# Chapter 21
# Trade and Gas Emission in Mauritius: Impact on Socioeconomic Health and Environmental Degradation

**Sheereen Fauzel and Verena Tandrayen-Ragoobur**

**Abstract** The chapter analyses the short-run and long-run effects of international trade on the environment. For this purpose, the bounds testing method to cointegration is applied to a small island country setting of Mauritius and over the period 1980–2018. The result shows that that trade has adversely impacted on the environment. In addition to that, higher economic growth is as well observed to generate higher $CO_2$ emission. Furthermore, the CUSUM and CUSUM square confirm the stability of the model for Mauritius.

**Keywords** Trade · $CO_2$ emissions · ARDL · Mauritius

## 21.1 Introduction

The increased trend in global trade and investment has stimulated greater interest amongst both policy makers and researchers on the prospective trade consequences on the environment. The literature on the trade liberalisation-environment nexus is rather extensive (for instance, Tisdell 2001; Beghin and Potier 1997; Ferrantino 1997). The findings of this literature remain, however, mixed. Given the controversy in the debate on the correlation between trade and environmental quality, this paper attempts to add to the existing empirical works by analysing the trade and environment link for a small island economy.

Mauritius is an interesting case study as the island faces inherent environmental vulnerabilities related to the characteristics of small island developing states (SIDSs). Despite having a low greenhouse gases (GHGs) emission of the order of 0.01%, Mauritius is very much prone to natural hazards and disasters, inadequate natural

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V. P. Singh et al. (eds.), *Environmental Degradation: Challenges and Strategies for Mitigation*, Water Science and Technology Library 104,
https://doi.org/10.1007/978-3-030-95542-7_21

resources and sensitive ecosystems amongst others.[1] Further, Mauritius is highly dependent on international trade and more than 70% of its imports comprise of food products. Being a geographically remote and small island, high freight costs associated with trading with the main traditional European and US markets remain a major challenge. The country also faces low economies of scale owing to limited productive capacity and difficulties to supply the demands of existing markets or diversify into new markets. Further, the gradual erosion of the island's competitiveness against low-cost and high-volume economies like Brazil, Thailand and Scandinavian economies poses important threats to Mauritius situation on global markets.

Further, to our knowledge, the existing work analysing the trade and environment linkage in small islands and in particular for the African continent is very scant. Most studies probing into the trade-environment nexus, undertake cross country or panel analysis where different countries are grouped together. For instance, Baliamoune-Lutz (2012) examines the marked impacts of trade and political institutions on the quality of the environment in Africa and further probes into the effects of political institutions on the trade-environment link. The study uses panel data for a group of African countries, covering the period from 1990 to 2008.The results reveal that, in the case of $CO_2$ emissions, political institutions affect the trade and environmental quality nexus. The findings are also unanimous with an environmental Kuznets curve when it concerns pollution ($CO_2$ emissions). However, this is not applicable when the net forest depletion (deforestation) variable is used. In addition, Tran (2020) investigates into the association between trade openness and environmental pollutants in 66 developing nations from 1971 to 2017. The study focusses on different factors affecting environmental quality in these countries and the findings reveal the negative consequences of trade openness on the environment. In addition, the results further provide support to the environmental Kuznets curve hypothesis.

However, the environmental policies and macroeconomic structures of economies are different, whether they form part of the same continent or they are part of a particular income group. Nations are heterogeneous and differ in a number of ways, so the association between trade and environment needs to be studied at the country level. The chapter thus builds on existing work to assess the trade-environment link for Mauritius from 1980 to 2018. The study adopts an autoregressive distribution lag model given the differing stationary nature of the variable, to probe into the relationship between trade and the environment. The chapter is structured as follows: Sect. 21.2 probes into the existing literature analysing the effects of trade on the environment. Section 21.3 analyses the Mauritian situation with respect to foreign trade and $CO_2$ whilst Sect. 21.4 sets out the methodology adopted. Section 21.5 highlights the findings, and Sect. 21.6 discusses the results. Finally, Sect. 21.7 conclude with relevant recommendations.

[1] https://www.unep.org/news-and-stories/story/reducing-climate-change-and-disaster-risk-mauritius.

