The Effect of Foreign Direct Investment on Human Well-Being: A Study of the Relationship Between the Carbon Intensity of Human Well-Being and Foreign Direct Investment in Nine Lower Middle-Income Countries

Hai Bac Dang, Thuan Nguyen, Diem Nga Thi Tran, and Oanh Hoa Thi Su

Abstract Economic growth is the primary purpose for human development of all nations in the world; however, it is needed to put into question whether the growth has brought more benefits to human-being or caused costly consequences for the environment and societies. The paper has studied the carbon intensity of human well-being (CIWB), the level of anthropogenic carbon emissions per unit of human well-being, to measure the relationship between economic growth and human well-being in terms of sustainability. Approach from the theory of ecologically unequal exchange, the study applied Prais–Winsten technique to analyze the function of CIWB and economic variables in nine lower middle-income countries in the period of 2000–2018. We found that economic activities have significantly enhanced human well-being, which hasn't supported the theory. The variables of foreign direct investment (FDI) over time and gross domestic product (GDP) showed negative effects on CIWB, which implies the more value of FDI and GDP, the less CIWB value. However, these countries should be cautioned on strategies for sustainable development, the FDI effect on decreasing CIWB over time is low and unstable. Moreover, the study revealed that energy consumption (EPC) positively impacts the value of CIWB.

Keywords Ecologically unequal exchange · Carbon intensity well-being (CIWB) · Foreign direct investment (FDI) · Lower middle-income countries

1 Introduction

The primary purpose of economics is to enhance human well-being (Dalziel et al., 2018). Though economic growth is seen as the main vehicle for improvements in

H. B. Dang · D. N. T. Tran · O. H. T. Su (✉)
University of Natural Resources and Environment, Ho Chi Minh City, Vietnam
e-mail: stohoa@hcmunre.edu.vn

T. Nguyen
Open University, Ho Chi Minh City, Vietnam

A. T. Nguyen et al. (eds.), *Contemporary Economic Issues in Asian Countries: Proceeding of CEIAC 2022, Volume 1*,
https://doi.org/10.1007/978-981-19-9669-6_16

well-being like higher incomes or better living conditions, it's apparent that economic growth for its own sake can result in environmental degradation or widen social inequalities (Bunker, 1984, 1985, 2019; Jorgenson, 2006; Martínez-Alier, 2002). Therefore, the concept of well-being has been transformed from welfare to human well-being at personal and collective levels (McGregor & Pouw, 2016). In the context of sustainable development, numerous measures of well-being have been developed to reflect a broader concept in consideration of the environment (Dietz et al., 2009).

Carbon intensity of well-being (CIWB), which is defined as anthropogenic carbon emissions per life expectancy, has been created in an effort of considering the trade-off between economic growth and the environment in a measure (Jorgenson, 2014). The CIWB is a new indicator of human well-being, which is relative to the harm we do to the environment while developing. Therefore, the success of economic growth is to achieve high levels of human well-being while placing relatively little stress on the environment, which means a low value of CIWB.

Jorgenson (2014) in the cross-national comparative research on economic development and CIWB across regions over time has shown surprising findings that just only the development in Africa has brought a decrease in CIWB over time, while it went into reverse for the remaining regions. Givens (2015) gave the same results that the impact of development on human well-being in terms of the environment from the high-income countries is positive and contradicted in low-income countries. In the case of lower middle-income countries (lower MICs), we found it interesting because they are facing a dilemma of rapid economic growth and have emitted a high amount of CO_2, hence, without appropriate sustainable development strategies, they may fall into a high value of CIWB which could damage the success of a development. However, in the body of literature on CIWB, there are no thorough studies on this group of countries.

2 Literature Review

The term middle-income countries (MICs) are defined by grouping nations according to their income. Lower MIC is a group of countries which just be over the threshold of low income and with a GNI per capita in between US$1,036 and 4,045 range. As to be one of the key sources of economic growth, the lower MICs have attracted FDI to boost their economies and enhance well-being (Forte & Moura, 2013; Sharma & Gani, 2004). However, the inward stocks of foreign investment often lead them toward export-oriented production and in many cases that has caused costly environmental externalities (Giljum & Eisenmenger, 2004; Grimes & Kentor, 2003; Jorgenson, 2005). By adopting a multidisciplinary approach, the theory of ecologically unequal exchange was proposed to describe the global economic structures and relationships that shape the unequal distribution of natural resources and environmental degradation (Bunker, 1984; Givens et al., 2019; Jorgenson, 2006).

