

Analysis of the financial determinants of non-hydrocarbon exports in Algeria

SOUFI Karima ^{1*}, LALALI Rachid ²

¹University of Bejaia (Algeria) , RMTQ Laboratory, karima.soufi@univ-bejaia.dz.

² University of Bejaia (Algeria) , LED Laboratory, rachid.lalali@univ-bejaia.dz.

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Abstract:

The aim of this study is to analyze the financial determinants of non-hydrocarbon exports in Algeria, for the period 1995 to 2022, using an econometric model based on the ordinary least squares (OLS) method. The study shows that credit granted to the private sector has a positive effect on non-hydrocarbon exports, while freedom to invest has a negative effect. Furthermore, the results corroborate that financial freedom, monetary freedom and the inflation rate, do not exert an effect on non-hydrocarbon exports.

Keywords: Non-hydrocarbon exports; banking system; financial development; financial determinants; bank credit.

JEL Classification: C54; F13; O24.

Introduction

The use of exports is unavoidable in the current international context. They play a crucial role in the growth of the economy (Griffith & Czinkota, 2012). However, the promotion of its policies is seen as a major solution to reduce the balance of payments deficit and boost the economic activities of local firms (Gueguen, Janssen, & Giacomini, 2015).

Over the last two decades, an abundant literature has developed on globalization strategies. Some research indicates that external support has a significant effect on export decisions (Leonidou, Katsikeas, Palihawadana, & Spyropoulou, 2007), although there is considerable disparity regarding financial constraints. Indeed, the issue of analyzing the effects of finance on exports has not ceased to be of particular concern to economists.

In its report on economic development in Africa, (UNCTAD, 2023) stresses the importance of access to finance for exports. African countries should better position SMEs as drivers of diversification, by facilitating their access to financial funds and services. Algeria, like these countries, has undertaken a number of structural reforms since the 1990s, but it is still dependent on the hydrocarbon sector and continues to proclaim the principle of export diversification.

The collapse of the oil market in 2014 and the drop in foreign currency earnings have considerably widened the balance of payments deficit and, as a result, reopened the debate on the need to move away from dependence on the hydrocarbons sector. This objective could be achieved by supporting the banking sector in its role as a provider of financial services and resources for productive, export-oriented businesses.

In this context, this paper contributes to the existing literature on this topic by attempting to empirically explore the financial determinants of HH exports¹, paying particular attention to domestic credit provided to the private sector, given its crucial importance in overcoming liquidity constraints. The aim is precisely to answer the following question:

What are the financial factors that explain Algeria's Non-Hydrocarbon exports?

In particular, our analysis is designed to test the hypothesis that credit granted to the private sector has a positive effect on HH exports. To do this, we will proceed in two stages. In the first, we will present a brief review of the theoretical and empirical literature on the subject, and in the second, we will study empirically, using the ordinary least squares (OLS) method, the effect that financial indicators can have on HH exports. The period studied is from 1995 to 2022.

We employ the term of HH exports for non-hydrocarbon exports¹

1- Literature review

The existing economic literature on the subject is essentially theoretical rather than empirical. Overall, empirical results consistently highlight the importance of intermediaries and financial markets for exports. (Bastidon & Kocoqlu, 2016), conducted an empirical study analyzing the relationship between exports and financial development in seven MENA countries over the period 1980-2011. They used specific indicators of financial development for banking institutions and financial markets. They also included control variables such as GDP per capita, the inflation rate, the investment rate and the terms of trade index. The results confirmed the value of the macroeconomic approach to the relationship studied. On the one hand, the results of the analysis support the negative impacts of the level of development of banking systems and the positive effects of financial markets on exports.

The empirical results of (Yot & Harvie, 2018) testify that the Export-Import Bank of Thailand (EXIM) contributes significantly to the promotion of Thai exports and export intensity. In the same vein, (Shekhar & Jena, 2021) provide strong evidence that there is a positive relationship between India bank lending and export performance thus; export financing is an important determinant of export performance. The authors incorporated an inferential linear regression model, on data from EXIM Bank of India for the period (2000/2001 to 2019/2020).

Based on data from 260 Chinese cities for the period 1997 to 2012 (Chen, Poncet, & Xiong, 2020) found that firms operating in financially vulnerable sectors underperformed in exports compared to those that are much stronger in terms of financial capability, indeed, prospective exporters are committed to improving their financial conditions before embarking on exporting (Qasim, Risov, & Zhang, 2021), this is supported by the results of the survey conducted by (Whang & Koo, 2022) among 1000 Korean SMEs supporting the importance of the external financial market for exporting SMEs facing various initial investments related to their export activities.

