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Analysis of economic growth of natural resource: case of Madagascar

Analyse de la croissance économique des ressources naturelles : cas de Madagascar

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Abstract: Madagascar is a country rich in natural resources; Malagasy natural capital intervenes in various ways in the national economy because it generates both goods and services. The links between the exploitation of natural resources and economic growth are based on the conversion of natural capital into other forms of capital. Resources are complementary to each other in the production process. Natural resources contribute to the country's GDP by creating jobs and contributing to the country's income. The mining sector, the forestry sector and the fishing sector which are the main sectors studied in our work are also the best performing sectors in the country. The uses of these three sectors in a manner in good governance only can help Madagascar escape poverty. Natural resources are important for the survival of a large part of the Malagasy population, but also important for the economy itself. So after bringing out the results of the econometric analysis through the application of the OLS model and various tests, we found that these resources are significantly and highly correlated with economic growth.

Key words: natural capital, national economy, economic growth, natural resources, GDP.

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1. Introduction

Since history, men have been arguing over the riches of the earth; it is no longer only a question of fighting for the appropriation of natural riches, but also of questioning the global exploitation by humanity attempting to bring into harmony with itself. The environment, through natural resources, comes into contact with man and many are interested in analyzing the economy of natural resources and especially the economic benefits in the exploitation of these resources. Furthermore, natural capital represents a quarter of all wealth in low-income countries, and natural resources are often the main source of income for the poorest populations.

In Africa, the life of the majority of the poor population is essentially based on the exploitation of natural resources; agricultural and forestry exploitation often provides more than 30% of GDP, employs nearly 70% of the population and creates the largest share of export earnings.

Madagascar has enormous and important natural resources. Indeed, 2% of the world's biodiversity flourishes in Madagascar: the island is one of the 17 rare countries of "mega biological diversity" on our planet. Most of the animal and plant species that live in Madagascar do not exist anywhere else on Earth. Of the 12,000 plant varieties, some produce spices or fruits that have strong export appeal, such as lychees or cloves. With 80 to 90% endemism which is a record rate, 85% of world vanilla production is also Malagasy and the total potential of national mining resources is estimated at 800 billion dollars. Exports of nickel and cobalt, in particular, could boost the country's income.

In Madagascar, natural resources provide the soil needed for food production, as well as water for drinking, washing and irrigation. Added to this are fish and wood, as well as a whole range of raw materials needed for a wide range of industrial activities. In addition, natural landscapes and wildlife reserves are important factors in attracting tourists. In other words, good management of natural resources means ensuring food production and preserving livelihoods and export opportunities.

In Madagascar, despite the existence of abundant and diversified resources which offer strong production potential for agriculture, fishing, mining and tourism, the country still remains in the tunnel of poverty. Natural resource exploitation is of growing importance as a source of income, employment and tax revenue in the economy, but it also leads to environmental degradation. It would therefore be preferable to mobilize and manage our resources rationally. So the question arises how do natural resources contribute to the economic growth of Madagascar?

2. Literature review

The literature review is a basic element making it possible to communicate the theoretical bases of scientific research. Thus, economic growth as “the sustained increase over a long period in the production of a country”.

According to François Perroux, economic growth is the increase of an economic unit achieved through changes in structure and possibly systems, accompanied by variable economic progress. It is a quantitative and one-dimensional concept. It depends both on the increase in the quantities of production factors used in the productive process, but also on the improvement of techniques allowing more goods and services to be produced with the same quantities of production factors. It is then essential to distinguish economic growth first from economic expansion which is a temporal increase in economic quantities (production, investment, consumption, etc.) in the short term and then from economic progress which occurs when we witness satisfaction. needs of the population as a whole and where we are also witnessing an improvement in social and health indicators, the reduction of inequalities and the reduction of the costs of economic growth and finally it should also be distinguished from economic development which designates the set of transformations in technical, mental and institutional structures which allow the appearance or prolongation of economic growth.

Thus, natural resources are essential to economic growth, particularly for countries undergoing development like Madagascar. Natural resources are a substance or phenomenon present in nature and exploited for the needs of a society. It also concerns the biotic and non-biotic elements of the earth, as well as the various forms of energy received or produced without human intervention.

But theoretically according to the Physiocrats, symbolizes the set of natural resources, they believe that it is thanks to wealth that we can satisfy the most basic physiological needs and the most essential to the economy. However, wealth can only come from the land or more precisely from its products. Productive activities release the "net product" which finds its origin in the association of natural forces and the work of the worker. Therefore, the contribution of natural resources is more visible and immediate through the results of agriculture. The "net product" which is the difference between the production of land and the means of substance necessary for agricultural production thus finds its origin in a free "gift" of nature. All natural resources not only contribute to production, but above all constitute wealth. Among the classics, if natural resources continue to play a central role in production, only natural resources are traded, that is to say exhaustible resources (energy, fossils and raw materials) as well as the earth are the object of science economic. They consider that natural resources have a driving role, both in industry and in agriculture. Production is in fact understood as a sequence of activities involving the extraction of materials or agricultural products and the transformation of these into objects of use. The classics also made the distinction between what belongs to nature and what belongs to economics. However, the two sets do not become independent since the first feeds the second, and certain elements are common to them.

Indeed, certain natural resources, due to their scarcity, become appropriable and then pass through the market. They therefore have an exchange value and are therefore considered economic goods. As for land, due to its limited quantity and the resulting appropriation, it appears as a marketable natural resource. Therefore, understood by economic analysis. Its role is fundamental since it is what conditions economic growth and promotes it through its fertility, or limits it due to its avarice as has been highlighted in the theory of rent. Malthus and Ricardo. Ricardo spoke of the imperishable prosperity of the earth to make it the only factor irreducible to the other two (work and fixed capital) since if machines can replace work on a large scale, they can only do so in very small proportions to the earth.

For the case of Madagascar, it is the fifth largest island in the world, located in the Indian Ocean off the coast of southern Africa. Despite considerable natural resources, its population of approximately 28 million (2020) has one of the highest poverty rates in the world. The big island's economic growth reached 5.7% in 2021 despite the COVID-19 pandemic and the multiple climate shocks which have exacerbated Madagascar's fragility. This rebound, after a 7.1% contraction in 2020, is mainly due to a recovery in the mining, services and construction sectors. However, poverty remains high and increasing in urban areas, reflecting the impact of rural exodus, lack of employment opportunities in cities and a decline in the productivity of private businesses.