The theory of ecologically unequal exchange suggests the existence of structural relationships that facilitate unequal material flows in which wealthier and more

powerful developed countries have greater power to access natural resources and emit pollution in the lesser-developed countries (Bunker, 2019; Ciccantell, 2019; Givens et al., 2019; Jorgenson, 2006). In other words, the lesser-developed countries are structured in a weaker position to fulfill the demands for raw materials and a sink for waste from the more-developed countries within the world economic system of extraction, production, consumption, and disposal (Jorgenson, 2006). In the case study of middle-income countries, Rooij and McAllister (2014) explained that their economic interests greatly overwhelm environmental interests, resulting in undermining various forms of legal, political, and social action against environmental degradation. Therefore, a combination of weak enforcement and pervasive noncompliance tends to create a vicious circle that works against pollution mitigation and control.

The origins of ecologically unequal exchange theory can be traced to the studies of Bunker (1984, 1985, 2019). He introduced the idea of the theory by building on earlier structural analyses of unequal economic exchange. He explained the underdevelopment of lesser-developed countries that they are preferring short-term benefits from the extractive economy. Emmanuel (1972) inherited from Marx's labor theory of value, then he added wage differentials to the basis of unequal exchange. In addition, Hornborg (1998) stated that the theory is influenced not only by labor as Emmanuel (1972) but also by natural factors. He also emphasized that while raw materials have greater productive potential, their price is lower than processed goods, a distorted valuation that drives global ecological degradation and inequalities.

Over the last two decades, the theory of ecologically unequal exchange has marked an advance in development when related studies have adopted quantitative analytic techniques to test world system theory and expanded to various topics (Ciccantell, 2019). Most of the studies have confirmed the theory by studying the relationship between trade and environmental indicator as deforestation (Austin, 2010; Jorgenson, 2006). Moreover, Givens (2018) also revealed the supported results of the theory that uneven global trade affects the CIWB of nations through a longitudinal study. Therefore, in line with these studies, the paper has chosen the FDI for the replacement of trade to investigate the relationship with CIWB to broaden topics for the theory.

For our case study of nine lower middle-income countries, we do an effort to test the hypothesis that whether the existence of ecologically unequal exchange in these countries when they promoted and attracted flow stock of FDI for development. The relationship between CIWB and economic variables such as GDP, FDI, and EPC will be the answer for the efficiency of economic performance activities for human well-being in consideration of global climate change. Moreover, the impact of FDI on CIWB through time will give us a whole picture of FDI effect on well-being during the period of studies in the lower middle-income nations. If unequal exits, it will make the increase in the value of CIWB and be gradually erasing the success of development by the high cost in environmental externalities.

3 Methodologies

3.1 Data Collection

We collected the cross-nations data in the period of 2000–2018 for nine lower middle-income countries including: Algeria, Bangladesh, Egypt, India, Morocco, Pakistan, Philippines, Uzbekistan, and Vietnam. Though they are diverse by size and population, they have many common characteristics which are aligned with their level of income as belonging to a rapid increase of GDP, population, life expectancy, and emerging serious environmental issues. In the progress of development, these countries have been enjoying increasing of economic growth by transforming their economies from primary agriculture to industry. As a result, they've got a quick increase in production-based CO_2 emissions, which is the consequence of the development of the consumption of fossil fuels (Hachaichi & Baouni, 2021). Our study has included 171 observations in the panel data set for testing the relationship between CIWB and economic variables as FDI, GDP, and EPC. In which, CIWB is converted by a division of production-based CO_2 per capita (CO_2) and average life expectancy (LE). The data was collected from many sources of information such as World bank, UNCTAD, Country economy, and Our world in data to ensure the complete data set in the study period.

For the calculation of CIWB, the coefficient of variation of CO_2 (the numerator) is much larger than that of LE (denominator); therefore, it is necessary to modify the value CIWB by adding a correction factor (CF) to the CO_2 numerator as the below equation (Dietz et al., 2012; Jorgenson, 2014):

$$\mathbf{CIWB} = ((\mathbf{CO_2} + \mathbf{CF})/\mathbf{LE}) * \mathbf{100} \tag{1}$$

where CF is inherited by studies of Dietz et al. (2012), using subscripts CO_2 and LE to indicate CO_2 emissions and life expectancy, respectively, the correction factor is

$$\mathbf{CF} = ([S_{\mathbf{CO2}} * M_{\mathbf{LE}}]/S_{\mathbf{LE}}) - M_{\mathbf{CO2}}$$

where S is standard deviation and M is mean value.