The study by (Paravisini, Rappoport, & Schnabl, 2023), carried out on Peruvian exports during the period (1994-2010), highlights the existence of a correlation between an exporter's credit from the bank and the volume of its exports. Similarly, the work of (Mataveli, Ayala, & Gil, 2021) aimed at analyzing the role of public and private banks in the export process of companies in Brazil. The results of the survey carried out on a sample of 318 Brazilian exporting companies highlighted the importance of credit for the export activities of these companies, which use the services of banks to overcome their export difficulties. This study highlights the need for more generous support for export activity from banks in terms of access to credit.

2- Econometric study of the effects of finance on non-hydrocarbon exports

The purpose of this analysis is to empirically verify the effects of certain key financial variables, mainly bank credit, on HH exports.

2-1- Study methodology and data

The number of financial variables used in econometric analyses of the effects of financial development on a given economic variable differs from one study to another. The work of King and Levine (1993) is the seminal study in empirical analyses of the relationship between financial development and economic growth, using four indicators (Eggoh, 2011, p. 144). Ang and Mc Kibbin, (2007), set three financial determinants that are widely used in the literature, namely: money supply (M2 or M3) as a percentage of GDP, bank credit provided to the private sector as a percentage of GDP and the ratio of assets issued by commercial banks (Lo & Ramde, 2019, p. 9).

In order to explore the effect of financial variables on HH exports in Algeria, our research method will consist in the construction of an econometric model based on Ordinary Least Squares (OLS). The estimation of equation (1) is based on annual data from 1995 to 2022, for a total of twenty-eight (28) observations for each variable.

The choice of variables for the sample is not arbitrary, and was made on the basis of a review of the theoretical and empirical literature, although it was constrained by the availability of data for the case of Algeria.

Among the determinants identified in the empirical literature, five (05) quantitative variables were selected, including: domestic credit provided to the private sector as a percentage of GDP (CSP), inflation rate (INF), financial freedom (LIBF), freedom to invest (LIBINV) and monetary freedom (LIBM,).

We consider that the variables chosen for our study are relevant; indeed, the choice of these is related to the characteristics of the Algerian financial system, which is an embryonic system, based heavily on bank intermediation with the coverage of almost all the financing of the economy by banks.

The inflation variable (INF) is used in the equation as a control variable, representing a proxy for macroeconomic imbalance.

The data exploited in our study were drawn from several secondary sources, namely: the periodic reports of the (CNIS, 2021), the (Bank of Algeria, 2023), the database of (World Bank, 2023) and the (Heritage foundation, 2022).

The formula applied to our model incorporates the variable to be explained, which is HH exports (EXPHH). It is expressed as a function of a

set of indicators that are likely to have an impact on it (explanatory variables): CSP, INF, LIBF, LIBINV and LIBM.

The variables are log-transformed to estimate the model by applying the log function to each variable. Equation (1) is given by the following formula:

$$\text{LEXP} = C(1) * \text{LCSP} + C(2) * \text{LINF} + C(3) * \text{LLIBF} + C(4) * \text{LLIBINV} + C(5) * \text{LLIBM} + C(6).$$

The statistical characteristics of the variables retained in our study are described in table number (01).

Table number (01): Descriptive statistics for study variables

	EXPHH	CSP	INF	LIBF	LIBM	LIBINV
Mean	1672.786	14.75780	5.691746	35.35714	73.56607	42.32143
Median	1429.000	13.35300	4.269400	30.00000	76.25000	47.50000
Maximum	5978.000	29.54520	29.77960	50.00000	84.30000	70.00000
Minimum	358.0000	3.907400	0.339100	20.00000	56.00000	20.00000
Std. Dev.	1276.011	7.465555	5.834653	9.615629	7.937651	14.74990
Skewness	1.720379	0.279430	2.984292	0.787962	-0.892877	0.177663
Kurtosis	6.280372	2.013534	12.18133	1.972597	2.763845	2.306221
Jarque-Bera	26.36626	1.499680	139.9075	4.128941	3.785467	0.708849
Probability	0.000002	0.472442	0.000000	0.126885	0.150659	0.701577
Sum	46838.00	413.2185	159.3689	990.0000	2059.850	1185.000
Sum Sq. Dev.	43961531	1504.832	919.1657	2496.429	1701.170	5874.107
Observation	28	28	28	28	28	28

