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Mining stock performance and its influence on Lima stock exchange profitability: A cointegration analysis approach

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Abstract

The study analyzes the behavior of mining stocks and their influence on the profitability of the Lima Stock Exchange (LSE), evaluating the potential cointegration of variables. This topic is attractive for the participants that make up the Peruvian stock market and the research community. The objective of the research is to determine the impact of mining stocks on the profitability of LSE and the long-term equilibrium relationship in the context of a cointegration analysis approach. In the study population, 1782 observations were considered, with a daily periodicity, corresponding to the years 2015 to 2021. The study has a quantitative and explanatory level approach, a regression model with first differences, a model with dummy variables and the Dickey Fuller statistical test were applied. In conclusion, the hypothesis indicating that mining shares have a significant impact on the profitability of the LSE is confirmed, and it is also proven that the behavior of these variables cointegrates.

Keywords: Mining stocks, stock market, stock market, mining activity, profitability.

INTRODUCTION

The level of development that financial markets can reach represents a sample of the economic growth of countries. The stock market is part of the financial market, where the dynamic participation of economic agents that demand and offer loanable securities is registered. This market is a mechanism that centralizes the negotiations of financial securities (Horna, 2020, p. 136). The Peruvian stock market also fulfills its condition of dynamic mechanism where companies and citizens come to acquire shares that allow them to eventually obtain profits. The stock exchanges offer stock market services that are carried out in a territory and represent the stock market of a locality. The Lima Stock Exchange (LSE) is the company that allows the meeting of proposals for the purchase and sale of securities in the Peruvian stock market, where different economic sectors participate, including the mining sector.

Mining activity represents one of the key pillars on which modern societies are strengthened today. The incidence of mining work generates direct economic, financial and social impacts in a territory where mining resources are found (Matute et al., 2021, pp. 214-215). Mining shares are valued as the productivity of mining activity increases, so that high mining productivity would imply a profitable return for investment in mining shares listed on the stock exchange.

The effect of mining activity is not only registered at the national level. For example, the extraction of Peru's main mineral, copper, has a direct and indirect effect at the district and departmental levels. At the district level, it has a direct and positive effect, albeit small, on education, health and road infrastructure, while at the departmental level it only has an indirect and limited effect on the education and health sector (Landa, 2017, p. 164). Therefore, it is valid to consider the effect of mining activity on the country's stock market.

In the LSE, mining stocks are measured through the S&P/BVL Mining Index which considers the adjusted capitalization based on the performance of the main mining stocks listed in the stock exchange. This mining stock index (MSI) includes in its measurement, part of the total capitalization of the stock exchange which is measured through the S&P/BVL Peru General Index, as an indicator that corresponds to the Lima Stock Exchange General Index (LSEGI) (BVL, 2020, pp. 7-9).

The profitability of the stock market is desired by the economic agents who see the value of the benefits obtained by their investment, and the profitability of their shares allows them to be creditors of an economic benefit after a given time. The profitability is a function of the risk that exists, having a correlated behavior, therefore, this investment alternative is determined by the profitability and risk of the sectors involved (Huertas, 2016, p. 184).

Therefore, the general objective of this research is to determine the impact of mining stocks on the profitability of the Lima Stock Exchange, considering their behavior in recent years and evaluating whether these variables present an equilibrium relationship in the long term.

Literature Review

Taking into account the study of Aboura and Chevallier (2015) on commodities versus financial markets, it is argued that volatility takes a major role in this relationship, the prices of international market linkages are determined by volatility, a low level of volatility would lead to lower price changes and weakened market linkages (pp. 18-19), since, it would affect the dynamics of the commodity market and its impact on the financial market. However, stock market shocks are not transmitted in the commodity markets, so an effect on the stock market would not damage the domestic commodity market too much (Adams & Glück, 2015, p. 108).