3.2 Methods

In order to review the relationship between human well-being related to environment and the economics variables as FDI, GDP, and EPC, we developed a function as below:

$$\mathbf{CIWB_{it}} = \mathbf{f}(\mathbf{FDI_{it}}, \mathbf{GDP_{it}}, \mathbf{EPC_{it}}) \tag{2}$$

According to Jorgenson and Clark (2012), the effect of economic performance activity on the environment may change over time and in a unique way for each nation. Therefore, to analyze the effects of economic development on CIWB over time, we've estimated by Prais–Winsten models with panel-corrected standard errors. This is an appropriate method because it has enabled solving the problems of serially (i.e., temporally) correlated, spatially (i.e., contemporaneously) correlated, and characterized by heteroscedasticity in comparative time series cross-sectional data (Beck & Katz, 1995). Moreover, we included country-specific and year-specific intercepts, making the model equivalent to a two-way fixed effects model to examine country-specific and year-specific effects (Givens, 2015; Jorgenson, 2014). As with a fixed effects model, this technique estimates effects within countries over time and controls for variation between countries. This model construction is especially well suited to hypothesis testing, as it controls out all period-specific and country-specific variations. The independent variables for economic development (FDI, GDP, and ECP) and FDI interaction variables over time have been analyzed for the impact of the variables on the CIWB, and changes in the effect of FDI on the CIWB refer to the impact value of the reference year (2000) over the period of study 2000–2018.

The estimated model of study is

$$\begin{aligned}\mathbf{CIWB_{it}} = {} & \boldsymbol{\theta_1}\mathbf{FDI_{it}} + \boldsymbol{\theta_2}\mathbf{FDI_{it}} * \mathbf{year2001} + \ldots. \\ & + \boldsymbol{\theta_{19}}\mathbf{FDI_{it}} * \mathbf{year2018} + \boldsymbol{\theta_{19}}\mathbf{year2001} + \ldots \\ & + \boldsymbol{\theta_{37}}\mathbf{year2018} + \boldsymbol{\theta_{38}}\mathbf{GDP_{it}} + \boldsymbol{\theta_{39}}\mathbf{ECP_{it}} + \mathbf{u}_i + \mathbf{e_{it}}\end{aligned}$$

where

$CIWB_{it}$	a metric of human well-being in the consideration of the environment, which is measured as a ratio of production-based CO_2 emission per capita to life expectancy.
θ_1	the estimated parameter of FDI, reflected the impact of FDI on CIWB in the reference year, 2000.
$(\theta_2;\ldots;\theta_{19})$	the estimated parameter of FDI, reflected the impact of FDI on CIWB over time from 2001 to 2018 and refer to the value of the reference year, 2000.
$(\theta_{19}\text{year2001} + \ldots + \theta_{37}\text{year2018})$	the year-specific intercepts.
θ_{38}	the estimated parameter of GDP, reflected the overall impact of GDP on CIWB.
θ_{39}	the estimated parameter of EPD, reflected the overall impact of EPC on CIWB.
u_i	the country-specific intercepts.
e_{it}	the error term for each country for each time point.

The estimated parameter of FDI (θ_1) is the unit change in the dependent variable ($CIWB_{it}$) in the reference year (2000). For the other time points, the effect,

if significant, is the sum of the coefficient for FDI (θ_1) and the coefficient for the interaction term; if the interaction term is not significant, the coefficient is the same as the reference year. In the case of a non-significant effect for the reference year, but a later significant interaction with time, the reference year is interpreted as being not significantly different from zero (Allison, 2009; Givens, 2017).

4 Results

4.1 Descriptive Statistics

Descriptive statistics for all variables included can be found in Table 1 and Figs. 1, 2, 3, and 4. According to Kline (2015), variables with skewness > ± 3 and kurtosis > ± 10, the data has problems with the normal distribution. The distribution of skewness and kurtosis for all our variables were within the acceptable ranges, we do not need to convert the data by using the natural logarithm.

The summary statistics of the model's independent variables is presented in Table 1. On average, nine nations in lower middle-income group which have 1.9614 USD gross domestic product per capita receive 38.2254 USD annual foreign direct investment. These nations use an average 7.5651 thousand Kwh energy consumption per capita and reach 34.0878 in value of CIWB.

As for the $CIWB_{it}$ ratio, our data shows that the coefficient of variation of CO_2 is 0.64 and ranges from 0.2 to 5.04. Meanwhile, the coefficient of variation of life expectancy (LE) is 0.049, and the range is 62.5–76.69. The coefficient of variation of CO_2 (the numerator) is much larger than that of the lifetime (denominator), because the coefficient of variation of the numerator affects the variation of this ratio. Therefore, it is necessary to resolve this problem before considering the CIWB ratio as a dependent variable. Following the studies of Dietz et al. (2012) and Jorgenson (2014), we added a constant to the numerator. The constant value calculated as Eq. (1) in