## 21.2 Literature Survey

Since the expansion of international trade, its effects on the environment are highly debated by scholars and policy makers (Neary 2006; Copeland and Taylor 2005). Globalisation has led to an increase in foreign trade and has contributed to massive increase in the world production of goods and services. Such a situation can have various positive effects on the economy as well as on the welfare of the population but it is also observed that there are negative externalities associated with it. For instance, increased production can lead to an increase in pollution and degradation of the environment. Moreover, environmental economists have been claiming that economic growth as a consequence of an increase in trade is not bad but there is the problem of pollution as well as the fear of an ultimate depletion in the natural resources. Hence, trade can impact adversely on environmental quality of a country mainly with poor environmental regulations (Ali et al. 2015). Countries which are more at a disadvantage when production increases due to trade are those whose export products are mainly linked with creating pollution, like those that involves the use of natural resources to produce them and those whose combustion leads to the emission of greenhouse gases. However, it is also debated that trade can as well lead to better environmental quality. For instance, these are trade that transfer environmental friendly technologies.

Theoretically, the effects of international trade on pollution levels are not straight forward. Using a conventional Heckscher-Ohlin approach, if a country has a relative abundance of 'environment' (reflected by emissions), freer trade leads to increased specialisation in 'environment-intensive' (pollution-intensive) goods. Conversely, from the Stolper-Samuelson theorem, the price of the environment relative to other inputs will rise, hence causing all industries to use less polluting-intensive techniques. In particular, Grossman and Krueger (1991) assess the linkage between trade and environment in terms of the scale, technique and composition effects. The scale effects refer to the rise in pollution and depletion of natural resources because of increased economic activities and consumption. Higher economic growth generated by greater market access leads to increased pollution (see Grossman and Krueger 1996; Lopez 1994). The second set of effects which are the technical impacts arise from the evolving techniques of production that go hand in hand with the liberalisation of trade. These may result from income-induced demand for stringent environmental regulations and procedures as well as greater access to eco-friendly production techniques and technologies. As trade and wealth expand, there is a tendency towards cleaner production processes and environmental best practices (Grossman and Krueger 1996). Lastly, the composition effect is the changing composition of an economy, namely its economic base where trade may create a high-tech and services-based economy or one based on extractive and polluting industries. This happens as countries specialise in activities where they have a comparative advantage. Overall, the environmental effects of trade thus arise from all three dimensions (Cole 2004).

A growing strand of the literature has also focussed on the environmental Kuznets curve (EKC) to explain a potential inverted U-shaped link between per capita income

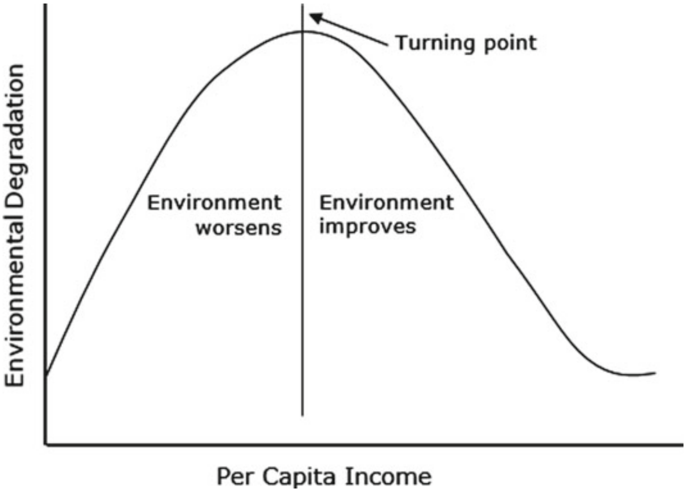


**Fig. 21.1** Source authors' computation from different sources

and pollution (see Shafik 1994; Selden and Song 1994; Grossman and Krueger 1995; Arrow et al. 1995; Stern et al. 1996; Ekins 1997; Cole et al. 1997; Stern and Common 2001). The inverted U-link between environment and economic growth through the Kuznets curve postulates that the quality of the environment deteriorates initially as GDP per capita increases, but as it reaches a certain point, environmental conditions improves (Grossman and Krueger 1991). This concept is shown on the diagram (Fig. 21.1).

