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Impact of Cause and effect of ecological degradation relationship economy: case of Madagascar

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Abstract: The exploitation of natural resources is at stake, because according to the Malthus theory "population progresses in a geographical way, while resources progressing an arithmetically". So, the exploitation of its natural resources brings about benefits to the State through various economic activities. Therefore, there is a very narrow correlation on economic activities by different variables such as deforestation that are presented a set off all disparity of its natural resources, reforestation, arrivals of foreign tourists and reforestation, all its variables. In addition, this work was modeled by the MEC error correction model analysis. This model makes it possible to know the cointegration and correlation between the variables by the short-term elasticity and the long term elasticity. Thus, deforestation in Madagascar is traditionally the massive form that is presented it as an exogenous variable and at the same time endogenous ones. It is through this model analysis of this error correction that allows us to know the causal effect according the Granger meaning. In general, the exploitation of this natural resources brings about economic benefit in a short-term way for the public minority, but in the long term it remains stable. On the other hand, the public majority suffer the consequences because the percentage of deforestation is very high compared to that of reforestation or forest restoration which requires many parameters such as financing, the moment, land to afforest etc ... While the State intervenes every year through different actors as companies, national and international NGOs such as REDD,... in order to curb and reduce the rate of deforestation.

Keywords: Deforestation, Natural resources, CEM, Exogenous, Reforestation.

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1 Introduction

The stakes of environmental degradation are enormous and concern all humanity. The drying up of oil does not mark the end of the energetical crisis, but on the contrary has made the biodiversity conservation programme complicated. Current research on renewable energies is limited to the so-called "green energy" agrifuel; while it begins to highlight environmental problems. In addition, the craze for the green energy business has relegated

food production at the second plan of food. Areas normally devoted to agricultural production were allocated to the production of green fuel.

Competitiveness remains one of the key concerns of the trade policies of countries that are competing on the global market (ADEME, in 2010). In particular, developing countries have productive capacities that cannot compared to those industrialized countries. Simply because natural capital is not sufficiently exploited to be undertaken (S.E.R., 2004). This correlation presents problems when we talk about the biodiversity loss or the biodiversity erosion. Despite this, this constatation remains a theoretical debate. Madagascar's 5000 km of coastline produce an excess of forest species (such as rosewood, ebony and palissander species) if governance, in concert with all stakeholders, manages the stock or "natural capital" with due care. The five years of political transition have seriously started the latter, whose economic value has been defined since a long time and has been revised upwards from year to year. The loss of natural resources constitutes what we called exogenous variables to economic growth. Given the fact that Madagascar is a mega-divers its country, the correlation still exists. So the economic situation of the country is paradoxical. Thus its position among the 10 poorest countries on the planet confirms this anomaly. The underground, underwater and on-land mining resources are there. Tourism was the second largest source of foreign exchange in Madagascar before 2009 (400 million US dollar 2008). That is to say Madagascar presented in 2008 a spectacular result in tourism. This is the first time that our country has presented an economic balance sheet in tourism. However, this industry tourism has known an unprecedented crisis from 2009 to 2015.

2 Materials and methods

2.1 Materials

The natural resource of Madagascar is characterized by the presentation of environmental experts and that of international researchers, but this characteristic evaluated chronologically, the change of Malagasy government system as well. After that Madagascar was presents itself as a country with mega-biological[1] diversity, the country concentrates indeed a high number of plant and animal species (12,000 species of plants and 1,000 species of vertebrates, mammals, reptiles, amphibians, birds) most of which are endemic to the Big Island (nearly 10,000 for plants and nearly 1,000 for vertebrates)[2]. In addition, the forests of the north-east of the country produce so-called precious wood species such as rosewood and ebony, which are exported at a high price (about $ 5 per kg), while the mangroves of the Mozambique Channel are used to breed quality shrimp called "Madagascar's rose gold", also exported. Finally, Madagascar is a tourist destination, especially for nature tourists attracted by lemurs (primates older than monkeys101), chameleons and frogs102, turtles and humpback whales or baobabs from southern Madagascar3. The tourism industry had become before the political crisis of 2009, the second largest source of foreign exchange on the island (US$ 400 million in 2008) after the shrimp industry.

