Articles

A comparative study of rice export levels before and during dollarization 1980-2020

Estudio comparativo de los niveles de exportación de arroz antes y durante la dolarización 1980-2020

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ABSTRACT

This research focuses on a comparative study between the levels of rice exports before and during dollarization, corresponding to the years 1980-2020; thus, the information from the World Bank, Central Bank of Ecuador and SENAE is used as a data base, which eventually leads us to a non-experimental research with a quantitative approach and through the t-test was able to determine the existence of a significant change in rice exports before and during dollarization. On the other hand, the coefficient of determination allows us to appreciate that with dollarization there is a 10% incidence between price and export levels, as well as establishing that during this stage, the dependence on international relations and the high production costs influence the degree of competitiveness of the price of rice.

Keywords: Dollarization, Price, Rice Exports

ABSTRACT

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JOURNAL OF BUSINESS and entrepreneurial studies
ISSN: 2576-0971

Journal of Business and entrepreneurial
April - June Vol. 7 - 2 - 2023
http://journalbusinesses.com/index.php/revista
e-ISSN: 2576-0971
journalbusinessentrepreneurial@gmail.com
Receipt: 09 October 2022
Approval: 24 March 2023
Page 30- 46

Journal of Business and entrepreneurial studies
ISSN: 2576-0971
http://journalbusinesses.com/index.php/revista

La presente investigación se enfoca en realizar un estudio comparativo entre los niveles de exportación de arroz antes y durante la dolarización, correspondientes a los años 1980-2020; es así que se recurre a tomar como base de datos la información del Banco Mundial, Banco Central de Ecuador y SENAE, misma que eventualmente nos lleva a una investigación no experimental con enfoque cuantitativo y que mediante la prueba t pudo determinar la existencia de un cambio significativo en las exportaciones de arroz antes y durante la dolarización. Por otro lado, el coeficiente de determinación permite apreciar que con la dolarización hay un 10% de incidencia entre el precio y los niveles de exportación, así como también se establece que durante esta etapa, la dependencia de las relaciones internacionales y los elevados costos de producción influyen en el grado de competitividad del precio del arroz.

Keywords: Dolarización, Precio, Exportación de Arroz

INTRODUCTION

Globalization has allowed the exchange of products, knowledge and even culture worldwide, being the export the activity that promotes and reactivates it constantly, it is the decision of each country to verify its resources and exploit them to the maximum, to obtain higher levels of income. If we analyze it geographically, Ecuador has enough resources to obtain a star export product such as rice, for example; which being a basic necessity within the country, has a high level of occupation for its production in the different provinces, mainly in Los Rios and Guayas. In addition, According to De Bernardi, 2017, rice is a cereal that is occupying the second place in production worldwide after corn.

However, rice production cannot be fully exploited, since it is not feasible to produce in large quantities if there are not enough buyers, since exports are not only Ecuador's source of income, it can be considered that all of Latin America puts it into practice and that is why the producers of different foods (oil, cocoa, rice, bananas, shrimp, etc.) are in constant competition to receive buyers.

This is where the differences between the levels (higher or lower) of export that each country has, because the importer is mainly fixed in the prices offered and based on this establishes the pact to form a new partnership. It is the seller's responsibility to find a way to ensure that his product is in great demand, which is why other countries devalue

Journal of Business and entrepreneurial studies
ISSN: 2576-0971
http://journalbusinesses.com/index.php/revista

their currency to attract consumers and automatically convert the price they propose into the most promising price in the international market.
Although the strategy imposed by other countries is neither wrong nor limited to be used, Ecuador cannot make use of it, since the currency it has is not its own and this prevents it from optimizing sales prices. This is also stated by Dávalos, 2004, who mentions that "since Ecuador implemented dollarization, it is tied in a certain way to monetary policies, since it is not independent". So, is there a variation in rice export levels before and during dollarization?
International trade and price competitiveness are some of the factors that place Ecuador at a disadvantage when exporting. Exports from the agricultural area have become a dynamism for Ecuador's economy because they allow maintaining a trade balance in the face of dollarization, just the shock of solvency due to the acquisition of foreign currency. Therefore, we intend to measure whether the fluctuation in rice prices has significantly affected rice export levels. Considering the implementation of dollarization as a turning point, and thus determine if this is an element that directly influences rice exports.