The analysis of markets allows to know the behaviors and alterations they suffer, and raw materials such as minerals also see their behavior and profitability altered by different factors related to the stock market. For example, the performance of mining stocks in South Africa has been affected by internal conflicts, such as strikes, affecting the production of the country's main mining companies and restricting the level of capitalization of the Johannesburg Stock Exchange (JSE) (Chinhamu et al., 2015, p. 41).

In the study of Maghyereh, Awartani y Bouri (2016) on the connection of directional volatility between crude oil and stock markets, after analyzing eleven major stock exchanges in the world, it is argued that stock prices cannot be priced in isolation to the uncertainty that is being perceived in the oil market, as a common feature in these stock markets it is concluded that this commodity is somehow linked to stock returns (pp. 89-90). However, oil consumption follows a similar behavior to energy consumption, the higher the price, the more immediate consumption is resisted. In the Iberian Peninsula there is a direct statistical relationship between these commodities and the futures market (Ordu & Soytas, 2016, p. 13).

In the research of Jain and Biswal (2016), based on the dynamic linkages between oil price, gold price, exchange rate and stock market in India, it is found that the highest correlation was between crude oil prices and Indian exchange rate for five years in a row, so also, it was correlated with the overall stock market index of the country (p. 142). This

means that oil has a strong impact on the stock market and economic growth in India.

The main minerals and hydrocarbons of a country end up being established by their extraction origin and impacting the growth of their economies generating chain improvements. In the study conducted by Gaytán et al. (2018) on mining and its productive linkages in Mexico, it is argued that mining activity belongs to a sector of the country with potential growth that has low backward linkages, but a high forward chain effect, being an activity with a supply function in the Mexican economy (pp. 27-28). In the research by Sutomo, Wahyudi et al. (2020), on the determinants of capital structure in the coal mining industry in the Indonesian Stock Exchange, they point out that the industry is affected by the profitability and asset structure of the companies involved, which determine the level of profitability of the mining industry in the Indonesian Stock Exchange (p. 171).

In the study of Akkoc and Civcir (2019) about the dynamic linkages between major mining commodities and the Turkish stock market, it is stated that gold has a strong and positive relationship with the performance of the Istanbul Stock Exchange, while oil has a low but more volatile relationship compared to gold (p. 238). In the study by Shabbir, Kousar and Batool (2020) on the impact of gold and oil prices on the Pakistani stock market, they argue that there is no long-term relationship between the gold and oil markets and the Indian stock market; however, these commodities are considered as the best source of investment in Pakistan because they have a very high liquidity ratio, and oil occupies a relevant place in the Pakistani economy (pp. 291-292).

In the research of Thakolsri (2021), on modeling the relationships between the price of gold, oil, exchange rate and stock index in Thailand, he argues that there is significant relationship between all price series, presenting cointegration, increasing gold and crude oil prices that have a negative effect on the country's stock market (pp. 268-269). Similarly, in the study of Aumeboonsuke (2021) on commodity prices and the stock market in Thailand, it was found that some commodity markets, including oil, natural gas and gold, have significant influence on the country's stock market in the long run; however, lagging values of stock indexes do not affect the variability of crude oil prices (p. 39). Thailand presents a slightly different situation than Turkey and Pakistan, as the influence becomes significant in the long run and the variables manage to cointegrate.

In all the countries mentioned, mining activity has a positive impact in some way on a nation's economy, although not all of them consider the indiscriminate expansion of the mining sector to be favorable. According to Torres and López (2017), the increase in mining export activity can slow down and reduce exports of industrial goods when exceeding a certain threshold, due to the effect of the intersectoral substitution curve, a situation that would lead to repel mining activity in Peru, denting the value of IBM shares (p. 144).

Mineral price levels generally affect other macroeconomic items of a country. According to Villa and Gomero (2019), the behavior of Peru's tax collection levels is adjusted the ups and downs of international mining prices, directly impacting the profits of companies engaged in mining, meaning that it also has an impact on their financial and stock market indicators (p. 45).