That said, although little developed, Madagascar does not escape environmental problems, which affect the living environment of the population. A 2008 study on the cost of environmental degradation in Madagascar shows that the two environmental degradations that cause the greatest loss of GDP are agricultural land degradation and indoor air pollution, respectively 2.5% and 1% of GDP per year.

The effects of agricultural clearing, then extensive livestock farming on the Highlands, have made Madagascar compare to a terracotta brick by its color and its loss of fertility.

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[1] Jean Christophe Carret, bienvenu Rajaonson, Paul Jean Feno and JurgBrand : « l'environnement a Madagascar : un atoutà préserver, des enjeux a maitriser » p 105-106

[2] Cette note de la Banque mondiale a été écrite en concertation avec la FAO, le PNUD, JICA, la Coopération allemande, l'USAID, la Norvège, l'AFD, la Coopération suisse, *Conservation International* (CI), *World Conservation Society* (WCS), *World Wildlife Fund for Nature* (WWF), Tany Meva et la Fondation pour les Aires Protégées et la Biodiversité de Madagascar (FAPBM). Elle a été discutée avec le groupe de partenaires techniques et financiers organisé autour de l'Environnement sous la direction actuelle du PNUD. Elle a été aussi partagée lors d'une session du *dialogue sur le développement économique* avec la participation de la société civile, du secteur privé, du secteur académique, des représentants techniques de Ministères et des média. Cette version a tenu compte des commentaires reçus lors de ces rencontres.

[3] 6 des 8 espèces mondiales de baobabs se trouvent seulement à Madagascar.

At the end of the dry period, farmers set fire to large areas of grassland to promote the recovery of grasses, at the same time preventing the regeneration of soil fertility. Hardy grasses, which alone grow on sterile, compacted laterites, become dry and inviable for livestock during the dry season. To the east, on the slopes of the escarpment, farmers practice rainfed rice cultivation (possible because of the climate) on slash-and-burn. They clear the forest (and appropriate the land) by burning it and planting rice for two or three seasons.
Firewood consumption, especially in semi-arid areas, is also a major source of deforestation, exacerbated by population growth and concentrated in some areas due to the expansion of protected areas.

2.2 Methods

The theory of cointegration was introduced by Granger in 1981. It has since undergone many developments. The link between and error-corrected model has been explained by Granger (1981, 1983), Granger and Weiss (1983) and Engle and Granger (1987). Before defining cointegration, we will briefly recall some definitions and properties relating to integration.

Let $y_t \to I(1), x_t$ and y_t are independent, if the following model is estimated using the MCO:

$$y_t = ax_t + b + \varepsilon_t$$

We get: $y_t - ax_t - b = \varepsilon_t \to I(1)$

$\varepsilon_t \to I(0), \varepsilon_t$ is not stationary (the DW is very low here)

In addition, we end up with a so-called fallacious or illusory regression "spurious regression", characterized by a very high R2 and Student's t while the two variables have no link between it.
We can avoid this problem by passing the variables into prime differences in order to make them stationary $(\Delta y_t \to I(0)$ and $\Delta x_t \to I(0)$ if x_t and y_t there are random non-stationary processes and performing the following regression:

$$\Delta y_t = a\Delta_t x_t + b + \mu_t$$

In addition, we get: $\Delta y_t - a\Delta x_t - b = \mu_t \to I(0)$

However, it happens that we want to work with variables rather in level than in first differences (so rather with non-stationary variables). In this case, how do you know if the regression performed is misleading or not? This is where the notion of co-integration comes into its own here. We do not have a fallacious regression when the variables x_t and y_t are cointegrated into it, that is, $y_t - ax_t - b = \varepsilon_t \to I(0)$

when we then have $y_t \to I(1)$ and $x_t \to I(1)$

Thus, Granger showed that if we have two non-stationary variables $y_t \to I(1)$ and $x_t \to I(1)$ we can have:

$y_t - ax_t - b = \varepsilon_t \to I(1)$ were $y_t - ax_t - b = \varepsilon_t \to I(0)$

