THE IMPACT OF FDI ON ENVIROMENTAL DEGRADATION IN AZERBAIJAN

Shahriyar Mukhtarov
Khazar University,
Azerbaijan State University of Economics (UNEC)
Baku Engineering University, Azerbaijan
smukhtarov@khazar.org

Shahriyar Aliyev
Charles University, Czech Republic
al.shahriyar@gmail.com

Jeyhun I. Mikayilov
King Abdullah Petroleum Studies and Research Center, Saudi Arabia
Azerbaijan State University of Economics (UNEC), Azerbaijan
jeyhun.mikayilov@kapsarc.org

Altay Ismayilov
Azerbaijan State University of Economics (UNEC), Azerbaijan
altay.ismayilov@unec.edu.az

ABSTRACT

World is struggling with the upcoming threats of CO_2 emissions, that is why, in order to achieve global environmental sustainability in the greenhouse gas emissions, several countries in 1997 agreed on Kyoto protocol which imposes some obligations on developed nations in the reduction of greenhouse gas emissions. The growing trend of CO_2 emissions is not only the case for developed nations, indeed, in the last decade emerging economies are capturing large scale of emissions and becoming much more hazardous for global warming. Especially, in developing economies foreign direct investments are dominant in polluting industries. Economic growth and FDI from this perspective, are causing CO_2 emissions to augment, if governments and industries are willingness in the alleviation of pollution. Thus, in this paper we have studied the impacts of FDI and economic growth on the Environmental degradation, proxied by consumption based CO_2 emissions for Azerbaijan country case. For this purpose, co-integration techniques were employed to the time series data over the period of 1996-2013. Cointegration test concluded that there is a long-run co-movement among the variables. Estimation results show that FDI and economic growth have positive and statistically significant impact on CO_2 emissions in the long-run. The findings of the study can be used by policymakers in making adequate decisions in related environmental degradation-FDI-economic growth circumstances.

Keywords: *Azerbaijan, CO2 emissions, co-integration, economic growth, FDI*

1. INTRODUCTION

Foreign Direct Investments (FDI) has remarkable positive impacts on economic growth and development in many nations in the last half-century. However, this progressive economic performance entailed some negative externalities. Environmental degradation is perceived among the most influenced. As a consequence of economic growth, increasing consumption of energy causes to greenhouse gas (CHG) emissions, which is one of the main actors in the global warming. According to the World Bank data (2018), Carbon-dioxide (CO_2) is considered the biggest pollutant being responsible for 68% of all greenhouse gas emissions in 2012.

Nations are struggling with the upcoming threats of CO_2 emissions, and in order to achieve global environmental sustainability in the greenhouse gas emissions, some countries in 1997 agreed on Kyoto protocol, which imposes some obligations on developed nations in the reduction of greenhouse gas emissions. The growing trend of CO_2 emissions is not only the threat for developed nations, indeed, in the last decade emerging economies are capturing large scale of emissions and becoming much more hazardous for global warming (Winkler et al., 2002). In this empirical study, we have analyzed the impacts of FDI and economic growth on CO_2 emissions for Azerbaijan country case, which is abundant by its oil and gas resources, and one of the fastest growing economies of last decade. The dominant source of this remarkable economic growth is its crude oil and gas extractions, that pumping foreign currency to the economy and attracting foreign investors. The average annual economic growth of the economy in the last 15 years is about 5% (World Bank data, 2018). In 2017, the share of fuel exports in the total merchandise exports was 90.1%, which indicates the strong dependency of economy from oil and gas revenues (WB data, 2018). After signing several contracts with 41 oil companies with 19 countries since 1994, and after the completion of construction Baku-Tbilisi-Ceyhan pipeline in 2005 Azerbaijan crude oil had wide access to world market. That is to say, during the period of 1996-2017, FDI increased from $627 million to $2.87 billion, and had its pick $5.29 billion in 2012 (WB data, 2018). There were many studies devoted to the impacts of FDI and economic growth on CO_2 emissions for different countries, where the findings vary across countries. Nevertheless, to the best of our knowledge, it is the first individual study for Azerbaijan country case, which examines the effect of FDI on CO2 emissions. In order to fill this gap, the aim of this research is to assess the influence of foreign direct investments and economic growth on CO_2 emissions, and to see the effectiveness and necessity of government's anti-pollution policies. The related empirical studies are reviewed in the section 2. In the section 3, we presented the methodology and data employed, with following its results in the section 4. The outcomes and policy recommendations are discussed in the section 5.

