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Studying the Effects of Economic and Financial Development as well as Institutional Quality on Environmental Destruction in the Upper-Middle Income Countries

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Abstract**—**The current study explored the effect of economic development, financial development and institutional quality on environmental destruction in upper-middle income countries during the time period of 1999-2011. The dependent variable is logarithm of carbon dioxide emissions that can be considered as an index for destruction or quality of the environment given to its effects on the environment. Financial development and institutional development variables as well as some control variables were considered. In order to study cross-sectional correlation among the countries under study, Pesaran and Friz test was used. Since the results of both tests show cross-sectional correlation in the countries under study, seemingly unrelated regression method was utilized for model estimation. The results disclosed that Kuznets' environmental curve hypothesis is confirmed in upper-middle income countries and also, financial development and institutional quality have a significant effect on environmental quality. The results of this study can be considered by policy makers in countries with different income groups to have access to a growth accompanied by improved environmental quality.

Keywords**—**Economic Development, Environmental Destruction, Financial Development, Institutional Development, Seemingly Unrelated Regression.

JEL classification**:** Q5, O17, O13, F18, C23

I. Introduction

PAYING attention to the environment and trying to decrease environmental pollutions is one of the policies that has been considered across the world in recent years. Given to the 2007 World Bank's report, in the year 1990, the biggest producers of carbon dioxide in the world were America with 23%, Japan with 5.75%, OECD countries with 24%, China with 11%, India with 3%, Brazil with 0.94%, and Russia with 3.80%. However, the figures for America and Japan were decreased to 22% and 5% respectively in 2007 and those of China, India, Brazil and Russia were increased to 16%, 5%, 1.15%, and 6% respectively. While evidences show that energy consumption has been reduced along with economic development, the fact that increasing the production in the economy, increases or decreases in the pollution in some of these countries is uncertain [1].

The relation between environmental pollution and economic development has been explored in numerous studies. Some studies have confirmed environmental Kuznets curve hypothesis for a number of pollutants so that pollution is increased by increasing income per capita and then it is decreased [2]-[4]. These authors showed that testing of Kuznets's environmental curve hypothesis for different explanations does not led to similar results. Stern provided the brief history of Kuznets's environmental curve hypothesis in his paper and asserted that some other deficiency measurement like dependence correlation, bias of omitted variables and the issues related to co-integration analysis have to be considered except those issues that are related to model explanation. Therefore, policy makers should pay attention to the opinions of those who agree and disagree with Kuznets' environmental curve hypothesis; because this curve has been converted into one of the important national and international issues [5].

It is noteworthy that the relationship between economic growth and environmental pollution has been explored in most of the studies. The present study explores the effect of financial and institutional development as two most important and effective factors on environmental pollution. The most important reason to explore financial development is that it causes to attract foreign direct investment (FDI) which can accelerate economic growth [6]. The second reason is that financial development provides a motivation and an opportunity to use modern technologies with less pollution [7]. The third reason is that financial development leads to economic growth which may create more industrial pollutions [8].

On the other hand, a strong organizational system is important for financial and economic development. Also, countries with strong organizational structure can control greenhouse gas emissions [9].

Thus, economic, financial and institutional development can affect the environment; so, it seems necessary to explore their effects on the environment. In this study, it has been answered to the following questions in upper-middle income countries:

1. Does financial development affect the environment?

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2. Can institutional development improve environmental quality?
3. Is Kuznets' environmental curve hypothesis confirmed?

This paper contains five sections. First section is introduction. Theoretical principles and some previous studies presented in Section II. Methods of data analysis are mentioned and interpreted in Section III. The results are presented in Section IV and summary of the study as well as general results are proposed in the last section.

II. Theoretical Principles

The relation between environment pollution and economic growth has been explored in numerous studies. According to Meadow et al., studies, despite that economic growth is a threat for the environment in long-term, it is necessary to improve the environmental quality. But what is certain is that concern about reverse effects of economic growth on environmental pollution is increasing every day [10]. Anderson explored the relation between economic growth and environmental pollution. According to him, what causes one overcomes the other in the relation between economic growth and environmental pollution is not similar in various policies and this relation can be affected by adopting special policies [11]-[14]. This is very important for countries that want to achieve a high economic growth and also be consistent with the environment. Researchers [15] suggested that there is a dynamic relationship between the environment, utilization of natural resources and economic activities. They pointed out that while using the resources, especially energy that leads to economic growth, has negative effects on the environment in long-term.