Two non-stationary series ($y_t \to I(1)$ and $x_t \to I(1)$) are said to be cointegrated if

$$y_t - ax_t - b = \varepsilon_t \to I(0)$$

The series x_t and y_t are then noted:

$$x_t, y_t \to CI(1,1)$$

Test cointegration between two variables, we have two steps for this test, for the order of integration and that of the long-term estimate.
Step 1: Test the order of integration of the variables:

A necessary condition for co-integration is that the series must be integrated in the same order. If the series are not integrated in the same order, they cannot be co-integrated.
If the series under consideration are not integrated in the same order, then there is no risk of co-integration and the procedure stops at this first stage.
Step 2: Estimation of the long-term relationship:

If we have: $x_t \to I(1)$ and $y_t \to I(1)$

We estimate by the least squares Ordinary MCO the long-term relationship:

$$y_t = ax_t + b + \varepsilon_t$$

For there to be cointegration, the residue resulting from the regression must be stationary:

$$e_t = y_t - \hat{a}x_t - \hat{b} \to I(0)$$

The stationarity of the residue is tested using the DF or DAF test.
If the residue is stationary we can then estimate an error-correcting model (ECM) that integrates variables in variation and level (Granger representation theorem). The use of an error-correcting model in the case of cointegration makes it possible to obtain more reliable forecasts than if we used the relationship by the non-stationarity of the series.

If we have two cointegrated $(y_t - \hat{a}x_t - \hat{b} \to I(0))$ series, we can estimate the following error correction model (ECM):

$$\Delta y_t = \gamma \Delta x_t + \beta(y_{t-1} - ax_{t-1} - b) + \upsilon_t \text{ with } \beta \prec 0$$

We can notice that the parameter must be negative for there to be a return of y_t its long term equilibrium value which is $(ax_{t-1} + b)$. Indeed, when is y_{t-1} greater than $(ax_{t-1} + b)$, there is only a force of return to long-term equilibrium only if $\beta \prec 0$

The ECM makes it possible to jointly mobilize short- and long-term dynamics
The short-term dynamic is written:

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \alpha_2 x_t + \alpha_3 x_{t-1} + \upsilon_t$$

The long-term dynamic is expressed as follows:

$$y_t = ax_t + b + \varepsilon_t$$

Because in the long term, we have $y_{t-1} = y_t, x_{t-1} = x_t$ and the short-term dynamic becomes in the long term:

$$y_t = \alpha_0 + \alpha_1 y_t + \alpha_2 x_t + \alpha_3 x_t + \upsilon_t$$

The MCE is obtained from the short-term dynamics:

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \alpha_2 x_t + \alpha_3 x_{t-1} + \upsilon_t$$

$$y_t - y_{t-1} = \alpha_0 + \alpha_1 y_{t-1} - y_{t-1} + \alpha_2 x_{t-1} - \alpha_2 x_{t-1} + \alpha_3 x_{t-1} + \upsilon_t$$

$$\Delta y_t = (\alpha_1 - 1) y_{t-1} + \alpha_2 (x_t - x_{t-1}) + \alpha_0 + (\alpha_2 + \alpha_3) x_{t-1} + \upsilon_t$$

$$\Delta y_t = -(1 - \alpha_1) y_{t-1} + \alpha_2 (x_t - x_{t-1}) + \alpha_0 + (\alpha_2 + \alpha_3) x_{t-1} + \upsilon_t$$

$$\Delta y_t = -(1 - \alpha_1)\left(y_{t-1} - \frac{\alpha_2 + \alpha_3}{1 - \alpha_1} x_{t-1} - \frac{\alpha_0}{1 - \alpha_1} \right) + \alpha_2 \Delta x_t + \upsilon_t$$

$$\Delta y_t = \gamma \Delta x_t + \delta(y_{t-1} - ax_{t-1} - b) + \upsilon_t$$

$$\delta = -(1-\alpha_1), a = \frac{\alpha_2 + \alpha_3}{1-\alpha_1} \text{ et } b = \frac{\alpha_0}{1-\alpha_1}$$

- Error-corrected model estimation

If the series x_t and y_t are co-integrated:

$$x_t, y_t \rightarrow CI(1,1)$$

We can estimate the ECM

Step 1: Estimation by the MCO of the long-term relationship:

$$y_t = ax_t + b + \varepsilon_t$$

Step 2: Estimation by the MCOs of the relationship of the short-term dynamic model:

$$\Delta y_t = \gamma \Delta x_t + \beta e_{t-1} + \upsilon_t \text{ with } \beta \prec 0$$

Where $e_t = y_t - \hat{a}\, x_t - \hat{b}$

The coefficient β must be significantly negative. Otherwise, the ECM type specification is not valid.