MATERIALS AND METHODS

In this research work, the hypothetical deductive method is used, since the general information found in secondary sources such as the Central Bank of Ecuador (BCE) and the National Customs Service of Ecuador (SENAE), was registered and organized through statistical tables and graphs, which allowed obtaining specific conclusions regarding each variable. In addition, correlational research was used to verify the influence between the independent variable "factors affecting rice exports" and the dependent variable "export levels".
Since there was no manipulation of the variables, the study is considered non-experimental, while descriptive research is used to gather information related to the phenomenon, essentially to determine the factors that affect export levels.

RESULTS

Interpret the historical behavior of export levels before and during dollarization.
Tons of rice exported by year.

Journal of Business and entrepreneurial studies
ISSN: 2576-0971
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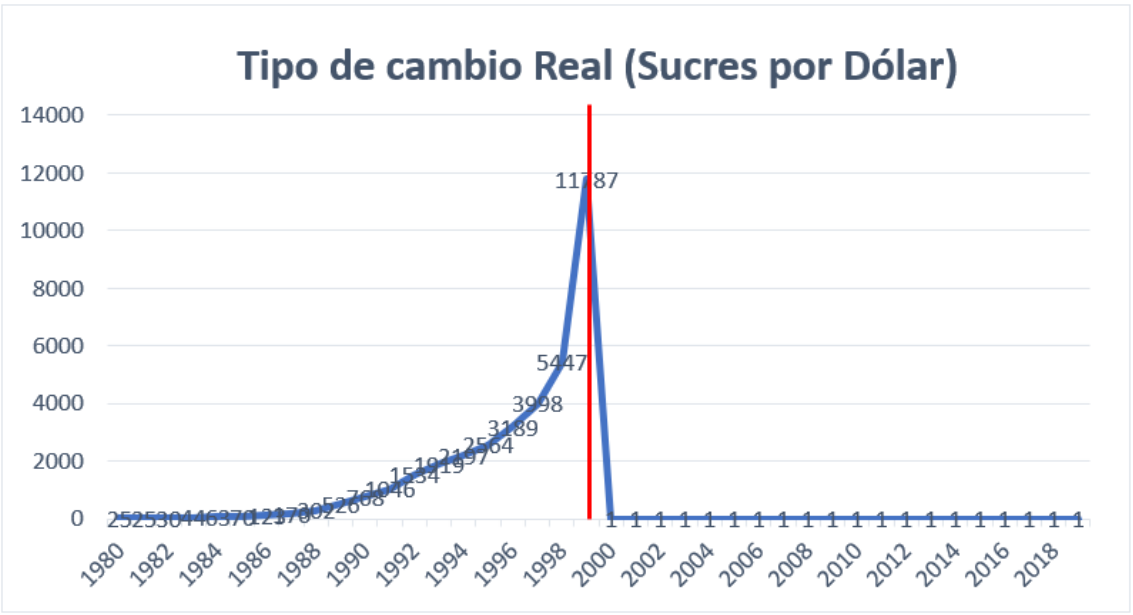
Figure 1. Rice export levels in tons 1980-2020.

Source: Prepared by the author, 2021.

During the years 1993 and 1997, rice exports showed an unprecedented increase, and then there was a drop until 2000, when dollarization was applied, and then between 2004 and 2007 exports reached their highest peak, followed by a drop in 2008, and continued with irregular fluctuations in the following years.

Real exchange rate

Figure 2. Real Exchange Rate Sucres per Dollar 1980-2020



Source: Central Bank of Ecuador: 90 years of statistical information.