One major criticism against the EKC is the exemption of trade patterns which may partly explain why pollution is rising in low income economies whilst a declining trend is observed in high-income countries. The pollution haven hypothesis (PHH) may create such trade patterns as there are differences across countries in environmental regulations and standards. With less stringent environmental laws in the South compared to the North, the former has a comparative advantage to pollution-intensive output whereas the North has an inclination to clean production. Hence, the relatively lax environmental standards in least developing economies may attract pollution-intensive trade and FDI which seek weaker regulations to avoid high pollution control compliance expenditure domestically (Copeland and Taylor 2005).

Analysing the empirical studies on the environment-trade nexus, it is found that no consensus can be reached. Analysing the link between national income and environment across both developed and developing countries, Grossman and Krueger (1995) show that in relatively poor, there is an inverse relationship between environment and economic growth, but once income level has increased to some critical level, environmental quality improves. This provides support to the Kuznet curve hypothesis. Further, Antweiler et al. (2001) investigate the consequences of trade liberalisation on pollution. They argue that trade liberalisation affects the environment through the scale effect. Since pollution is the by-product of consumption and production, hence a rise in the scale of these economic activities will impact the environment. Further, the technique effect was discussed whereby the different procedures of production can have varied risks of damaging the environment. More so, there is the composition effect which results from the fact that each good has its own polluting propensity.

Their empirical results reveal that trade enhances the technique and scale effects and as such may lead to a net fall in pollution. Finally, they discuss that free trade is not bad for environment.

It is also noted in the literature that the environment-trade nexus is different for developing countries as compared to developed countries. For instance, Azhar et al. (2007) find that across developing countries, the impact of international trade on environment operates via the agricultural sector and the exploitation of natural resources. This is explained by the fact that these countries want to keep a balance of payment surplus. For instance, the study concentrates on Pakistan where it was observed that its high trade volume leads to an overexploitation of natural resources, impacting negatively the environment in both the short and longer term. In addition to that, Ali et al. (2015) examine the effect of trade openness on environment for Pakistan where a causal relationship between FDI and $CO_2$ emissions was observed.

Another strand of literature pointed out that FDI can as well result in environmental degradation. This happens mainly when foreign investment is concentrated essentially in the resource base industries like oil extraction and mining of minerals. International trade has also been found to result in high rate of tropical deforestation. For instance, trade with developed countries has compelled Latin American and Southeast Asian countries to increase deforestation. For the African case, trade liberalisation has resulted in the extermination of valuable animal and plant (Rudel 1998). Hence, it is observed that though extensive research has been conducted, no consensus has been reached on the environment-trade linkage.

## 21.3 Situational Analysis of Trade and GHG Emissions in Mauritius

### *21.3.1 Foreign Trade in Figures*

Located in the middle of the Indian Ocean, near Madagascar, Mauritius has 1.3 million inhabitants and a total land area of 2040 km$^2$. It has recently moved into the high-income league with a GNI per capita of US $ 12,740 in 2019, a 3.5% increase over the 2018 figure (World Bank 2020). The island's economy has gone through major structural changes in the last five decades. Starting from a mono crop sugarcane economy, Mauritius has diversified to manufacturing, financial services, tourism and information and communication technology (ICT). Today, the island's landscape has changed to a service-oriented economy where the services sector contributes to around 76% of GDP (Statistics Mauritius 2019).

The island has achieved a welfare paradigm that is consistently progressive. As such, Mauritius' Human Development Index (HDI) for 2019 stood at 0.804, which placed the country in the very high human development group. This places Mauritius at 66 out of 189 countries and territories studied. Between 1990 and 2019, Mauritius' HDI value rose from 0.624 to 0.804, which represents a rise of 28.8%.

Although, Mauritius is viewed as an economic success in the African continent, the country still faces a number of challenges in terms of increased income inequality, growing trade and budget deficits and high competition on the world market. In essence, income inequality has been rising with a gini coefficient rising from 0.388 in 2006/07 to 0.413 in 2012 and then slightly falling to 0.400 in 2017 whilst poverty rate shot to 9.4% in 2017 and 2012 relative to 7.9% in 2006/07. Mauritius has a very liberal economic and trade policy. Mauritius trade to GDP ratio for 2019 was 92.81%, a 2.3% decline from 2018 (Statistics Mauritius 2020a, b). Mauritius is a member of the World Trade Organisation since 1995 and has joined different regional economic communities like the Southern African Development Community (SADC), the Common Market for Eastern and Southern Africa (COMESA) and the Indian Ocean Commission (IOC).