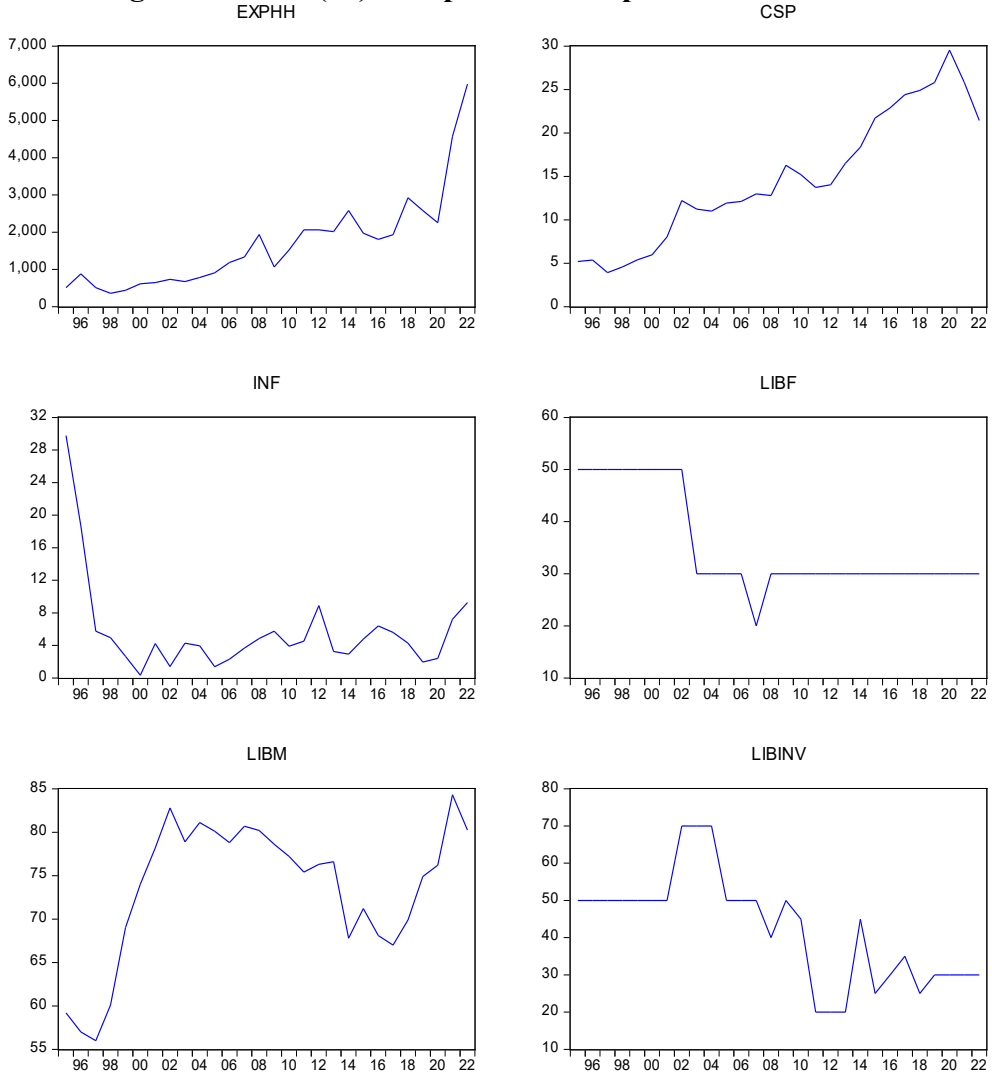
Source: Prepared by the authors, based on the outputs of Eviews 9

We note that all the series display a high level of consistency, given that their various mean and median values are positioned respectively in their maximum and minimum values.

Before proceeding with the econometric study of the series of variables selected, it is important to begin with a graphical analysis of the evolution of the different variables selected, in order to get a general idea of their different evolutions.

The graphical presentation of the different time series is illustrated in figure number (01).

Figure number (01): Graphical development of time series



Source: Eviews 9 outputs

Figure number (01) shows that, overall, variations in HH exports (EXPHH) remained minimal over the period 1995-2022. This can be explained by the rentier nature of the Algerian economy and the predominance of hydrocarbons in total exports.

