INVESTIGATING THE CAUSAL RELATIONSHIP BETWEEN FINANCIAL DEVELOPMENT AND CARBON EMISSION IN THE EMERGING COUNTRY

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Abstract

The current study investigates the causality relationship between financial development and carbon dioxide (CO_2) emission in Bahrain by adopting time series data from 1980–2018. The vector error correction model (VECM) is employed as an appropriate model in order to analyse the data. While the augmented Dickey-Fuller (ADF) test was used in order to detect the stationary variables. However, the domestic per capita has been used as a proxy of economic growth, while financial development is measured by domestic credit provided by the financial sector. The results indicate that there is a long-term association amongst all intended variables at a 5% significant level. Meanwhile, only financial development has an impact on carbon emission in the short term. For the Granger causality test, only financial development and population led positive impact on CO_2, while carbon emission does not Granger-cause financial development and population. However, the study findings did not support the hypothesis of the environmental Kuznets curve (EKC), and these findings are in line with other previous empirical findings (Saidi & Mbarek, 2017). These findings are essential and contribute to policymakers controlling credit policies that confirm that the loans availed by the financial sector to the domestic firms are used as friendly machinery tools for the environment that can decrease CO_2 emission.

Keywords: Financial Development, CO_2, Bahrain, VECM, EKC

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1. INTRODUCTION

To ensure the sustainability of the economic growth and offering high standards of living, that demand to have a healthy financial development. However, the good health of financial development needs to explore the most factors that affect the financial development. One of the main factors that have been deemed to have an effect on financial development is carbon dioxide (CO_2) emission. However,

the association between financial development, economic growth, and CO_2 emission has been titled in several empirical pieces of research for the last few decades. The stability of the environment for a country is one of the key issues that help the country's economy to be developed. The threat of environmental alteration due to CO_2 emissions from fossil fuels is considered to be the crucial environmental threat from the current energy system (Balat, Balat, & Acici, 2003; Demirbas, Bozbas, & Balat, 2004). According to the World Bank (2017), CO_2 emissions are defined as those stemming from the burning of fossil fuels and the manufacture of cement. They comprise CO_2 produced during the consumption of liquid, solid, and gas flaring and gas fuels. Accordingly, when the country's population increases with highly using energy as a continuous globalization technology, this directly increases the CO_2 emission and adversely affects the pollution. On the other hand, the economic growth of countries drives a concentrated use of energy which results in growing CO_2 emissions, consequently, pollution is connected directly with financial development and economic growth (Kasperowicz, 2015). Sadorsky (2010) discussed that financial development influences energy demand as financial development has the power to drive economic growth in emerging economies.

Financial development rises carbon emission for different reasons; the first reason — a good financial system might effectively release the problem of asymmetric information, expand funding channels, to allow the firms to obtain lending funds with much lesser costs which facilitate their growth of the production scale (like, renting or buying more machines and equipment, purchase a new production line, and hiring more employees), and consequently, significantly raise CO_2 emission. The second reason — the development of the financial system might offer additional and better consumption credit service, which facilitates their intertemporal consumption and foster them to buy more commodities, such as automobiles, properties, and other electric devices. These would naturally endorse the expansion of social consumption and further rise of CO_2 emission. The third reason, — the capital market generally performs as an imperative index of economic development, the good performance of the stock market often indicates the fast growth and prosperity of the economy, which, in turn, greatly enriches the confidence of firms and customers and stimulates the activities of consumption and production, thus leading to the increasing energy consumption and CO_2. These can be called the "positive impact" of financial development on CO_2 emission (Sadorsky, 2010; Dogan & Turkekul, 2016; Nguyen & Ngoc, 2020).

As the importance of the CO_2 emission challenges around the world, some scholars intended in their studies to examine the impact of CO_2 emissions on the corporation's financial performance which is measured by return on assets (ROA), return on equity (ROE), and return on investment (ROI). They found that corporations with integrating green investment initiatives designed to lower CO_2 emission can reach a high level of financial performance and maximize the stockholders' wealth (Ganda & Milondzo, 2018).

