Financial development, economic growth, and environmental degradation nexus in ASIAN emerging markets

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Abstract: Environmental degradation is one of the major problems in the world recently and one of the United Nations' (UN) sustainable development goals (SDGs). Emerging markets countries that have become major players in the global economy and the main source of world economic growth have great potential to contribute the environmental degradation due to increased economic activities. This paper investigates the impact of financial development and economic growth on environmental degradation in Asian emerging markets. A panel environmental degradation model using financial development from banking sector and capital market sector, economic growth, Foreign Direct Investment (FDI), and urbanization variables that are major determinants of CO_2 emission as a proxy of environmental degradation. The periods considered were 1980 – 2018 for banking model, and 1996 – 2018 for financial sector model (banking sector and capital market sector). A panel data approach applied such as cross-section dependence, panel unit root, panel cointegration, Fully Modified OLS (FMOLS) and Dynamic Ordinary Least Square (DOLS). The empirical finding revealed that in Asian emerging markets there is positively long-term relationship between financial development from banking model with environmental degradation. Nevertheless, we do not find any long-term relationship between financial development from financial sector model with environmental degradation. Moreover, the quadratic negative signed for economic growth showed the existence of Environmental Kuznets Curve (EKC).

Keywords: financial development, environmental degradation, CO_2 emission, economic growth, EKC

JEL Classification: E44, G21, O44, Q01, Q50

1. INTRODUCTION

In this era of rapid development, the world has faced environmental problems which are one of the focuses of sustainable development, and its increasingly impact on climate change. One of the main causes of climate change is pollution from massive energy consumption. Energy consumption contributes to CO_2 emission as a result of economic activities that began from industrial revolution period. As an international response to overcome environmental degradation, United Nations Framework Convention on Climate Change (UNFCCC) was founded in 1992, agreed in principle to a range of policies known as the Kyoto Protocol in 1997 and Paris Agreement in 2015. They are intended to reduce countries' CO_2 emissions by 2% compared to early industrial revolution period.

Emerging markets economies, countries with low or medium income and high potential growth of economic, are one of parties who co-signed Paris Agreement. Indonesia, Malaysia, Philippines,

Thailand, China, and India, included as Asian emerging markets also signed that agreement. As major players in the global economy and the main source of world economic growth, Asian emerging markets deal with huge challenges for committing CO_2 emission reduction. Based on globalcarbonatlas.org data in 2018, China was the first biggest emitter of CO_2 emission world ranking. Other Asian emerging markets, India and Indonesia were the third and the tenth of CO_2 emission world ranking. By signing Paris Agreement, Asian emerging markets committing the reduction of CO_2 emission as well as supporting other climate change actions, including adaptation to domestic and international climate change that have an impact on environmental degradation.
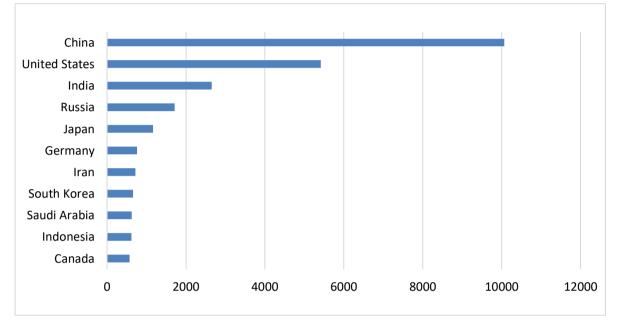

Figure 1. CO_2 emission world ranking, 2018
Source: globalcarbonatlas.org, 2018

In accordance with the Environmental Kuznets Curve (EKC) hypothesis, environmental degradation increases at the beginning of economic phase and at one level point of income, economic growth will lead to environmental improvement (Stern, 2004). Gross Domestic Product (GDP) or Per Capita GDP, which will vary for different indicators, is used as an axis in EKC as a proxy of economic growth. GDP calculation is inseparable from the contribution of all economic sectors in a country.

Capital is one of primary needed for all economic sectors to produce goods and services. Capital can be obtained from financial sector as an intermediary institution. Commonly, a major financial sector in countries is banking sector. In Indonesia, 74% of financial service's total asset is on banking sector (OJK, 2016). Moreover, capital market also is considered for obtaining capital. Thus, a better financial development leads to economic growth. On the other side, financial development also triggers environmental degradation because financial development alleviates the credit constraints, facilitate investment, helps the economic output to expand which results in more energy consumption and higher CO_2 emission (Abassi & Riaz, 2016).