Before dollarization, the Central Bank of Ecuador (BCE) was the government entity in charge of issuing the currency. In 1980 a dollar in Ecuador cost 25 sucres, since then its

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ISSN: 2576-0971
http://journalbusinesses.com/index.php/revista

price has been rising slowly but steadily. By the year 2000, 25 thousand sucres were needed to obtain one dollar, at which time the country was registering the highest inflation in its history. According to Villalba (2019), the excessive printing of sucres resulted in an oversupply of the currency, which in turn caused monumental inflation.
The lack of control was caused by several factors, among them the "sucretization", which consisted of an uncontrolled issuance of currency to save businessmen who had high debts in dollars with foreign suppliers. The measure was taken by the State in collusion with private banks to try to rescue a deficient economic and productive structure marked by the already unstable public policies. To identify the factors affecting rice export levels between 1980-2020. The following are the elements that determined the cost of rice after dollarization.
Production costs.

Table 1. *Rice Production Costs (LCU and Dollars per Tons)*

1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
5630	6790	7620	13810	19260	27220	34020	23740	53290	102970
225,20	271,60	254,00	313,86	305,71	388,86	276,59	139,65	176,46	195,76
1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
127060	158770	262240	284440	368170	495000	608000	902000	1145000	1431000
165,44	151,79	170,95	148,22	167,58	193,06	190,66	25,61	210,21	121,40
2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
160	136	130	149	226	191	165,4	238,2	290	250
160,00	136,00	130,00	149,00	226,00	191,00	165,40	238,20	290,00	250,00
2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
260	340	347,7	355,3	363	385,9	362,7	344,9	292,5	321,9
260,00	340,00	347,70	355,30	363,00	385,90	362,70	344,90	292,50	321,90

Note: Source: FAO.org Prepared by the Author
According to MAGAP (2013), high costs affect rice production and exports. While in an average country the cost of operations is 20.2 % and raw material is 21.9 %, in

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ISSN: 2576-0971
http://journalbusinesses.com/index.php/revista

Ecuador it is around 24.9 %, 3 percentage points above the average. In addition, labor costs have increased 3.2% since 2000 as a direct effect of dollarization. The price of transportation must also be taken into account, since once dollarized, Ecuador experienced a significant increase in fuel costs. Currently, the local currency requires higher levels of efficiency so that the price of rice is competitive in terms of international prices with respect to neighboring countries.

The rice price history is also presented, which is an indicator directly associated with costs and affects exports:

Rice price per sack 1980-2020

Source: Prepared by the author, 2021.

It can be seen in the graph that the behavior of the price of rice before dollarization has fluctuated but with a downward trend, and as of the year 2000 there has been a gradual growth with an upward trend. Clearly, by adopting the dollar as the currency, this effect is produced since prices and costs do not depend on the value of the country's own currency.

International rice price

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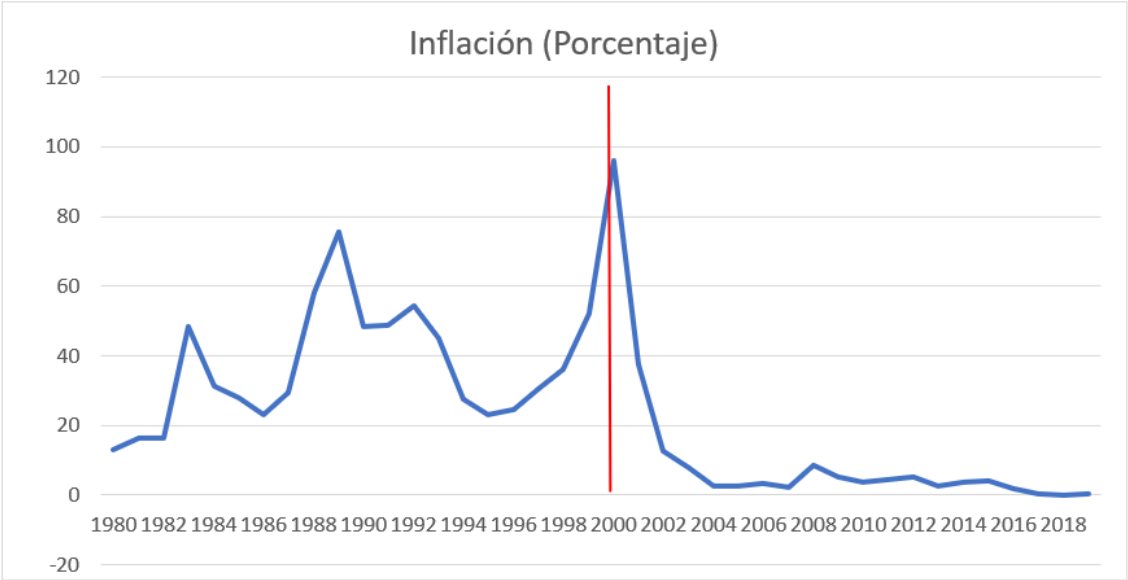
ISSN: 2576-0971
http://journalbusinesses.com/index.php/revista