The principal goal is to move the country towards an open and globally competitive economy and facilitate its integration into the world market. In 2017, the main exports were prepared or preserved fish, cane or beet sugar and clothing (mostly t-shirts, shirts and suits). Mauritius is a heavy importer of petroleum products, frozen fish, cars, medicaments and radio transmission equipment. It mainly trades with France (15.8%), the United Kingdom (11.9%), the US (11.2%), South Africa (8.9%) and Italy (6.9%); whilst China (16.4%), India (16.4%), South Africa (8.5%) and France (8.0%) were the leading import countries. The island economy is highly dependent on imports which is the cause of a significant trade deficit. In 2017, exports were USD 2.3 billion whilst imports were USD 5.2 billion. The following table shows foreign trade figures for Mauritius (Table 21.1).

### *21.3.2 Greenhouse Gas (GHG) Emissions*

In recent years, there has been special focus from the government to integrate green economy principles and initiatives into mid- and long-term development plans. There has been a number of policy reforms to build knowledge and create awareness about green economy opportunities in the public and private sectors.

From 2018 to 2019, GHG emissions rose by 2.9%. In 2019, carbon dioxide ($CO_2$) was the main GHG representing 73.9% of total GHG emissions. Methane (CH4) contributed 23.3%, nitrous oxide2.6% and hydrofluorocarbons 0.2% (Statistics Mauritius 2020a, b). Figure 21.2 shows a rising trend in average $CO_2$ concentration as well as methane concentration over the period 2010–2019.

In addition, in 2019, the energy sector makes up for the largest share of emissions (74.2%) (see Fig. 21.3), followed by the waste sector (23.0%) (Statistics Mauritius

**Table 21.1** Foreign trade indicators from 2013 to 2017

| Foreign trade indicators | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|
| *USD million* | | | | | |
| *Goods* | | | | | |
| Imports | 5397 | 5610 | 4792 | 4654 | 5253 |
| Exports | 2869 | 2650 | 2457 | 2361 | 2363 |
| *Services* | | | | | |
| Imports | 2143 | 2426 | 2176 | 2068 | 2231 |
| Exports | 2734 | 3119 | 2654 | 2867 | 2981 |
| Trade balance | −2270 | −2260 | −1862 | −2031 | −2629 |
| *Goods and services* | | | | | |
| *Yearly percentage change (%)* | | | | | |
| Imports | −1 | 8 | 6 | −0 | n/a |
| Exports | −6 | 11 | −0 | −5 | n/a |
| *As a percentage of GDP (%)* | | | | | |
| Total foreign trade | 110 | 113 | 108 | 98 | 97 |
| Imports | 62 | 62 | 59 | 54 | 55 |
| Exports | 48 | 51 | 49 | 45 | 42 |

*Source* WTO—World Trade Organisation, World Bank—Latest available data

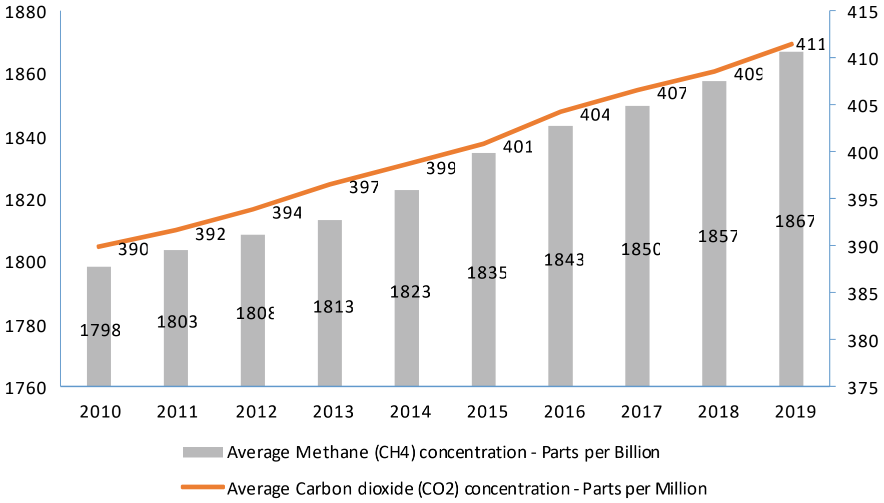


**Fig. 21.2** Average carbon dioxide ($CO_2$) and methane ($CH_4$) concentration from 2010 to 2019. *Source* Authors' Computation from Digest of Environment Statistics 2019, Statistics Mauritius 2020a, b