The stock market also presents diverse factors that explain and have an impact on its behavior, which makes it an attractive variable for researchers to study. De la Rosa, Ordoñez, Cabera y Berroterám (2021). In their multivariate statistical study of the Mexican Stock Exchange, they have a clear picture of the profitability of the companies listed on the stock market, through the classification and segmentation assigned to them by the model (p. 20).

Based on the relevant literature on the study of prices and shares of mining companies and their impact on the profitability of a country's stock market in the short and long term, it is appropriate to conduct this research

that develops and deepens the Peruvian case, studying the level of influence of mining shares on the profitability of the Lima Stock Exchange, a reference for future research to be developed with the objective of improving the stock market.

Methodology

The objective of this research is to determine the behavior of mining stocks on the profitability of the Lima stock exchange, as well as to evaluate if the behavior of these variables cointegrates, that is, if they have a long-term equilibrium relationship. The study is characterized by having a quantitative approach. The research level is explanatory because it tries to explain the influence of the mining stock index, which is the independent variable, on the stock market performance, which is the dependent variable. The design is non-experimental, since the variables under study were not manipulated. On the other hand, the observations of the analyzed variables mining stock market index and profitability of the LSE are characterized by having a daily periodicity and correspond to the years 2015 to 2021, being a total of 1782 observations, the same that were extracted from the Central Reserve Bank of Peru (CRBP), whose data processing was performed with the help of Eviews 10 software.

Since the variables analyzed are economic time series, they are generally not stationary, so the existence or not of stationarity was tested by means of the Dickey Fuller statistical test. In this sense, the series are integrated of order 1, likewise, a statistical analysis was made in order to verify if both series have a long-term equilibrium relationship, that is, if they are cointegrated.

The notion of cointegration, to which Engle and Granger (1987) gave a formal treatment, makes potentially significant regressions involving I (1) variables. Cointegration analysis verifies that a set of integrated variables of the same order are all cointegrated, thus ensuring the existence of a relationship that is not spurious between them. Moreover, it is stationary, i.e., equilibrium in the statistical sense. The concept of cointegration is the statistical notion equivalent to the idea of stable equilibrium, in the sense that when a relationship of this type exists between economic variables, the deviations from this relationship cannot be strong or grow without limit (Johnston & Dinardo, 2002).

If there is a regression of the following type:

$$Y_t = \beta_1 + \beta_2 X_t + u_t$$

this regression is known as cointegrating regression, and the slope parameter is known as the cointegrant parameter. β_2 as the cointegrating parameter. This concept can be extended to a regression model containing k regressors, and, therefore, there will be k co-integrating parameters.

Error correction models have been introduced by Granger (1981), Granger and Weiss (1982) and Engle and Granger (1987). When working with non-stationary series, there are two main obstacles: the test statistics no longer have standard distributions, thus invalidating the inference; while the risk of working with spurious or meaningless regressions turns out to be quite high. One of the solutions consists in differencing the series as many times as necessary to convert them into stationary processes (Wooldridge, 2010).

The alternative path consists in the use of dynamic models, the error correction model being one of the most popular formulations.

If the variables Y_t y X_t have the same order of integration and are cointegrated by the relationship $Y_t = \beta_1 + \beta_2 X_t + u_t$ then the associated error correction model is:

$$\begin{aligned}\Delta Y_t = \alpha + \delta \Delta X_t + \gamma\left(Y_{t-1} - \widehat{\beta_1} - \widehat{\beta_2} X_{t-1}\right) \\ + e_t \\ = \alpha + \delta \Delta X_t + \gamma \widehat{u_{t-1}} + e_t\end{aligned}$$

Thus, the variations of Y_t depend on the experimental variations in X_t through $\delta \Delta X_t$ and of the equilibrium that occurred in the previous period $Y_{t-1} - \widehat{\beta_1} - \widehat{\beta_2} X_{t-1}$ through the error correction term $\gamma\left(Y_{t-1} - \widehat{\beta_1} - \widehat{\beta_2} X_{t-1}\right)$.