Graph 4. International rice price 1980-2020

Source: FAO.org Prepared by the Author

On the other hand, it can be observed that the cost of rice at the international level has had its ups and downs, in the first part (before dollarization) the highest price was $79, but after dollarization it had a higher increase, reaching $112 in 2005.

Graph 5. Inflation (1980-2019)



Source: FAO.org Prepared by the Author

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ISSN: 2576-0971
http://journalbusinesses.com/index.php/revista

Social skepticism towards the new currency and the impossibility of issuing it within the national territory caused speculation in the market, shortages of the currency, rounding of prices above cost and, consequently, an inflation of 10% during the first quarter of 2000. Almost two years after the adoption of the U.S. currency, Ecuador managed to stabilize its annual inflation levels to single digits. From 2004 onwards, some highs and lows have been due to mismatches between supply and demand.

Farmers point out that at present, both domestic and imported inputs needed for production are continually increasing in price. The amount of products that are available on the market is often due to the timing of harvests, which could be altered by adverse weather conditions, which in turn cause shortages, increased prices for foodstuffs and transportation.

According to MAGAP (2015), foreign trade policies affect rice exports. Therefore, it is vitally important to have excellent international relations because through them it is possible to maintain an adequate flow of a currency whose origin is foreign and without which the domestic economy could be in serious trouble. This aspect is related to the acquisition of technologies, raw materials, machinery and equipment to optimize rice production processes, as well as commercial alliances to facilitate the exchange of this product.

To evaluate the relationship between rice export levels and the factors that affect it during the years 1980-2020. Next, the relationship between the international price of rice and production costs (independent variables) and rice export levels (dependent variable) in Ecuador between 1980-2020 will be established, for which a multiple linear regression was performed using the Grettel statistical program.

First, the stationarity of the variables is determined, to verify whether they are stationary in levels or have some order of integration different from zero, given that they are time series and there is a risk of finding a spurious regression if the variables are not stationary or are not cointegrated.

To certify the stationarity of the dependent variable "Exports", the Augmented Dickey-Fuller test was applied in levels, and its result showed a p-value of 0.0238, so it is not stationary in levels, since it was detected that it has a unit root. Continuing with the independent variable "International Price", the same test was applied, yielding a result of 0.275; therefore, it was verified that it is not stationary in levels and has a unit root. In the same way we proceeded with the independent variable "Production Cost" resulting in a p-value of 0.788, also determining that it has a unit root and is not stationary in levels.

Therefore, the Engle-Granger cointegration test is applied before running the regression to find out if the variables cointegrate and, therefore, there is no risk of finding a spurious regression.

Below we can observe different p-values of the individual significance t-test, to determine the statistical significance of the coefficients of each variable. These data indicate that the variable "INT PRICE" has a coefficient equal to 0.000, that is, it does not have a statistically significant relationship, unlike the independent variable

"COSTOPROD" whose coefficient is 0.0188, demonstrating the individual significance. It can be observed then that there is a direct relationship between rice production costs and export levels, rejecting the international price as a variable that directly affects exports.