As for credit to the private sector (CSP), the overall orientation of the curve indicates that the rates of credit granted to the private sector as a percentage of GDP during the period (1995-2022) are negligible, which

testifies to the shallowness of the financial sector and the low level of bank financing for the private sector. In fact, the Algerian banking sector is heavily dominated by public banks, which do not wish to use their funds for jobs that are too risky.

The inflation rate (INF) has fallen remarkably since 1996, reaching a low of 0.33% in 2000. This can be justified by the adoption of the IMF's structural adjustment programs in 1994, with the application of restrictive financial and monetary policies which greatly reduced inflationary pressures. The period (2001-2022) recorded unstable values, with the highest rate at 8.89% in 2012, which can be explained by the increase in the price of food consumer goods following the rise in international food prices. In addition, the index of financial freedom (LIBF) stabilized at 50 during the period (1995-2002), which can be explained by significant state intervention. The index fell from 50% to 30% in the period 2003-2006, which can be explained by excessive state control over financial institutions and credit allocation. This indicator reached its lowest level in 2007, at 20, and finally stabilized at 30 during the remaining period (2008-2022).

The index of monetary freedom (LIBM) has fluctuated relatively little. The value of the index fell during the period (1995-1998), only to record a remarkable increase in 2007, with a value of 80.70, which can be justified by the opening up of the Algerian market and the freedom of prices controlled by the state. This indicator was at its highest level in 2021, with a value of 84.30.

Finally, we note that the freedom to invest index (LIBINV) stabilized between 1995 and 2001 at 50, then rose during the period (2002-2004), before falling from 2005 until 2022, which can be explained overall by the various constraints on investment (financial, bureaucratic, etc.).

2-2- Estimating the financial determinants of HH exports

The results of the estimation of the effect of the selected variables on HH exports are shown in table number (02).

Table number (02): Multiple regression estimation results

Dependent Variable: LEXPHH
 Method: Least Squares
 Date: 09/18/24 Time: 11:55
 Sample: 1995 2022
 Included observations: 28

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LCSP	0.758270	0.192390	3.941309	0.0007
LINF	0.125782	0.086131	1.460347	0.1583
LLIBF	-0.123997	0.397707	-0.311780	0.7581
LLIBINV	-0.604755	0.211733	-2.856220	0.0092
LLIBM	0.534566	0.781945	0.683636	0.5013
C	5.437473	4.057389	1.340141	0.1939
R-squared	0.839820	Mean dependent var	7.174463	
Adjusted R-squared	0.803415	S.D. dependent var	0.721418	
S.E. of regression	0.319862	Akaike info criterion	0.745554	
Sum squared resid	2.250854	Schwarz criterion	1.031026	
Log likelihood	-4.437752	Hannan-Quinn criter.	0.832825	
F-statistic	23.06902	Durbin-Watson stat	1.721705	
Prob(F-statistic)	0.000000			

Source: Eviews 9 outputs

The coefficient of determination (R^2), which can take a value between 0 and 1, is used to measure the quality of a multiple linear regression. It gives the degree of variability of the variable to be explained by the explanatory variables, with two possible cases (Confais & Le guen, p. 234).

- If R^2 is close to 1, indicates that the model explains reality perfectly;
- If R^2 is close to 0 means that the model does not explain reality. We need to move towards another model.

From the results of the regression displayed in table, the coefficient of determination (R^2) is estimated at 0.83, which is a value very close to 1, indicating that the model explains reality perfectly. In other words, we can conclude that non-hydrocarbon exports (EXPHH) are 83% explained by the linear combination of explanatory variables (CSP, INF, LIBF, LIBINV and LIBM).

The Student's t test is used to check whether an explanatory variable has an effect on the variable to be explained, taking into account the value of the surplus value of the variables, which must be less than 5%. According to the results obtained, the p-value of the variables credit to the private sector (CSP) and freedom to invest (LIBINV) are less than 5%, which means that the coefficients associated with these variables are statistically significant. The coefficients associated with the variables inflation (INF), financial freedom (LIBF) and monetary freedom (LIBM), are statistically insignificant.