3 Results and Discussions

3.1 Results

3.1.1 Deforestation in Madagascar

Despite these difficulties in defining the concept of forest, data on forest areas in Madagascar exist. These data are not available at regular time intervals, and the methodologies used are not standardized. The use of satellite images is, for example, recent.

Previously, during the colonial period, forest areas were calculated from estimates made during exploration (Guichon, 1960). The use of satellite images is the methodology used for several decades by the forestry administration to estimate the areas covered by forests in Madagascar. Thus currently the data are available from the Ministry of Environment Madagascar.

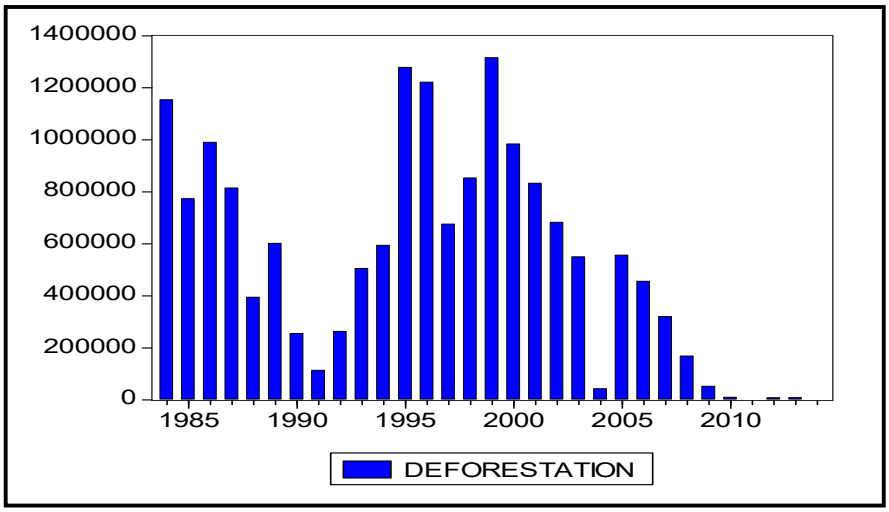

Figure 1: Deforestation (ha)[4]
Source: Author using DGF/DVRF/SRRL data, 2020

[4] Donnée statistique auprès de ministère de l'environnement, DGF/DVRF/SRRL 2014

This figure shows that before the year 2003, the exploitation of forest resources is very serious by agriculture, charcoal in wood, bush fire... And we noticed that the weak part of this figure represents the end of the mandate of the regime of ruler of this country, and then the situation worsens during the transition phase until the new government is stable. Like the year 1990-1995, 1996-1997, 2002-2005, this three periods the political situation is not very complicated, and especially the first period (1990-1995), the situation is very long and very complicated. That is to say, the agents exploiting forest resources, whether national or foreign, benefit from the destabilization of the political situation.

Thus figure is equal to shows us that compared to other countries of the Indian Ocean, Madagascar has more in terms of space, but very fragile on deforestation by bush fire and forest fires throughout the western part of the Big Island, this fire remains very dominant among the causes of the destruction of natural resources in Madagascar. However, the burning of grasslands is explained by the preparation for pasture renewal in the rainy season. Some cleaning and brush clearing fires carried out by farmers living near the forests are not under control and degenerate. In some cases, it seems that the fires are practiced to show some public discontent with the authorities and the state.

Thus, the overexploitation of forest species, the Malagasy population remains highly dependent on forest resources compared to other neighboring islands. The forest is considered, for the most part, as an inexhaustible source of products to be exploited as it pleases. This fact leads to the overexploitation of resources reflecting their irrational and abusive exploitation.