3. Methods

In the methodology, we adopt the ordinary least squares (OLS) method. We will have to estimate the coefficients so as to minimize the squared distance between each observed point y_t and each point $\hat{y}_t$ given by the line. Thus, the estimates are made using the following different tests:

Student's test, to find out if a variable plays an explanatory role in a model, we carry out a Student's test or significance test of the coefficient of the explanatory variable.

To do this with a Student test, you must first check that the errors follow a normal law:

$$\varepsilon_t \sim > N(0, \sigma_\varepsilon^2)$$

Let us first pose the hypotheses of the Student test:

Consider the following general model:

$$y_t = a_0 + a_1 x_{1t} + a_2 x_{2t} + \cdots + a_{k-1} x_{(k-1)t} + \varepsilon_t \text{Pour } t=1,2,\ldots,T$$

H0 : ai = 0 où i = 0,1,…,(k-1) ⇒ the coefficient is not significant.

H1 : ai ≠ 0 ⇒ the coefficient is significant

The Decision Rule is as follows:

If | t | > t* where t* is the critical value of the Student table for a fixed risk and a number of degrees of freedom equal to (T-k) ⇒ we reject H0 and we accept H1: the coefficient is significantly different from zero and the variable plays an explanatory role in the model.

Fischer test, the Fisher test allows you to test the significance of all the coefficients of a model. Consider the general model:

$$y_t = a_0 + a_1 x_{1t} + a_2 x_{2t} + \cdots + a_{k-1} x_{(k-1)t} + \varepsilon_t \text{ for } t=1,2,\ldots,T$$

The assumptions of the Fisher test are as follows:

H0 : a1 = a2 = … = ak-1 = 0 (the constant a0 is non-zero) ⇒ all of the coefficients of the model are not significant.

H1: there is at least one non-zero coefficient.

The decision rule is as follows:

If f >f*(p,q) where f*(p,q) is the value given by the Fisher table for given p and q and for a fixed risk ⇒ We accept H1: there exists at least one non-zero coefficient .

This test is rarely used because when it indicates that there is at least one non-zero coefficient, it does not specify that this test is Student's.

Autocorrelation of errors, means that the errors of adjacent observations are correlated. If the errors are correlated, least squares regression may underestimate the standard error of the coefficients. On the other hand, if the errors are underestimated, the coefficients may appear significant even though they are not.

In our work, we used the Breusch Godfrey serial correlation LM test although there are several other tests that can be used.

Assumption :

H0: errors are not self-correlated

H1: Errors are self-correlated

Heteroscedasticity of errors, is used in statistics, and more particularly in the context of linear regression or the study of time series, to describe the case where the variance of the model errors is not the same for all observations, then that often, one of the primary assumptions in modeling is that the variances are homogeneous and that the errors of the model are identically distributed.

The Breusch Pagan Godfrey test was developed by Breusch and Pagan (1979), then improved by Koenker (1981), and makes it possible to identify cases of heteroscedasticity which prevents the reliability of classic estimators of linear regression parameters. If e is the vector of model errors, the hypothesis H0: “the error terms have a constant variance”

H0: the error variance is not heteroscedastic

H1: the error variance is heteroscedastic

The decision rule is as follows:

If the p-value is greater than 0.05, then we reject H1 and accept H0, so the errors are not heteroscedastic.

Test for normality of errors, JarqueBera test is a hypothesis test that seeks to determine whether the data follows a normal distribution

H0: Errors are normally distributed

H1: Errors are not normally distributed.

The decision rule is as follows:

If the p-value of the test is greater than 0.05 then we accept H0 and the errors are normally distributed.

4. Results and discussions

We will present the evolution of the variables and the estimates of the OLS model between mining sector variables and GDP.

4.1. Results

4.1.1. Mining industry

4.1.1.1. Mining sector and economic growth

The extractive industry is a sector which has been expanding in Madagascar over the last 10 years. Its contribution to the country's GDP has continued to increase over the years until it has become one of the most profitable sectors in Madagascar. In the table below, we represent the share of the contribution of extractive industries to Madagascar's GDP from 2004 to 2018.

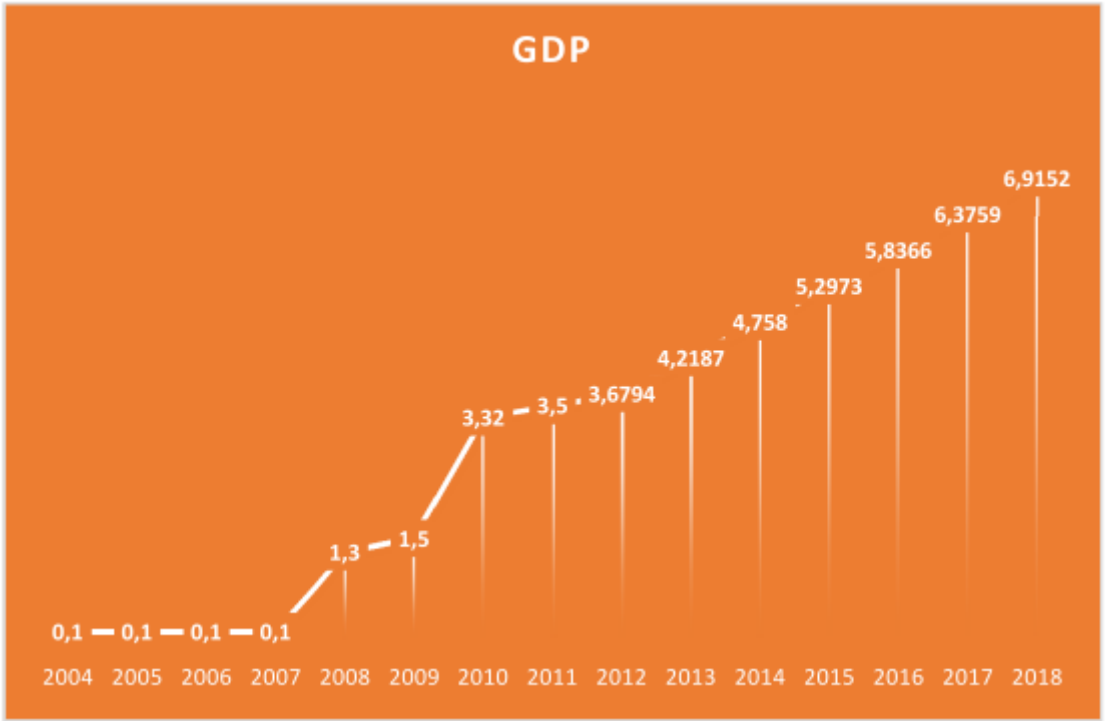

Figure 1: evolution of extractive industries in GDP (in %)

This result shows us a very important evolution, but compared to the data collected, it is difficult to obtain precise statistics of revenues from mining in Madagascar because most of the exploitations are informal and often illegal activities of the Artisanal and small-scale mining operations result in significant losses of potential revenue for the State.

