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## Provided in Cooperation with:

International Journal of Energy Economics and Policy (IJEPP)

*Reference:* Jreisat, Ammar (2021). Financial development and economic growth impact on the environmental degradation in Jordan. In: International Journal of Energy Economics and Policy 11 (4), S. 157 - 161.

<https://www.econjournals.com/index.php/ijeep/article/download/11161/5902>.

doi:10.32479/ijeep.11161.

This Version is available at:

<http://hdl.handle.net/11159/7764>

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## Financial Development and Economic Growth Impact on the Environmental Degradation in Jordan

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Received: 07 February 2021

Accepted: 23 April 2021

DOI: <https://doi.org/10.32479/ijeeep.11161>

### ABSTRACT

Conflicting results exist in the literature on the role of financial development and economic growth on environmental degradation. The study's focus is to investigate the influence of economic growth and financial development on environmental degradation. The study examines the impact of financial development and economic growth on environmental degradation in Jordan. The ordinary least square model results depict the significant positive impact of financial development on environmental degradation in fossil energy consumption, urbanization, and trade openness as a control variable. Results base the data from 1976 to 2018 for the economy of Jordan. Some control variables also have an insignificant positive impact on carbon emission, a proxy of environmental degradation. This study recommends Jordan's policymakers push the banking and non-banking financial institutions to provide loaning to facilitate the green and environmentally friendly projects, which causes decreased carbon dioxide emissions.

**Keywords:** Energy, Environment, Degradation, Urbanization, Trade

**JEL Classifications:** Q43, Q50, O44, O16, F62

### 1. INTRODUCTION

World economic growth became possible with industrialization. The openness in trade facilitates economic development and leads to better urbanization and general human wellbeing. Industrial development comes at the cost of the higher use of fossil fuel-based energy, and global development costs the environment badly (Phong, 2019). The greenhouse gas emission reached the saw a sharp increase after the 1900s and reached the 36.44 Billion metric ton in 2019, and resulted in a rise in global temperature by 1.1°C in the last 100 years (World Bank, 2019).

Worldwide policymakers of developed and developing economies are more concerned about the fast decrease in environmental quality caused by ecological degradation (Ramuhulu and Chiranga, 2018; Lohnert and Geist, 2018). Human emission of greenhouse

gases mostly based on the emission of CO<sub>2</sub> and the rise of the temperature around the globe, evident with the climatic change observed worldwide (Shahbaz et al., 2016; World Bank, 2019).

However, a nation's economic development relates to higher energy use, mostly fossil fuels (Salahuddin et al., 2018). The use of energy in a country proxy by the CO<sub>2</sub> emissions (Shahzad et al., 2017). Tang and Tan (2014) and Taher (2019) investigate the relationship between economic growth and environmental degradation. In the same context, Samaila et al. (2018) suggest the role of financial development in ecological degradation and other researchers. Mix relationship of financial growth and environmental degradation reported in the literature. A positive association between financial development and ecological degradation was reported by Rasiah et al. (2018) and Tsaurai (2019). In contrast, the studies conducted by Tamazian and Rao

(2010) and Phong (2019) reported the negative relationship between financial development and environmental degradation.

A recent empirical study by Taher (2019) indicates that carbon emission, a proxy of environmental degradation, depicts an essential relationship with economic growth. Academicians and environmentalists are keenly observing the relationship between economic growth and environmental degradation, but no clear conclusion possible. Theoretical views are taking different versions while defining the relationship between financial development and environmental degradation. Few of these indicates a positive relationship, while others suggest a negative or no relationship. Due to these mixed views, the concept needs further exploration. The relationship between financial development and economic growth is still ignorant in the context of Jordan.

The study attempts to investigate the impact of financial development and economic growth on environmental degradation in Jordan. Previously very few studies were conducted to examine the relationship. Onanuga (2017) conducted a study for Sub-Saharan African countries and found that the impact of financial development on carbon dioxide emission is different for low income, middle income, and high-income countries. This study facilitates Jordan's government and policymakers to design the policy to optimize financial development and carbon emission.

## 2. LITERATURE REVIEW

Several studies conducted and investigated the relationship between economic growth, financial development, and environmental degradation. Taher (2019) and Khan et al. (2018) enhanced environmental degradation literature. Literature indicates that a unified conclusion has not been drawn about the relationship based on theoretical or empirical discussions. Even direction of the relationship between economic growth, financial development, and environmental degradation has not a unified conclusion.