However, different hypotheses have been developed to examine the linkage between environmental degradation and economic development. In this regard, the hypothesis of the environmental Kuznets curve (EKC) is considered one of the most famous hypotheses, and different previous studies have relied on this hypothesis. EKC proposes that there is a positive association between environmental degradation and economic growth. The current study will examine if the findings support the EKC hypothesis in the case of Bahrain.

Previous related empirical studies have confirmed that there is a significant relationship between financial development and carbon emission but the specific relationship is still disputed and needs more clarification (Jiang & Ma, 2019). Therefore, the value of the current research can be explained as follows. To the best of the authors' knowledge, this is the very first study implemented on Bahrain case to explore the relationships between financial development, economic growth, and carbon emissions using recent period, while previous studies considered to explain the relationship between selected macroeconomic variables with emission of CO_2. Moreover, the findings may offer a better understanding, a clear image with new evidence for policymakers, local and foreign investors, and alert regulators to some issues in the Bahrain case.

The rest of the current research paper is organized as follows. Section 2 displays the literature review. Section 3 describes the research methodology. Section 4 provides empirical results, and Section 5 outlines the conclusion.

2. LITERATURE REVIEW

2.1. Previous empirical studies

By using various econometrics techniques to evaluate the relationship between economic growth, financial development, and carbon emission, the EKC hypothesis was used in most of the previous studies (Jalil & Feridun, 2011; Farhani & Ozturk, 2015; Dogan & Turkekul, 2016; Saidi & Mbarek, 2017; Rahman, Murad, Ahmad, & Wang, 2020). However, the following displays different previous studies conducted implementing several econometric techniques in numerous countries to address and investigate it.

Empirically, several research papers explored the relationship between financial development, economic development, and CO_2 emission. Jiang and Ma (2019) studied the linkage between financial development and carbon emission in 155 countries using a generalized method of moments (GMM) from 1990 to 2014. Findings found that financial development increases significantly CO_2 emission in developing markets and developing countries. Meanwhile, there is an insignificant influence on financial development and CO_2 emission.

Using the autoregressive distributed lag (ARDL) approach, Ali et al. (2019) examined the influence of financial development growth, trade openness, energy consumption, and economic development on CO_2 emission for the period of 1971–2010. They found a co-integration relationship between variables in long run. However, economic growth, energy consumption, and financial development positively

influence CO_2 emission, while trade openness adversely influences CO_2 emission. Moreover, Abbasi and Riaz (2016) employed the ARDL approach to assessing the long-run relationship between carbon, a set of macroeconomic variables, financial variables, and carbon emissions, where the error correction model was used to capture the short-run relationship among the variables. The results indicated that the financial development played a role in emission mitigation only in the latter period where a greater degree of liberalization and financial sector development occurred. Accordingly, Asongu, El Montasser, and Toumi (2015) investigated the association between energy consumption, CO_2 emissions, and GDP in 24 African countries using the ARDL panel approach. Their results demonstrated that there is a long-term linkage between CO_2 emission, energy consumption, and GDP. Their findings also showed that there is a long-term influence from energy consumption to GDP and CO_2, apparently, with reciprocal paths. While, Saidi and Mbarek (2017) examined the influence of financial development, urbanization, trade openness, and income on CO_2 emissions for the number of developing countries using time series data for the period from 1990 to 2013. Findings displayed that there is a positive monotonic linkage between CO_2 emission and income. Thus, all models do not support the hypothesis of EKC. Moreover, the findings showed that financial development has an adverse long-term relationship with CO_2 emission, which means that financial development decreases environmental degradation. More recently, Tariq, Khan, and Rahman (2020) examined the relationship between financial development and economic growth in Pakistan using the threshold regression model for the period of 1980–2017. The result indicates that economic growth responds positively to financial development when the level of financial development surpasses the threshold value of 0.151. Also, Rahman et al. (2020) expand a study to contain four economic corridor countries BCIM-EC (Bangladesh–China–India–Myanmar) by applying two different analysis methods, time series, and panel data. The study attempts to evaluate the EKC hypothesis in the relationship among CO_2 emissions, GDP per capita, energy use, and trade openness. The findings were interesting with mixture signs, as the findings from panel data analysis confirmed a positive relationship among GDP per capita and energy consumption with CO_2 emission, and negative from a quadratic term of GDP in short-term. For the EKC hypothesis, the findings reported that there is only a short-term phenomenon in the paned data analysis. According to ARDL approach results, the EKC hypothesis exists in India and China, while the EKC hypothesis holds in Bangladesh and Myanmar with regard to disregarding breaks within the short-term.