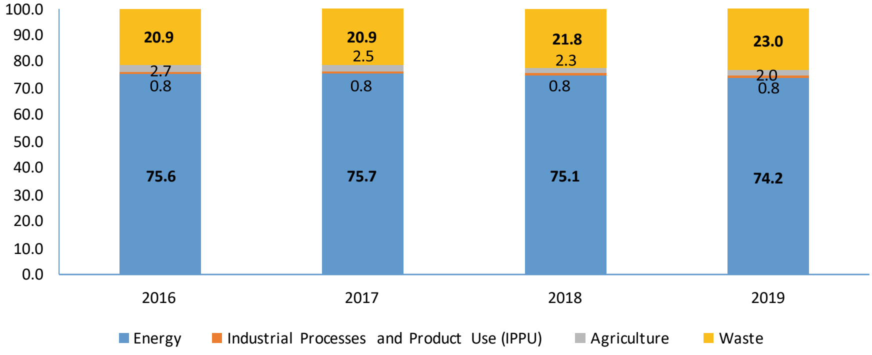


**Fig. 21.3** National inventory of greenhouse gas emissions by sector as a % of total GHG emissions, from 2016 to 2019. *Source* Authors' Computation from Digest of Environment Statistics 2019, Statistics Mauritius 2020a, b

2020a, b). In 2019, GHG emission from the energy sector rose by 1.8% relative to 2018.

In fact, the energy industries mainly electricity generation contributed to 57.1% of GHG emission followed by the transport sector (26.4%), the manufacturing sector and construction (8.3%) and the remaining 8.2% are from other sectors.

## 21.4 Econometric Model

The chapter analyses the link between trade and the environment for Mauritius over the period 1980 to 2018. For this purpose, annual data have been used. The econometric model has been adopted from Ali et al. (2015), Cederborg and Snöbohm (2016), Fauzel et al. (2017) and Fauzel (2017).

$$ENV = f\,(OPEN,\ GDP,\ EDU,\ POP) \tag{21.1}$$

To deal with the issue of heteroskedascity, the variables are converted in logarithm form as follows;

$$\ln ENVt = \beta_0 + \beta_1 \ln OPENt + \beta_2 \ln GDPt + \beta_3 \ln EDU + \beta_4 \ln POP\varepsilon t \tag{21.2}$$

where $t$ signifies time; $\varepsilon$ is the random error term and $\beta_1 \ldots \beta_4$ characterise the parameter estimates (Table 21.2).

**Estimation Issues**

Prior to estimating the model, the univariate properties of all the individual data series have to be explored. First and foremost, the unit roots of all variables are investigated.

**Table 21.2** Sources and definitions of variables used

| Variables | Definition | Literature | Sources |
|---|---|---|---|
| ENV | $CO_2$ emission per capita | Tiwari (2011) and Han et al. (2013) | World development indicators (WDI) |
| TRADE | Exports as a % of GDP | Akin (2014) | WDI |
| GDP | GDP per capita | Tiwari (2011) and Han et al. (2013) | WDI |
| EDU | Secondary enrolment ratio | Cooray (2009) | Statistics Mauritius |
| POP | Population size | Fauzel (2017) | WDI |

*Source* Authors' Compilation, 2020

This is followed by an investigation of possible long-run relationship amongst the variables.

**Unit root test**

Adding trends in time series data cause it to be non-stationary. Performing a regression analysis on such data can lead to spurious outcomes (Granger and Newbold, 1974). Phillips (1986) argues that the results will be misleading unless cointegration exists. Hence, the findings from the ordinary least square regression will only be credible provided that the variables are stationary. In fact, for cointegration to exist, it is important to ensure the stationarity of variables. There are different statistical tests, as suggested in the literature that can be used to check the stationarity of data. For the actual study, the augmented Dickey-Fuller (ADF) (1979) unit roots tests are used. The stationarity tests reveal that the variables are integrated of order 1 and are therefore stationary in first difference.