One kind of investment that has received more attention from the government is Foreign Direct Investment (FDI). In addition to improving the economy, FDI is expected to provide technological advances that can increase effectiveness and efficiency in the industrial sector. Nevertheless, FDI can affect increasing of environmental degradation (Sadorsky, 2010; Abassi & Riaz, 2016). Environmental degradation is also factored by size of population. However, the increasing of population highly triggers energy consumed which also results in environmental degradation. China, India, Indonesia as Asian emerging markets are the first, second, and fourth largest population in the world. On their average, 49,50% of the population lives in urban areas and 50,50% live in rural areas. The population in urban areas is increasing every year, although the rate

of urbanization shows a decreasing trend. Moreover, urbanization will affect the increase of CO_2 emissions from supporting facilities' construction and energy consumption.

From an empirical point of view, several environmental literature studies have received considerable attention to the relationship between financial development, economic growth, and environmental degradation. Moreover, most previous studies show mixed results, so it can not provide a robust result to make policy recommendations that can be applied across countries. Therefore, this paper proves further light on the robustness relationship between financial development, economic growth, and environmental degradation and also contributes to the empirical literature by employing Fully Modified OLS (FMOLS) and Dynamic OLS (DOLS) approaches to complement the previous research analysis techniques that have also been carried out using other analytical techniques in Asian emerging markets. Furthermore, FMOLS and DOLS are considered to cover the shortcomings of the usual biased and inconsistent OLS method.

2. LITERATURE REVIEW

Highly correlated with capital flows in financial institutions, capital markets and Foreign Direct Investment (FDI), financial development can be broadly defined as financial depth, financial size, financial efficiency, financial openness, financial structure, financial growth, and financial ecology (Chang, 2015). Financial development directly affects the economic growth by credit services and investment given to increase consumption and goods and services produced. It's also considered to have a positive role to increase environmental quality by reducing CO_2 emissions through credit services and investment that support of environmentally friendly technology for both industries and households (Shahbaz, Tiwari, & Nasir, 2013; Shahbaz, et al., 2013). As the consequences, financial development increasing the consumption of energy that trigger CO_2 emissions (Sadorsky, 2010; Boutabba, 2014; Acheampong, 2019; Nasir, Huynh, & Tram, 2019). The difference of empirical results bring this study to investigate the robustness of the relationship between financial development and environmental degradation.

Furthermore, relationship between economic growth and environmental degradation also have much debate in empirical study previously. One school said that economic growth cause environmental degradation, other said that economic growth reduce environmental degradation. These closely related to Environmental Kuznets Curve (EKC) hypothesis. On the early stage of economic growth, a positive relationship with environmental degradation does exist. It's usually called pre-industrial economy stage. Then, when countries achieved higher level of economic stage, environmental outcomes becomes important (Omri, 2015). Thus, higher economic growth will decrease environmental degradation. In other words, at post-industrial economy stage, the economy has shifted towards a green economy.
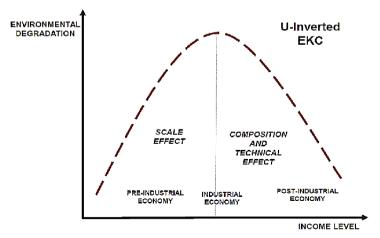

Figure 2. Environmental Kuznets Curve
Source: Halkos (2003)

One of another correlated with financial development is FDI. FDI are considered to trigger environmental quality with increasing country's productivities and deliver low carbon technology. However based on empirical result, FDI can afford the contrast result (Nasir, Huynh, & Tram, 2019). Asian emerging markets are one of mainly attract destination to home countries for FDI. The objectives are home countries can extended the market reach or by providing a global supply base and the lower cost of labours and capital resources in emerging markets are considered.

Next in literature previously, urbanization also affect the environmental degradation. Urbanization is triggered by infrastructure development and a fast growing economy in urban such as education and health centre. However, all these facilities contribute to increased CO_2 areas, so that it also has an impact on increasing the development of other supporting facilities emissions which can increase environmental degradation (Muhammad, 2020).