Another study was conducted by Farhani and Ozturk (2015) who investigated the association between financial development, energy consumption urbanization, trade openness, GDP, the short-term and long-term relationship between the variables. Results of their analysis exposed a positive relationship for the coefficient of financial development, which implies that Tunisia's financial development has influenced the environmental pollution expense. The findings also revealed a positive association between GDP and CO_2 emissions. However, the findings did not support the hypothesis of EKC. However, Oudat, Ahmad, and Yazis (2015) implemented a study to explore the linkage between economic development and CO_2 emissions and the Islamic banking system using the ARDL approach, the results showed that there is a positive association between Islamic banking system energy consumption.

Dogan and Turkekul (2016) examined the linkage among financial development, urbanization, GDP, energy consumption, and CO_2 emission for the period from 1960 to 2010 in the USA using the ARDL method. They found that there is a co-integration among variables based on the bounds testing. The findings also confirmed a long-term association between urbanization and energy consumption and they increase environmental degradation, whereas financial development does not influence environmental degradation. Another important finding for this paper is that the study does not support the hypothesis of EKC for the USA case. Granger causality test outputs displayed that there is bi-directional causality between CO_2 emission and energy consumption; CO_2 emission and urbanization; CO_2 emission and GDP; trade openness and GDP, and urbanization and GDP; whereas no causality found among CO_2 emission and financial development, CO_2 emission, and trade openness.

Another study conducted by Islam, Ahmed, Saifullah, Huda, and Al-Islam (2017) to explore the influence of financial development and economic growth on CO_2 emission in developing economy, employed the ARDL model to investigate the correlation between intended variables. Their findings presented that only in the latter period, the financial variables affect the emission mitigation where a larger degree of liberalization and financial growth happened. Ozturk and Acaravci (2013) explored the linkage between CO_2 emission, trade openness, energy consumption, GDP, and Turkey's financial development for the period of 1960–2007. Empirical evidence confirms that trade openness drives carbon emissions, but financial development does not affect CO_2 emissions in the long term.

Shahbaz (2013) investigated the correlation between financial volatility and environmental degradation in Pakistan for the period from 1971 to 2009. The ARDL model was conducted to analyse the long-term connection, while the error correction model (ECM) is implemented to investigate the short-term association. The study results confirmed that there is a long-term connection between the intended variables, and financial volatility rises environmental degradation. Jalil and Feridun (2011) examined the influence of economic growth, financial development, trade openness, and energy consumption, on CO_2 emissions over the period from 1953 to 2006 in China. Employing the ARDL model, the results exposed an insignificant association between financial development and CO_2 emissions in the long run, whereas there is a significant linkage between economic development, energy consumption, trade openness, and CO_2 emissions. Moreover, the results confirmed and supported the hypothesis of EKC.

