Energy Economics 51 (2015) 275–287

Contents lists available at ScienceDirect

Energy Economics

journal homepage: www.elsevier.com/locate/eneco

Does foreign direct investment impede environmental quality in high-, middle-, and low-income countries?

Muhammad Shahbaz [a,b], Samia Nasreen [c], Faisal Abbas [d], Omri Anis [e,*]

[a] Energy Research Centre, COMSATS Institute of Information Technology, Lahore Campus, Pakistan
[b] IPAG Business School, 184 Boulevard Saint-Germain, 75006 Paris, France
[c] Government College Women University Faisalabad, Faisalabad, Pakistan
[d] COMSATS Institute of Information Technology, Islamabad Campus, Pakistan
[e] Higher Institute of Industrial Management, Sfax, Tunisia

ARTICLE INFO

Article history:
Received 10 February 2015
Received in revised form 14 June 2015
Accepted 24 June 2015
Available online 3 July 2015

JEL classification:
F3
F43
P28
Q5
C23
F01

Keywords:
Foreign direct investment
Economic growth
Environment

ABSTRACT

Under a multivariate framework, this paper aims to investigate the nonlinear correlation between foreign direct investment and environmental degradation for high-, middle-, and low-income countries with economic growth and energy consumption as additional determinants of environmental degradation. All variables were found to be nonstationary and cointegrated based on recent panel data unit-root tests and cointegration techniques. On applying fully modified ordinary least squares (FMOLS), the long-run results suggest the presence of an environmental Kuznets curve. In turn, foreign direct investment increases environmental degradation, thus confirming the pollution haven hypothesis (PHH). Moreover, the bidirectional causality between CO_2 emissions and foreign direct investment is observed globally. The findings are sensitive to different income groups and regional analyses. In particular, these empirical findings aid sound economic policymaking for improving environmental quality and sustainable economic development.

1. Introduction

The late 1980s saw world economies opening up, economic and social reforms, foreign direct investment (FDI) inflows, and resulting economic growth. However, this also effected an erratic increase in energy consumption and CO_2 emissions. For example, the average annual global per capita FDI of US$ 7.74 in the early 1980s increased to US$ 126.37 during 1996–2000. This substantial increase was a positive result of effective outsourcing and international production strategies on the host economy. However, the average annual per capita FDI has been reduced, at an estimated US$ 204.12, 23% less than the estimate for 2006–2010 given the global financial crisis (see Table 1). The average annual global per capita gross domestic product (GDP) increased from US$ 1986.14 to US$ 8579.57 in 1976–1980 and 2006–2010, respectively. Further, this GDP increased to US$ 10,159.36 for 2010–2011. This unprecedented growth in per capita income globally has resulted in increased energy demand. The average global energy consumption was 1547.50 kg of oil equivalent per capita in 1976–1980, and this increased to 1917.98 kg of oil equivalent per capita in 2010–2011. The tremendous economic growth and energy demand have, in turn, increased environmental pollution. For example, the average annual per capita CO_2 emissions increased from 4.36 metric tons in 1976–1980 to 4.89 metric tons in 2010–2011 (see Table 1). In the past two decades, FDI in developing countries clearly increased, especially in middle- and low-income countries. However, FDI in high-income countries is more likely to exploit assets such as technologies and intellectual property (Zeng and Eastin, 2012). Presently, global FDI has become especially challenging. Many investors are forced to hold their investments in the Asia Pacific, the Middle East, and European regions due to the political instability in the Middle East, global oil price crises, European financial market crises, and several natural disasters. Foreign investments in North America, Latin American countries such as Brazil, Russia, India, China, and South Africa have caused a peak in environmental pollution.