3. MATERIALS AND METHODS

This paper analyzes the relationship between financial development, economic growth, and environmental degradation in Asian emerging markets. These are Indonesia, Malaysia, Thailand, Philippines, China, and India based on International Monetary Fund (IMF), FTSE Russel, MSCI, and S&P Dow Jones Indices. Pakistan was not included to the list because it was recently categorized as emerging markets in 2017 by MSCI.

For represent the influence of each financial development, this paper employs two empirical model. First, banking model is from 1980 – 2018 including all the variables unless financial development from capital market sector. Second, financial sector model consist of both banking sector and capital market sector is from 1996 – 2018 including all the variables.

We employ panel data approach such as cross-section dependence, panel unit root, panel cointegration, Fully Modified OLS (FMOLS) and Dynamic Ordinary Least Square (DOLS). The FMOLS and DOLS estimation are considered very efficient in overcoming the endogeneity between the regressors and the serial correlation on errors. The FMOLS estimation uses a non-parametric approach to solve endogeneity and autocorrelation problems, while the DOLS estimation uses a parametric approach by including lag and lead from the explanatory variables (Kao & Chiang, 2000).

Thus, FMOLS and DOLS are considered to cover the shortcomings of the usual biased and inconsistent OLS methods also can control heterogeneity in long-term equilibrium relationship and panel cointegration. Therefore, for long-run equilibrium estimation, the empirical equation is specified as follows:

Banking model

$$LnCO_{2\,it} = \alpha_0 + \alpha_1 DCP_{it} + \alpha_2 LnGDP_{it} + \alpha_3 LnGDP_{it}^2 + \alpha_4 FDI_{it} + \alpha_5 LnUrb_{it} + \mu_{it} \quad (1)$$

Financial sector model

$$LnCO_{2\,it} = \beta_0 + \beta_1 DCP_{it} + \beta_2 SMT_{it} + \beta_3 LnGDP_{it} + \beta_4 LnGDP_{it}^2 + \beta_5 FDI_{it} \quad (2)$$
$$+ \beta_6 LnUrb_{it} + \varepsilon_{it}$$

Where:
$LnCO_2$ = Natural logarithm of CO_2 emissions ($MtCO_2$/million tones CO_2)
DCP = Domestic credit to private sector by banks (% GDP)
SMT = Stock market turnover (%)
$LnGDP$ = Natural logarithm of real GDP (constant 2010 US$)
$LnGDP^2$ = Square of Natural logarithm of real GDP (constant 2010 US$)
FDI = Foreign direct investment, stock inward (% GDP)
$LnUrb$ = Natural logarithm of urban population (% total population)
α_0 / β_0 = intercept
$\alpha_{1-5} / \beta_{1-6}$ = coefficient
μ / ε = error term
i = sample country
t = period of time

4. RESULTS AND DISCUSSION

4.1. Descriptive statistics

The Table 1 below shows the characteristics of the dataset used. The average LnCO2 of the sample on the studied period is 5,72. The average minimum value of this indicator is recorded in Philippines 3,329) while the maximum value is in China (9,21). As far as the ratio of credit to the private sector by banks in GDP is concerned, we can notice that Thailand records the maximum value (166,504) while Indonesia holds the lowest value (9,528). Moreover, the stock market turnover ratio shows the best results for the benefit of China (482,302) while Thailand has the lowest value (6,900). As a result, there is not a specific country in Asian emerging markets that holds the lower financial development indicator for affecting environmental degradation.

Table 1. Descriptive statistics of the model variables

Variable	LnCO2	DCP	SMT	LnGDP	LnGDP^2	FDI	LnUrb
N	234	234	138	234	234	234	234
Mean	5,724	66,615	72,738	26,663	712,370	16,051	11,103
Std. Dev.	1,563	40,815	69,596	1,213	66,705	13,491	1,356
Min	3,329	9,528	6,900	24,547	602,552	0,249	8,666
Max	9,217	166,504	482,302	30,010	900,619	62,438	13,638
Variance	2,442	1665,853	4843,586	1,471	4317,129	181,996	1,839
Skewness	0,546	0,519	2,404	0,679	0,787	1,102	0,226
Kurtosis	2,381	2,031	11,497	3,059	3,255	3,560	1,771

Source: Author calculation

4.2. Cross-section Dependence Test

Cross-sectional dependence is one of the most important diagnostics that a researcher should investigate before performing a panel data analysis. This paper employs Pesaran (2004) CD test, Frees (1995) test, Friedman (1937) test, and Breusch and Pagan (1980) LM test. For a detailed explanation of the tests and the findings were reported in Table 2.