4.1.1.2 Mining royalty

Is the amount paid by a company exploiting natural resources. We will present here the figures of Madagascar's mining revenues from 2004 to 2018.

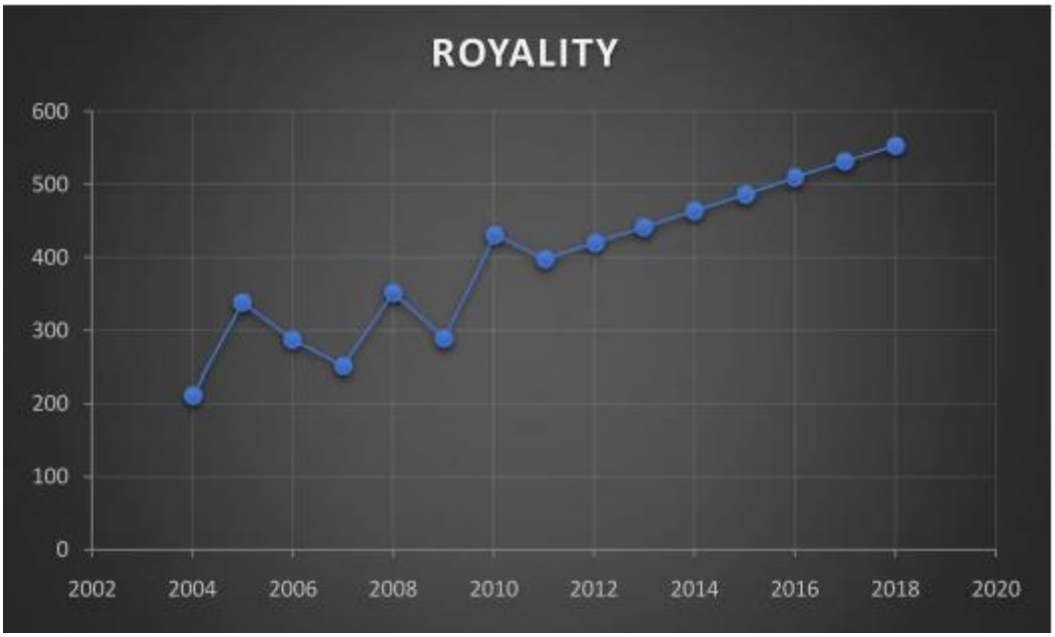

Figure 2: evolution of mining royalties in Millions of USD

It is also important to clarify that mining is an activity that can take place during periods when there is no work in agriculture, or in other underemployment situations. The activity often takes place in poor and remote locations, which means that the mining sector offers pro-poor benefits that other branches of the private sector, the public sector or the action of donors do inability to provide.

4.1.1.3 Estimation of coefficients using the OLS method

We will present in the table below the results of the estimation of the coefficients of our OLS model.

Table I: Estimation of coefficients using the OLS method

Dependent Variable : GDP
Method : Least Squares
Date : 09/20/23 Time :20 :40
Sample : 2004 2018
Included observations : 15

Variable	Coefficient	Std. Error	T-Statistic	Prob.
C	-5.752272	0.746903	-7.701496	0.0000
REDEVANCE	0.022327	0.001817	12.28731	0.0000

R-squared	0.920721	Mean dependent var	3.140073
Adjusted R-squared	0.914623	S.D. dependent var	2.448394
S.E. of régression	0.715406	Akaike info criterion	2.291632
Sum squared resid	6.653473	Schwarz criterion	2.386039
Log likelihood	-15.18724	Hannan-Quinn criter.	2.290627
F-statistic	150.9780	Durbin-Watson stat	2.467891
Prob(F-statistic)	0.000000		

For the mining sector, regarding the Student statistics at the 5% threshold, the royalties derived by the sector are positive 12.28731 and the Student p-value is less than 5% which shows that the royalties are

very significant. The elasticity between GDP and the fee is also positive at 0.022327, which shows that the more the fee increases this has a positive influence on GDP.

The degree of explanation of the explained variable GDP by the explanatory variable Royalty is good in this model with an R^2 of 0.92 which is higher than the minimum threshold of 50%. The R^2 is stable; this can be seen by the values of R^2 and adjusted R^2. When the number of explanatory variables increases or in certain cases the number of observations increases, then R^2 also tends to increase.

As observations increase, the model becomes stable and the explanatory variables explain the explained variable well.

The Fisher statistic shows a p-value that is less than 5% (0.05), which shows that the coefficients of our model are overall significant.

The Breusch-Godfrey Serial Correlation LM Test (see appendix table IV) shows that the errors in our model are not self-correlated; hence it is a good model.

Heteroskedasticity Test: Breusch-Pagan-Godfrey (see appendix table V) reveals that the error variance of this model is not heteroscedastic, which means that the error variance is the same for each variable.

4. 1.2. Forestry sector

4.1.2.1. Forestry sector and GDP growth

The forestry sector plays an important role in growth and employment. It represents an intermediate share of GDP in Madagascar. This sector also makes a valuable contribution to national economies, particularly in terms of income and exports. Among other things, informal activities in the sector contribute to the creation of income and jobs.