2. LITERATURE REVIEW

There is a broad range of studies conducted in the last two decades, which studied the nexus of environmental degradation, FDI and income (GDP). The relationship mainly investigated for the group of countries and as well as for the individual country cases. In this section we reviewed some papers studied the CO2 emissions-FDI nexus. China as one of the largest FDI recipient in the world, attracted remarkable amount of studies related to its environmental effects. Liu et al. (2017) analyzed the spatial environmental consequences of FDI in 112 Chinese cities employing Simultaneous Equations Model (SEM) for the period of 2002-2015, and found negative relationship between FDI and environmental pollution. Their study exerts that as more FDI flows to the Chinese economy, as less it degrades the environment. Another analogous paper by Huang et al. (2017) for the 30 Chinese provinces over the period of 2001-2012, demonstrating the significant negative effects of FDI and FDI to GDP ratio on pollution index. The study of Huang et al. (2017) used Spatial Durbin Model in order to look at the regional spillovers of FDI, where the coefficient of total effects of FDI on pollution index was found to be –0.20, suggesting that China's FDI inflows are environmentally friendly, especially, those FDI inflows which are flowed from the OECD member countries. However, there are some investigations (Ren et al, 2014 and Liu et al. 2018) argued about the positive relationship between China's FDI and environmental pollution. By employing GMM estimation model over the period of 2000 to 2010, Ren et al. (2014) found the FDI coefficient to be 0.24. Shahbaz et al. (2018) analyzed the nexus with more data sample of 62 years (1955-2016) for France, found significant positive relationship between FDI and carbon emissions with the coefficient of 0.08. Moreover, Bakhsh et al. (2017) also found significant positive relationship between FDI and CO_2 emissions for Pakistan, by employing SEM model for the period of 1980-2014.

Tang and Tan (2015) for Vietnam case, found that long-run, FDI has significant negative impact on CO_2 emissions with the –0.07 coefficient, although the short-run negative effect of FDI is statistically insignificant. Lau et al. (2014) investigated the relationship for the Malaysian case. The study exerts the long and short-run relationship between FDI and CO_2 emissions with employing cointegration approaches, where they have found significant and positive relationship between FDI and CO_2 emissions with the 0.07 coefficient. Gökmenoğlu and Taspınar (2016) displayed long and short-run positive effects of FDI on Turkey's case, with 0.03 significant positive coefficient. The country specific studies display varying results of FDI on environmental pollution, and it is interesting to look at the nexus on the country group level as well. Rafindadi et al. (2018) studied the environmental impacts of FDI for Gulf Cooperation Council (GCC) countries for 1990-2014, and surprisingly found significant negative relationship. They employed the Pooled Mean Group (PMG) methodology for six GCC countries, and suggesting that 1 percentage increase in FDI inflows to GCC countries will reduce CO_2 emissions by 16 percent. The relationship is also found significantly negative for the 30 OECD countries in the research of Pazienza (2015) for the period of 1981-2005, with the coefficient of –0.09. Income levels are considered in the investigation of Shahbaz et al. (2015), where 99 countries are split into three homogeneous low-middle-high income level groups, for the 1975-2012. In their research, FDI effects on income groups are changing, as in high-income countries, FDI inflows have negative impact on environmental pollution, which shows that foreign investors use good management practices and advanced technology, which alleviates the CO_2 emissions. The result is U-shaped for the middle-income level country groups, while it is positively correlated for the low-income level groups. When it comes to Latin American (LA) countries, the relationship shows significantly positive linkage in the recent research of Sapkota and Bastola (2017). By employing the data of 14 LA countries for the period of 1980-2010, they found 0.04 positive coefficient. The empirical studies are varying across the countries, and do not provide unilateral interpretation related to the environmental impacts of FDI. Although almost all studies recommend advanced technological implementation in reduction of the degradation effects of FDI, some studies (Pazienza, 2015 and Shahbaz et al. 2018) covering the developed countries, who were applying anti-pollution technologies for a long-time may display positive relationship. On the other hand, studies (Rafindadi et al. 2018; Tang and Tan, 2015; Lau et al. 2014) covering the countries which are weak in anti-pollution measures can show negative correlation.