Table 1 Descriptive statistics of all the independent variables in the model

Variables	GDP US dollar at current and constant (2010) price	ECP (thousand Kwh per capita)	FDI US dollar at current and constant (2010) price
Mean	1.9614	7.5651	38.2254
Std. Dev.	1.1132	5.4536	36.1727
Min	0.5249	1.0652	− 14.7132
Max	4.8301	24.0247	162.2256
Skewness	0.9799	1.2178	1.157
Kurtosis	3.2083	3.7254	3.7308

Source Authors' computation

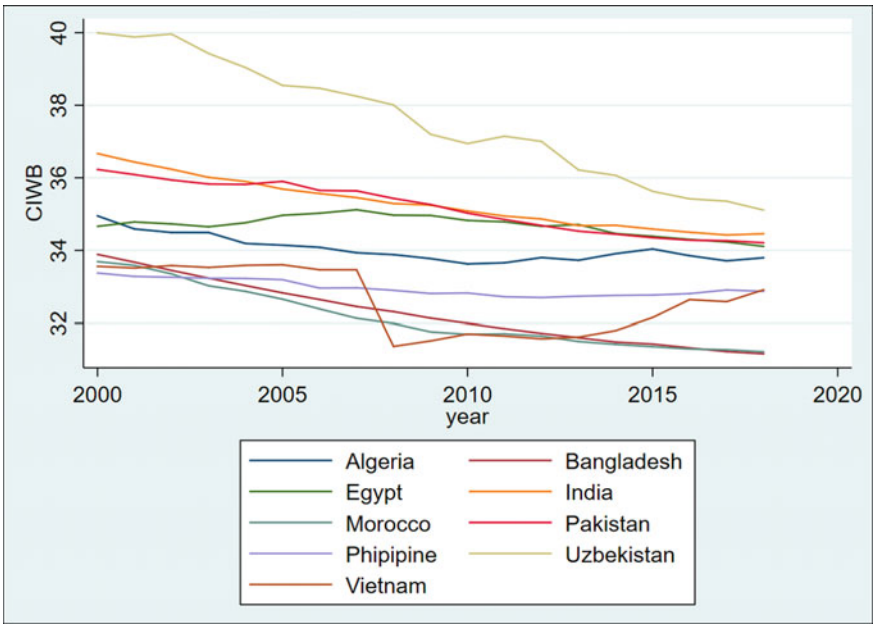

Fig. 1 CIWB for nine nations during 2000–2018 *(Source* Author's own*)*

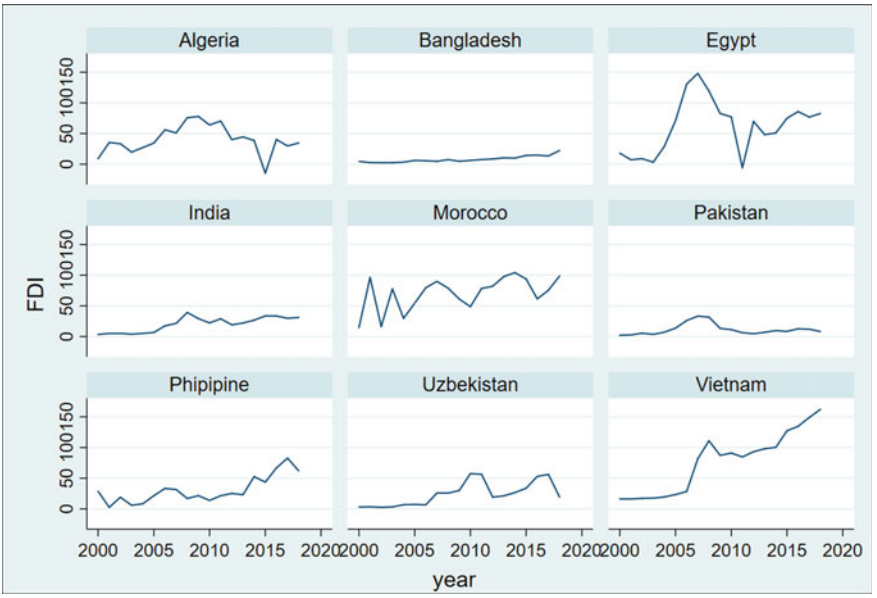

Fig. 2 FDI per capita measures for nine nations 2000–2018 *(Source* Author's own*)*