Mining: In Madagascar, large mining operations are now in the extraction/production phase. They affect natural forests of the littoral type, dense humid or sclerophyll. All the characteristic species of these forests are thus uprooted for the exploitation of various open-pit mining deposits (cobalt, nickel, ilmenite, gold, etc.). Some investments with legal permits have environmental specifications and carry out forest rehabilitation and/or restoration actions. Others are illegal and forest vegetation in logging sites is therefore doomed to extinction. These are the illicit mining of precious stones such as sapphires and rubies.

3.1.2 Granger causation test

Granger introduced the concept of non-causality in 1969 with the aim of making variable-level prediction optimal. The objective of this test is to evaluate the temporal order and predictive capacity of variables (Araujo et al. 2004)[5]. Thus, it makes it possible not only to formalize statistically the economic and ecological relations, between these variables for obvious reasons of economic and environmental policy, but also to study the variables that would be likely predict the evolution of macroeconomic variables in order to study the cause of the correlation between ecological and economical. The analysis of causality will highlight the interactions between macroeconomic and ecological variables. Thus, it also makes it possible to have "information on the temporal links between variables" (Hairault 1995, p.110).

The use of raw or filtered variables has been the subject of much controversy between statisticians and economists. The former argue that "raw series filtering avoids spurious correlations and eliminates relationships that may exist between series trends[6]" while the latter claim that this filtering process destroys all economic information contained in the series. This Granger-sense study of economic relations between ecological and macroeconomic variables is based on the approach of economists. The formulation of the causal relationship in Granger's sense is as follows:

Let (X_t) and (Y_t) be two time series with their past: $X_t = \{X_t, X_{t-1}, ...\}$ and $Y_t = \{Y_t, Y_{t-1}, ...\}$, (X_t) cause (Y_t) in the Granger sense if and only if $E(Y_t / Y_{t-1}, X_{t-1}) \neq E(Y_t / Y_{t-1})$. In other words, the past values of will ipso facto be necessary to make excellent predictions about

The assumptions of the causality test are as follows:

Prob is the critical probability (probability of acceptance)

The null hypothesis (non-causality) is accepted as soon as probability is greater than 5%.

[5] ARAUJO, C. et al. « Econométrie », Bréal, 2004, p.30

[6] Claude MONTMARQUETTE and Paul FOREST, « Application et interprétation d'un test statistique de causalité à la politique fiscale et monétaire canadienne », Revue Canadienne d'Economique, Vol. 12, N°2, (May, 1979), p. 284

Table 1.Granger Causality Test

VAR Granger Causality/Block Exogeneity Wald Tests
Date: 01/04/23 Time: 02:05
Sample: 1984 2020
Included observations: 36

Dépendent variable: D(AT)

Excluded	Chi-sq	df	Prob.
D(DF)	0.692975	2	0.7072
D(RB)	6.761700	2	0.0340
D(RT)	1.958017	2	0.3757

Dépendent variable: D(DF)

Excluded	Chi-sq	df	Prob.
D(AT)	1.205008	2	0.5474
D(RB)	2.819683	2	0.2442
D(RT)	1.557156	2	0.4591

Dépendent variable: D(RB)

Excluded	Chi-sq	df	Prob.
D(AT)	10.44385	2	0.0054
D(DF)	0.448728	2	0.7990
D(RT)	5.196024	2	0.0744

Dependent variable: D(RT)

Excluded	Chi-sq	df	Prob.
D(AT)	5.875688	2	0.0530
D(DF)	1.251553	2	0.5348
D(RB)	6.101774	2	0.0473

The causality test results show that a significant relationship of these variables, i.e. variables that don't cause a variable because this probability associated to superior 5%:

Arrivals of non-resident visitors at AT borders cause RB reforestation; and does not cause deforestation or fire DF, and the foreign currency revenue at tourism RT in the sense of Granger at the statistical threshold of 5%, it is preferable to rely on these three variables for a good foresee on the arrivals of non-resident visitors at the AT borders.