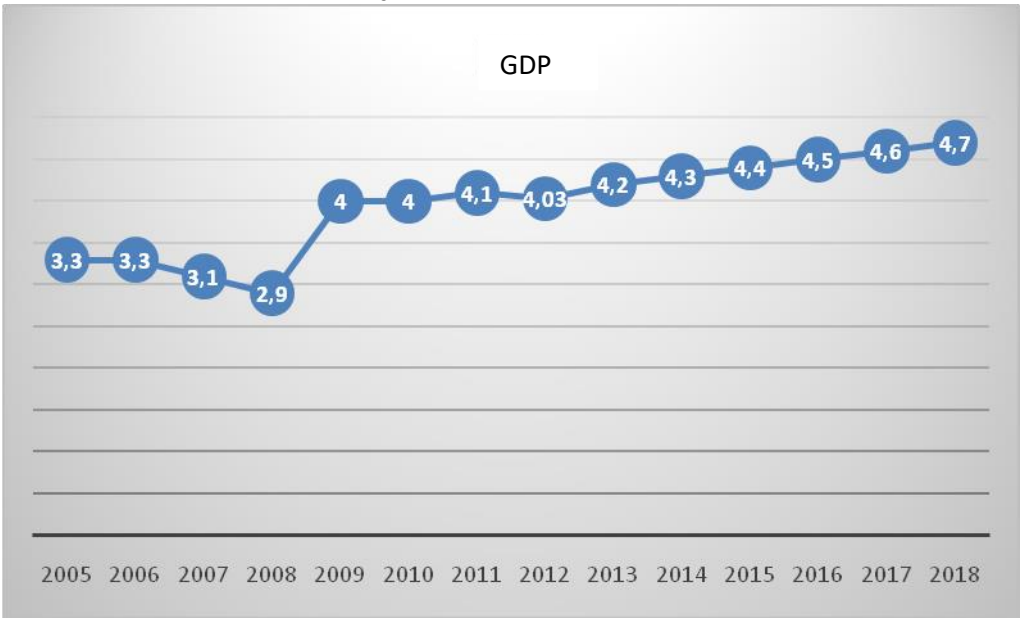

Figure 3: Evolution of the contribution of forestry to GDP in %

4.1.2.2. Royalty for exploitation of forest resources

Forestry royalty is the sum paid by an operator to the owner of forest land in return for the privilege of using this land for cultivation, harvesting, etc. purposes. In the following table we will present the evolution of royalties from the exploitation of forest resources in Madagascar from 2005 to 2018.

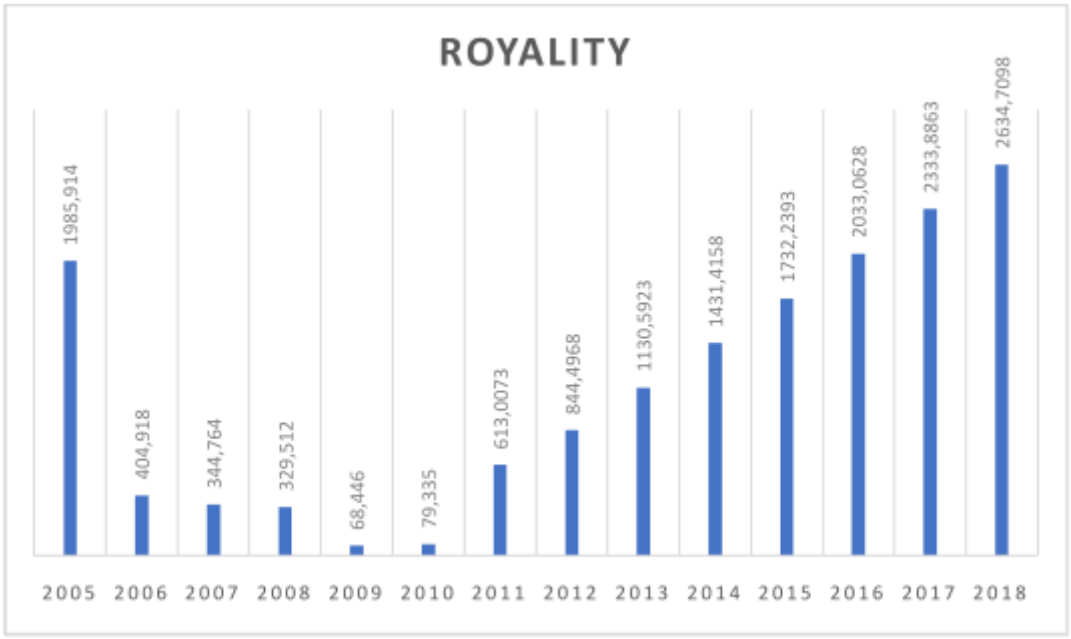

Figure 4 : Evolution of Royalty for exploitation of forest resources

4.1.2.3. Forets, exportation et emplois

The forestry sector in Madagascar generates significant revenues from the export of forest products such as rosewood or essential oils. We represent in the table below the evolution of revenues linked to exports of forest products from 2005 to 2018 in Madagascar.

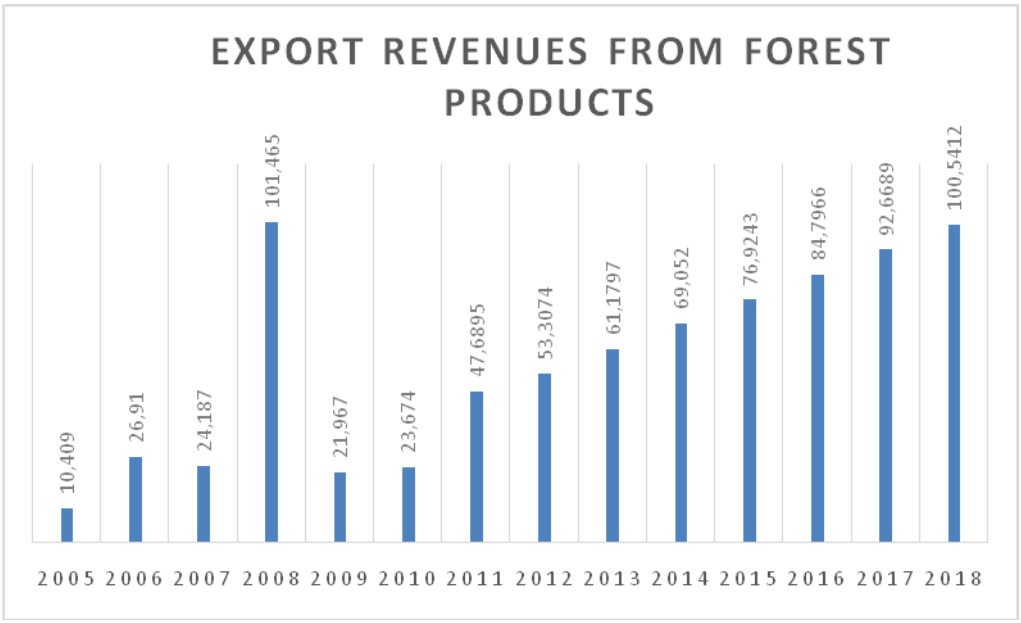

Figure 1 : Evolution of export revenues from forest products in billions of Ariary

Forestry production is generally used locally in Madagascar for construction and furniture; forests represent a significant part of exports, i.e. more than 10% of total exports.