Similarly, it can be noted that the R2 of 0.7127 is the percentage of variability of the dependent variable, i.e. 71.2% of rice exports is explained by the cost of production. In order to demonstrate that the results obtained are statistically valid, we proceed to test the regression assumptions. First we have the linearity contrast, it will be demonstrated that the linear equation obtained is adequate to explain the dependent variable, we proceeded to run the RAMSEY RESET test, this test demonstrates that the linear specification is sufficient to explain the variability of the dependent variable, given that the p value of the test is above the significance level, that is to say that a linear specification is well used.

The Contrast of normality of the errors was also applied, applying the JARQUE-BERA test, in which we observed that the p-value is 0.000 and tells us that the sample has a non-normal behavior. Applying the WHITE test, the homoscedasticity contrast of the errors was determined, where the p-values were 0.00 and 0.00, therefore there is no homoscedasticity. Contrast of no serial autocorrelation of the residuals, applying the Serial Correlation LM Test with 2 lags, we have a p-value of 0.68 and 0.65 so we do not reject H0, that is to say that the errors do not present serial correlation of order 1 or 2.

In the multicollinearity analysis of the model, applying the Inflated Variance Factor test, the international price obtained 1.0105 and production costs 1.0105. Therefore, there is no multicollinearity, i.e., there is no correlation between them.

Since the tests were not positive and the correlation assumptions such as homoscedasticity and normality of the data were not met, we proceeded to perform another analysis considering rice exports before and during dollarization using t-Student.

The following table shows the annual rice export table by tons during the period 1980-2020 with the percentage variation rate

Table 2. *Annual rice exports by tons and percentage variation rate.*

Expo/ton before	Expo/ton Des	Rate before	Rate of
0,00	11703,00	0	5,6816201
0,00	78195,00	0	-0,66559243
0,00	26149,00	0	0,44464415
0,00	37776,00	0	-0,95605676
11,00	1660,00	-1	17,9048193
0,00	31382,00	0	4,13144478
2189,00	161035,00	12,53677478	-0,37816624
29632,00	100137,00	-0,985826134	-0,94588414

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ISSN: 2576-0971
http://journalbusinesses.com/index.php/revista

420,00	5419,00	58,52380952	-0,05683705
25000,00	5111,00	-0,3944	3,11113285
15140,00	21012,00	0,034280053	1,01418237
15659,00	42322,00	-0,209911233	-0,65930249
12372,00	14419,00	-0,74862593	1,99750329
3110,00	43221,00	8,729903537	-0,62830568
30260,00	16065,00	-0,135723728	-0,93071895
26153,00	1113,00	2,421481283	-0,81042228
89482,00	211,00	0,248452203	1,11848341
111714,00	447,00	-0,515226382	69,5950783
54156,00	31556,00	-0,444641406	-0,08014324
30076,00	29027,00	-1	-1
		558%	510%

Note: Prepared by the Author

Using these data, a T-Student is performed to determine if there is a significant difference in a single sample, i.e., before dollarization, in the period 1980-1999 and during dollarization, the period 2000-2020, obtaining the following data:

Table 3. *Descriptive statistics for a sample*

	N	Media	Deviation Deviation	Avg. error
Exports in tons	40	27583,35	35592,847	5627,723

Note: Prepared by the Author

Table 4

Paired two-sample t-test for paired sample means

	2189	12,53677
Media	33367,697	4,9636414
Variance	1346679101	247,87581
Remarks	33	33
Pearson correlation coefficient	-0,2972279	
Hypothetical difference of means	0	
Degrees of freedom	32	
Statistic t	5,22193089	
P(T<=t) one tail	0,000	
Critical value of t (one-tailed)	1,694	

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ISSN: 2576-0971
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P(T<=t) two-tailed	0,000
Critical value of t (two-tailed)	2,03693334

Note: Prepared by the Author

It can be noted that if there is a difference in the mean, because the significance level is 0.000, the researcher's hypothesis is accepted, in this case, rice exports show significant changes.