From the results presented in table number (02), the estimation of the multiple regression model, gives us the following equation:

$$\text{LEXP} = 0.758270 \cdot \text{LCSP} + 0.125782 \cdot \text{LINF} - 0.123997 \cdot \text{LLIBF} - 0.604755 \cdot \text{LLIBINV} + 0.534566 \cdot \text{LLIBM} + 5.437473$$

From the results of the model estimation, all other things being equal indicate that a:

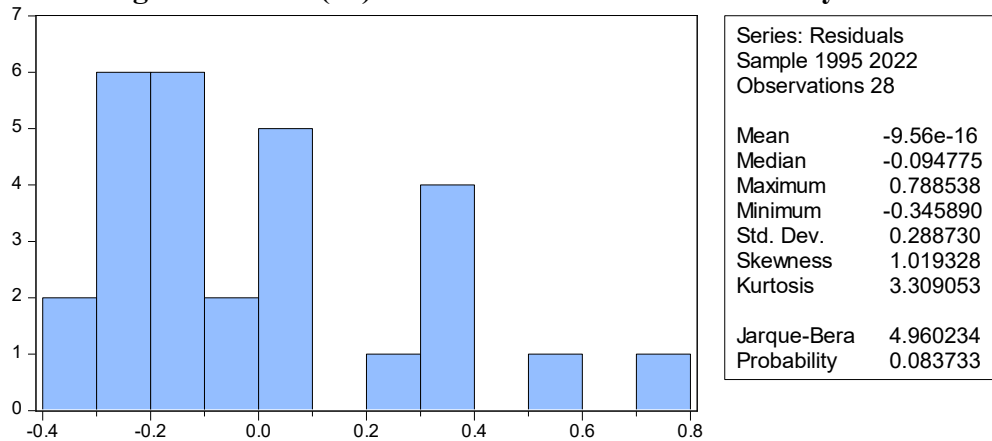
- A 1% increase in credit provided to the private sector (CSP) leads to a 0.75% increase in non-hydrocarbon exports, this result is in line with theoretical predictions and consistent with the findings of (Mataveli, Ayala, & Gil, 2021), which highlighted the need for more generous support for export activity from banks both in terms of access to credit.
- A 1% increase in the freedom to invest index (LIBIV) generates a 0.60% decrease in non-hydrocarbon exports.
- $C=5.437473$, this is the autonomous value. If all variables equal 0 EXPHH will record an increase of 5.437473 which can be explained by other variables not used in our model.

2-3-Validation tests

Validation of the model requires various statistical tests to be carried out on the residuals and coefficients. The results of these tests are presented in the figures and tables below:

2-3-1- Residual normality test

Figure number (02): Results of the residual normality test



Source: Eviews 9 outputs

The Jarque-Berra value is 4.96, which is below the critical value of 5.99 ($4.96 < 5.99$), and the probability of the Jarque-Berra statistic is equal to 0.083, which is well above the 5% threshold ($0.083 > 0.05$), so we accept H_0 and we can say that the residuals from the model follow a normal distribution and the basic assumption of ordinary least squares (OLS) linear regression is verified.

2-3-2- Correlogram of the residual series

Table number (03): Correlogram of the residual series

Date: 09/18/24 Time: 12:20
 Sample: 1995 2022
 Included observations: 28

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob
		1 -0.00...	-0.00...	0.0025	0.960
		2 -0.20...	-0.20...	1.3957	0.498
		3 0.021	0.018	1.4110	0.703
		4 0.138	0.100	2.0789	0.721
		5 -0.26...	-0.26...	4.6016	0.466
		6 -0.08...	-0.04...	4.8654	0.561
		7 -0.04...	-0.16...	4.9424	0.667
		8 0.256	0.255	7.6949	0.464
		9 -0.20...	-0.24...	9.4933	0.393
		1... -0.04...	0.029	9.5931	0.477
		1... 0.064	-0.05...	9.7977	0.549
		1... -0.02...	-0.15...	9.8226	0.632

Source: Eviews 9 outputs

Following the correlogram, we can suggest that it is stationary, given that on the one hand the autocorrelation bounds have no particular structure and on the other hand the probability of the Ljung-box Q statistic at lag $h=5$ is equal to 0.46 which is above the critical threshold of (5%), thus the null hypothesis of white noise accepted.

2-3-3- Breusch-Godfrey test

To test whether the residuals are auto-correlated or not, we opted for the Breusch-Godfrey test, which is used to test whether the residuals are not auto-correlated.