In general, FDI has the following three important effects on the host country economy: boosting said country's development efforts (Alfaro, 2003), offering itself as a source of external capital (Bustos, 2007), and filling the gap between targeted investment and domestic savings

* Corresponding author. Tel.: +216 97914294.
E-mail addresses: shahbazmohd@live.com, Muhammad.shahbaz@ipag.fr (M. Shahbaz), sami_lcu@yahoo.com (S. Nasreen), faisal_abbas26@yahoo.com (F. Abbas), omrianis.fsegs@gmail.com (O. Anis).

http://dx.doi.org/10.1016/j.eneco.2015.06.014
0140-9883/

Table 1
Trends in global FDI, GDP, CO_2 emissions, and energy consumption.
Source: World Development Indicators (CD-ROM, 2012)

Year	Per capita FDI (US$)	Per capita GDP (US$)	Per capita CO_2 emissions (metric tons)	Per capita energy consumption
1976–1980	7.74	1986.14	4.36	1547.50
1981–1985	12.03	2493.59	4.06	1399.25
1986–1990	29.28	3596.67	4.20	1496.09
1991–1995	38.61	4674.34	4.09	1622.66
1996–2000	126.37	5205.36	4.08	1632.43
2001–2005	126.96	6023.82	4.30	1704.22
2006–2010	265.76	8579.57	4.75	1826.33
2010–2011	204.12	10,159.36	4.89	1917.98

(Bosworth and Collins, 1999). Furthermore, FDI helps reduce the gap between foreign exchange requirements and net exports earnings (Ndikumana and Verick, 2008). In fact, FDI may provide direct capital financing; generate positive externalities; and consequently stimulate economic growth through technology transfer, spillover effects, productivity gains, and the introduction of new processes and managerial skills (Lee, 2013). Furthermore, FDI can also aid innovative learning, such as a mixture of technical skills. More importantly, FDI offers local enterprise opportunities and in turn employment for skilled and unskilled labor in the recipient country (Omri and Kahouli, 2014a). FDI promotes economic growth but at the cost of the environment (He, 2006; Xing and Kolstad, 2002).[1] This is because governments of developing countries tend to undermine environmental concerns through relaxed or non-enforced regulation, which is termed as *pollution haven hypothesis* (PHH) (Copeland and Taylor, 1994, Cole, 2004). Furthermore, firms are more likely to shift production to countries with less stringent environmental regulations reduced production costs, which is called *industrial flight hypothesis* (Asghari, 2013). Favoring relaxed environmental regulations or increased production opportunities has deleterious consequences on the environment of host countries. By contrast, foreign companies employ better management practices and up-to-date technologies that result in a relatively clean environment in the host countries (Zarsky, 1999). This is known as *pollution halo hypothesis*. Studies in favor of the *PHH* does not support the general industrial flight hypothesis; rather, they claim that environmental regulations guide firms' locational decisions, especially in resource and severely polluted sectors (Lu et al., 2008). Existing empirical studies also prove the *pollution halo hypothesis* in energy-intensive sectors with a technological base (BIAC, 1999; Blackman and Wu, 1998).

Rapid industrialization has led to increasing environmental concerns, such that the links between economic growth and environment have been intensely debated, especially in the last couple of decades. Empirical evidence (see inter alia; Grossman and Krueger, 1995; Rothman, 1998; Selden and song, 1994) confirmed an inverted U-shaped relationship between environmental degradation and economic growth. All of these studies supported the hypothesis that the environmental degradation curve moves upward initially, reaches a maximum point, and starts moving downward as the economy develops further. This systematic inverted U-shaped relationship has been termed as the environmental Kuznets curve (EKC). FDI has an impact on economic growth and hence energy consumption (Sabia et al., 2014). In addition, FDI can lower energy demand only when foreign companies adopt advanced technology for production process. The existing empirical studies also correlate the increase in per capita income or energy demand due to FDI with CO_2 emissions (Omri and Kahouli, 2014b; Shahbaz and Leitão, 2013; Shahbaz et al., 2013; Solarin and Shahbaz, 2015).