Table 2. Cross-section dependence test

Banking Model

Test	Parameter	Prob.	Results
Pesaran CD	-1,111	0,267	Failed to reject null hypothesis
Frees	0,556*	0,000	Reject null hypothesis at 1%
Friedman	26,585	0,000	Reject null hypothesis at 1%
Breusch Pagan LM	68,107	0,000	Reject null hypothesis at 1%

Financial Sector Model

Test	Parameter	Prob.	Results
Pesaran CD	-0,178	0,859	Failed to reject null hypothesis
Frees	0,350	0,000	Reject null hypothesis at 1%
Friedman	21,978	0,001	Reject null hypothesis at 1%
Breusch Pagan LM	34,357	0,001	Reject null hypothesis at 1%

Source: Author calculation

The result from Table 2 shows that the null of "no cross-sectional dependence" is rejected at 1% level of significance according to Frees (1995) test, Friedman (1937) test, and Breusch and Pagan (1980) LM test both banking model and financial sector model. Nevertheless, Pesaran (2004) CD test failed to reject null hypothesis both banking model and financial sector model. Thus, we need to proceed with tests and estimation techniques that can take account of cross-sectional dependence.

4.3. Panel Unit Root Test

Next for panel cointegration analysis, we investigate panel unit root test for stationary. This empirical work uses both the first and second-generation test for panel unit root test. We employ Levin, Lin and Chu (2002) known as LLC as first generation for panel unit root test and Pesaran (2006) known as cross-sectionally augmented IPS (CIPS) as second generation for panel unit root test. The consideration of these test because the result from cross-sectional dependence test shows the existence of cross-sectional dependence and not.

Table 3. Panel unit root test

Banking Sector Model

Variable	Test	Level	First Difference	Result
LnCO2	CIPS	-2,149	-5,072	Stationary at first difference with 1% level of significance
	LLC	0,000	-9,322	Stationary at first difference with 1% level of significance
DCP	CIPS	-2,284	-5,346	Stationary at first difference with 1% level of significance
	LLC	-0,151	-8,955	Stationary at first difference with 1% level of significance
Ln GDP	CIPS	-0,745	-4,169	Stationary at first difference with 1% level of significance
	LLC	1,728	-6,187	Stationary at first difference with 1% level of significance
LnGDP2	CIPS	-0,951	-4,183	Stationary at first difference with 1% level of significance
	LLC	2,424	-5,793	Stationary at first difference with 1% level of significance
FDI	CIPS	-1,362	-4,914	Stationary at first difference with 1% level of significance
	LLC	-0,753	-9,652	Stationary at first difference with 1% level of significance
LnUrb	CIPS	-1,163	-3,060	Stationary at first difference with 1% level of significance
	LLC	0,981	-3,792	Stationary at first difference with 1% level of significance

Financial Sector Model

Variable	Test	Level	First Difference	Result
LnCO2	CIPS	-1,149	-4,194	Stationary at first difference with 1% level of significance
	LLC	1,632	-7,813	Stationary at first difference with 1% level of significance
DCP	CIPS	-2,134	-4,577	Stationary at first difference with 1% level of significance
	LLC	-2,705	-7,527	Stationary at level with 5% level of significance
SMT	CIPS	-3,639	-5,519	Stationary at level with 1% level of significance
	LLC	-2,079	-10,028	Stationary at level with 5% level of significance
Ln GDP	CIPS	-1,342	-3,858	Stationary at first difference with 1% level of significance
	LLC	3,232	-8,596	Stationary at first difference with 1% level of significance
LnGDP2	CIPS	-1,412	-3,848	Stationary at first difference with 1% level of significance
	LLC	3,667	-7,822	Stationary at first difference with 1% level of significance
FDI	CIPS	-1,504	-4,382	Stationary at first difference with 1% level of significance
	LLC	-0,947	-9,973	Stationary at first difference with 1% level of significance
LnUrb	CIPS	-0,598	-3,178	Stationary at first difference with 1% level of significance
	LLC	1,734	-3,451	Stationary at first difference with 1% level of significance