Returning to the MCE model:

$$\Delta Y_t = \alpha + \delta \Delta X_t + \gamma\left(Y_{t-1} - \widehat{\beta_1} - \widehat{\beta_2} X_{t-1}\right) + e_t$$
$$= \alpha + \delta \Delta X_t + \gamma \hat{u}_{t-1} + e_t$$

If variable Y was in period t-1 above its equilibrium value, it is expected to be negative., and γ to be negative. If variable Y was in period t-1 below its equilibrium value, it is expected to be positive, and γ to be positive.

Stylized Facts

Figure 1 shows that the mining industry has a great importance within the portfolio of financial assets traded in the Lima Stock Exchange, with respect to foreign stock market capitalization, which represents 55.96%, while 18.96% corresponds to domestic or national investment. Consequently, Lima Stock Exchange is mainly mining, hence the importance of studying the evolution of mining assets and their impact on profitability. Figure 2 shows the variation of Peru's gross domestic product (GDP) and the behavior of the mining GDP. In this regard, it can be concluded that both show the same behavior, which allows to deduce that the mining sector is relevant and explains the evolution of the Peruvian economy.

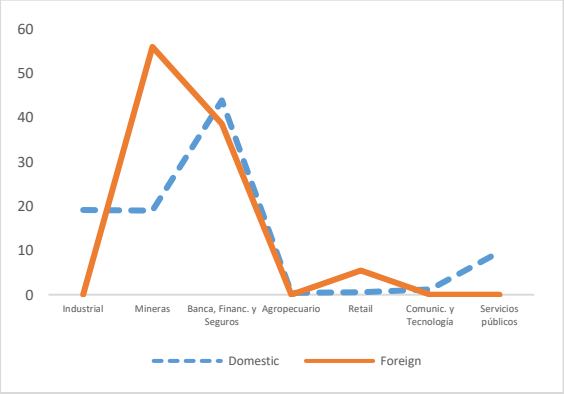

Figure 1 *% of market capitalization by economic sector -2020*

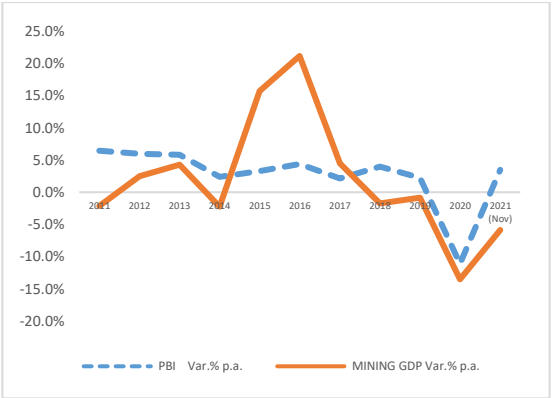

Figure 2 *% change in GDP and mining GDP*

Figure 3 shows the relationship or degree of association between the mining stock index (MSI) and the General Index of the Lima Stock Exchange (LSEGI). The correlation coefficient is 86.4%, which means that there is a high degree of relationship. Likewise, both variables analyzed have a positive direction, which indicates that as the IBM increases, so does the LSEGI, which reaffirms the degree of dependence on the performance of the Peruvian stock exchange. Figure 4 shows total exports, as well as exports of metallic and non-metallic minerals. In this regard, mineral exports, such as copper, gold, silver, iron, lead, among others, represent 62.8% of total exports, while non-metallic minerals only represent 1.07%, which shows the importance of mining in Peru's exports.