Deforestation or fire DF don't cause reforestation RB, arrivals of non-resident visitors at the AT borders and foreign currency revenue for RT tourism within the meaning of the Granger at the statistical threshold of 5%. It is therefore preferable to base on the three variables to do a good foresee so as to minimize deforestation.
RB reforestations cause arrival of non-resident visitors to arrive at AT frontiers in the meaning of the Granger. It does not cause DF deforestation, and the foreign currency revenue for RT tourism at the statistical threshold of 5%; it is therefore preferable to rely on these two variables to make a good forecast in order to promote BR reforestation.
Finally, the foreign currency revenue for RT tourism causes the arrival of non-resident visitors at the AT borders and reforestation RB in the sense of Granger. It does not cause deforestation or fire DF at the statistical threshold of 5%; so it is necessary to have a good forecast to minimize deforestation or fire DF in order to improve the revenue in currency under tourism RT.
The presence of causality denotes only mutually influential variables in terms of predictive capacity. Thus this result also shows that deforestation is an exogenous variable; it corroborates a narrow relationship that is linked to a change in arrivals of non-resident visitors at the AT borders and RB reforestation.

3.1.3. Error corrected model

The use of the error-correcting model makes it possible to highlight the common cointegration relationship (the common tendency) and to deduce the interactions between the variables[7].
We propose to estimate the error-corrected model according to the representation of the following Hendry model by the least squares method in a single step:

$$D(LDF_t) = \beta_0 + \beta_1 D(LAT_t) + \beta_2 D(LRT_t) + \beta_3 D(LRB_t) + \beta_4 D(LDF_{t-1}) + \beta_5 D(LAT_{t-1}) + \beta_6 D(LRT_{t-1}) + \beta_7 D(LRB_{t-1}) + \varepsilon_t$$

D is the prime difference operator defined by $D(X_t) = X_t - X_{t-1}$.

The coefficients $\beta_1, \beta_2,$ and β_3 represent the short-term dynamics and the coefficients $\beta_5, \beta_{6,}$ and β_7 characterize the long-term equilibrium. The coefficient β_4 is the error correction coefficient, it must be less than the unit and negative. The error correction coefficient indicates the rate of adjustment of the endogenous deforestation variable DF to return to long-term equilibrium following a shock. The coefficient β_0 represents the constant of the model.
The short-run elasticity is: $\beta_1, \beta_2,$ and β_3
The long-run elasticity is: $\frac{-\beta_5}{\beta_4}, \frac{-\beta_6}{\beta_4}$ and $\frac{-\beta_7}{\beta_4}$
The results of the estimation of the ordinary least squares error-corrected model are given in the table below:

[7] Régis Bourbonnais, « Econométrie », 6ème édition, Dunod, Paris, 2005, p. 279.

Table 2. MCO estimate of ECM model

Dependent Variable: DIFFRT
Method: Least Squares
Date: 01/04/23 Time: 23:59
Sample (adjusted): 1988 2020
Included observations: 37 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	9.082062	79.04038	0.114904	0.9097
DIFFAT	0.011322	0.001675	6.759659	0.0000
DIFFRT	-3.178839	2.914751	-1.090604	0.2891
DIFFRB	0.361487	0.191001	1.892595	0.0737
LDF(-1)	-0.288960	0.165442	-1.746589	0.0969
LAT(-1)	-0.004667	0.002712	-1.720789	0.1015
LRT(-1)	1.397738	2.903695	0.481365	0.6358
LRB(-1)	0.091760	0.258100	0.355522	0.7261

R-squared	0.909338	Mean dependent var	127.3880
Adjusted R-squared	0.875936	S.D. dependent var	1064.177
S.E. of regression	374.8318	Akaike info criterion	14.93203
Sum squared resid	2669478.	Schwarz criterion	15.31598
Log likelihood	-193.5824	F-statistic	27.22425
Durbin-Watson stat	2.341353	Prob(F-statistic)	0.000000

The results from the table above show that the error-corrected term associated with the recall force β_4 is negative (-0.288) and is significantly different from zero at the statistical threshold of 5% (the student t is greater than 1.96 in absolute value). There is therefore a catch-up towards the equilibrium value, in other words, a long-term error correction mechanism, the imbalances between deforestation, foreign currency revenue for tourism, arrivals of non-residents at the borders, and reforestation compensate each other so that the series have similar evolutions. The value $R^2 = 90{,}09\%$ illustrates an explanatory power of the model.