Environmental degradation literature includes many studies investigating the relationship between economic growth, financial development, and environmental degradation. Tamazian and Rao (2010) conducted a study to examine the impact of financial advancement on ecological deterioration by using the sample of twenty-four emerging economies. The study measured environmental deterioration by carbon emission. The study results illustrate the significant negative impact of financial advancement on carbon emission. A similar influence of financial improvement on the environmental decline was indicated by Jalil and Feridun (2011) for China's economy by using data from 1953 to 2006. The study uses carbon emission to measure environmental degradation. The study portrays a significant negative relationship between environmental degradation and financial development. However, the positive and significant impact of economic growth on energy dependence depicts by Çoban and Topcu (2013) for the selected European countries based on the data for 1990-2011. Comparable results of economic growth and financial development seen from the study of Islam et al. (2013) conducted on Malaysia's economy by using 1971-2008 data. The study reported the significant

positive impact of financial advancement and economic growth on environmental degradation.

For the Turkish economy data taken from 1960 to 2007 indicates that the financial advancement has a significant negative impact on ecological deterioration (Ozturk and Acaravci, 2013), for the study the carbon dioxide emission taken as a proxy of environmental deterioration. A study conducted by the same author Taher (2018), to study the role of renewable energy and fossil energy in economic growth, was completed in Lebanon on the data of 1990 to 2012. The study's results show that fossil energy consumption has significantly impacted economic growth in a positive direction. Taher (2019) recently studied the role of environmental changes on economic growth in the Lebanese economy from the period 1990 to 2015 and reported a significant and negative relationship between the study variables. Carbon emission use as a proxy for environmental changes (Taher, 2018; Taher, 2019).

In contrast, the impact of renewable energy on economic growth is significant, with a negative sign. Similarly, Boutabba (2014) studied the long-run equilibrium between carbon dioxide emission, financial development, energy consumption, economic growth, and trade openness for India's economy. The study reported a causal relationship between all variables. The study results reported a relationship indicating that energy and financial growth increase the CO<sub>2</sub> emission.

Saidi and Mbarek (2017) conducted a study on emergent economies. The panel for the period of 1990 to 2013 depicts that the financial development has a significant negative impact on carbon emission, measuring environmental deterioration. Contrarily, a study conducted by Shahzad et al. (2017) for Pakistan's economy depicts a positive and significant impact on financial development's ecological degradation. The study also uses carbon dioxide emission as a proxy for ecological degradation. Salahuddin et al. (2018) conducted a study on the Turkish economy for the time frame of 1980 to 2013 reported a positive and significant impact of output advancement, financial development, energy utilization, and carbon emission.

Some studies in environmental degradation literature indicate that there is no causal relationship prevails in economic growth, financial development, and environmental degradation. Aye and Edoja (2017) suggest that low economic growth is insignificantly related to the environmental degradation among developing countries. The regime changes or prevailing hostile conditions disturb economic growth and affect carbon emission (Saad, 2014; Tsurai, 2019). Individual country characteristics are essential for developing and using energy to cause environmental degradation (Taher, 2018). With low economic growth and higher insecurity, investors lead to slow industrialization and the least use of energy for commercial purposes (Charfeddine and Kahia, 2019). Naceur and Omran (2008) also depict an insignificant relationship between financial reforms and the MENA countries' development from the data taken from 1979 to 2005.

Recently Charfeddine and Kahia (2019) conducted a study on MENA countries from 1980 to 2015. The study's panel results affirmed that the relationship of environmental degradation is very

weak with both financial development and economic growth. From the above literature, we can conclude that the relationship between financial development, economic, and environmental degradation may be positive, negative, or no relation. This study is an effort to unfold the relationship of economic growth, financial development on environmental degradation, and some control variables for Jordan’s economy. The main research hypotheses are as under:

- H<sub>1</sub>: Financial development and economic growth have a significant positive impact on environmental degradation.
- H<sub>2</sub>: All control variables have a statistically significant impact on environmental degradation.