The chapter thus adopts the autoregressive distributed lag (ARDL) method to cointegration in line with Pesaran et al. (2001). The ARDL bounds cointegration method is selected, based on several deliberations, to ascertain the long-run and short-run linkages. As per Pesaran et al. (2001), ARDL models generate consistent estimates of the long-run coefficients that are asymptotically normal regardless of whether the macroeconomic time series are I(1) or I(0). Further, ARDL models produce unbiased long-run estimates and valid *t*-statistics despite endogenous regressors (Harris 2002). The endogeneity bias may well be corrected by the inclusion of the dynamics as shown by Inder (1993) and Pesaran et al. (1997).The bound approach is better than the Johansen cointegration method whilst taking into account the sample size and the number of estimated parameters. However, the bound approach estimates a system of equations which can cause a substantial loss in degree of freedom. Hence, the ARDL cointegration method estimates the long and short-run coefficients. The bounds *F* test is used to establish whether a long-run relationship prevails across the macroeconomic time series. Hence, Eq. (21.1) below is estimated as a conditional ARDL error correction model (ECM):

$$\Delta \ln CO_{2t} = \propto_0 + \sum_{i=1}^{n} \propto_i \Delta \ln X_{t-1} + \sum_{i=1}^{n} \partial_i \Delta \ln GDP_{t-1} + \sum_{i=1}^{n} \delta_i \Delta \ln EDU_{t-1} + \sum_{i=1}^{n} \beta_i \Delta \ln POP_{t-1} + \Delta_1 \ln CO_{2t-1} + \Delta_2 \ln X_{t-1} + \Delta_3 \ln GDP_{t-1} + \Delta_4 \ln EDU_{t-1} + \Delta_5 \ln POP_{t-1} + \Delta_8 \ln TO_{t-1} + \varepsilon_t \quad (21.3)$$

where the drift component is represented by $a_0$ and the white noise error term is $\varepsilon_t$. In Eq. 21.3, the lagged level variables are in fact the long-run multipliers. The symbols $a_i$, $\delta_i$, $\beta_i$, $\sigma_i$ and $\gamma_i$ characterise the short-run influences on $CO_2$ emission. The ordinary least squares method is utilised in estimating the equation. Furthermore, it is important to test whether there is cointegration in the model. Hence, the null hypothesis of no cointegration; $(H_0: \eta_1 = \eta_2 = \eta_3 = \eta_4 = 0)$ is set against the alternative hypothesis $(H_0: \eta_1 \neq 0, \eta_2 \neq 0, \eta_3 \neq 0, \eta_4 \neq 0)$. This is done by using the F test alongside an asymptotic non-standard distribution. Two asymptotic critical value bounds deliver a test for cointegration when the independent variables are $I(d)$ with $0 \leq d \leq 1$. For instance, the lower bound posits that the variables are integrated of order 0 that is $I(0)$, and the upper bound posits that they are integrated of order 1 that is, $I(1)$. Therefore, as per Pesaran and Pesaran (1997), if the computed $F$-statistic is above the upper level of the band, it indicates that there is cointegration, and the null hypothesis is thus rejected. In contrast, if it is below the lower level band, then it can be concluded that there is no cointegration. Hence, when the long-run link is being obtained, the final step of the ARDL is to estimate the long-run coefficients (see Pesaran and Pesaran, 1997). There are two additional steps which are involved at this stage. The first step is to select the orders of the lags based on Schwarz Bayesian Information Criteria (SBIC) or the Akaike Information Criteria (AIC). Second, the ARDL model restricted to the selected lag structure is predicted by incorporating both the short-run dimensions and the error correction model.

An error correction term in lagged form is then included to replace the set of lagged variables. Hence, the short-run coefficients as an error correcting model is estimated as well as the long-run coefficients as follows:

$$\Delta \ln CO_{2t} = \propto_0 + \propto_0 + \sum_{i=1}^{n} \propto_i \Delta \ln X_{t-1} + \sum_{i=1}^{n} \partial_i \Delta \ln GDP_{t-1} + \sum_{i=1}^{n} \delta_i \Delta \ln EDU_{t-1} + \sum_{i=1}^{n} \beta_i \Delta \ln POP_{t-1} + W_t ECM_{t-1} + \gamma_t \quad (21.4)$$

In the above equation, the error correction term is signified by the $ECM_{t-1}$ and the term $\psi_t$ is the speed of adjustment.