Table number (04): Result of the second-order auto-correlation test (2) on the residuals

F-statistic	0,923028	Prob. F (2,20)	0,4136
Obs*R-squared	2,366082	Prob. Chi-Square (2)	0,3063

Source: Eviews 9 outputs

We find that the probability is equal to 0.41, which is greater than the 5% threshold ($0.41 > 0.05$), so we accept $H_0=0$ and can conclude that the residuals are not auto-correlated.

2-3-4- Breusch-Pagan-Godfrey residual Heteroskedasticity test

Table number (05): Result of Heteroscedasticity of residuals

F-statistic	0,584987	Prob. F (5,22)	0,7113
Obs*R-squared	3,285791	Prob. Chi-Square (5)	0,6560

Scaled explained SS	2,341926	Prob. Chi-Square (5)	0,8001
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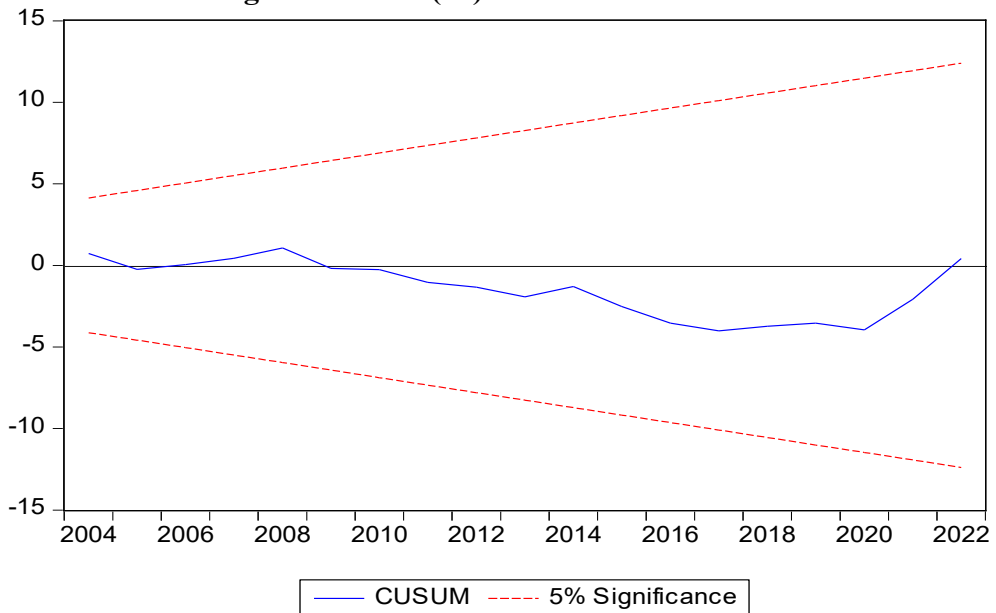
Source: Eviews 9 outputs

The results shown in table number (05) indicate that the probability associated with the Fisher statistic is equal to 0.71. This value is greater than 5% and we can therefore confirm that there is no heteroskedasticity in the model.

2-3-5- CUSUM Squares test

The CUSUM test is used to check the stability of the coefficients. This test is based on the cumulative sum of the square of the repetitive residuals. In principle, under the null hypothesis that the relationship is stable, the value of the statistic should lie between two lines representing the limits of the interval.