### 3. RESEARCH METHODOLOGY

To check the role of financial development and growth of the economy on environmental degradation, we use the World Bank’s available data. This study uses the data from 1976 to 2018 for the economy of Jordan. The natural log of all variables taken to cope with outliers and normality issues (World Bank, 2019). CO<sub>2</sub> emission used as a proxy of environmental degradation and measured as metric tons per capita. The proxy for the economic growth is per capita GDP. Domestic credit to the private sector indicates the financial development and measured by the ratio of domestic lending to the private sector as a percentage of GDP. Fossil fuel energy consumption as a percentage of total energy consumed uses to measure the energy consumption. Trade as a percentage of GDP taken to capture trade openness and urban population as a percentage of the total population taken as a proxy of urbanization. Natural log transformation used for all the variables as proposed by Shahbaz et al. (2006). A natural log of all variables is used with the Log-linear equation to capture a time series’s dynamics, a multiple regression model used to seize environmental degradation variations. This study uses the ARMAX test to check the stationarity and the least absolute deviation (LAD) test employ to check the model’s goodness of fit. An appropriate model for environmental degradation as follows:

$$CO_{2t} = \beta_0 + \beta_1 (EG_t) + \beta_2 (FD_t) + \beta_3 (FEC_t) + \beta_4 (UP_t) + \beta_5 (TO_t) + \epsilon_t \tag{I}$$

CO<sub>2</sub> is a carbon dioxide emission and measure in metric tons per capita.

EG indicates the economic growth and measured by GDP per capita in constant 2010 US \$.

FD is used for financial development and computed by the domestic credit provided to the private as a percentage of GDP.

FEC denotes fossil energy consumption, which is a fossil energy consumption measured as fossil fuel energy consumption as a percentage of energy consumed in total.

UP denotes the urban population as a percentage of the total population.

TO indicates the trade openness computed as a percentage of GDP.

According to the data availability, our sample contained data from 1976 to 2014 for Jordan. For the robustness checks, the period was extended to 1976-2018. All the variables were extracted from the World Development Indicators database of the World Bank. Table 1 displays the descriptive statistics of the variables for the main regression analysis.

All the variables used in the study are natural logarithm. Annual data from world development indicators taken for 1976 to 2018 for Jordan.

### 3.1. Data Estimation and Interpretation of Results

In equation I, the dependent variable log of carbon dioxide emission regressed on the log of economic growth and log of financial development along with the log of multiple control variables.

## 4. RESULTS AND DISCUSSION

The OLS approach employed and the results reported in Table 2 shows that the financial development growth positively and significantly influences carbon emission. The study coincides with the outcome reported by Xing et al. (2017). The availability of credit and financial resources promotes the buying of energy-consuming machinery and automobiles. The results show the insignificant impact of economic growth on carbon emissions. The current study finding results supported by Naceur and Omran (2008) that the economic growth not impacting the carbon emission as the country may lack in the development of the large manufacturing sector and the energy consumption may not increases as well. The effect of control variables on the environmental degradation as carbon emission s also comes insignificant.

### 4.1. Robustness Check with ARMAX and LAD

For testing the stationary of the study regression equation, two model robustness tests were utilized. The autoregressive-moving-average (ARMA) and least absolute deviation (LAD) methods were used in the study. The results show that the baseline aggression estimation was stationary concerning economic growth (Table 3). The second part of the ARAM with the moving average (MA) shows the model’s stationery as the AR root is >1 and the MA root is also 1>1 in absolute term. The ARMAX results depict somewhat the same as the OLS model. The result for the LAD method shows the same results for financial development. The results show a good fit of the model. The results provided in Table 4. The robustness test shows the OLS results that the FD remains significant for influencing the carbon emission, and other control variables are not significant.

**Table 1: Descriptive statistics of the study variable**

	Mean	Median	Std. dev.	Minimum	Maximum
l_FD	4.4165	4.2182	0.24270	3.3524	4.5053
l_EG	8.0107	8.0404	0.14947	7.6191	8.2426
l_FEC	4.5917	4.5903	0.01063	4.5643	4.6051
l_UP	4.3228	4.3597	0.13630	4.0602	4.5106
l_TO	4.7629	4.7634	0.14217	4.4048	5.0070
l_CO	1.0175	1.0833	0.23172	0.3295	1.2954

l\_FD: Log of financial development, l\_EG: Log of economic growth, l\_FEC: Log of fossil energy consumption, l\_UP: Log of Urbanization, l\_TO: Log of trade openness, l\_CO: Log of Carbon emissions

**Table 2: Ordinary least square regression: For the observation from 1976 to 2018 (t=39)**

Dependent variable: $\ln CO_2$				
	Coefficient	Std. error	t-statistic	P-value
C	-26.16590	16.2658	-1.609	0.1172
$\ln FD$	0.827647	0.13308	6.219	0.0000
$\ln EG$	0.034254	0.10381	0.3299	0.7435
$\ln FEC$	4.87116	3.19389	1.5250	0.1367
$\ln UP$	0.327830	0.47608	0.6886	0.4959
$\ln TO$	-0.060075	0.146412	-0.4403	0.6842
R-squared		0.861590	Adj R-squared	0.844765
Mean dependent variable		1.017503	SE dependent variable	0.231720
Sum squared resid.		0.275063	SE of regression	0.091298
F (5, 33)		49.83410	P-value	0.00000
Log-Likelihood		41.27054	Akaike Criterion	-70.54109
Schwarz Criterion		-60.55972	Hannan-Quinn	-66.95986
RHO		0.444297	Durbin-Watson	1.104800