Source: Author calculation

The results from LLC as first generation for panel unit root test are reported in Table 3. From banking model indicate that LnCO2, DCP, LnGDP, LnGDP^2, FDI, and LnUrb contain unit root at their level but become stationary at their first differences. A little different with banking model, on financial sector model indicate that $LnCO_2$, LnGDP, LnGDP^2, FDI, and LnUrb become stationary at their first differences, but DCP and SMT stationary at their level. The second generation for panel unit root test applied is CIPS. The result in Table 3 indicate that for banking model, LnCO2, DCP, LnGDP, LnGDP^2, FDI, and LnUrb contain unit root at their level but become stationary at their first differences. Meanwhile for financial sector model, LnCO2, DCP, LnGDP, LnGDP^2, FDI, and LnUrb also stationary at their first differences, but only SMT stationary at their level. Because this result supports evidence for a possible cointegration relationship between the financial development, economic growth, and environmental degradation, this study applies panel cointegration tests that

requires checking whether there exists a cointegration relationship.

4.4. Panel Cointegration Analysis

This study searches for possible cointegration relationship between the analyzed variables in banking model and financial sector model. The approach from cointegration test for panel data employs residual-based tests are Pedroni (1999) and Kao (1999), and Westerlund (2007) for error correction-based test which allows the existence of cross-sectional dependence. The null hypothesis postulates that there is no co-integration in all tests. The result of panel cointegration test is specified in Table 4.

Table 4. Panel cointegration test

Panel cointegration test – Pedroni

Test-Statistics	Banking Model		Financial Sector Model	
	Statistic	p-value	Statistic	p-value
Modified Phillips-Perron	1,544*	0,061	2,850***	0,002
Phillips-Perron	-2,299**	0,011	-4,089***	0,000
Augmented Dickey-Fuller	-1,537*	0,062	-4,049***	0,000

Panel cointegration test-Kao

Test-Statistics	Banking Model		Financial Sector Model	
	Statistic	p-value	Statistic	p-value
Modified Phillips-Perron	1,527*	0,063	-3,026***	0,001
Phillips-Perron	-1,330*	0,092	-2,204**	0,014
Augmented Dickey-Fuller	-1,537*	0,051	-2,990***	0,001
Unadj. modified Dickey-Fuller	-1,588*	0,056	-3,070***	0,001
Unadjusted Dickey-Fuller	-1,357*	0,087	-2,218**	0,013

Panel cointegration test-Westerlund

Test-Statistics	Banking Model		Financial Sector Model	
	Statistic	p-value	Statistic	p-value
Variance ratio	-1,295*	0,0978	-1,331*	0,092

*p<0,10; **p<0,05; ***p<0,01

Source: Author calculation

For the result above, the majority of tests indicate rejection of the null hypothesis. It is clearly seen that in Pedroni (1999) both banking model and financial sector model show rejection of the null hypothesis of no cointegration. These models are cointegrated with respect to the all of the test statistics. The second panel cointegration test, Kao (1999), has similar test similar procedure as the Pedroni test but includes cross-homogeneous coefficients on the first-stage regressors while Pedroni is applicable for heterogeneous panels. Both banking model and financial sector model show a cointegration relationship between the analyzed variables in all of the test statistics.

Last cointegration test used in this research is Westerlund (2007) which is considered to be allowing for cross-sectional dependence. The result show both banking model and financial sector model have cointegration relationship for all panels. Based on these cointegration tests, we conclude a robustness cointegration between financial development, economic growth, and environmental degradation.

4.5. Long-run Estimation: Fully Modified Ordinary Least Square (FMOLS) & Dynamic Ordinary Least Square (DOLS)

After we find that variables on banking model and variables on financial sector model are cointegrated, to further explore the long–run estimation we employ both Fully Modified Ordinary Least Square (FMOLS) and Dynamic Ordinary Least Square (DOLS)**.** Panel DOLS and FMOLS estimator eliminate the endogeneity and autocorrelation problems between independent variables and error term and produce effective results. The output of FMOLS and DOLS for banking model are given in

Table 5.