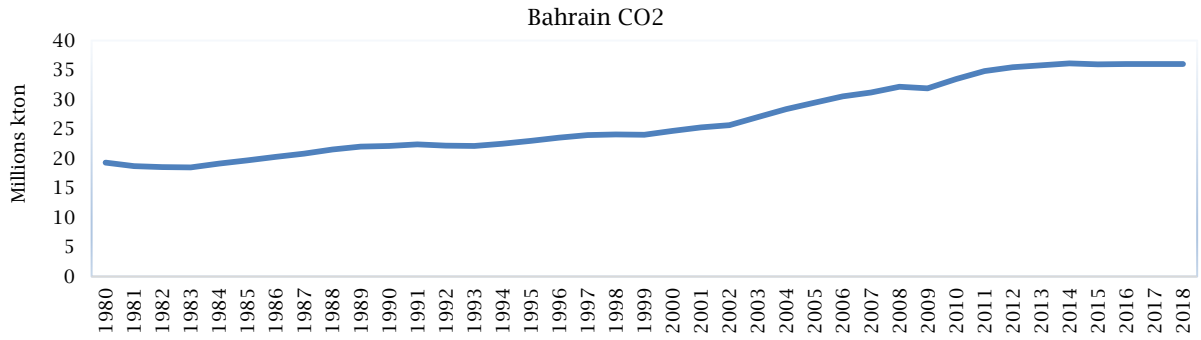
The previous studies have confirmed that there are conflicting results regarding analyzing the link between financial development and CO_2 emissions. This could add the importance of the current study

to fulfil apart from the literature in this field by inspecting the connotation between financial development and CO_2 emission in another emerging market.

2.2. Bahrain emission of CO_2

In Bahrain, the 2030 Economic Vision was launched in 2008 with the aim of comprehensive economic development, which includes the renaissance of the government sector alongside the private sector in order to raise the living standards of all Bahraini citizens. However, to reach the Economic Vision objectives, it is necessary to study economic development and financial development from different perspectives (Camba & Camba, 2020; Oudat, Hasan, & Alsmadi, 2020; Bui, 2020; Alsmadi & Oudat, 2019). The current study tries to contribute with others studies that could help the Bahrain government and policymakers to take advantage of their results. The main aim of this research is to examine the causality linkage between financial development and CO_2 emission in Bahrain. Figure 1 displays that Bahrain's CO_2 emission had an annual growth rate of 2% over the period of 1980–2018. From the figure, it clearly appears that the increase of CO_2 per capita amount in Bahrain from (19324327 kton) in 1980 to (36044319 kton) in 2018, the increasing change in CO_2 could affect positively or adversely the economic development and financial system development in Bahrain during this period.

Figure 1. Carbon emission in Bahrain for the 1980–2018 period



Source: World Bank (2018).

3. RESEARCH METHODOLOGY

To evaluate the relationship between economic growth, financial development, and CO_2 emissions, various econometrics techniques might be applying. However, as mentioned before, different studies used several methods such as time series and panel data analysis. Accordingly, the current study attempts to analyse the relationship between the selected variables by implementing time series analysis. Moreover, there are different models that might be used to analyse the relationships between the dependent and independent variables in time series data like vector autoregression (VAR), vector error correction model (VECM), and autoregressive distributed lag (ARDL) models. According to the unit root tests and lag length tests the appropriate model can be chosen among these models. According to the current study, the time series data (annually) for Bahrain from 1980 to 2018 is used. The data was gained from the World Bank. In this paper, CO_2 is expressed in metric tons per capita. Meanwhile, the economic growth measured by gross domestic per capita (GDPC), financial development for Bahrain measured by domestic credit provided by the financial sector (DCPS) and populations (POP). All dependent and independent variables are transformed to logarithmic procedures to address the heteroskedasticity issues and persuade stationarity in the variance-covariance matrix (Alghusin, Alsmadi, Alkhatib, & Alqtish, 2020; Mugableh & Oudat, 2018a; Ahmad, Yazis, & Oudat, 2015; Chang, 2010). Thus, the following equation was developed:

$$LCO2_t = \alpha_1 + \beta_1 LFD_t + \beta_2 LGDPC_t + \beta_3 POP_t + \varepsilon_t \quad (1)$$