Table 5. *Correlation matrix of variables*

PreIntArr	TipCamSuc	CostProdArr	CostProdArUS	InflPorcent	
1,0000	0,1195	0,1887	-0,1022	-0,2506	PreIntArr
	1,0000	0,9600	-0,3682	0,3184	TipCamSuc
		1,0000	-0,3523	0,3140	CostProdArrozLC
			1,0000	-0,5092	CostProdArrozUS
				1,0000	InflPorcent
			PrecArrfincaSac	ExportTon	
			-0,1928	0,8160	PreIntArr
			-0,4028	0,1995	TipCamSuc
			-0,3912	0,2822	CostProdArr
			0,8801	-0,2989	CostProdArUS
			-0,4052	-0,1215	InflPorcent
			1,0000	-0,3330	PrecArrfincaSac
				1,0000	ExportTon

Note: Prepared by the Author

Therefore, it is evident that the independent variables, international price and real exchange rate, are positive figures, this means that the correlation is positive with 81% and 19% of exports, as an analysis we say that the international price should maintain a positive balance so that exports do not decrease and thus consumers will always be willing to purchase them. However, the cost of production, the price per bag and inflation have a negative correlation, which means that when inflation increases, we have an unfavorable impact on the costs and price of rice, which has a direct impact on rice exports.

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Table 6. *Model 1: OLS, using the observations 1980-2019 (T = 40)*
Dependent variable: exports in tons

	Coefficient	Standard deviation	Statistic t	p-value	
PrecIntArroz	1102,70	90,4374	12,19	<0,0001	***

Average of the vble. dep.	27583,35	D.T. of the vble. dep.	35592,85
Sum of quad. residues	1,66e+10	T.D. of regression	20626,08
R-square not centered	0,792187	R-square centered	0,664179
F(1, 39)	148,6686	p-value (of F)	7,02e-15
Log-likelihood	-453,6237	Akaike Criteria	909,2473
Schwarz Criteria	910,9362	Hannan-Quinn Crit.	909,8579
rho	0,207710	Durbin-Watson	1,583015

Note: Prepared by the Author

The adjusted R-Squared shows a coefficient of 0.66 which indicates that there is a dependence between these variables (international price and rice exports) and since the statistical significance level is less than 0.0001, it indicates that it is significant.

Contrast of normality of residuals -
Null hypothesis: [The error has Normal distribution].
Contrast statistic: Chi-square (2) = 17.3676
With p-value = 0.00016931

The normality of the residuals in this model is shown to be normal because the p-value is non-zero.

White's heterocedasticity contrast -
Null hypothesis: [No heteroscedasticity].
Contrast statistic: LM = 10.6475
With p-value = P (Chi-square (2) > 10.6475) = 0.00487448

The test indicates that there is no heteroscedasticity demonstrated with a p-value different from zero, in this case 0.00487.

LM contrast of autocorrelation up to order 1 -
Null hypothesis: there is no autocorrelation.
Contrast statistic: LMF = 1.7451
With p-value = P (F (1, 38) > 1.7451) = 0.194394

This test shows that the variables analyzed are not autocorrelated, since the contrast statistic indicates that the p value of this indicator is 0.19.

Normality of waste
Frequency distribution for residual, observations 1-40
Number of boxes = 7, Mean = -982.559, Avg.typ.dev.=20602.1

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ISSN: 2576-0971
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Interval midpoint frequency rel accum.