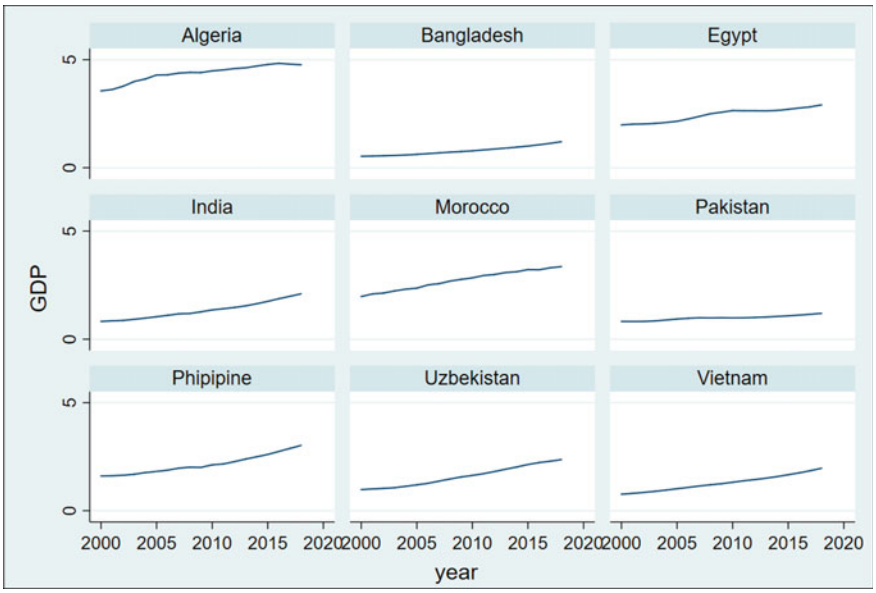

Fig. 3 GDP per capita measures for nine nations 2000–2018 (Source Author's own)

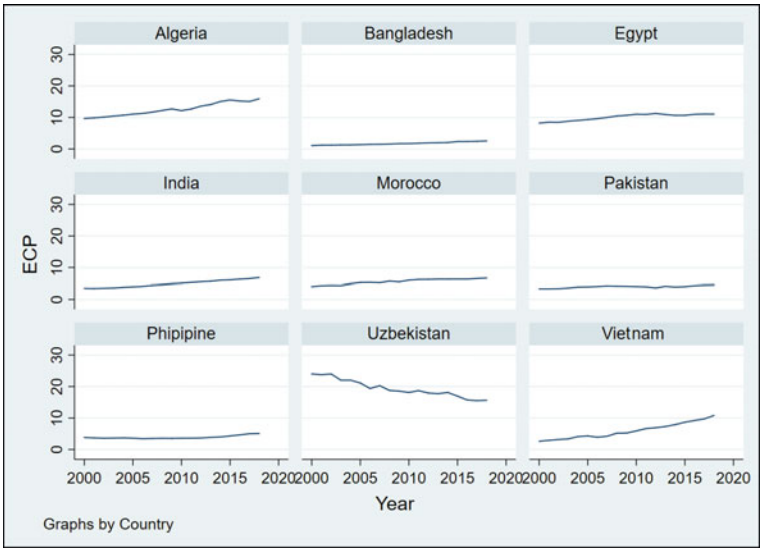

Fig. 4 ECP per capita measures for nine nations 2000–2018 (*Source* Author's own)

Sect. 3.1 from our sample data was 21.98 and added to the value of CO_2. The adjusted value of CIWB is in Fig. 1.

Figure 1 shows the overall downtrend of CIWB for nine lower middle-income countries in the study period with a value from 32 to 40. Vietnam is an exception with a slightly down and gradual uptrend, though its value in a lower level (32–36) but the plunge in 2008, it continuously increases until 2018. Uzbekistan got attention by a successful decrease from a higher to lower value level of CIWB as well as India and Pakistan. The good examples of a better CIWB value are Morocco and Bangladesh with a gradual decrease, while other countries noted a slight fall in the study period.

Besides that, Fig. 2 presented the mixed direction in changing FDI for nine nations from 2000 to 2018. Bangladesh, India, and Pakistan experienced a slightly upward trend in this period. Particularly, Bangladesh is the one attracting FDI which is the smallest in lower middle-income group. In contrast, the FDI value of Algeria, Philippines, and Uzbekistan which grew markedly through time. However, from 2015 to 2018, these nations had a fall in appealing to FDI. The nations which rapidly increased FDI are Egypt, Morocco, and Vietnam. Also, FDI of Egypt dramatically went down in 2011, but it went up in 2012 and continued until 2018, whereas the FDI of Morocco experienced fluctuation in the last 18 years. For Vietnam, FDI value remained stable at the beginning of this stage, in 2007, it surged and then following the upward trend until 2018.