The valuation procedure in this research containing four phases. The first phase is the unit root test which is implemented to examine the stationary level and first difference by using Akaike augmented Dickey-Fuller (ADF) test (Seddighi, 2011). Accordingly, the appropriate equation was developed as follows:

$$\Delta\gamma_1 = \beta_1 + \beta_2 + \varphi\gamma_{t-1} + \delta_i \sum_{i=1}^{j} \gamma X_{t-1} + \varepsilon_t \quad (2)$$

where γ is the dependent variable; Δ considered as the t time trend and the difference operator; ε is the error term, t is the time of trend, and the $(\beta_1, \beta_2, \delta_1 \ldots \delta_n)$ is a set of parameters to be evaluated. If the variable series is stationary and does not have a unit root, indicates acceptance of the alternative hypothesis (H_1). However, if the variable series is non-stationary and has a unit root, thus the null hypothesis (H_0) will be accepted.

Therefore, to simplify, the hypotheses formulation:

$$H_0: \theta = 0 \ (not\ stationary\ or\ exist\ of\ unit\ root\ test) \tag{3}$$

$$H_1: \theta \neq 0 \ (stationary\ or\ not\ exist\ of\ unit\ root\ test) \tag{4}$$

The second phase is to decide the maximum of lag selection by VAR model. There are five criteria utilized, i.e., Schwarz information criterion (SIC), Akaike information criterion (AIC), final prediction error criterion (FPE), sequential modified likelihood ratio (LR) statistic test, and Hannan-Quinn information criterion (HQC). Those criteria are probably not similar on the optimum lag selection, thus we take maximum lag selection by nominated of one or more criteria. The third stage is to test the existence of co-integration. The Johansen co-integration test (Johansen, 1988) is used to investigate the long-run association among research variables (Oudat, Alsmadi, & Alrawashdeh, 2019; Lee & Brahmasrene, 2018; Mugableh & Oudat, 2018b; Almsafir & Alsmadi, 2014). The test comprises dual statistic tests, i.e., trace statistics and maximum eigenvalue test. The equation for the Johansen co-integration test is as follows:

$$Y_t = \alpha_1 + \alpha_2 X_t + \varepsilon_t \tag{5}$$

And the residual equation is:

$$\widehat{\varepsilon_t} = Y_t - \widehat{\alpha_1} - \widehat{\alpha_2}\, X_t \tag{6}$$

Furthermore, when it is confirmed that there is co-integration among the variables, then VECM will be implemented and Granger causality test in the last phase. The following VECM is estimated as follows:

$$\Delta Y_t = \beta_0 + \sum_{i=1}^{p} \beta_i \Delta Y_{t-i} + \sum_{j=1}^{p} \beta_j \Delta x_{t-j} + \mu_1 ECT_{t-1} + \varepsilon_{1t} \tag{7}$$

$$\Delta x_t = \gamma_0 + \sum_{i=1}^{p} \gamma_i \Delta Y_{t-i} + \sum_{j=1}^{p} \gamma_j \Delta x_{t-j} + \mu_2 ECT_{t-1} + \varepsilon_{2t} \tag{8}$$

where ECT_{t-1} is the lagged residual from co-integration between variables in level. Engle and Granger (1987) point out that when the variables are co-integrated, there exists the error correction term (ECT), indicating that if changes on the predicted variable are a function of disequilibrium level in the co-integrating association as taken by the *ECT*.

4. EMPIRICAL RESULTS

Table 1 displays the findings of the unit root test (ADF) for all selected variables. The result indicates that selected variables are not significant at level, which they have unit root test for both intercepts with and without trends. However, when we converted to the first difference, all intended variables are stationary at a 1% significance level except the CO_2 is stationary at a 5% significance level. This result considers that we can proceed on Johansen co-integration to check the long-term connection among all intended variables. In this regard, the VAR model is used to determine the optimum lag selection for the equation model.