< -74437, -84567, 1 2,50% 2,50%
-74437, - -54176, -64306, 0 0,00% 2,50%
-54176, - -33915, -44046, 3 7,50% 10,00% **
-33915, - -13655, -23785, 3 7,50% 17,50% **
-13655, - 6605,7 -3524,6 20 50,00% 67,50% ********************
6605,7 - 26866, 16736, 12 30,00% 97,50% **********
>= 26866, 36997, 1 2,50% 100,00%

Contrast of the null hypothesis of Normal distribution:
Chi-square (2) = 17.368 with p-value 0.00017
Regarding the distribution of the model's residuals, it can be said that they have a normal distribution, as evidenced by the p coefficient, with 0.00017, which, being different from zero, rejects the null hypothesis and accepts the alternative hypothesis.
Heterocedasticity
White's heteroscedasticity test
OLS, using the observations 1980-2019 (T = 40)
Dependent variable: uhat^2

Coefficient Standard Deviation t statistic p-value
---
const -1.59793e+08 2.96929e+08 -0.5382 0.5937
PriceInternational~ 2.04954e+07 1.76053e+07 1.164 0.2518
sq_Internal_Price~ 33566.7 183602 0.1828 0.8559

R-squared = 0.266187

Contrast statistic: TR^2 = 10.647483,
With p-value = P (Chi-square (2) > 10.647483) = 0.004874
In this case, the error heteroscedasticity test shows that there is homoscedasticity because the r-squared coefficient is non-zero (0.004874), i.e., the error variance is constant. If the error variance is not constant across observations, the regression is heteroscedastic.

Autocorrelation
Breusch-Godfrey contrast of first-order autocorrelation
OLS, using observations 1980-2019 (T = 40)
Dependent variable: uhat

Coefficient Standard deviation t statistic p-value

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ISSN: 2576-0971
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PriceInternational~ -16.9177 90.4964 -0.1869 0.8527
uhat_1 0.211955 0.160448 1.321 0.1944

R-squared = 0.043907

Contrast statistic: LMF = 1.745101,
With p-value = P (F (1.38) > 1.7451) = 0.194

Alternative statistic: TR^2 = 1.756293,
With p-value = P (Chi-square (1) > 1.75629) = 0.185

Ljung-Box Q' = 1.80767,
With p-value = P (Chi-square (1) > 1.80767) = 0.179

This test shows that the variables analyzed are not autocorrelated, since the contrast statistic indicates that the p-value of this indicator is 0.19.
Distributed lag model
The Ordinary Least Squares model is applied:

Table 7. *Distributed Lag Models*
MCO reg Exp L1. Exp L2. Exp Price

Source	SS	df	MS	Number of obs:	39
Model	1.4839e+10	3	4.9462e+09	F(3, 35) Prob > F	5.22 0.0044
Residual	3.3141e+10	35	946881443	R-squared Adj R-squared	0.3093 0.2501
Total	4.7980e+10	38	1.2626e+09	Root MSE	30771

Exp	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval] [95% Conf.
L1.	.4884583	.1560378	3.13	0.004	.1716848 .8052318
L2.	-.2750368	.1564905	-1.76	0.088	-.5927293 .0426557
Price	-1445.296	689.9119	-2.09	0.043	-2845.891 -44.70002
_cons	56439.97	18380.13	3.07	0.004	19126.33 93753.6

Lag* reg Exp L1. Exp L2. Exp Price

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ISSN: 2576-0971
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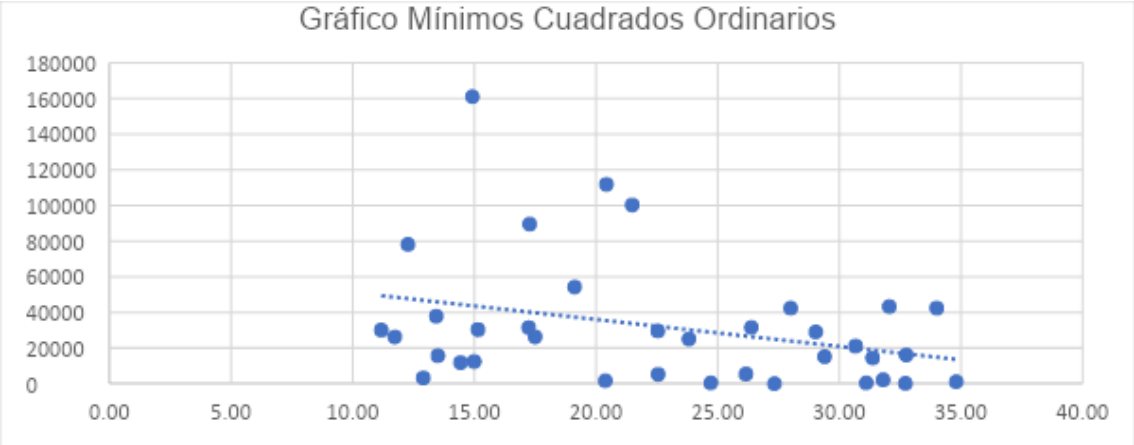
Figure 6. OLS- Distributed lags (1980-2019)