Figure number (03): CUSUM test results

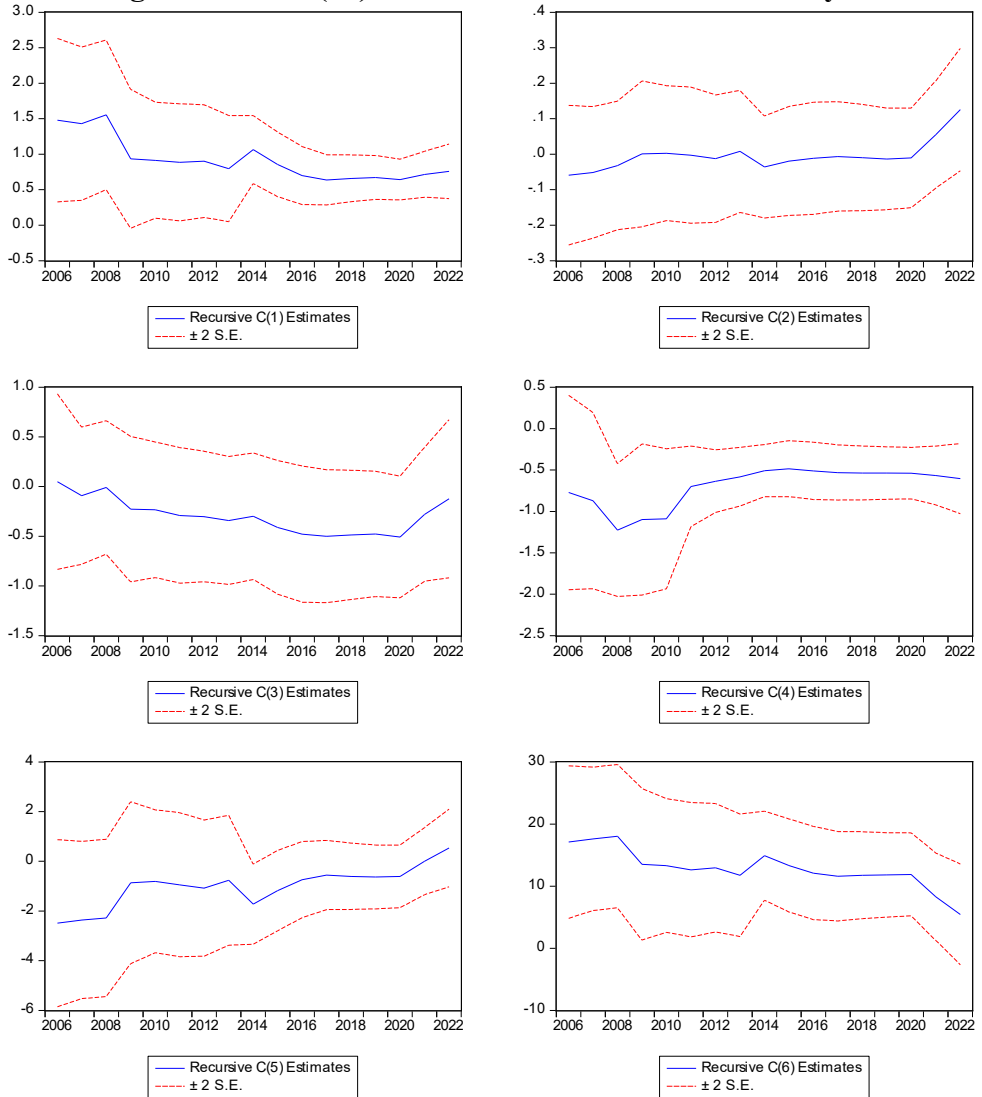


Source: Eviews 9 outputs

The CUSUM statistic in our case evolves within the confidence interval and we can therefore conclude that the parameters are stable.

2-3-6- Coefficient stability test

Figure number (04): Results of the coefficient stability test



Source: Eviews 9 outputs

The figure number (04) shows that the coefficients of the variables used in our study are within the confidence interval, so we can conclude that the parameters are stable.

Conclusion

By way of conclusion, our work has highlighted the importance of the macroeconomic approach to the effect of finance on HH exports in Algeria, using an econometric model based on the ordinary least square's method carried out in Eviews 9, covering the period 1995 to 2022.

The results of our study showed that domestic credit provided to the private sector (CSP) measuring financial development exerts a significant and positive effect on HH exports in Algeria. This result is consistent with theoretical predictions and confirms our main hypothesis, while HH exports are negatively affected by the freedom to invert (LIBIV). Moreover, the regression estimation indicates that the variables: financial freedom (LIBF), monetary freedom (LIBM) and inflation (INF) are not statistically significant in explaining the endogenous variable non-hydrocarbon exports (EXPHH).

Our analysis highlights the preponderant role of the banking sector in the potential of HH exports. Bank financing is identified as an essential tool, but all the same, a development strategy is needed to resolve the problems of bank intermediation and the low levels of credit granted to the private sector. This strategy should focus in particular on strengthening support for businesses in their export activities. We set out below, the recommendations we have made in relation to this subject:

- Create an export bank that should take charge of providing financing for the development of export-oriented activities;
- Diversify the offer of banking products and services to export activities. Banks must bring themselves up to speed with the requirements of exporting companies;
- Boost exports by mobilizing savings towards productive investment;
- Ensure that the relationship between banks and exporting companies is strengthened, particularly with exporting SMEs;
- Strengthen competitiveness in the banking sector by proceeding with the gradual liberalization of interest rates;

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