3. DATA AND METHODOLOGY

3.1. Functional Specification and Data

The functional specification used in the current study can be described as follow:

$$lnCO_{2t} = \beta_0 + \beta_1 lnFDI_t + \beta_2 lnGDP_t + \varepsilon_t \quad (1)$$

Where, all the elements of model are in logarithmic forms, and
$CO_{2,t}$ is consumption based Carbon-dioxide emissions in per capita terms,
FDI_t is Foreign direct investment, net inflows (% of GDP),
GDP_t – is Gross Domestic Product in per capita terms, and
ε_t is an error term.

It's important to emphasize that the data in almost all sections of the science is difficult to collect for Azerbaijan. As, the data collection and its proper categorization was significantly weak in Soviet Union period. The availability to obtain the data before 1990s is mostly impossible. Furthermore, the engagement of Azerbaijan in war with Armenia in 1992-1994 years, and having changed government administration several times within these years, also

damaged the data collection process. That is, the majority of data created after the year 1994. For the reasons mentioned above (data availability and reliability), the current study uses time series data for the period of 1996-2013. CO_2 emissions are in million tons of carbon per year, GDP per capita in constant 2010 US$, and FDI is FDI inflows as the share in GDP per capita terms. The data for CO_2 emissions are updated from Peters et al. (2011) and Hasanov et al. (2018). The data for GDP and FDI World Bank database (WB, 2018).

3.2. Econometric methodology

In empirical part first, we tested the variables for unit root, then for the common long-run trend (cointegration), and then estimated the long-run relationship among them. For unit root exercise we employed the Augmented Dickey Fuller (ADF, Dickey and Fuller, 1981) and Phillips-Perron (PP, Phillips and Perron, 1988) tests, while for testing the cointegration relationship the Engle-Granger (Engle and Granger, 1987), and Bounds Testing approach to cointegration (Pesaran et al, 2001) are utilized. The long-run relationship is estimated using two cointegration methods. First, the Bounds Testing Approach to Autoregressive Distributed Lagged (ARDL, Pesaran and Shin, 1999; Pesaran et al, 2001) model is used as a main tool, then the Fully Modified Ordinary Least Squares Method (FMOLS, Saikkonen, 1992 and Stock and Watson, 1993) is employed for the robustness check.

4. EMPIRICAL RESULTS AND DISCUSSION

First, the stationarity properties of the employed variables are tested using ADF and PP unit root tests and the results are given in Table 1.

Table 1: Unit root tests results

Variable	The ADF test				The PP test	
	Level	K	First difference	k	Level	First difference
co_2	-2.84*	0	-6.78***	0	-2.88*	-6.55***
fdi	-1.46	0	-3.32**	0	-1.46	-3.29**
gdp	-0.86	0	-2.67*	0	-0.86	-2.65*

*Notes: ADF and PP denote the Augmented Dickey-Fuller and Phillips-Perron tests respectively. Maximum lag order is set to two and optimal lag order (k) is selected based on Schwarz criterion in the ADF test; ***, ** and * indicate rejection of the null hypotheses at the 1%, 5% and 10% significance levels respectively; The critical values are taken from MacKinnon (1996) for the ADF and PP tests respectively.*

As can be seen from Table 1, all the variables are stationary at first difference, hence we can test them for the cointegration. The Bounds Test and Engle-Granger cointegration test results are provided at the right side of Table 2. Both cointegration tests concluded the existence of the long-run relationship among the variables. Therefore, the long-run relationship is estimated, where the estimation results are given at the left side of the Table 2. The residuals of the model are tested for Gauss-Markov conditions and all the results are in line with the requirements, the model also tested for misspecification and concluded that there is no misspecification problem[1].

Table following on the next page

[1] The results of these tests are not given here due to the space limitation, but are available from the authors upon request.

Table 2: Cointegration and Long-run estimation results

	ARDL	FMOLS	Cointegration Tests			
FDI	0.09	0.10	F-stat	9.12	EG tau-stat	-5.04
	(0.00)	(0.00)	Critical Values			(0.01)
GDP	0.09	0.09	10%	3.70	EG z-stat	-22.47
	(0.00)	(0.00)	5%	4.43		(0.00)
Constant	0.40	0.35	1%	6.27		
	(0.08)	(0.04)				

Notes: F-stat= F-statistics for Bounds Cointegration test based; Critical values=Narayan's (2005) critical values for Bounds test; EG tau-stat=Engle-Granger cointegration tests tau-statistics; EG z-stat=Engle-Granger cointegration tests z-statistics; p-values are in parenthesis.