Source: Prepared by the Author

Here we can observe the least squares as the dependent variable, while rice exports and price as the independent variable; since the "probability" value is less than 0.05, it means that this independent variable (price) has a significant impact on the dependent variable (rice export levels). It can also be seen that the R-squared value is 0.1044, which means that the variables within the study are related by 10%.

Discussion

By interpreting the historical behavior of export levels before and during dollarization, it could be revealed that the exchange rate or the value of currencies, within international trade, is a vital point; because in every international commercial transaction it is required to establish an exchange rate. These statements coincide with Fiallo (2017), who pointed out the importance of the agricultural sector in a dollarized economy where agriculture reaches 9% (Gross Domestic Product of the Country) helping to comply with food sovereignty, it also reaches 26.8% in terms of representation of the economically active population of Ecuador. On the other hand, Lascano and Robinzon (2018), state that rice exports are fundamental, especially towards the Chinese market for small producers of the Gloria de Dios Association.

Likewise, when identifying the factors that affect rice export levels between 1980-2019, production costs can be highlighted, since they do not remain constant due to changes in labor, raw materials, machinery and assemblies. In addition, with dollarization these costs had an inflation, as it caused speculations in the market, currency shortages, rounding of prices above cost and finally a breakdown in the international relationship, the latter being one of the most important according to MAGAP (2015) who points out that through international relations it is possible to maintain an adequate flow of a currency whose origin is foreign and without which the domestic economy could be in serious trouble.

It is also known that rice production is a process of change and potential, as producers are currently in search of new markets, since current markets are unstable and

dwindling, causing the maintenance and increase of rice production to be very competitive.

Rice occupies 17% of the arable land (including both permanent and transitory crops) and is the most important transitory crop, with at least 40% of the area planted. Rice accounts for 12% of agricultural GDP and 0.8% of GDP at the national level, however, rice production in Ecuador as a whole does not exceed the 4 MT/ha line, despite the increasingly extensive sown soils which places the country slightly below the world average according to the study conducted between 2002 and 2011. Zambrano et. al (2019) do not agree with the above, for them, SME exports depend on factors such as production levels, legislation, innovation, market purchasing power, unemployment, financing options, competitiveness and international investment.

CONCLUSIONS

When interpreting the historical behavior of export levels before and during dollarization, it was found that the value of currencies in international trade is a vital point and if a greater number of units of other currencies are required to acquire a single currency, it is said that it is overvalued and as a consequence the prices of the goods and services that this country sells will be artificially increased, thus making it less competitive in international prices. In addition, dependence on a foreign currency brought with it high production costs due to inflation, making it impossible for the sector to develop sufficiently to supply local demand and to export in competition with the surrounding countries.

With respect to the identification of the factors affecting rice export levels between 1980-2020, production cost, exchange rate, international price, price per bag and inflation were identified as independent variables that in one way or another have a negative or positive impact on exports per ton.

Through correlation, multiple linear regression and ordinary least square, it was possible to evaluate the relationship between the levels of rice exports and the factors that affect it, during the years 1980-2020; through which it was determined that there is a positive correlation between the export per ton of rice with the international price and the cost of production; while the negative values obtained for the independent variables: exchange rate, price per bag and inflation show that there are no statistically significant correlations. Also, the t-test determined that there was a significant change in rice exports before and during dollarization.

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Journal of Business and entrepreneurial studies
ISSN: 2576-0971
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