4.1.2.4. Estimates of coefficients using the OLS method,

We will present in the table below the results of the estimation of the coefficients of our OLS model.

Table II: Estimation table by OLS

Dependent Variable : GDP
Method : Least Squares
Date : 09/20/23 Time :20 :45
Sample : 2005 2018
Included observations : 14

Variable	Coefficient	Std. Error	T-Statistic	Prob.
C	3.385974	0.282815	11.97238	0.0000
EXPORT	0.003526	0.005165	0.682730	0.5089
REDEVANCE	0.000327	0.000186	1.759102	0.1063

R-squared	0.388620	Mean dependent var	3.959286
Adjusted R-squared	0.277460	S.D. dependent var	0.580298
S.E. of régression	0.493267	Akaike info criterion	1.611876
Sum squared resid	2.676433	Schwarz criterion	1.748817
Log likelihood	-8.283134	Hannan-Quinn criter.	1.599200
F-statistic	3.496043	Durbin-Watson stat	0.995920
Prob(F-statistic)	0.066790		

The econometric analysis of the forestry sector is done with a multiple linear regression because we have two explanatory variables which are the royalty and the exports to explain the GDP of the sector. In our study by the OLS method, we found the Student statistics at the 5% threshold for exports of the positive sector to be 0.682730. But the p-value is 0.5089 which is greater than the Student threshold, and is not significant. Therefore the elasticity of GDP in relation to exports is positive 0.003526 which means that the more exports increase, the GDP also increased, but it is not significant. For royalties, we find that royalties are not significant with a Student statistic of 1.759102 and a p-value of 0.1063 which is greater than the minimum value of the Student test which means that royalties are not significant to GDP.

The overall significance of the coefficients studied with the Fischer test shows a result of 0.066790 while in the hypotheses of the test, for the coefficients to be significant, the results of the Fischer test must be less than 0.05 therefore the coefficients of our model are not significant.

The degree of explanation of GDP in relation to royalties and exports is less good and low value because we found in our calculations an R^2 of 0.388620 and an adjusted R^2 of 0.277460.

For the autocorrelation of errors, we find with eviews that our errors are not autocorrelated (see appendix, table V). And the error variance of our model is not heteroscedastic (see appendix, table VII).

4.1.3. Fishing sector

4.1.3.1 Fishing for growth

Fish stocks in Madagascar are seriously threatened by overfishing even though fishing can be an important source of wealth for the country. The contribution to GDP of the fishing sector in

Madagascar represents a significant part of Madagascar's economy. We will see in the table below the contribution to the GDP of the fishing sector of Madagascar from the year 2005 to 2018.

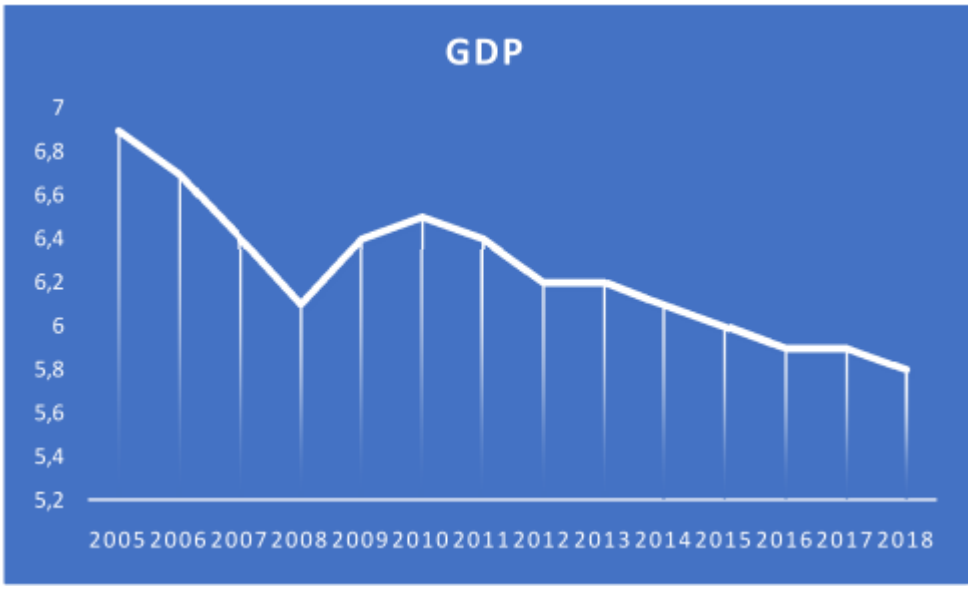

Figure 6: Evolution of the contribution of the fishing sector to GDP (in %)

Employment in the fisheries sector is significant in developing countries like Madagascar and is experiencing steady growth in most low- and middle-income countries. (OECD, 2009).

4.1.3.2. Exports of fishery products

For Madagascar, exports of fishing products constitute an important part of the country's economy. The main operating products of the fishing sector in Madagascar are: shrimp, crabs, lobsters and other products such as tuna. We will see in the following figures the quantities exported as well as the values of its products during the period from 2005 to 2018.