What has been stated in various studies is that net effects of economic growth on environmental quality depend on the kind of pollution [16]-[18]. For instance, there is a reverse U-shape relation between economic growth and environmental pollution for some pollutants such as sulfur dioxide, carbon monoxide and nitrogen oxide [7]. Selden and Song studied Kuznets' environmental curve hypothesis for pollutants such as sulfur dioxide, carbon monoxide and nitrogen oxide and found similar results. [13].

Financial development can play a significant role in improvement of the environment. A more developed financial sector can facilitate investment in environmental projects. Financing environmental protection projects by public sectors, as part of their activities, is very important for the local, state and national government. Financial development is very important for the private sector too, for instance, the energy sector in CIS (Commonwealth of Independent States) countries has attracted a considerable portion of FDI. About 28 million dollars that are allocated, relatively 60% of the Russian FDI, was invested in the electric and gas industry in Russia in 2007. In previous years, almost 10 to 25 percent of FDI was invested in the energy sector [19].

Cleassens and Feijen pointed out that the development of the financial sector can improve environmental quality by improving the governance method [20]. Kumbaroglu et al. stated that financial system development stimulates investment in the energy supply sector leading to decrease pollution rate [21]. Also, the governments in developing countries can control financial markets by introducing the organized plans in order to improve environmental performance of firms [22]. Similarly, Desgupta et al. investigated reaction of investors of companies under study that refrain from accepting national environmental rules and regulations of Korea. They found out that market value of these firms has decreased significantly. Their general results revealed that a developed financial system may create a motivation to decrease carbon dioxide emissions [23].

A strong institutional system is important for success in economic and financial development [9], [24]. Countries with strong institutional framework are usually more successful in implementing the pollution rules. Pollution in poor countries with weak financial institutions is increased when economic growth is enhanced but it is decreased in poor countries which have strong financial institutions. Stokey and John and Pecchenino proposed a model in which the relation between pollution and income was considered as a reverse U-shaped curve. Maximum of this diagram is where the corner-point solution is changed into the optimal internal point despite the positive investment in pollution control [25], [26]. Low-income countries use the most pollutant-intensive technologies; thus, pollution is increased by increasing income or consumption. When income or consumption are increased, marginal utility of consumption is decreased and it finally continuous towards the point where clean technologies are optimal. Therefore, pollution is decreased if preferences towards the environmental quality are adequately high.

Congleton claimed that authoritarian countries should have lower environmental standards, because dictatorial rules have a shorter temporal durability. Therefore, a dictator maintains a more portion of national incomes but it has to cover more expenses to support the environment. In his article, Congleton suggested that a higher degree of investment increases personal income and thus consumption such as the environmental protection. On the other hand, higher income increases the cost of environmental regulations [27].

Torras and Boyce showed that with the addition of institutional factors can be a determinant in Kuznets' environmental curve hypothesis. They found out that a more suitable power distribution has a positive effect on environmental Kuznets curve hypothesis. According to the stated reasons, they maintained that these factors are due to the effects of executing the rules whose purpose is to internalize external expenses arising from pollution-generating activities. They perceived that literacy, political rights and freedom of citizens are effective on environmental quality in low-income countries [28]. Also, in the study of Panayotou indicated that the quality of policy-makings and institutions can decrease environmental destruction in low-income countries significantly, thus increasing the environmental quality improvement in high-income countries.

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Thus, Kuznets' environmental curve hypothesis can become flatter through better policies. [29].

There are various studies including [30]-[36], that each one has explored the effective factors on the environmental quality in different regions and countries using different methods.

III. Methodology and Desciption of Data

Levin, Lin and Chu unit root test (2002), known as LLC test and Im, Pesaran and Shin test (2003), known as IPS test were used in this study. Also, Frees test (2004) was used to test cross-sectional dependence correlation [37], [38], [39].