Table 1. Unit root test for variables

Variable	*Level*		*1st difference*	
	Intercept	*Intercept and trend*	*Intercept*	*Intercept and trend*
LCO2	-905560 (0.7753)	-1.902643 (0.6330)	-4.123674*** (0.0027)	-3.954429** (0.0194)
LGDPC	-2.824108 (0.0646)	-1.667536 (0.7449)	-7.424177*** (0.0000)	-6.557643*** (0.0000)
LFD	-0.206276 (0.9291)	-2.097249 (0.5307)	-5.000679*** (0.0002)	-5.035795*** (0.0013)
POP	-0.859233 (0.7902)	-2.143722 (0.5059)	-6.239159*** (0.0000)	-6.172230*** (0.0001)

*Note: ***, **, * indicate significance at 1%, 5%, and 10% levels, respectively.*

Table 2 represents the optimum lag selection results. It can be seen from the table, the Akaike information criterion suggests the optimal lag length is three. However, sequential modified LR statistic test, FPE, and HQC suggest the optimum lag selection is two lags. Meanwhile, SIC recommends the optimum lag selection is one lag length. Based on those results, we selected AIC as commonly used, which lag length selected was three. Thus, we can proceed on a co-integration test.

Table 2. Lag length selection results

Lag	*LR*	*FPE*	*AIC*	*SIC*	*HQC*
0	NA	0.000173	2.688999	2.864945	2.750409
1	268.1432	7.42e-08	-5.071894	-4192161*	-4.764843
2	33.41306*	5.43e-08*	-5.420526	-3.837007	-4.867835*
3	21.27470	5.75e-08	-5.456623*	-3.169318	-4.658293

*Note: * indicates lag order selected by the criterion.*

Table 3 reveals the findings of the co-integration test based on trace stat and maximum eigenvalue statistics. It can be seen that the suggestion number of the co-integration equation in the VECM is three. The result mentioned that two co-integrating equations are found at a 5% level. Co-integration results display a linkage between economic growth, financial development, and population with CO_2 emissions in the long run. However, co-integration cannot determine the direction of the associations. Thus, the Granger causality test is adopted to investigate the causality association among variables.

Table 3. Co-integration test results

Rank	*Max. eigen. statistic*	*Critical value (eigen.) at 5%*	*Trace statistics*	*Critical value (trace) at 5%*
None*	32.18161	27.58434	64.01808	47.85613
At most 1*	20.93288	21.13162	31.83648	29.79707
At most 2	5.954541	14.26460	10.90360	15.49471
At most 3	4.949059	3.841466	4.949059	3.841466

*Note: * denotes rejection of the hypothesis at the 0.05 level.*

Table 4 presents the result for short-term VECM. The parameter of error correction is adversely and statistically significant at a 5% level in the model below. The ECT confirms that carbon emission will congregate towards its long-run equilibrium after modification in the economic growth, financial development, and population. The result on VECM also indicates that if a dependent variable changes, it will affect in the short run independent variables. Moreover, only financial development does affect the carbon emission, but the economic growth and population do not affect the carbon emission in Bahrain. This means that the results have not propped the EKC hypothesis, which proposes a positive association between economic growth and environmental degradation. These findings are consistent with those from Saidi and Mbarek (2017), Dogan and Turkekul (2016), Ozturk and Acaravci (2013). The findings indicate that financial development decreases CO_2 emissions in Bahrain's environment. However, to preserve the ecosystem, the decision-makers in Bahrain should follow the financial development from different perspectives and introduce the modern technological variables into the financial system which leads to more development for this sector.