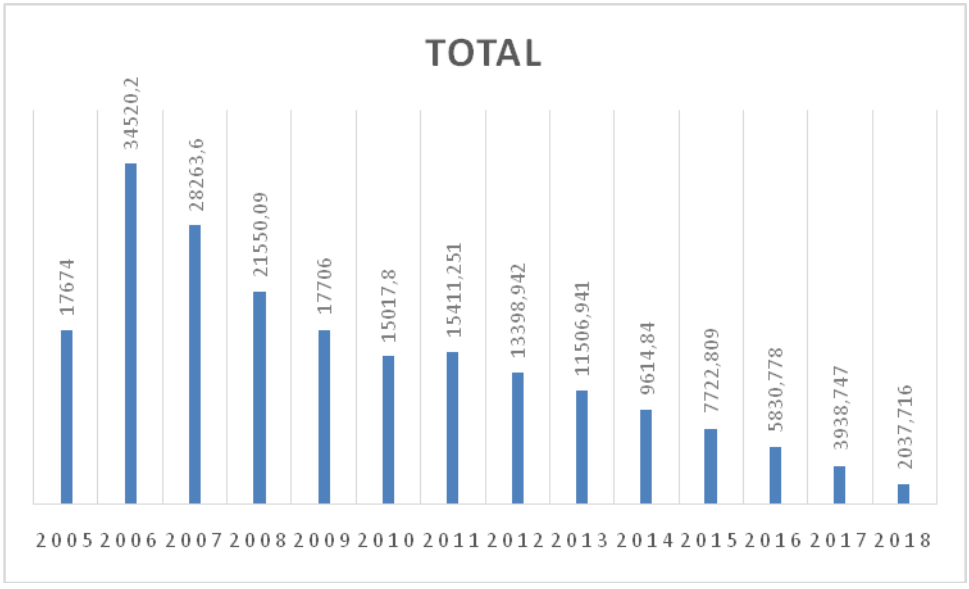

Figure 7: Evolution of exports of fishery products (Quantity in tonnes)

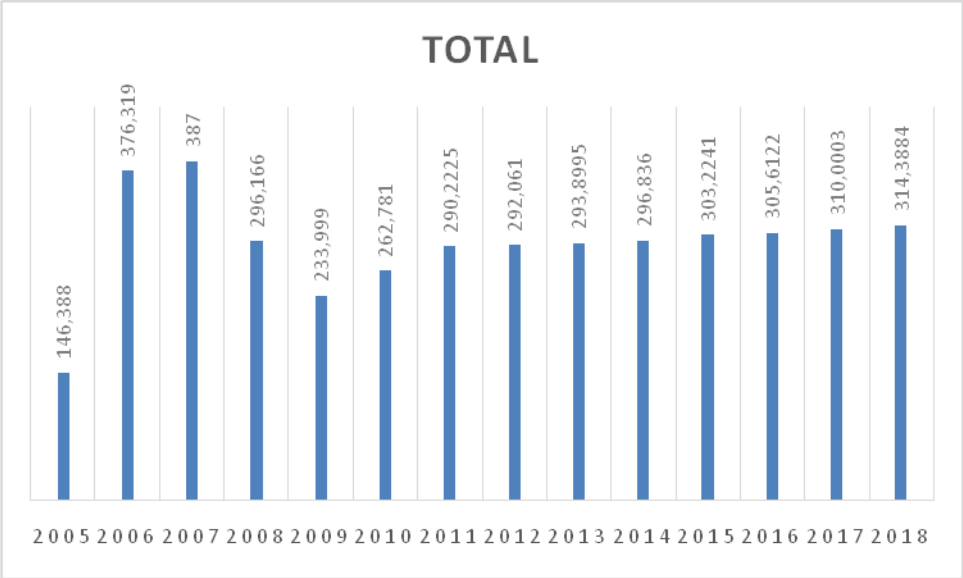

Figure 8: Evolution of exports of fishing products (value in billions of MGA ariary)

We note that in Madagascar the most exported fish products are shrimp, but also other fish products here such as tuna.

4.1.3.3. Public revenue from fishing

Fishing royalties are the income received by the State for the exploitation of fishing resources. In the following table, we will see the evolution of fishing royalties from 2005 to 2010.

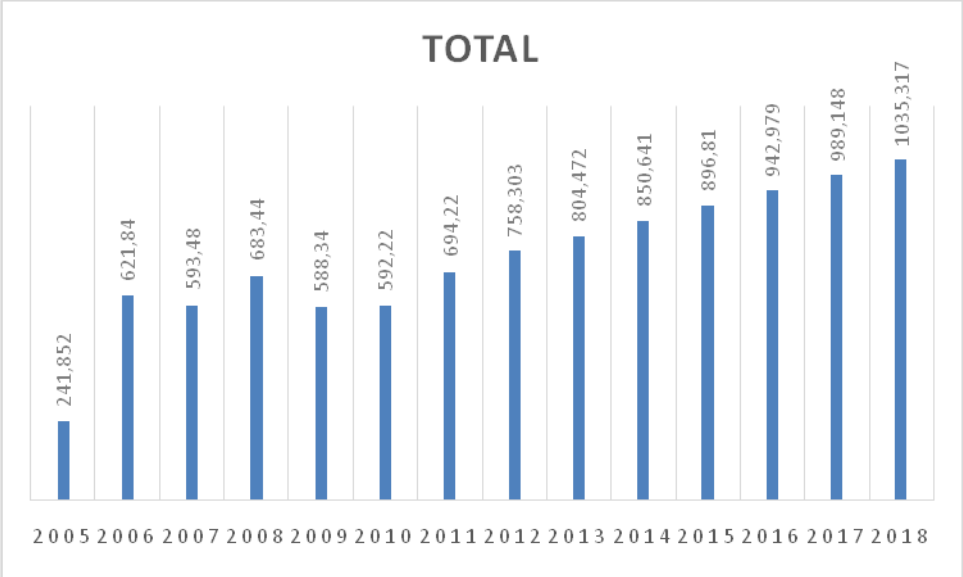

Figure 9: Fees collected in the issuance of operating cards in millions of Ariary.

Fishing taxes can be an important source of revenue that supports many poor communities in Madagascar. Thanks to fishing, many poor families are less exposed to the risk of famine, and can supplement and diversify their income. Fishing also provides a safety net for poor populations when other economic outlets are limited or during seasons when other sources of food such as agriculture decline.

4.3.4. Estimation of coefficients using the OLS method

We will present in the table below the results of the estimation of the coefficients of our OLS model.

