducted by Saidi and Hammami (2015) and Kahouli, Miled, and Aloui (2022). In the same manner, it is observed that GDP exhibits a correlation with increasing energy demand across all specifications, albeit with a minimal impact. Three estimations of energy consumption show an increase of 0.0012, 0.006, and 0.006 units respectively in response to a unit increase in GDP. The findings of Saidi and Hammami (2015), as well as Tang, Tiwari, and Shahbaz (2016), align with our own research, as these scholars also draw a positive correlation between energy consumption and economic growth.

Following that, it is observed that there exists a positive correlation between energy consumption and industrialization. In each of the three models, it is observed that a unit increase in industrialization is associated with a corresponding increase in energy consumption by 0.04, 0.04, and 0.03 units, respectively. This discovery suggests that the energy consumption of higher manufacturing surpasses that of conventional manufacturing or agricultural operations. In previous studies, Kahouli, Miled, and Aloui (2022) and Sahoo and Sethi (2020) reported comparable findings. In line with previous research conducted by Wang (2014) and Sadorsky (2014), our findings indicate that urbanisation plays a detrimental role in energy consumption. In three separate analyses, it was observed that a unit increase in urbanisation resulted in reductions of energy use by 0.11, 0.06, and 0.10 units, respectively. The presence of a negative coefficient in the context of urbanisation suggests that urbanisation facilitates the process of large-scale production, consequently leading to a decrease in energy requirements.

Table 6: Model 2: Economic Growth

Variables	FMOLS		DOLS		CCR	
	Beta	Prob	Beta	Prob	Beta	Prob
FD	-0.749***	0.0430	-5.271***	0.0101	-0.722**	0.0909
CO_2	6.488***	0.0372	3.783***	0.0020	2.483***	0.0508
EC	6.442	0.514	7.540***	0.0235	1.013	0.252
URB	-0.953	0.743	-8.730***	0.0516	-4.423	0.463
IND	-0.947***	0.0499	-1.747***	0.0033	-0.0757***	0.0498
C	6.909***	0.0123	9.232**	0.0021	8.402***	0.0080
R^2 value	0.74		0.90		0.92	
Adjusted R^2 value	0.66		.80		.88	

Second, we will now proceed with the analysis and interpretation of the findings for Model 2. Initially, it is observed that there exists a negative and statistically significant relationship between financial development and GDP in Iraq. This finding is consistent with the research conducted by Iheanacho (2016) as well as the study conducted by Adu, Marbuah, and Mensah (2013). The results of our study indicate that the implementation of expansionary monetary and financial policies, which result in an excessive increase in the money supply, can have detrimental effects on economic growth. Specifically, our findings reveal a decrease in economic growth coefficients by 0.74, 5.27, and 0.72 units across three different specifications, corresponding to a unit increase in FD. Both the environment and energy consumption have a positive and significant impact on economic growth. This implies that due to its crucial role in the manufacturing process, EC serves as a principal catalyst for economic expansion. Likewise, a positive correlation exists between heightened levels of environmental pollution and greater investments in the renewable energy sector and green technologies, resulting in the generation of additional employment prospects within an economy. The findings of our study are consistent with the conclusions drawn by Al-Mulali and Sab (2012) as well as Elfaki, Handoyo, and Ibrahim (2021). Finally, it is observed that the coefficients pertaining to urbanisation and industrialization exhibit statistical significance and a negative relationship, indicating that these factors have a detrimental impact on economic growth in Iraq. This finding aligns with the conclusions drawn by Jelilov, Enwerem, and Isik (2016) as well as Nathaniel and Bekun (2021). This suggests that there may be a correlation between urbanisation and a decline in employment opportunities within the country, as indicated by the population residing in urban areas. Furthermore, this implies that it is imperative to implement effective strategies aimed at enhancing human capital development. These strategies are necessary to equip individuals with the requisite skills needed to effectively utilise existing technology and disseminate it across various industrial domains. By doing so, overall productivity across all sectors can be improved, thereby fostering economic growth.

Table 7: Model 3: CO2 Emission

Variables	FMOLS		DOLS		CCR	
	Coeff	Prob	Coeff	Prob	Coeff	Prob
FD	0.0216***	0.000	0.0283***	0.000	0.0248	0.0001
EC	0.601***	0.000	0.568***	0.000	0.611***	0.0000
GDP	0.0017***	0.021	0.0021***	0.002	0.0014***	0.0099
URB	0.0829***	0.001	0.0659***	0.000	0.0759***	0.0008
IND	0.0292***	0.000	0.0320***	0.000	0.0290***	0.0000
C	-0.765***	0.0195	1.17300	0.002	-0.732**	0.0180
R^2 value	0.94		.98		.94	
Adjusted R^2 value	.93		.96		.92	

To interpret, we interpret the Model 3 CO2 emission model results. All variables within the model exhibit statistically significant and positive associations with CO2 emissions. In all three estimations, there is a notable and statistically significant impact of positive financial development on CO2 emissions. Three analyses indicate that there is a positive correlation between financial development and CO2 emissions. Specifically, each unit increase in financial development is associated with an observed increase of 0.021, 0.028, and 0.024 units in CO2 emissions, as reported in the aforementioned analyses. The presence of a positive sign indicates that an escalation in financial development facilitates the acquisition of funds from the stock market, resulting in additional investments being made in production. Consequently, this heightened investment contributes to an increase in carbon dioxide (CO2) emissions. Another additional factor to consider, alongside the aforementioned ones, is the wealth effect. This phenomenon pertains to consumers' capacity to enhance their wealth by means of reduced financial constraints, leading to increased expenditure on high-value items. Consequently, this heightened consumption pattern contributes to elevated energy usage and, ultimately, the emission of CO2. In previous studies conducted by Shoaib, Rafique, Nadeem, and Huang (2020) and Jiang et al. (2022), certain findings were reported.