**Table 21.3** Cointegration test

| Dependent variable | $F$ statistics | | Lower bound | Upper bound |
|---|---|---|---|---|
| | | 1% critical $F$ values | 3.29 | 4.37 |
| $LnCO_2$ | 4.7429 | 2.5% critical $F$ values | 2.88 | 3.87 |
| | | 5% critical $F$ values | 2.56 | 3.49 |
| | | 10% critical $F$ values | 2.20 | 3.09 |

Source: Authors' Computation, 2020

## 21.5 Findings

### *21.5.1 Results for Unit Root Test*

The stationarity test was carried out and it was noted that there is a combination of both $I(0)$ and $I(1)$ variables.

### *21.5.2 Results for Bounds F Test*

The bounds $F$ test is as per Table 21.3 which relates the computed $F$-statistic with the bounds. It is observed that the computed $F$-statistic is larger than the upper bound critical values at 1, 2.5, 5 and 10% significance levels. The null hypothesis of no cointegration is, therefore, rejected. Hence, the results confirm stable long-term cointegration link between trade and $CO_2$ emission.

Once, cointegration relationship was identified, the coefficients of the long-run and short-run ECM were determined using Eq. 21.4. Results show a statistically significant coefficient of the lagged error correction term, ecm(−1), of value 0.55. In addition, diagnostic test in terms of the Breusch-Godfrey serial correlation LM test is applied. The findings reveal no problem of serial correlation.

## 21.6 Discussions

The estimated coefficient of the long-run relationship between $CO_2$ emission and export is positive and significant. It, therefore, implies that a rise in exports leads to an increase in $CO_2$ emissions in Mauritius. More precisely, a 1% increase in exports increases $CO_2$ emission by 0.608%. The technique used to produce the goods as a result of trade liberalisation can affect the environment. For instance, if the techniques of producing goods for trade are harmful to the environment and increase pollution levels in an economy, this implies negative effects on environmental quality (Ali et al. 2015). Relating this result to the case of Mauritius, it is noted that whilst trade has been increasing, the level of pollution is also on the rise. A 3% rise in green gas emissions has been observed from 2016 to 2017, with an increase in gross emissions from 5403 to 5572 thousand tonnes of $CO_2$ equivalent and an increase from 5040 to 5207 thousand tonnes $CO_2$ equivalent in net emissions, after absorption by forest and land use practices (Statistics Mauritius 2018).

The findings indicate that a rise in GDP is likely to raise $CO_2$ emission in the country. In fact, in the long run, a 1% rise in GDP contributes to a 0.92% rise in $CO_2$ emission. Similar results were obtained by Seetanah and Sannassee (2011). Other studies revealing results alike to the present study are Ferda (2008) and Coondoo and Dinda (2002) for the case of Africa and Asia. These results support the 'scale effect' of international trade specifying that trade tends to expand economic activities, which ceteris paribus worsen the environment.

Moreover, it is noted that the population coefficient is positive but insignificant. Further, the result for education as well insignificantly influence carbon emission as per the present study. Moreover, as a follow up to the ARDL findings, the short-run estimates are next reported. As the variables are cointegrated, the ECM representation is applied to analyse the short-run dynamics. The findings are depicted in Table 21.4 whereby a positive and significant short-run impact of exports on $CO_2$ emissions is noted. In addition, the signs of the short-run dynamics are preserved to the long run.

Overall, there is support for the view that international trade has increased pollution in both the long run and short run for the small island of Mauritius. Further, economic growth has contributed towards a degradation in the environment.

**Table 21.4** Long-run and short-run results

| Regressor | | Ln $CO_2$ | |
|---|---|---|---|
| | | Coefficient | |
| Long run | LX | 0.608** | |
| | LGDP | 0.924*** | |
| | LEDU | −0.574 | |
| | LPOP | 2.224 | |
| | Constant | −8.094** | |
| Short run | D(LX) | | 0.336*** |
| | D(LGDP) | | 0.511*** |
| | D(LEDU) | | −0.317 |
| | D(LPOP) | | 1.229 |
| | constant | | −4.472** |
| | ecm(-1) | | −0.553*** |
| MODEL SUMMARY $R^2$ = 0.99 | | DIAGNOSTIC TEST | |
| | | Serial correlation: 0.531 | |