The results from the regression in Table 2 show that the effect of FDI in the reference year 2000 is negative (−0.0223), and the interaction of FDI and the yearly dummy variables (2001) is positive and statistically significant. In the remaining years, the interactions are positive but not statistically significant, which means keeping the effect value in the reference year, 2000 (because there is an insignificant change in the value of interaction variables referring to the reference year). Thus, the relationship between CIWB and FDI in these countries is negative. However, it appeared to move upward in 2001, then went down in 2002 and became flat in the research period, which is demonstrated by Fig. 5.

International scholars argued that the effect of economic performance activities on the environment may change over time (Dietz et al., 2012; Grossman & Krueger, 1995; Jorgenson & Clark, 2012; Knight & Rosa, 2011). The results of our study show that for those lower middle-income countries, the effect of FDI on CIWB is negative in reference year (2000) but all the interaction coefficients got positive, resulting in a lower impact of FDI on a decrease of CIWB. Though just only the interaction coefficient in 2001 got positive and statistic significant, it also shows unstable sustainable strategies of attracting FDI in those countries. These countries should be caution on selecting the flow stock of FID in to enhance human well-being with less stress on environment.

Figure 5 shows the elasticity coefficients for FDI of lower middle-income countries over 18 years from reference year, 2000. The plotted line in Fig. 5 shows the effect of FDI on CIWB, which reached a peak in 2001 by an increase of 0.0218 in changing the effect, afterward it becomes flat as same as the reference year (2000) at 0.0223.

Table 2 Effects of FDI on CIWB over time from 2000 to 2018

Independent variables	Coefficients	Panel corrected standards errors	$P > \|z\|$
FDI	**− 0.0223***	0.0127	0.079
FDI_2001	**0.0218***	0.0131	0.097
FDI_2002	0.0195	0.0137	0.155
FDI_2003	0.0212	0.0137	0.107
FDI_2004	0.0166	0.0147	0.257
FDI_2005	0.0195	0.0135	0.148
FDI_2006	0.0191	0.0130	0.143
FDI_2007	0.0194	0.0129	0.132
FDI_2008	0.0112	0.0129	0.384
FDI_2009	0.0138	0.0130	0.289
FDI_2010	0.0170	0.0130	0.190
FDI_2011	0.0186	0.0130	0.151
FDI_2012	0.0163	0.0132	0.216
FDI_2013	0.0175	0.0133	0.191
FDI_2014	0.0173	0.0133	0.193
FDI_2015	0.0192	0.0130	0.138
FDI_2016	0.0203	0.0132	0.124
FDI_2017	0.0188	0.0133	0.156
FDI_2018	0.0188	0.0133	0.158
GDP	**− 0.6217*****	0.0627	0.000
ECP	**0.2657*****	0.0146	0.000
Constant	**34.590*****	0.1810	0.000
R^2	0.9923		
Rho	0.7937		

Note * significant at 10%; ** significant at 5%; *** significant at 1%

Source Authors' computation

Besides, the coefficient of GDP is also negative and statistically significant, which reflects the positive effect of development on CIWB over time. With a unit increase in GDP per capita, it will lead to a 0.6217 unit decrease in CIWB, the result is in line with the findings of Jorgenson and Clark (2012); Jorgenson and Givens (2015) for non-high income countries. Overall, in the case of these lower middle-income countries, the benefit of economic development for human well-beings is over the cost in terms of environment.

Moreover, the study shows the same positive effect of energy consumption (EPC) making an increase of CIWB (Nguyen & Dang, 2021), which implies the current growth pathway based on fossil consumption will make a cost for these countries and lead them to be less sustainable. In other words, it indicates that energy consumption

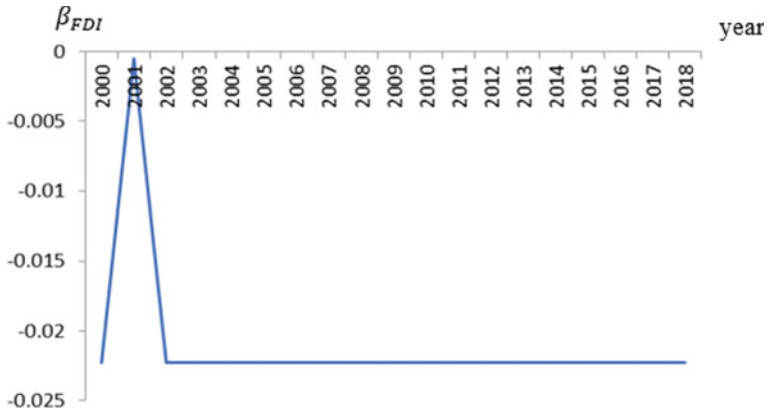

Fig. 5 Coefficients of FDI on CIWB through 2000 to 2018 (*Source* Author's own, *Note* The coefficient of FDI in 2002–2018 is as same as the one in 2000 because rejected hypothesis of the coefficient is different to the reference year in 2000 (sig > 0.05))

has been creating more stress on the environment due to an enormous amount of CO_2 emissions in the air.