As was mentioned in the methodology section, the main tool in empirical estimations is ARDL model, the results of which are given in the first column of Table 2. The results of FMOLS method, as a robustness check, are given in the second column of that table. As can be seen from the outcomes of both models are very close to each other either significance or magnitude wise. The coefficients have the expected signs, and are statistically significant. Since the variables are in logarithmic form, the coefficients can be interpreted as elasticities of variables. Based on the ARDL estimation results, we can say that the 1% increase in FDI and GDP results in 0.09% increase in CO_2 emissions. Based on the reviewed literature we can say that our finding of positive impact of FDI on carbon-dioxide emissions are in line with the conclusions of many studies in the case of developing countries. In terms of magnitude, our coefficient is close to the findings of Lau et al. (2014) and Shahbaz et al. (2018).

5. CONCLUSION

The impact of either local or international economic activities on environmental degradation is one of the hot topics of environmental economics since its direct influence on the climate change/global warming problem. One strand of the research devoted to the above-mentioned problem is the impact of foreign direct investment within a certain country on the CO_2 emissions level. In this regard, the current paper investigates the impact of foreign direct investment on CO_2 emissions in Azerbaijani case. The study uses consumption based CO_2 emissions, since it is a more proper proxy to measure the impact of international economic activities. For this purpose, ARDL and FMOLS cointegration techniques were employed over the period of 1996-2013. After testing variables for unit root, the results showed their stationarity at first differenced form. Hence, the variables can be tested for a common long-run trend. The Engle-Granger test and Bounds Testing methods were used to analyze the long-run relationships between the variables. The results indicated that there is a long-run co-movement among the variables. Results of the estimations revealed that FDI and GDP have statistically significant, positive impact on CO_2 emissions. This implies that 1% increase in FDI and GDP will increase CO_2 emissions by 0.09%. Our findings give us an opportunity to argue that FDI inflows to Azerbaijan are not so environmentally friendly. We also have found that increase in economic activity increases the CO_2 emissions, which shows the importance of anti-pollution measures. In this regard, we think that besides supporting foreign and domestic investors, policymakers should increase the technological requirements for both producers for decreasing the carbon emissions and its other negative externalities. In other words, the positive correlation of FDI and GDP with CO2 emissions showing weak anti-pollution measures, which should be developed in order to have environmentally sustainable economic growth.

LITERATURE:

1. Bakhsh, K., Rose, S., Ali, M. F., Ahmad, N., Shahbaz, M. (2017). Economic growth, CO2 emissions, renewable waste and FDI relation in Pakistan: New evidences from 3SLS. *Journal of Environmental Management 196*: 627-632.
2. Dickey, D., Fuller, W. (1981). Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root. *Econometrica* 49: 1057–1072.
3. Engle R.F., Granger, C.W.J. 1987. Co-integration and error correction: representation, estimation and testing. *Econometrica* 55(2): 251-276.
4. Gökmenoğlu, K. and Taspinar, N. (2016). The relationship between Co2 emissions, energy consumption, economic growth and FDI: the case of Turkey. *The Journal of International Trade & Economic Development* 25(5): 706-723
5. Hasanov, F.J., Liddle, B., Mikayilov, J.I. (2018). The impact of international trade on CO2 emissions in oil exporting countries: Territory vs. consumption emissions accounting. *Energy Economics 74:* 343–350.
6. Huang, J., Chen, X., Huang, B., Yang, X. (2018). Economic and environmental impacts of foreign direct investment in China: A spatial spillover analysis. *China Economic Review* 45: 289-309.
7. Lau, L. S., Choong, C. K. Eng, Y. K. (2014). Investigation of the environmental Kuznets curve for carbon emissions in Malaysia: Do foreign direct investment and trade matter? *Energy Policy 68*: 490-497.
8. Liu, Q., Wang, S., Zhang, W., Zhan, D., Li, J. (2018). Does foreign direct investment affect environmental pollution in China's cities? A spatial econometric perspective. *Science of the Total Environment 613–614:* 521–529
9. Liu, Y., Hao, Y., Gao, Y., (2017). The environmental consequences of domestic and foreign investment: evidence from China. *Energy Policy 108*: 271–280.
10. Mikayilov J. I., M. Galeotti, and F.J. Hasanov. (2018a). The impact of economic growth on CO2 emissions in Azerbaijan. *Journal of Cleaner Production* 197: 1558-1572.
11. Mikayilov J. I., Apergis N., Hasanov F.J. (2018b). CO2 Emissions-Economic Growth Relationship Revisited: New Insights from the Time-Varying Cointegration Approach. *Submitted to Ecological Indicators.*
12. Mikayilov J. I., Shukurov, V., Mukhtarov, S., Yusifov S. (2017a). Does Urbanization Boost Pollution from Transport? *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis, 65(5)*: 1709–1718.
13. Mikayilov J., Shukurov, V., Yusifov, S. (2017b). The impact of economic Growth and population on CO2 emissions from transport sector: Azerbaijan case. *Academic Journal of Economic Studies 3*: 60-67.
14. Narayan, P.K. (2005). The Saving and Investment Nexus for China: Evidence from Cointegration Tests. *Applied Economics 37*: 1979–1990.
15. Ozturk, I., (2015). Sustainability in the food-energy-water nexus: Evidence from BRICS countries. *Energy 93*: 999-1010.
16. Pazienza, P. (2015). The relationship between CO2 and Foreign Direct Investment in the agriculture and fishing sector of OECD countries: Evidence and policy considerations. *Intellectual Economics. 9:* 55-66.
17. Pesaran, M. Shin, Y., (1999). An autoregressive distributed lag modeling approach to cointegration analysis in S. Strom, (ed) Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch centennial Symposium, Cambridge University Press, Cambridge.
18. Pesaran, M.H.; Shin, Y.; Smith, R.J. (2001). Bound Testing Approaches to the Analysis of Level Relationships. Journal of Applied Econometrics 16: 289–326.

19. Phillips, P.B. Perron, P. (1988). Testing for Unit Roots in Time Series Regression. *Biometrika,* 75**:** 335–346.
20. Peters G.P., Andrew R., Lennox J. (2011). Constructing a multiregional input-output table using the GTAP database. *Economic System Research* 23: 131-152.
21. Rafindadi, A. A., Muye I. M., Kaita, R. A. (2018). The effects of FDI and energy consumption on environmental pollution in predominantly resource-based economies of the GCC. *Sustainable Energy Technologies and Assessments* 25:126-137.
22. Ren, S., Yuan, B., Ma, X., Chen, X. (2014). International trade, FDI (foreign direct investment) and embodied CO2 emissions: A case study of Chinas industrial sectors. *China Economic Review 28,* 123–134.
23. Saikkonen, P. (1991). Asymptotically efficient estimation of cointegrated regressions. *Econom. Theory* 7, 1–21.
24. Sapkota, P., Bastola, U. (2017). Foreign direct investment, income, and environmental pollution in developing countries: Panel data analysis of Latin America. *Energy Economics* 64: 206–212.
25. Shahbaz, M., Nasir, M.A., and Roubaud, D. (2018). Environmental Degradation in France: The Effects of FDI, Financial Development, and Energy Innovations. *Energy Economics 74*: 843–857
26. Shahbaz, M., Nasreen, S., Abbas, F. Anis, O. (2015). Does foreign direct investment impede environmental quality in high-, middle-, and low-income countries? *Energy Economics*. 51: 275-287.
27. Stock, J.H.; Watson, M.W. (1993). A simple estimator of cointegrating vectors in higher order integrated systems. *Econometrica* 61: 783–820.
28. Tang, C.F., Tan, B.W., (2015). The impact of energy consumption, income and foreign direct investment on carbon dioxide emissions in Vietnam. *Energy* 79: 447–454.
29. Winkler, D.W., Dunn, P.O., McCulloch, C.E. (2002). Predicting the effects of climate change on avian life-history traits. *Proceedings of the National Academy of Sciences of the United States of America* 99, 13595–13599.
30. World Bank (WB), (2015). Retrieved 11. 10. 2018 from https://data.worldbank.org /indicator/EN.ATM.CO2E.PC.
31. World Bank (WB). (2018). World development indicators. Retrieved 11. 10. 2018 from https:// data.worldbank.org/indicator/.