Table 4. Short-run VECM

Variable	*Coefficient*	*t-statistic*	*Prob.*
ΔLCO2	0.09103	0.4431	0.662
ΔLGDPC	-0.0082	-1.6097	0.122
ΔLFD	-0.0848*	-1.9085	0.0701
ΔPOP	-0.0007	-1.4342	0.1662
ECT (-1)	-0.1809**	-2.1978	0.0393

*Note: *, **, and *** denote statistical significance at 10%, 5%, and 1% level, respectively.*

Table 5 indicates the Granger causality test which determines the causal link between two factors. If the F-statistic is below the F-critical, that means that there is no Granger-cause between both variables. For the correlation with carbon emission as a dependent variable, the result found financial development has a short-run causal relationship with carbon emission at a 1% significance level, while the population is Granger-cause to carbon emission on a significant level of 5%. For the correlation with economic growth, financial development, and population as the dependent variables, it is found no independent variables are Granger-cause to the dependent variable. For the long-run causality, it is confirmed that the existence of co-integration association that statistically significant at a 5% level only for carbon emission as a dependent variable.

Table 5. Granger causality Wald test

Dependent variable	*Short-run causality (Wald test)*					*Long-run causality*
	ΔLCO2	*ΔLGDPC*	*ΔLFD*	*ΔPOP*	*All*	ECT_{t-1}
ΔLCO2	-	5.614612 (0.1319)	17.03089*** (0.0007)	8.280058** (0.0406)	33.19078*** (0.0001)	-0.1089** [-2.198]
ΔLGDPC	3.311457 (0.3461)	-	2.976778 (0.3952)	1.936902 (0.5856)	6.301844 (0.7094)	-0.31027 [-1.45071]
ΔLFD	1.325008 (0.7232)	3.949550 (0.2670)	-	0.095206 (0.9924)	6.541520 (0.6847)	0.31261 [0.88469]
ΔPOP	0.476918 (0.9239)	3.11508 (0.3749)	0.314248 (0.9573)	-	5.349248 (0.8029)	-30.0695 [-1.47794]

*Notes: The values in [] and () are t-statistic and p-value, respectively. *, **, and *** denote the significance at 10%, 5%, and 1% level, respectively.*

5. CONCLUSION

The current research inspects the causality association among financial development, economic growth, and carbon emissions in the case of an emerging country (Bahrain) using annual time series data from 1980 to 2018. Overall, there are four stages for the estimation procedures. First, the ADF test is employed to inspect the stationary of study data. Once the result is confirmed on the first difference, then we proceed to find the optimum lag length selection. In the third step, the Johansen test was used to check the co-integration between variables. However, in the final step, the Granger causality (Wald test) based on VECM was adopted to define the causal relationship between variables in both the short term and long term.

Based on the current research analysis results, it can be summarized that the dependent and independent variables were stationary at a 1% significant level on the first difference. The findings reported that there is a co-integration between economic growth, financial development, and population with CO_2 emissions in long run at a 5% significant level. However, the ECT results confirmed that carbon emission will congregate towards its long-run equilibrium after modification in the economic growth, financial development, and population. Moreover, the result traced from VECM also indicated that if a dependent variable changes it will affect in the short run independent variables. The findings also showed that not only financial development does affect carbon emission, but the economic growth and population do not affect the carbon emission in the case of Bahrain. Therefore, the findings outlined from the Granger causality test, stated that financial development and population led to a positive impact on carbon emission, while carbon emission does not Granger-cause financial development and population. The findings of the current research paper provide a clear image of the relationship between financial development, economic growth, and CO_2 emissions which may be helpful for policymakers in Bahrain government and corporations, local and foreign investors.

However, there are some limitations for the current research paper which can be drawn as follows. The study considered to assess the relationships between the selected variables represented by emission of CO_2, GDP, domestic credit provided by the financial sector and populations, while the study did not use other important factors like foreign direct investment, inflation rate, money supply rate, and corporation's financial performance. Furthermore, the current study adopted time series data by employed the VCEM model with focusing on only one emerging country (Bahrain). It is, however, highly recommended that future studies should contain other variables to explore the relationship with emission of CO_2, using another analysis method like the ordinary least square method (OLS) or panel data framework. Other studies might be useful by doing a comparison between Gulf Cooperation Council Countries (GCC) employing the GMM model. Other further research may consider explaining the linkage between the emission of CO_2 and corporation's financial performance measuring through ROA, ROE, and ROI in the emerging countries context.

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