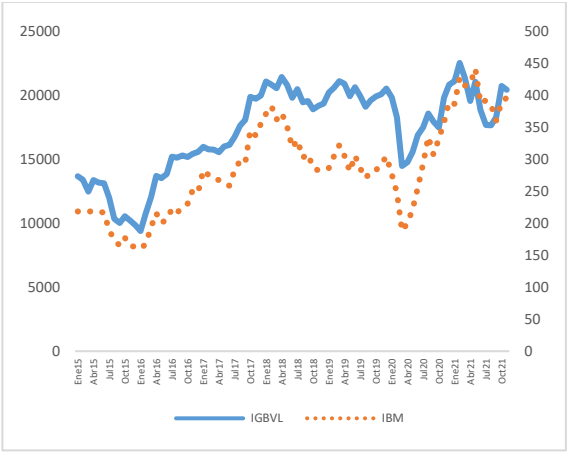

Figure 3 *Evolution of the IGBVL*

Note: Taken from the Lima Stock Exchange - BVL

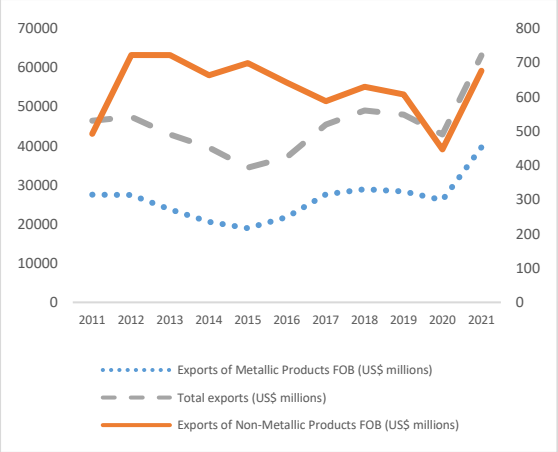

Figure 4 *Export of mining products*

Note: Taken from BCRP.

Figure 5 shows that copper is the product with the highest participation in the metallic mining export portfolio, representing 55.4% of the mining portfolio. Gold participates with 23.7%, zinc with 6.9% and iron with 5.7%, among the main export products. In this regard, copper is one of the main minerals within this sector, the same that from the year 2020 has had a sustained growth, mainly due to the increase in demand from China, as well as the increase in price of 37.1% from the year 2021 to the previous year, as can be seen in Figure 6, since all minerals have had a growing trend except for iron.

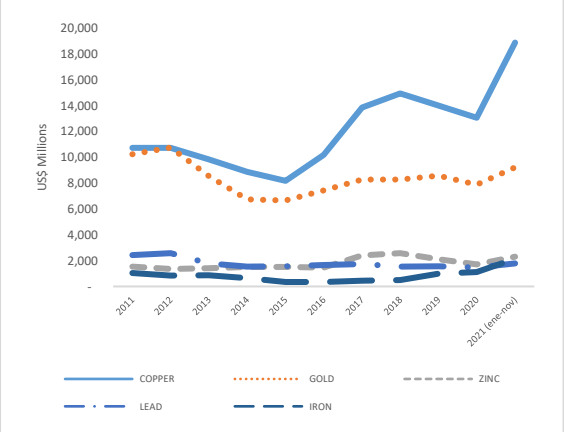

Figure 5 *Value of metallic exports*

Note: Taken from BCRP and Ministry of Energy and Mines.

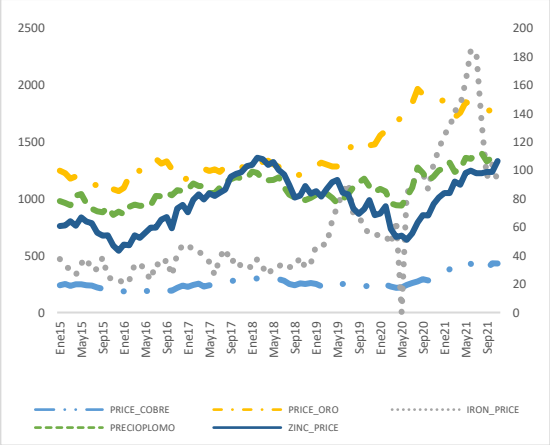

Figure 6 *Evolution of mining product prices*

Note: Taken from BCRP and Ministry of Energy and Mines.