β_4 represents the rate at which any imbalance between desired and actual levels of deforestation is resolved within one year of any shock. They make it possible to adjust 30% of the imbalance between the desired and actual level by deforestation. This percentage of 30% destroys in some economic sectors in particular the disappearance of natural resources with implies environmental fluctuation, and at the level of economic activity. In the event of shocks on macro-environmental variables, the stabilization process is persistent, tending towards the long term. This explains the volatility of the main environmental macroeconomic aggregates.

3.1.4. Analysis of short and long term elasticity

Short- and long-term elasticity makes it possible to analyze the impact of cyclical fluctuations on the behavior of variables.

Short-term elasticity

Deforestation, the arrival of non-residents at borders, and reforestation generate short-term elasticity that is interpreted as follows:

- The short-term elasticity of deforestation with respect to the arrivals of non-resident visitors at the AT borders is =0.011322, this implies that in the short run the arrivals of non-resident visitors at the AT borders increases by 10%, while deforestation intensifies environmental destruction by 1.13%. At the arrivals of certain non-resident visitors at the AT borders therefore are sensitive to the disappearance of this natural resource, and may be by

illegal exploitation of this resource which superimposes on the reservation of existing forest by the cutting of simple woods, precious woods, extraction whether formal or an illegal marl of mining product.

- The short-term elasticity of DF deforestation with respect to the foreign currency revenue for RT tourism is = -3.178839, this implies that in the short run if the foreign currency revenue for RT tourism increases by 10%, then DF deforestation massively destroys our forest at point 317.88%. That is to say, the improvement of profit on the natural resources exploitation aggravates the environmental destruction by deforestation. This illustrates the current situation on the massive destruction of the environment by fires or clearing to make the land suitable for cultivation.
- The short-term elasticity of deforestation with respect to reforestation RB implies that in the short term reforestation RB improves by 10%, then deforestation increases by 36.1487%, i.e. improvement of reforestation by 10%, decrease of deforestation by 36.61%. This result corroborates the roles of tropical forests in the fight against climate change of RDD++ of Madagascar.

Long-term elasticity

Long-run elasticity is interpreted as follows:

- The long-term elasticity of DF deforestation with respect to the arrivals of non-resident visitors at the AT borders implies that in the long term, if the arrivals of non-resident visitors at the AT borders by 10%, deforestation decreases significantly by 1.61%. Arrivals of non-resident visitors at the AT borders do not have much of a long-term impact on deforestation.
- The long-term elasticity of DF deforestation with respect to RT revenue implies that in the long term, if the foreign currency revenue for tourism RT 10%, then deforestation increases significantly by 483.7133%. Similarly in the long term the improvement of the profit in exploitation of natural resource or RT massively destroys natural resources by the exploitation and extraction of natural resources whether also illicit or formal compared to the short-term analysis.
- We deduce that the low rate of deforestation, improves the revenue of the State in foreign currency for tourism RT. The decline that the rate of deforestation remains sensitive to the improvement of national economic activity. If deforestation is 10% in 36 years (between 1988 and 2020), if it is by calculation: deforestation = $\frac{0.1}{36} X100 = 0.27\%$, we have a decrease of 0.27% per year of deforestation.

So the report on environment state after Rio 20 in 2012 is corroborated, because in the years between (2000-2005), there was a decrease of 0.55% per year instead of 0.82% per year during the 1990s.

- The long-term elasticity of deforestation with respect to reforestation RB is this implies that in the long term, if reforestation by 10%, DF deforestation increases significantly by 31.7553%. We deduce that reforestation reduces vacant space or open space, improves the environmental situation and the climate. As a result, economic activity improves economic activity, particularly agriculture and livestock. This result corroborates national and international environmental policy or REDD++ because reforestation is a means to fight against global warming, the protection of existing resources and fight against deforestation.