* significant at 10%, ** significant at 5%, *** significant at 1%
*Source* Authors' Computation, 2020

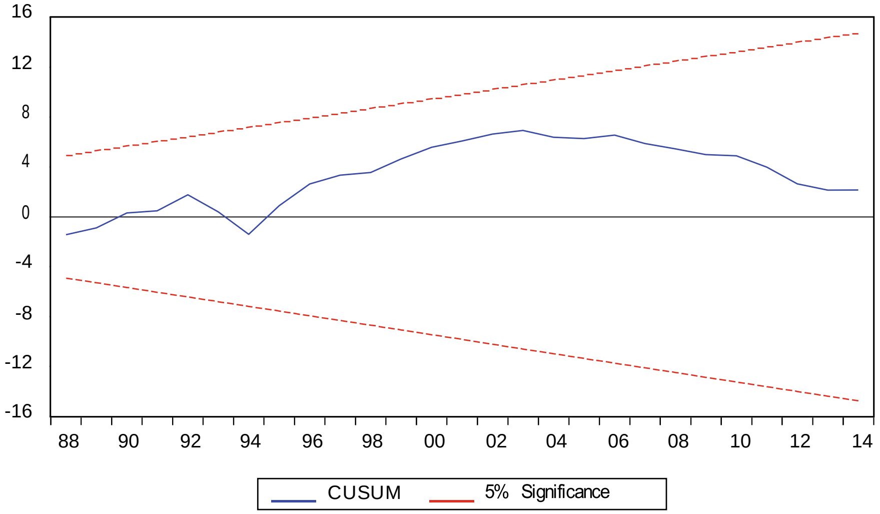


**Fig. 21.4** Structural stability. *Source* Authors' Computation, 2020

**Stability of the Model**

The last step probes into the stability of the long-run coefficients and the short-run dynamics. The CUSUM (Brown et al. 1975) tests were adopted in line with Pesaran and Pesaran (1997). In fact, the tests are carried out on the remnants of the model. Precisely, the CUSUM test evaluates the cumulative sum of recursive residuals based on the first set of n observations and is updated recursively and plotted against break points. We do not reject the null hypothesis that the estimated coefficients in the ECM are stable as the plot of CUSUM statistics is within the critical bounds of 5% significance level. The results are shown below and it can be depicted that there is no evidence of any significant structural instability (Fig. 21.4).

## 21.7 Conclusions

By using an ADRL approach, this chapter investigates the potential association between international trade and environment in the small island economy of Mauritius from 1980 to 2018. There is evidence that international trade has eventually led to an increase in pollution as measured by $CO_2$ emissions in both the short run and long run. Moreover, an increase in economic activity also leads to environmental degradation. The results support the 'scale effect' of international trade specifying that trade expands economic activities, which ceteris paribus tend to worsen the environment. Moreover, the CUSUM test proves that the model is stable.

The findings indicate that the construction and planning of strategies of any country is highly dependent on the identification of the consequences of international trade on the environment, especially for small island economies where a significant rise in trade openness has been recorded. Nonetheless, further investigation on the negative consequences of trade openness on the environment has not been prioritised.

## 21.8 Policy Recommendations

Though trade objectives are achieved in terms of foreign exchange revenue, creation of employment and new industries and activities as well as higher economic growth, the environmental perspective needs to be considered in policy making. From the results, there are serious negative environmental effects of trade on the environment. These can in turn have important social effects on communities and the vulnerable segments of the population. Hence, the need to reduce environmental damage should be addressed in the early phases of the design of trade policies. This necessitates the development of integrated trade-environment policies to ensure sustainable trade without causing harm to the environment. Moreover, more focus should be laid on environmental friendly technologies and production techniques which will stimulate green technological innovation that will help Mauritius moves towards sustainable and inclusive development. There is a need to unlock the green economy potential of the island so much that policies are centred on SDG linkages, and where business and industries across varied sectors as well as the financial markets support such transition.

There should be a process designed by policy makers to develop sustainable development policy packages to embrace a proactive environmental policy stance. There is a need for greater commitment to environmental protection in Mauritius and as such develop an overall environmental regulation policy to minimise the environmental impact of international trade. However, the implementation of such policy should not be too restrictive as it may lead to a contraction in production and affect economic growth negatively.

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