Table 5. Panel Cointegration Estimation – Banking model

Estimation of cointegrating relationship by FMOLS – Banking model

Dependent Variable = LnCO2

Variable	Coefficient	Std Error	t-statistic	Prob
Constant	-53,402***	16,440	-3,248	0,001
DCP	0,013***	0,001	9,369	0,000
LnGDP	3,338***	1,216	2,745	0,006
LnGDP^2	-0,057***	0,022	-2,610	0,009
FDI	-0,001	0,005	-0,191	0,848
LnUrb	0,886***	0,113	7,821	0,000
R-Squared	0,684			
Adj. R-squared	0,677			

Estimation of cointegrating relationship by DOLS – Banking model

Dependent Variable = LnCO2

Variable	Coefficient	Std Error	t-statistic	Prob
Constant	-62,034**	24,899	-2,491	0,013
DCP	0,013***	0,002	6,616	0,000
LnGDP	3,984**	1,842	2,162	0,031
LnGDP^2	-0,069**	0,033	-2,079	0,038
FDI	0,000	0,007	0,017	0,986
LnUrb	0,879***	0,169	5,200	0,000
R-Squared	0,977			
Adj. R-squared	0,975			

*p < 0,10; ** p < 0,05; *** p < 0,01
Source: Author calculation

As shown in Table 5, the FMOLS and DOLS for banking model results indicate that there is a significant positive relationship between financial development from banking sector (DCP) and environmental degradation (LnCO2), economic growth (LnGDP) and environmental degradation (LnCO2), and urbanization (LnUrb) and environmental degradation (LnCO2). It means 1% increasing of each DCP, LnGDP, and LnUrb trigger 0,013%, 3,338%, and 0,886% the increasing of LnCO2 for FMOLS and 0,013%, 3,984%, and 0,879% for DOLS. LnGDP obtains the highest coefficient among them. It means economic activities yield more CO_2 emissions than granting credit to private sector and urbanization activities. The quadratic negative signed for economic growth (LnGDP2) showed the existence of Environmental Kuznets Curve (EKC). Furthermore, Foreign Direct Investment (FDI) doesn't affect to environmental degradation (LnCO2).

In financial sector model, we add stock market turnover as a proxy of financial development from capital market sector and use reduced sample period for 1996 – 2018. Table 6 below shows the long–run estimation results among financial sector model's variables. For FMOLS and DOLS estimation, we find that financial development from banking sector (DCP), economic growth (LnGDP), and urbanization (LnUrb) have a significant positive relationship with environmental degradation (LnCO2). It means 1% increasing of DCP, LnGDP, LnUrb trigger 0,010%, 6,451%, 0,553% the increasing of LnCO2 for FMOLS and 0,010%, 6,564%, and 0,551% for DOLS. The results FMOLS and DOLS obtained are currently the same as the estimation results in the banking model previously. Stock market turnover (SMT) as the main highlighted variable in financial sector model, it even has an insignificant relationship with environmental degradation. It is indicated from its p-value that is greater than 0,10. Beside SMT, FDI also has an insignificant relationship with LnCO2. Just like banking model's estimation result, in financial sector model's estimation result also reflect the existence of EKC. It is indicated from the coefficient's negative sign of the quadratic term of economic growth (LnGDP2). From these estimation result, banking model and financial sector model, we can conclude that in general both FMOLS and DOLS give the similar result.

Table 6. Panel Cointegration Estimation – Financial sector model

Estimation of cointegrating relationship by FMOLS – Financial sector model

Dependent Variable = LnCO2

Variable	Coefficient	Std. Error	t-statistic	Prob
Constant	-97,257***	17,483	-5,564	0,000
DCP	0,010***	0,001	8,068	0,000
SMT	0,001	0,001	1,560	0,119
LnGDP	6,451***	1,282	5,032	0,000
LnGDP2	-0,107***	0,023	-4,571	0,000
FDI	0,002	0,004	0,573	0,567
LnUrb	0,553***	0,112	4,927	0,000
R-Squared	0,973			
Adj. R-squared	0,972			