3.2 Discussions

Compared to the previous result, the causes and effects of forest degradation are at stake for the Sub-Saharan African countries, particularly Madagascar. Because forests have disappeared, biological flora has been erased to make way for rural lands, cities, bushfire for battle, and industrialization has polluted seas, rivers and the atmosphere. So governments and environmentalists are looking for ways to reduce the damage and prediction errors that humans have caused. Although backtracking time would never be possible, alternative ways to resolve the troubles that human beings caused can be very promising. Knowing the pros and cons of deforestation could give us the right ones deplete it of its natural resources.

Could it really benefit from deforestation? Well, that's a hard thing to answer. Listing its disadvantages is much simpler though, but to be honest, we will try to know the facts about deforestation, the benefits that the land and humans can benefit from it, and the many disadvantages that we already know.

Is it a true for deforestation pros?

Although deforestation is not totally good, it has some promising benefits for the people. Its goals have direct effects, which contribute significantly to the atmosphere and the environment. For example, trees cutting allows carbon dioxide to stay on them rather than emitting it into the air as in the case of dying and rotten trees.

In addition, much of the vast forest is left unused which can be turned to agricultural sites or tourist site instead. In this way, it will help millions of food-hungry people. Parts of the forest can also be turned into large infrastructure, which will give rise to a thriving economy, helping people. Grazing animals are also one way deforestation becomes useful. In truth, the benefits could be quite innumerable. However, weighing the good and evil that brings deforestation should always be considered.

The defects of countless deforestation: While the benefits of deforestation are countless, its disadvantages come in a million ways. Deforestation introduces many communities and environmental damages.

The abrupt and irreversible consequences of deforestation around the world are guaranteed to jeopardize the Earth's existence. The domino effect of deforestation includes: the extinction of biodiversity, the annihilation of indigenous peoples (inhabitants of the region) and global climate change. A false movement can lead us all to an empty and meaningless world.

The consequence of deforestation is claimed to be a domino effect, as a single step to the destruction of nature causes the death or disappearance of many more species. After the death of animal and plant life is the partial loss of human life through poverty and pollution. If things continue in this way, human extinction could also be inevitable. Years wear on, and every day of this year trees are cut down and land is removed from natural wonders. If things continue in this way, human extinction could also be inevitable. If the world was a better and cleaner place to live, then we could definitely be able to start reliving those days now.

The only known way to stop this is to stop all the causes of deforestation. Regardless of the advantages and disadvantages of deforestation, we only have to think about one thing, and that is the revival of nature, protecting what is still existing and reforesting what is missing, while it is still possible to be saved. Then there is only a sufficient amount of time, we would need to rebuild nature and stop its total destruction.

Although it could not arrive in just one click of time, the possibilities are much higher if all breeds participate in bringing damaged forests back to life. The only way to repay nature is to be kind to it.

4 Conclusion

As a conclusion, compared to the result of our analysis on the cointegration model by the ECM Error Correction Model test, it is difficult to propose solutions for a developing country like Madagascar, we can propose and define some of the following solutions:

Green economy: is "an economy that leads to improved human well-being and social equity while significantly reducing environmental risks and resource scarcity". The green economy is by definition characterized by low carbon emissions and resource efficiency;

Green growth, according to the OECD, "is about fostering economic growth and development while ensuring that natural assets continue to provide the environmental resources and services on which our well-being depends." Green growth is based on two types of investment and innovation: those that lead to sustainable growth and those that exploit the niche related to new economic opportunities created by environmental considerations,

Madagascar according to Rio+20, The transition to the green economy will undoubtedly be one of the main challenges after Rio+20. The adoption of new approaches to multisectoral planning, the reform of the economy towards new consumption and production patterns and, above all, towards better resource allocations, and the establishment of appropriate institutional tools and arrangements will be the main challenges.

The sharing of responsibilities between the State, the private sector and civil society, capacity building, the implementation of tools such as green accounting and the promotion of economic instruments for environmental management will also be of paramount importance. The main achievements such as the establishment of the MECIE legal framework defining the obligations of the private sector towards the environment and social issues and the creation of a national environmental assessment and monitoring body to ensure the implementation of the MECIE, namely the ONE, will have to be capitalized.

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