Moving ahead, the research reveals that there is a positive correlation between economic growth and CO2 emissions. There is a positive relationship between a one-unit increase in GDP and corresponding increases of 0.0017, 0.0021, and 0.0014 units in three different specifications. The aforementioned finding is supported by justifiable reasoning, as it is widely observed that an upsurge in economic growth is consistently accompanied by a corresponding increase in energy consumption and utilisation of natural resources. Regrettably, Iraq, similar to other nations, exhibits a significant dependence on energy consumption derived from fossil fuels, a primary catalyst for the emission of carbon dioxide. Thirdly, there exists a strong and positive correlation between energy consumption and the emission of carbon dioxide (CO2). In three specifications, it has been observed that there is an increase of 0.6, 0.5, and 0.6 units in CO2 emissions for every unit increase in energy usage. The outcome can be deemed justified in the context of Iraq due to its significant dependence on fossil fuel-based energy for economic development, which serves as a primary contributor to environmental pollution. The findings of our study are strongly supported by the works of Munir, Lean, and Smyth (2020), Roespinoedji, Juniati, and Ali (2020), and Chontanawat (2020).

Ultimately, it is determined that there exists a positive and statistically significant correlation between urbanisation, industrialization, and CO2 emissions across all specifications. A rise in urbanisation by one unit is associated with an increase of 0.08, 0.06, and 0.07 units in emission levels according to the FMOLS, DOLS, and CCR models, respectively. Urbanisation is commonly linked to the escalation of deforestation, transportation demands, and inadequate management of expanding waste resources. Likewise, the process of industrialization is commonly linked to increased prospects for production and income, resulting in a corresponding escalation in energy consumption and emissions. A notable increase of 0.02, 0.03, and 0.02 units in carbon dioxide (CO2) emissions is observed across three distinct specifications when industrialization experiences a unitary increase. The previous studies conducted by Anwar, Younis, and Ullah (2020), Brahmasrene and Lee (2017), and Anwar, Younis, and Ullah (2020) provide robust support for the positive impact of industrialization and urbanisation on emissions.

5. Conclusion and Policy Recommendations

While there has been extensive empirical research on the energy-growth-environment nexus, the role of financial development in this relationship has not been previously investigated. With the objective of addressing this existing gap in the literature, this study aims to assess the impact of financial development on the nexus between growth, energy, and the environment in Iraq. The study encompasses a time period ranging from 2000 to 2022. In order to achieve this objective, the study formulates three distinct models. The three models under consideration are the energy model, economic growth model, and carbon emission model. Based on preliminary unit root and cointegration testing, it has been determined that all variables exhibit a first-order integration and long-term cointegration. Consequently, the FMOLS, DOLS, and CCR estimations have been chosen as suitable methods for conducting the empirical analysis. Based on our research, it has been determined that financial development has a detrimental impact on both energy consumption and economic growth. However, it plays a significant and positive role in the increase of CO2 emissions in Iraq. The study's findings indicate that the development of the financial sector in Iraq does not yield positive outcomes in terms of both economic growth and environmental considerations. These results suggest deficiencies within the system, highlighting its inadequate level of development.

Therefore, the current study provides valuable recommendations for policymakers and the government of Iraq in relation to the advancement of financial development. As previously indicated, there exists no positive correlation between financial development and both economic growth and environmental quality. Thus, it is advisable for Iraq to undertake a process of financial system redevelopment through the implementation of more efficient reforms. Efficient reforms should be directed towards enhancing the quality and standard of financial services in order to attain the desired outcomes, which constitute the fundamental objective of financial system development.The attainment of positive effects on economic growth through the financial sector can be facilitated by expanding the structure of the financial system and enhancing competition within it. This can be accomplished by implementing effective government regulatory policies. The emphasis on enhancing the quality of this sector is crucial for augmenting its yield and productivity. It is imperative for governments and politicians to exhibit a sincere commitment to constructing and improving financial systems that cater to the needs of both domestic and foreign investors. This represents a crucial element in this context. Furthermore, it is imperative for policymakers in the region to actively promote the involvement of financial institutions in facilitating and supporting energy-efficient projects within both the domestic and industrial sectors. In addition, it is our strong conviction that there should be a prioritization of the adoption of renewable energy technologies, specifically wind and solar power initiatives. This prioritization should include facilitating the process of securing funding and ensuring accessibility to more affordable financing options. In summary, it is imperative to enhance the financial system in a developing nation such as Iraq in order to fully harness its potential as a catalyst for genuine economic growth.

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