Therefore, the contribution of this paper to empirical energy economics literature is sixfold: (i) This pioneering effort investigates the nonlinear relationship between FDI, economic growth, energy consumption, and CO_2 emissions for a global panel consisting of 99 countries. (ii) This study covers the period of 1975–2012 for 99 high-, middle-, and low-income countries using the data of the global heterogeneous panel. (iii) Panel unit-root tests and panel cointegration approaches were applied to determine the stationary properties of the variables and long-term relationship between the variables. (iv) The fully modified ordinary least squares (FMOLS) method was applied to examine the long-run impact of FDI, economic growth, and energy consumption on CO_2 emissions. (v) The direction of causality between the variables is determined by applying the Dumitrescu and Hurlin (2012) causality tests. (vi) Three homogeneous subpanels that are constructed based on the income level of the sample countries (high-, middle-, and low-income subpanels) were also considered. Our results validate the EKC, an inverted U-shaped curve termed as the *pollution haven hypothesis* (PHH). Economic growth and energy consumption result in increased CO_2 emissions. FDI and CO_2 emissions are interrelated.

The paper is organized as follows: the related literature is briefly reviewed in Section 2; the model construction and the econometric methodology are outlined in Section 3; the empirical findings are presented in Section 4; and the paper is concluded and some policy implications are offered in the final fifth section.

2. Literature review

The role of FDI and economic growth in environment sustainability remains debatable worldwide due to contradictory empirical results. Furthermore, a number of studies theoretically explained the impact of FDI on economic growth (for example, Lucas, 1988; Rebelo, 1991; Romer, 1986, 1993). For instance, Romer (1993) stated that FDI can be an important source for transferring technological and business knowledge to host countries with substantial positive spillover effects. On the contrary, with the existing liberalization, deregulation, and privatization policies, FDI is predicted to hamper allocation of resources and decrease growth (Boyd and Smith, 1992). Theoretical studies also highlight the success of countries that used FDI to better their economy at the cost of environmental degradation. For example, Grossman and Krueger (1995) showed that environmental pollution increases with economic growth and then declines when the income growth reaches a certain threshold level. This phenomenon is known as EKC hypothesis. The threshold at which environmental pollution starts to decline was found to range from an income level of $4000 to $8000 (Grossman and Krueger, 1995). In this context, several studies have investigated the relationship between economic growth and CO_2 emissions with the EKC hypothesis. Stern (2004a,b) empirically proved the EKC, showing an initial increase in environmental degradation and then falls with an increase in per capita income.

Theoretically, this debate can be classified into two broad perspectives. One is rooted in the classical trade perspective of comparative advantage in the literature. Here, environment is considered another

[1] Following constant return to scale, FDI directly affects economic activity and stimulates GDP growth in the host country. This in turn influences energy consumption, which is called the *scale effect* when the income effect is kept constant. This implies that the *scale effect* has an indirect positive impact of foreign direct investment on energy demand and hence CO_2 emissions via economic activity. This depends upon the association between FDI and real GDP growth, as well as the circumstances of the host country (Rahman and Shahbaz, 2011; Shahbaz et al., 2011). Comparatively, any change in the production of energy-intensive goods is determined by the sectoral structure changes of an economy, termed as *composite effect* (Cole, 2006). The economy shifts from the agricultural to industrial sector at the early stages of economic development. The industrial sector demands more energy than the agricultural sector does, which indicates the positive *composite effect*. Once the economy achieves the matured level of economic development, then it shifts from the industrial to service sector (light industry), where the latter is less energy intensive with low CO_2 emissions compared with the former. This demonstrates the negative *composite effect* (Stern, 2004a,b; Lee, 2013a,b). This pattern of economic development explains the variations in the *comparative advantage* of an economy in international markets (Cole, 2006). The comparative advantage of an economy is influenced by capital–labor ratio, rules and regulation of environmental sustainability, as well as availability of skilled human capital. Foreign direct investment seems to affect the *composite effect* when the sectoral structure of an economy changes. The sectoral shifts can be seen by industrial contribution to gross domestic product (GDP). The effect of adopting advanced technologies on energy consumption and hence on CO_2 emissions is termed as the *technique effect* (Antweiler et al., 2001; Cole, 2006). The technique effect reveals that advanced technologies consume lesser energy and emit lower CO_2 emissions but produce more output than traditional technologies do (Arrow, 1962).