Analyzing some stock market indicators of Latin American countries, which are shown in Figure 7, such as Peru, Chile, Colombia and Argentina, it is concluded regarding the domestic stock market capitalization for the period of analysis 2017 - 2021, a fall for the last two years of 17.8%, while for Peru it is of 10.6%, for Colombia of 14.7% and finally, Argentina has been the only country that has shown a growth of 17.7%. This behavior is partly due to the effects of the health pandemic and on the other hand, due to the size of the markets in these emerging markets, which are very sensitive to external shocks of the world market, given the interdependence of the markets.

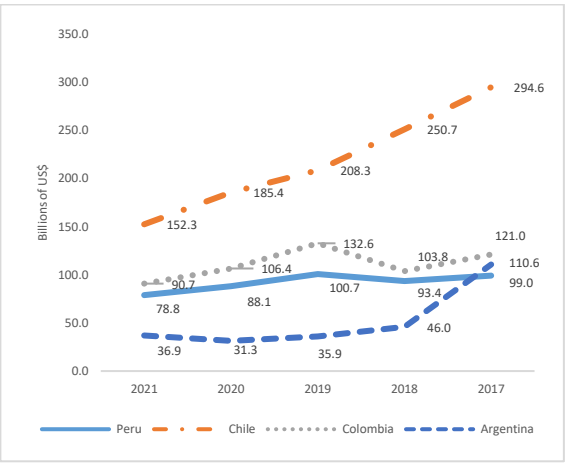

Figure 7 *Domestic market capitalization*

Note: Taken from the Federación Iberoamericana de Bolsas-FIAB

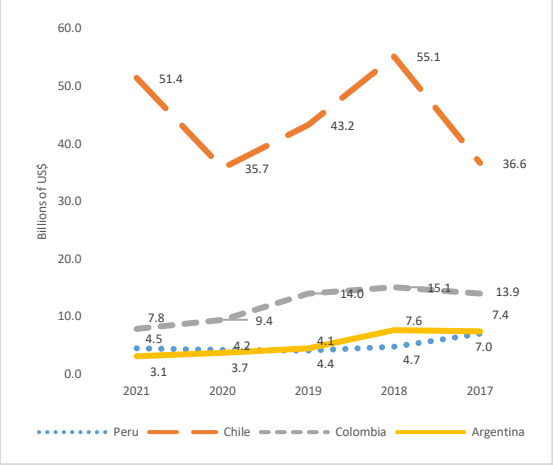

Figure 8 *Total amount traded in shares*

Note: Taken from the BCRP and the Lima Stock Exchange - BVL.

Figure 8 shows the evolution of the amount traded in some Latin American markets, with respect to the last year 2021. It can be seen that the countries of Chile and Peru have shown a growth of 43.8% and 7.6% respectively; however, Argentina and Colombia show a decrease of 16.1%.

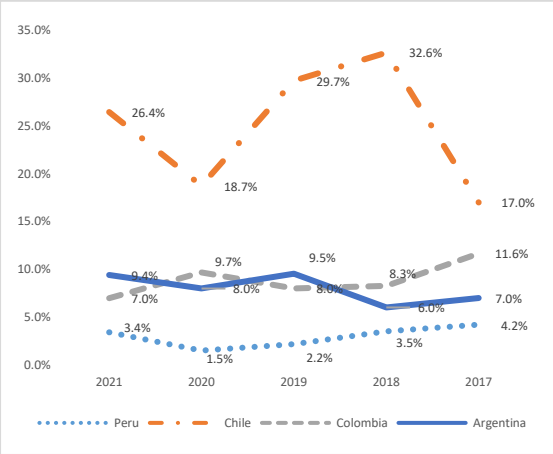

Figure 9 *Market turnover*

Note: Taken from the Iberoamerican Federation of Exchanges-FIAB

Figure 9 refers to market turnover, Chile has a high turnover of 26.4%, which has presented a significant growth in the last year analyzed, which denotes greater liquidity. Peru has an index of 3.4%, which has doubled its index to 2021, for these first two countries. This behavior is explained by the increase in the prices of the main minerals, Colombia has decreased its index and Argentina has experienced a slight growth.