$\ln FD$ : Log of financial development,  $\ln EG$ : Log of economic growth,  $\ln FEC$ : Log of fossil energy consumption,  $\ln UP$ : Log of Urbanization,  $\ln TO$ : Log of trade openness,  $\ln CO_2$ : Log of Carbon emissions

**Table 3: ARMAX Analysis, Using observation from 1976 to 2018 (t = 39)**

Dependent variable: $\ln CO_2$ ; Standard error based on Hessian				
	Coefficient	Std. error	Z-statistic	P-value
Constant	-16.6185	8.64473	-1.922	0.0546
Phi_1	0.931013	0.05720	16.27	0.000
Theta_1	-0.06499	0.14303	-0.4544	0.6495
$\ln FD$	0.727914	0.17391	4.185	0.0000
$\ln EG$	0.003816	0.13596	0.20807	0.9776
$\ln FEC$	1.39030	1.78171	0.7803	0.4352
$\ln UP$	1.11030	0.47062	2.359	0.0183
$\ln TO$	0.117565	0.09544	1.232	0.2180
Mean Dependent Variable		1.017503	SE Dependent Variable	0.231720
Mean of innovations		0.002646	SD of innovations	0.05519
Log-likelihood		41.23091	Akaike Criterion	-95.37945
Schwarz Criterion		-80.40739	Hannan-Quinn	-90.00760
	Real	Imaginary	Modulus	Frequency
AR				
Root 1	1.0741	0.000	1.0741	0.000
MA				
Root1	15.3847	0.000	15.3847	0.000

$\ln FD$ : Log of financial development,  $\ln EG$ : Log of economic growth,  $\ln FEC$ : Log of fossil energy consumption,  $\ln UP$ : Log of Urbanization,  $\ln TO$ : Log of trade openness,  $\ln CO_2$ : Log of Carbon emissions

**Table 4: LAD, using observation from 1976 to 2018 (t=39)**

Dependent variable: $\ln CO_2$				
	Coefficient	Std. error	t-statistic	P-value
$\ln FD$	0.980620	0.187868	5.220	0.000
$\ln EG$	0.0748582	0.1432336	0.5259	0.6024
$\ln FEC$	-0.039954	3.314512	-0.127	0.8997
$\ln UP$	-0.547607	0.327316	-1.673	0.1035
$\ln TO$	-0.226575	0.183517	-1.235	0.2254
Median Dependent Variable		1.083268	SD Dependent Variable	0.231720
Sum absolute Resid.		2.469087	Sum Sq. of Resid.	0.356670
Log-Likelihood		41.59608	Akaike Criterion	-73.19216
Schwarz Criterion		-64.87435	Hannan-Quinn	-70.20780
RHO			Durbin-Watson	0.412210

$\ln FD$ : Log of financial development,  $\ln EG$ : Log of economic growth,  $\ln FEC$ : Log of fossil energy consumption,  $\ln UP$ : Log of Urbanization,  $\ln TO$ : Log of trade openness,  $\ln CO_2$ : Log of Carbon emissions

## 5. CONCLUSION AND DISCUSSION

One crucial issue that needs attention in the literature is the impact of economic and financial development on environmental

degradation. The current study attempts to enhance environmental degradation literature that gets affected by economic growth and financial development. The study mainly investigated the role of economic growth and financial development in carbon emission



in Jordan by taking fossil energy consumption, urbanization and trade openness as control variables. The study results confirm the significant positive impact of financial development, on carbon dioxide emission, which is a proxy of environmental degradation, in Jordan. From the results of this study, Jordan's government has to make decisions that encourage renewable energy and green and sustainable investment in the country. This may be achieved by subsidizing the machinery that runs on renewable energy like electric cars, providing subsidies for solar energy for manufacturing and household use. The government can also direct or encourage the banks and other financial institutions to offer easy and subsidized loans to invest in capital projects based on renewable energy or promote renewable energy use. Shortly, the government of Jordan should encourage and support the green investment projects in Jordan. With the help of international institutions and donors, the government can foster different projects which minimize carbon emission and ultimately decrease environmental degradation.

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