In summary, though there is a sign of unstable sustainable strategies to attract FDI flows for nine lower middle-income countries, the inward stocks of foreign investment have still brought a positive effect on both economic development and human well-being. However, if their economic growth has been mainly based on natural resource extraction and the consumption of fossils, the reverse effects may exist. They will be the victims of an ecologically unequal exchange system; therefore, environmental protection and sustainable development strategies should be more cautioned to protect and attain economic achievements.

5 Conclusions

Adopted the thinking that the purpose of economic growth is not only increasing welfare but also human well-being, the study has chosen the case study of nine lower middle-income countries to test whether they have developed sustainably. They are special cases thanks to just getting out from low-income group to lower middle level, but they are facing a dilemma of rapid economic growth and starting a significant pressure on the environment. They are also taking the risk of ecologically unequal exchange while being influenced by more powerful nations on economic development. Without a special caution on environment protection and sustainable development strategies, they are likely to fall into a high value of CIWB, which could lead to environmental degradation and damage the economic achievements.

The results of the study show that these countries still got benefits in term of human well-being on the cooperation with higher-income nations. The negative effects of

FDI on CIWB over time imply that the more inward stocks of foreign investment, the more value of CIWB decreases. In addition, the GDP variable has also given the same results which are in line with studies on CIWB in Africa and in non-high income countries (Givens, 2017; Jorgenson & Givens, 2015). However, the variable on energy consumption is in reverse effect, which has caused stress on the environment by a positive effect on CIWB. This can be explained by the consumption of non-renewable energy, resulting in a huge rate of CO_2 emissions within this group of countries.

In order to decouple the economic growth and environment, maintaining a low value of CIWB is necessary. Givens (2017) presented the findings of associations between world society, world polity, and CIWB value. The more level of engagement in International Government Organizations such as World bank, UN, and WTO, the more decrease in CIWB value the nations can get. Though the study has just shown significant empirical evidence of decreasing CIWB value among less developed nations in the early 1990s and more developed nations in the late of 2000s, we still have an idea that active involvement in such organizations will help the nations develop sustainability.

References

Austin, K. (2010). The "hamburger connection" as ecologically unequal exchange: A cross-national investigation of beef exports and deforestation in less-developed countries. *Rural Sociology, 75*(2), 270–299. https://doi.org/10.1111/j.1549-0831.2010.00017.x

Beck, N., & Katz, J. N. (1995). What to do (and not to do) with time-series cross-section data. *The American Political Science Review, 89*(3), 634–647. https://doi.org/10.2307/2082979

Bunker, S. G. (1984). Modes of extraction, unequal exchange, and the progressive underdevelopment of an extreme periphery: The Brazilian Amazon, 1600–1980. *American Journal of Sociology, 89*(5), 1017–1064. https://doi.org/10.1086/227983

Bunker, S. G. (1985). *Underdeveloping the Amazon: Extraction, unequal exchange, and the failure of the modern state* (pp. 5–21). University of Chicago Press.

Bunker, S. G. (2019). Toward a theory of ecologically unequal exchange. In R. S. Frey, P. K. Gellert, & H. Dahms (Eds.), *Ecologically unequal exchange* (pp. 13–48). Palgrave Macmillan.

Ciccantell, P. S. (2019). Ecologically unequal exchange and raw materialism: The material foundations of the capitalist world - economy. In R. S. Frey, P. K. Gellert, & H. Dahms (Eds.), *Ecologically unequal exchange* (pp. 49–73). Palgrave Macmillan.

Dalziel, P., Saunders, C., & Saunders, J. (2018). From economic growth to wellbeing economics. In P. Dalziel, C. Saunders, & J. Saunders (Eds.), *Wellbeing economics: The capabilities approach to prosperity* (pp. 1–21). Springer International Publishing.

Dietz, T., Rosa, E. A., & York, R. (2009). Environmentally Efficient well-being: Rethinking sustainability as the relationship between human well-being and environmental impacts. *Human Ecology Review, 16*(1), 114–123.

Dietz, T., Rosa, E. A., & York, R. (2012). Environmentally efficient well-being: Is there a Kuznets curve? *Applied Geography, 32*(1), 21–28. https://doi.org/10.1016/j.apgeog.2010.10.011

Emmanuel. (1972). *Unequal exchange: A study of the imperialism of trade* (pp. 54–72). Monthly Review Press.