With regards to the current theoretical principles and conducted studies, such as [7] and [1] as well as limited access to the information, annual data of variables of carbon dioxide emissions logarithm were used as the dependent variable that can be regarded as an index for environmental destruction or quality considering its effects on the environment. Similarly, income per capita logarithm and inflation rate were considered as economic development variables; bank debt, ratio of demand deposit to total assets of bank, ratio of demand deposit to gross domestic product, total value of shares traded and foreign direct investment were considered as financial development variables; and institutional development index, the Voice and Accountability, Political Stability and the Absence of Violence, Government Effectiveness, Regulatory Quality, Rule of Law, Control of Corruption were considered as institutional development variables. In order to obtain better results, two variables of energy consumption and first lag of carbon dioxide emissions were entered the model as control variables. The countries under study included Albania, Algeria, Ecuador, Thailand, Tunisia, Argentina, Dominican, Gabon, Russia, Turkey, Azerbaijan, Costa Rica, Iran, Romania, Uruguay, Bulgaria, Colombia, Jamaica, Peru, Venezuela, Bosnia, China, Kazakhstan, Panama, South Africa, Belarus, Chile, Lebanon, Latvia, Brazil, Botswana, Libya, and Lithuania during the time period 1999-2011. Reviews 6 software was used to test unit root of variables and Stata 11 software was utilized to test cross-sectional correlation and estimation via seemingly unrelated regression method (SUR).

IV. Results

As Table I shows, all variables considered for upper-middle income countries are at a stable level based on ILP and LLC tests.

TABLE I
Unit Root Test of Variables in Middle to High-Income Countries

Variable	Unit root test	Test statistic (probability level)
Ratio of bank deposit to total assets	IPS	-5.015 (0.000)*
	LLC	-25.086 (0.73)
Carbon dioxide emissions logarithm	IPS	-0.190 (0.424)
	LLC	-7.819 (0.00)
Ratio of bank deposit to gross domestic product	IPS	-0.385 (0.349)
	LLC	-10.330 (0.000)
Energy consumption logarithm	IPS	-1.719 (0.042)
	LLC	-6.94 (0.000)
Income per capita logarithm	IPS	-1.752 (0.045)
	LLC	-3.89 (0.000)
Bank debt	IPS	-5.015 (0.000)*
	LLC	-25.086 (0.73)
Foreign direct investment	IPS	-0.840 (0.799)
	LLC	-2.189 (0.014)
Institutional development index	IPS	-0.427 (0.334)
	LLC	-0.840 (0.799)
Control of Corruption	IPS	-5.464 (0.000)
	LLC	-1.125 (0.105)
Government Effectiveness	IPS	-5.116 (0.000)
	LLC	-0.681 (0.247)
Political Stability and the Absence of Violence	IPS	-1.220 (0.111)
	LLC	-2.189 (0.014)
Regulatory Quality	IPS	-1.430 (0.076)
	LLC	-6.845 (0.000)
Rule of Law	IPS	-2.795 (0.002)
	LLC	-10.122 (0.000)
Voice and Accountability	IPS	-1.207 (0.113)
	LLC	-6.295 (0.000)
Inflation rate	IPS	-3.207 (0.000)
	LLC	-9.492 (0.000)

* The figures in parentheses show significance level.
Source: Research calculations

Six models were selected for countries under study and Table II shows the results of cross-sectional dependence correlation test and model estimation. As shown in Table II, it is clear that among the economic development variables considered in upper-middle income countries, inflation does not have a significant effect on carbon dioxide emissions. But, income per capita has a positive and significant effect on carbon dioxide emissions in all six estimated models. Its coefficient changes from 0.270 to 0.396 which are stable coefficients. To test Kuznets' environmental curve hypothesis, square root of income per capita was considered in models 2 to 6.