RESULTS

First, it will be determined whether the performance of mining stocks influences the profitability of the Lima stock exchange.

Table 1 *Descriptive statistics*

ESTADÍSTICOS	PERU_GENERAL_INDEX	MINING_INDEX
Mean	1197.36	204.02
Median	1218.21	202.21
Maximum	1545.19	328.92
Minimum	657.24	103.30
Std. Dev.	208.73	48.73
Skewness	-0.63	0.08
Kurtosis	2.54	2.19

Table 1 shows the descriptive statistics of the Lima Stock Exchange general index and the Peruvian mining stock index. The former, since it covers all sectors of the economy, has a higher measure of central tendency than the mining index, which only covers this sector. The IGBVL data has a greater dispersion and has a bias to the left unlike the IBM.

The two financial series analyzed are not stationary, but they have a random walk.

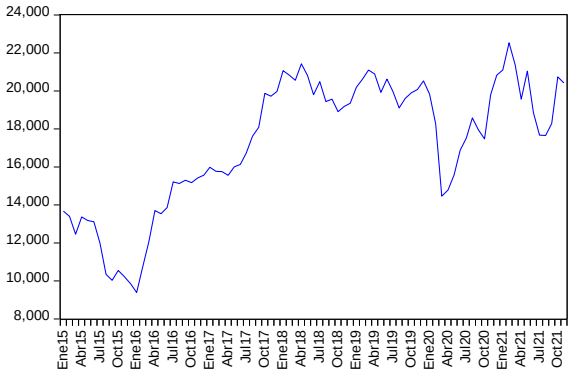

Figure 10 *IGBVL series in levels*

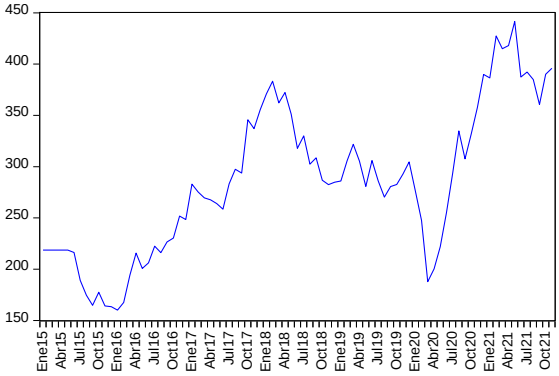

Figure 11 *IBM series in levels*

Figures 12 and 13 show the series analyzed in first differences, i.e., integrated of order I (1); likewise, this seasonality was verified through the application of the augmented Dickey Fuller statistical test.