Forte, R., & Moura, R. U. I. (2013). The effects of foreign direct investment on the host country's economic growth: Theory and empirical evidence. *The Singapore Economic Review, 58*(03), 135–175. https://doi.org/10.1142/S0217590813500173

Giljum, S., & Eisenmenger, N. (2004). North-south trade and the distribution of environmental goods and burdens: A biophysical perspective. *The Journal of Environment & Development, 13*(1), 73–100. https://doi.org/10.1177/1070496503260974

Givens, J. E. (2015). Urbanization, slums, and the carbon intensity of well-being implications for sustainable development. *Human Ecology Review, 22*(1), 107–128.

Givens, J. E. (2017). World society, world polity, and the carbon intensity of well-being, 1990–2011. *Sociology of Development, 3*(4), 403–435. https://doi.org/10.1525/sod.2017.3.4.403

Givens, J. E. (2018). Ecologically unequal exchange and the carbon intensity of well-being, 1990–2011. *Environmental Sociology, 4*(3), 311–324. https://doi.org/10.1080/23251042.2018.1436878

Givens, J. E., Huang, X., & Jorgenson, A. K. (2019). Ecologically unequal exchange: A theory of global environmental injustice. *Sociology Compass, 13*(5), 126–133. https://doi.org/10.1111/soc4.12693

Grimes, P., & Kentor, J. (2003). Exporting the greenhouse: Foreign capital penetration and CO? Emissions 1980?1996. *Journal of World-Systems Research, 9*(2), 261–275.

Grossman, G. M., & Krueger, A. B. (1995). Economic growth and the environment. *The Quarterly Journal of Economics, 110*(2), 353–377. https://doi.org/10.2307/2118443

Hachaichi, M., & Baouni, T. (2021). Virtual carbon emissions in the big cities of middle-income countries. *Urban Climate, 40*, 109–126. https://doi.org/10.1016/j.uclim.2021.100986

Hornborg, A. (1998). Towards an ecological theory of unequal exchange: Articulating world system theory and ecological economics. *Ecological Economics, 25*(1), 127–136. https://doi.org/10.1016/S0921-8009(97)00100-6

Jorgenson, A. K. (2005). Unpacking international power and the ecological footprints of nations: A quantitative cross-national study. *Sociological Perspectives, 48*(3), 383–402. https://doi.org/10.1525/sop.2005.48.3.383

Jorgenson, A. K. (2006). Unequal ecological exchange and environmental degradation: A theoretical proposition and cross-national study of deforestation, 1990–2000. *Rural Sociology, 71*(4), 685–712. https://doi.org/10.1526/003601106781262016

Jorgenson, A. K. (2014). Economic development and the carbon intensity of human well-being. *Nature Climate Change, 4*(3), 186–189. https://doi.org/10.1038/nclimate2110

Jorgenson, A. K., & Clark, B. (2012). Are the economy and the environment decoupling? A comparative international study, 1960–2005. *American Journal of Sociology, 118*(1), 1–44. https://doi.org/10.1086/665990

Jorgenson, A. K., & Givens, J. (2015). The changing effect of economic development on the consumption-based carbon intensity of well-being, 1990–2008. *PLoS One*, *10*(5). https://doi.org/10.1371/journal.pone.0123920

Kline, R. B. (2015). *Principles and practice of structural equation modeling* (4th ed., pp.126–173). New York: The Guilford Press.

Knight, K. W., & Rosa, E. A. (2011). The environmental efficiency of well-being: A cross-national analysis. *Social Science Research, 40*(3), 931–949. https://doi.org/10.1016/j.ssresearch.2010.11.002

Martínez-Alier, J. (2002). *The environmentalism of the poor: A study of ecological conflicts and valuation* (pp. 34–69). Edward Elgar.

McGregor, J. A., & Pouw, N. (2016). Towards an economics of well-being. *Cambridge Journal of Economics, 41*(4), 1123–1142. https://doi.org/10.1093/cje/bew044

Nguyen, T., & Dang, B. H. (2021). The impact of energy consumption on Carbon Intensity of Human Well-Being (CIWB). *Ho Chi Minh City Open University Journal of Science*, *11*(1), 19–28. https://doi.org/10.46223/HCMCOUJS.econ.en.11.1.1360.2021

Paul D. A. (2009). *Fixed effects regression models* (Vol. 160, pp. 38–72). SAGE Publications, Inc.

Rooij, B., & McAllister, L. K. (2014). Environmental challenges in middle-income countries. In R. Peerenboom & T. Ginsburg (Eds.), *Law and development of middle-income countries: avoiding the middle-income trap* (pp. 288–306). Cambridge University Press.

Sharma, B., & Gani, A. (2004). The effects of foreign direct investment on human development. *Global Economy Journal, 4*(2), 185–215. https://doi.org/10.2202/1524-5861.1049