Table III: OLS estimation table

Dependent Variable : GDP
Method : Least Squares
Date : 09/20/23 Time :20 :47
Sample : 2005 2018
Included observations : 14

Variable	Coefficient	Std. Error	T-Statistic	Prob.
C	7.136527	0.164346	43.42385	0.0000
EXPORT	0.000857	0.000622	1.377395	0.1958
REDEVANCE	-0.001548	0.000171	-9.047581	0.0000

R-squared	0.896466	Mean dependent var	6.250000
Adjusted R-squared	0.877641	S.D. dependent var	0.318047
S.E. of régression	0.111252	Akaike info criterion	-1.366625
Sum squared resid	0.136147	Schwarz criterion	-1.229684
Log likelihood	12.56638	Hannan-Quinn criter.	-1.379302
F-statistic	47.62254	Durbin-Watson stat	1.780073
Prob(F-statistic)	0.000004		

For the fishing sector, as for the forestry sector, we use multiple linear regression because we have two variables to explain GDP. After estimating the coefficients using the OLS method, we must first look at the individual significance of the coefficients. The Student's test at the 5% threshold reveals that exports in the fishing sector are not significant in relation to GDP with a result of 1.377395 and a p-value of 0.1958, on the other hand, royalties. are significant with a Student's p-value which is within the norms to accept the test.

Concerning the overall significance of the coefficients, according to the Fischer test, the coefficients are overall significant. And the degree of explanation of GDP in relation to our explanatory variables (Export and Royalty) is also within the standards indicated with an R^2 of 0.896466.

4.2. Discussions

We will develop ideas on which the results of our research are based in order to identify possible problems that may arise in this research work.

In terms of the mining sector, the mining sector is a booming sector in Madagascar; it represents an important source of foreign currency income, growth and development. Madagascar was ranked 9th among the most attractive African countries in mineral resources in 2016. In 2023, the country is not in the top 10 this may be due to the fact that during 2 years of the pandemic which affected the world.

The mining sector in Madagascar actively contributes to GDP. From 2004 to 2018, the contribution to GDP had an average of 3.14%. In the study by ANDRIANIRINA Yves Fidèle before the political crisis of 2009, the mining sector contributed 0.1% to GDP from 2003 to 2007. It was only in 2008 that the mining sector began to grow in increasing to 1.3% then to 1.5% in 2009. After the political crisis of 2009, the mining sector saw a significant increase and its contribution to GDP increased from 1.5% in 2009 to 3.3% in 2010 an increase of 1.8%. The mining sector continues to grow and in 2018, its contribution to GDP was 6.9%. It is the only sector to have reached such a level of contribution to GDP in the country in our research.

The arrival of two modern players, QMM and SHERIT in Madagascar represented a level of FDI of more than 5 billion USD for Madagascar. For royalties collected by the mining sector, since 2009 mining royalties have only increased although in our study it was the year 2009 which obtained the lowest rate of income with 290 million USD compared to 352.6 million USD in 2008. But from 2010, revenues from the exploitation of mining resources began to increase and rose to 431 million USD, an increase of 48.6% per year. Compared to 2009. In 2011, we noted a drop in the royalty level which was 7.6% compared to 2010, going from 431 million USD to 398.3 million USD. From 2012 to 2018, there was no further decline in revenues linked to the exploitation of mining resources; on the contrary, the sector became prosperous, ranging from 420.4 million USD in 2012 to 553.5 million USD. in 2018.

In terms of the forestry sector, the forestry sector also plays a very important role in the growth of Madagascar. Despite the political crisis of 2009, the forestry sector was able to maintain a contribution to GDP of 4% unlike the mining sector which was almost at a standstill during this period. During the year following the crisis, in Madagascar the contribution of the forestry sector to GDP continued to increase, but very slowly. Its progression does not reach the 5% contribution to GDP in the big island. This shows a slight stagnation in this sector. In 10 years, the contribution to GDP of the forestry sector increases from 4% in 2009 to 4.7% in 2018, a change of 0.7% in 10 years.

In Madagascar, logging operations are systematically and largely undervalued in official statistics. Forests provide important functions that are not generally taken into account by markets, including the protection of watersheds, soil management, pollination, etc. For State royalties from the exploitation of forest resources, Madagascar recorded 68.446 million ariary in 2009 compared to 79.335 million ariary in 2010, an increase of only 15.9%. This increase can be explained by the fact that in 2009 it was the year of the political crisis in Madagascar and all sectors of activity were on pause, but in 2010 the country began to recover but this increase did not is not at all significant compared to the years following 2010. For the years 2010 and 2011, Madagascar recorded a significantly higher increase going from 79.335 million ariary to 613.0073 million ariary, a net increase of 533.6723 millions of ariary in the space of a year. From 2011, annual royalties have continued to increase in Madagascar, reaching 2,634.7098 million ariary in 2018.

Concerning the jobs created by the forestry sector, just like the mining sector, there is not enough data regarding jobs, but we know that the forestry sector creates many jobs although the majority are in the informal sector which means that the government is unable to provide precise data concerning the jobs generated by the forestry sector.

In terms of the fishing sector, the fishing sector is important in developing countries like Madagascar and is experiencing regular development in many low- or middle-income countries. In Madagascar, the contribution to the GDP of the fishing sector has been in constant decline since 2004, which represented 7.4% of Madagascar's GDP, which remains the percentage of contribution to the GDP of this sector to date according to the study by ANDRIANIRINA Yves Fidèle. In 2009, its contribution to the sector's GDP amounted to 6.4%, i.e. -8.8% than in 2004, a decrease which is relatively small, but unlike other sectors, the contribution of the fishing sector remains high in 2009 marked by the political crisis and a coup d'état. Other sectors such as the mining sector and the forestry sector had respectively 1.3% and 4% contribution compared to this, we can affirm that the fishing sector has resisted the crisis well. On the other hand, unlike other sectors which are relaunching, the fishing sector continues to decline, going from 6.4% in 2009 to 5.8% in 2018.

Fishing is an important source of foreign exchange. Fish is the most traded fish product with the most value internationally. Revenues earned by Madagascar from exports of fishery products amounted to 233.999 million ariary for 17,706 tonnes exported in 2009. In 2010, the quantity of exports was 15,017.8 tonnes which is lower than that of 2009, but the revenues from the year 2010 are 262.781 billion ariary, this can be explained by the variation in the international exchange rate of the ariary.