Estimation of cointegrating relationship by DOLS – Financial sector model

Dependent Variable = LnCO2

Variable	Coefficient	Std. Error	t-statistic	Prob
Constant	-98,434***	21,879	-4,499	0,000
DCP	0,010***	0,002	6,014	0,000
SMT	0,001	0,001	1,366	0,172
LnGDP	6,564***	1,609	4,081	0,000
LnGDP2	-0,109***	0,029	-3,731	0,000
FDI	0,000	0,006	0,072	0,943
LnUrb	0,551***	0,144	3,840	0,000
R-Squared	0,990			
Adj. R-squared	0,987			

*p < 0,10; ** p < 0,05; *** p < 0,01
Source: Author calculation

4.6. Discussions

Cointegration estimation for Asian emerging markets was conducted using FMOLS and DOLS. The results perspicuously present the existence of a statistically significant long-run cointegrating relationship between CO_2 emissions, domestic credit to private sector by bank, and urban population, while stock market turnover and FDI yield statistically insignificant long-run cointegrating relationship. Domestic credit to private sector by bank (DCP) shows a significant upward trend during 1980 – 2018. China is recorded run into 95 times increasing of DCP for 39 years. At the same time, Indonesia reaches 21 times increasing of DCP.

This financing is given by the bank to the private sector as an additional capital for industries. The capital structure generally consists of debt and equity. Financing from bank is included in the source of the capital which comes from debt. This capital is used to finance the operations, and business development that can produce massive energy consumption or does not lead industries to a green economy. So that with the development of industries it will also increase industrial activities that cause increase energy use which impact to increases CO_2 emissions.

Furthermore, financial development from banking sector will lead to increase banking infrastructures such as the amount of bank branch, ATM, office equipment, and banking's Information and Communication Technologies (ICT). These contributes to CO_2 emissions from the use of electrical energy. Even, ICT contributes to CO_2 emissions much bigger. From Nature' report (2018) data center, one of main things in iCT, consumes 200 terawatt hours (TWh) annually and accounts for approximately 0,3% of total CO_2 emissions.

This result corresponds to the estimates conducted by Boutabba (2014), Omri (2015), and Nasir, Huynh, & Tram (2019), but contrary with Jalil & Feridun (2011), Shahbaz, et al. (2013), Shahbaz, Tiwari, & Nasir (2013), Al-Mulali, Tang, & Ozturk (2015), Abassi & Riaz (2016), Bashir, et al.

(2019), and Acheampong (2019). They found that financial sector from banking sector reduce CO_2 emissions.

Next, financial development's indicator used is capital market sector. Nevertheless, this paper doesn't show any relationship between stock market turnover as a proxy of financial development from capital market and CO_2 emissions in Asian emerging markets. The reason is estimated that on average the capital market in Asian emerging markets is not as developed as the capital market in developed countries. This can be seen from the number of local investors involved in the capital markets of Asian emerging markets, on average, which is still low. In Indonesia, the ownership of local investors has just increased in the last 6 years. In 2014 the share of ownership by local investors was 35,51% and foreigners were 64,49%. Then in 2019 the ownership of local investors in the Indonesian capital market continued to increase and almost rivaled the portion owned by foreign investors, reaching 49,36%, while foreign investors amounted to 50,64%. It turns out only 2,4 million people or equivalent to 0,9% of the total population of Indonesia. Given the low average capital market development in Asian emerging markets, it doesn't have much contribute to affect environmental quality. These findings were difference with the study by Abassi & Riaz (2016) that financial development from capital market sector increase CO_2 emissions in Pakistan. And on contrary, Nasir, Huynh, & Tram (2019) shows the opposite in ASEAN-5.

The result on economic growth showed a positive impact of real GDP on CO_2 emissions. These findings were in line with the study by Jalil & Feridun (2011), Shahbaz, Tiwari, & Nasir (2013), Shahbaz, et. al. (2013), Boutabba (2014), Omri, et al. (2015), Al-Mulali, Tang, & Ozturk (2015), Abassi & Riaz (2016), Acheampong (2019), and Nasir, Huynh, & Tram (2019). In Asian emerging markets where economic growth is increasing sharply when compared to both advanced markets and frontier markets, an increase in GDP leads to an increase in industrial activities. The increase in industrial activities trigger a massive increase in energy consumption which has an impact on increasing CO_2 emissions. In this case, most of the energy used is non-renewable energy, because it reduces production costs.