TABLE II
RESULTS OF ESTIMATION IN MIDDLE TO HIGH-INCOME COUNTRIES (CARBON DIOXIDE EMISSIONS LOGARITHM IS THE DEPENDENT VARIABLE)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Economic development variables						
Income per capita	0/270 (0/000)*	0/270 (0/069)	0/353 (0/097)	0/278 (0/097)	0/370 (0/028)	0/396 (0/030)
Square root of income per capita	-	-0/006 (0/046)	-0/018 (0/042)	-0/122 (0/032)	-0/170 (0/041)	-0/165 (0/047)
Inflation	-	-	-	-	-	-0/0007 (0/738)
Financial development variables						
Foreign direct investment	-0/080 (0/000)	-0/078 (0/000)	-0/073 (0/000)	-0/076 (0/000)	-0/055 (0/008)	-0/058 (0/005)
Ratio of bank deposit to total assets	0/070 (0/082)	0/270 (0/186)	-	-	-	-
Ratio of bank deposit to gross domestic product	-	-	-0/002 (0/036)	-0/002 (0/028)	-0/002 (0/026)	-0/002 (0/031)
Bank debt	0/328 (0/082)	0/335 (0/000)	-0/080 (0/000)	-0/082 (0/000)	-0/087 (0/000)	-0/087 (0/000)
Institutional development variables						
Institutional development index	-0/113 (0/045)	-0/114 (0/044)	-	-	-	-
Voice and Accountability	-	-	-	-	0/040 (0/463)	-
Political Stability and the Absence of Violence	-	-	-	0/075 (0/120)	-	-
Government Effectiveness	-	-	-0/031 (0/729)	-	-	-
Regulatory Quality	-	-	-	-	-0/161 (0/014)	-0/127 (0/005)
Rule of Law Rule of law	-	-	-	-0/100 (0/111)	-	-
Control of Corruption	-	-	-0/112 (0/174)	-	-	-
Control variable						
Energy consumption	0/294 (0/000)	0/298 (0/000)	0/306 (0/000)	0/320 (0/000)	0/314 (0/063)	0/301 (0/000)
Constant	-2/936 (0/008)	-6/708 (0/218)	-9/194 (0/081)	-9/136 (0/000)		-12/255 (0/025)
Pesaran test	1/724 (0/084)**	2/124 (0/033)	2/509 (0/012)	2/934 (0/000)	1/861 (0/089)	2/340 (0/003)
Friz test	3/422 (0/000)	3/166 (0/000)	3/028 (0/000)	3/012 (0/000)	3/044 (0/000)	3/180 (0/000)
R^2	0/340	0/341	0/353	0/345	0/353	0/353

* The figures in parentheses show significance level of coefficients.
** The figures show test statistic and those in parentheses show significance level.

Since income per capita has a positive and significant effect and square root of income per capita has a negative and significant effect on carbon dioxide emissions, environmental Kuznets curve hypothesis is co nfirmed in countries under study. Among financial development variables, foreign direct investment and ratio of bank deposit to gross domestic product have a negative and significant effect on carbon dioxide emissions. These results confirm those of [1], [7], [20], [21]. But, significance of bank debt on carbon dioxide emissions is not confirmed.

The results of model 1 and 2 show that institutional development index has a n egative and significant effect on carbon dioxide emissions. Models 3 to 6 were estim ated to explore the effect of variables of institutional quality. As the results indicate, among six variables of institutional quality, only Control of C orruption has a negative and significant effect on carbon dioxide emissions in these countries and significance of other variables of institutional quality is not statistically confirmed. Generally, it can b e stated that institutional quality has had a negative and significant effect on carbon dioxide emissions in upper-middle income countries according to theories. These results are similar to [7] results.

V. CONCLUSION

The present study explored the effects of economic development, financial development and institutional development on e nvironmental destruction in upper-middle income countries during the time period 1999-2011. To this end, annual data of variables of c arbon dioxide emissions logarithm, income per capita logarithm, square root of income per capita logarithm, bank debt logarithm, ratio of demand deposit to total assets of bank, ratio of demand deposit to gross domestic product, logarithm of total value of shares traded and foreign direct investment, institutional development index, the Voice and Accountability, Political

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Stability and the Absence of Violence, Government Effectiveness, Regulatory Quality, Rule of Law, Control of Corruption, and energy consumption logarithm were employed. The tests of [38], [39] were used to investigate cross-sectional correlation among the countries under study. Because the results of these two tests showed cross-sectional correlation, seemingly unrelated regression was used for estimation.

Results of this study revealed that Kuznets' environmental curve hypothesis is confirmed in upper-middle income countries. Since the effects of economic growth on the environment has been explored in most of the existing researches, it was showed in this study that financial and institutional development can have a determining role in the environment in countries under study where in most of them are developing countries. Therefore, policy makers can help improve the environment and decrease greenhouse gases in long-term by enacting strong policies and improving the structures. As a result, message of this study for policy makers is that improvement of institutional structures in short-term can help improve the environment in developing countries in long-term.

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