The year 2012 continues with an increase in the value of exports but an increase which is not felt too much because exports go from 290.2225 billion ariary in 2011 to 292.061 billion ariary in 2012. From there, the values of income derived from the exploitation of fishery products continued to increase until reaching 314.3884 billion ariary in 2018 but the year with the greatest value in terms of income derived from fishing The export of fishing products remains the year 2007 with 387 billion ariary in revenue and the year with the highest peak in quantity exported to Madagascar remains the year 2006 with 34,520.2 tonnes of products exported. The most exported fish products to Madagascar are shrimp and other products such as tuna. But in terms of value, shrimp are the most valuable internationally.

Royalties derived from the exploitation of fishing resources have continued to increase since 2005, which remains the year with the low royalty rate which is 241.852 million ariary. This growth continued until 2009, there was a brief decrease compared to 2008 with 683.44 million ariary in royalties in 2008 compared to 588.34 million

ariary in 2009. After the year of the crisis, royalties for the exploitation of fishing resources continued to increase until reaching 1,035.317 million ariary in 2018. Between products freshwater and marine products, it is marine products that are exploited the most.

5. Conclusion

Natural capital represents a quarter of the total wealth of low-income countries (OECD 2009). For the poorest people in these countries, especially those living in rural areas, fishing, forests and mineral resources are the main sources of income. The international context in which natural resource management takes place is evolving rapidly. Many emerging economies now import large quantities, and this increased demand makes better management of these resources even more urgent. This is why, if low-income countries want to achieve economic growth, they must rely on the wealth of natural resources available to the poor.

Natural resources can generate sustainable growth and thus reduce poverty. It is therefore urgent to emphasize the need to improve the management of natural resources with a view to long-term economic growth. By this term we mean growth that, by its pace and nature, would strengthen the capacity of women and men living in poverty to contribute to and benefit from growth.

In Madagascar, natural resources contribute greatly to the country's economic growth by creating jobs, also contributing to subsistence, but also to the conservation of biodiversity. But natural resources in Madagascar are undergoing rapid degradation due to overexploitation and climate change. This worries the population and the State because natural resources are a way for the country to develop and get the country out of poverty.

The econometric analysis made it possible to see the significance of the explanatory variables in relation to the explained variable QQ. In this analysis, the most influential variable to the GDP of each sector is the royalty

The mining sector is the most profitable sector in the country due to Madagascar's rich soil with precious and semi-precious minerals and stones that are sought after by many countries. With all this, can Madagascar rely solely on natural resources to escape poverty?

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APPENDIX

Table IV : Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.008650	Prob. F(2,11)	0.3961
Obs*R-squared	2.324560	Prob. Chi-Square(2)	0.3128

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 09/22/23 Time: 12:05
Sample: 2004 2018
Included observations: 15
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.642090	0.908561	-0.706710	0.4944
REDEVANCE	0.001573	0.002210	0.711504	0.4916
RESID(-1)	-0.496208	0.356968	-1.390063	0.1920
RESID(-2)	-0.145443	0.330647	-0.439875	0.6685

R-squared	0.154971	Mean dependent var	-2.36E-15
Adjusted R-squared	-0.075492	S.D. dependent var	0.689382
S.E. of regression	0.714930	Akaike info criterion	2.389915
Sum squared resid	5.622380	Schwarz criterion	2.578729
Log likelihood	-13.92436	Hannan-Quinn criter.	2.387904
F-statistic	0.672433	Durbin-Watson stat	1.867038
Prob(F-statistic)	0.586599		

Table: Heteroskedasticity Test : Breusch-Pagan-Godfrey

F-statistic	3.051969	Prob. F(1,13)	0.1042
Obs*R-squared	2.851958	Prob. Chi-Square(1)	0.0913
Scaled explained SS	3.174536	Prob. Chi-Square(1)	0.0748

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 09/22/23 Time: 12:11
Sample: 2004 2018
Included observations: 15

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.748134	0.770694	2.268260	0.0410
REDEVANCE	-0.003276	0.001875	-1.746989	0.1042

R-squared	0.190131	Mean dependent var	0.443565
Adjusted R-squared	0.127833	S.D. dependent var	0.790442
S.E. of regression	0.738193	Akaike info criterion	2.354344
Sum squared resid	7.084081	Schwarz criterion	2.448750
Log likelihood	-15.65758	Hannan-Quinn criter.	2.353338
F-statistic	3.051969	Durbin-Watson stat	1.972199
Prob(F-statistic)	0.104205		

Table VI : Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.208213	Prob. F(2,9)	0.3429
Obs*R-squared	2.963272	Prob. Chi-Square(2)	0.2273

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 09/22/23 Time: 15:57
Sample: 2005 2018
Included observations: 14
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.027277	0.181259	-0.150485	0.8837
EXPORTATION	2.85E-06	0.000701	0.004069	0.9968
REDEVANCE	3.48E-05	0.000172	0.202630	0.8439
RESID(-1)	0.153465	0.337495	0.454718	0.6601
RESID(-2)	-0.458392	0.306347	-1.496318	0.1688

R-squared	0.211662	Mean dependent var	3.89E-16
Adjusted R-squared	-0.138710	S.D. dependent var	0.102337
S.E. of regression	0.109204	Akaike info criterion	-1.318740
Sum squared resid	0.107330	Schwarz criterion	-1.090505
Log likelihood	14.23118	Hannan-Quinn criter.	-1.339867
F-statistic	0.604107	Durbin-Watson stat	2.078664
Prob(F-statistic)	0.669564		

Table VII : Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	4.436362	Prob. F(2,11)	0.0387
Obs*R-squared	6.250685	Prob. Chi-Square(2)	0.0439
Scaled explained SS	5.679556	Prob. Chi-Square(2)	0.0584

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 09/22/23 Time: 15:58
Sample: 2005 2018
Included observations: 14

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.018385	0.020688	-0.888696	0.3932
EXPORTATION	0.000219	7.84E-05	2.798034	0.0173
REDEVANCE	-4.93E-05	2.15E-05	-2.288155	0.0429

R-squared	0.446477	Mean dependent var	0.009725
Adjusted R-squared	0.345837	S.D. dependent var	0.017315
S.E. of regression	0.014004	Akaike info criterion	-5.511499
Sum squared resid	0.002157	Schwarz criterion	-5.374558
Log likelihood	41.58049	Hannan-Quinn criter.	-5.524175
F-statistic	4.436362	Durbin-Watson stat	2.692606
Prob(F-statistic)	0.038658		