Other variable estimation, FDI showed result of no long-run relationship with CO_2 emissions in Asian emerging markets. This is because in Asian emerging markets, on the average, FDI value is not much as compared to GDP. Even though in emerging markets, labor, raw materials, and acquisition of assets are low cost, the high risk due to lack of security and political instability has hampered the rise in FDI. Hence, even FDI can bring ecofriendly technology, Asian emerging markets have not been able to influence environmental quality. These findings were in line with the study by Abassi & Riaz (2016), but different with Shahbaz, et. Al. (2013) and Nasir, Huynh, & Tram (2019) that FDI leads to environmental quality in Malaysia and ASEAN-5, respectively. Urbanization variable, in this paper, showed that having long-run relationship with CO_2 emissions in Asian emerging markets. Urbanization is triggered by infrastructure development and a fast growing economy in urban areas, so that it also has an impact on increasing the development of other supporting facilities such as education and health centers. This result was in line with the study by Shahbaz, Tiwari, & Nasir (2013), Omri, et al. (2015), Al-Mulali, Tang, & Ozturk (2015), and Acheampong (2019). But the contrast result is shown by Jamel & Maktouf (2017).

Based on the result shown with model regression, a negative quadratic term of real GDP confirms the existence of EKC. It means that in Asian emerging markets, there is a decrease in CO_2 emissions when the real GDP increases after passing a certain point. The existence of the EKC in this study is estimated because the economy in Asian emerging markets has shown a fairly rapid development over the last several periods as indicated by the increase in industrial activities which has an impact on environmental degradation. Emerging market countries are currently still focusing on the stage of economic development in which countries will relatively try to increase their economic capacity. Of course, the use of low capital costs will accelerate economic growth. Hence, many industries still use fossil-based energy to produce goods and services that are more efficient. However, the use of fossil-based energy certainly has an impact on environmental damage, namely an increase in CO_2 emissions. At this time the economy was in pre-industrial economic period.

After an increasing of growth to a point, countries began to pay attention to environmental degradation. Industrial development no longer pays attention to controlling the cost of capital but

pays attention to the impact of industrialization itself. At that time the industry had moved towards a green economy. The products and services produced are not intended for profit only but also pay attention to sustainable development. Hence, further economic development will reduce environmental degradation. At this time the economy was in a post-industrial economic period. From the calculation, a turning point of real GDP on this research is USD2,655 (thousand million) on average. It can be concluded that Asian emerging markets are still in the pre-industrial economic stage or graphically, they are still on an increasing line. However, if we look at Asian emerging markets country's member, only China is already in post-industrial economic stage. The existence of EKC were in line with the study by Jalil & Feridun (2011), Shahbaz, Tiwari, & Nasir (2013), Boutabba (2014), Omri, et al. (2015), and Nasir, Huynh, & Tram (2019), while Acheampong (2019) wasn't.

5. CONCLUSIONS

This study investigated long-run cointegrating relationship between financial development, economic growth, and environmental degradation using panel FMOLS and DOLS estimation in case of Asian emerging markets (Indonesia, Malaysia, Thailand, Philippines, China, and India) over the period 1980–2018 for banking model and 1996–2018 for financial sector model. Our results perspicuously demonstrate the existence of a statistically significant long-term relationship between CO_2 emissions, domestic credit to private sector by bank, real GDP, and urban population. Stock market turnover ratio as proxy of financial development from capital market sector and foreign direct investment didn't show any significant long-term relationship with CO_2 emissions. This was clearly implied that financial development from banking sector is rather more influential on the environmental degradation in the long run. Our empirical results also lead us to conclude that urbanization triggers an increase of environmental degradation in Asian emerging markets. Moreover, real GDP also contributes to environmental degradation to a turning point of real GDP where increasing real GDP leads to the environmental quality. Thus, in Asian emerging markets, Environmental Kuznets Curve (EKC) were exist.

In this study we only employ small sherd indicators of financial development. However, for further research we proposed that the research can be extended by adding more indicator aspects for financial development. Further research may also employ other econometric techniques to fulfill literature resources and to more convince that these results of studies were robust.

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