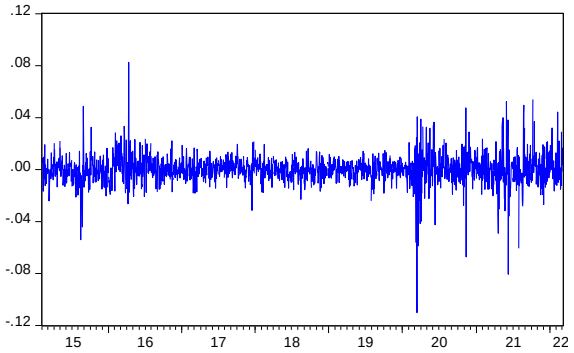

Figure 12 *IGBVL Series in first differences*

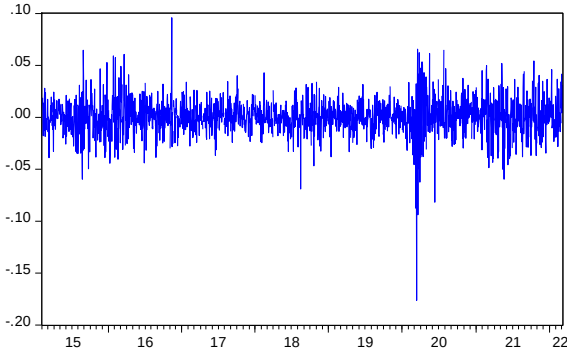

Figure 13 *IBM Series in first differences*

Given that the t-test statistic has a probability of 0.000, which is less than the significance level of 0.05, it is concluded that the series are stationary in first differences, as can be seen in Table 2 at a confidence level of the Dickey Fuller test statistic increased to 1%, 5% and 10% respectively.

Table 2 *Unit root test*

	Prueba ADF				Prueba Phillips Perron			
	t-Statistic	1%	5%	10%	t-Statistic	1%	5%	10%
IGBVL	**-26.67721**	-3.433824	-2.862961	-2.567575	**-41.40167**	-3.433821	-2.86296	-5.567573
IBM	**-42.13191**	-3.433821	-2.86296	-2.567573	**-42.14376**	-3.433821	-2.86296	-2.567573

Dependent Variable: PERU_GENERAL_INDEX
Method: ARMA Maximum Likelihood (OPG - BHHH)
Date: 03/07/22 Time: 20:53
Sample: 2/02/2015 3/04/2022
Included observations: 1782
Convergence achieved after 7 iterations
Coefficient covariance computed using outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MINING_INDEX	2.827675	0.030561	92.52672	0.0000
C	611.0910	72.34019	8.447462	0.0000
AR(1)	0.997251	0.001712	582.4060	0.0000

R-squared	0.998389	Mean dependent var	1197.359
Adjusted R-squared	0.998386	S.D. dependent var	208.7273
S.E. of regression	8.384420	Akaike info criterion	7.095791
Sum squared resid	124990.7	Schwarz criterion	7.108104
Log likelihood	-6318.349	Hannan-Quinn criter.	7.100338
F-statistic	367328.6	Durbin-Watson stat	2.013456
Prob(F-statistic)	0.000000		

Figure 12 *Regression model*

Figure 12 shows that the MSI, which represents the basket of financial assets that are traded in the stock market and belong to the mining sector, is significant and explains 99.8% of the profitability behavior of the Peruvian stock market. On the other hand, given the (partial) correlogram, it was observed that only the first bar was significant, so the model was adjusted to an Ar (1), which is also significant, thus eliminating the autocorrelation of the model.

Second, the study analyzes whether the performance of mining stocks and the profitability of the Lima stock exchange have a long-run equilibrium relationship, i.e., whether they cointegrate. From Figure 14, the residuals have directionless random walk.

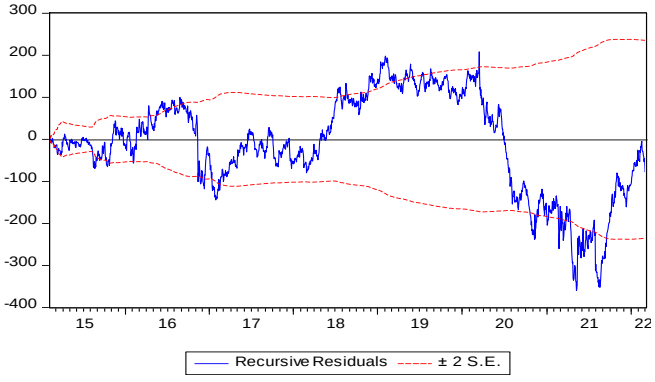

Figure 14 *Recursive residuals chart*

In order to verify if the variables of the analyzed model cointegrate, the possible structural change on the regression results was analyzed, for which the recursive residuals graph was obtained, as shown in Figure 14, which shows possible structural changes, that is, points where the graph cuts the confidence bands, which may be due to dramatic changes in the price of minerals.

Table 3 *Adjusted regression model*

Dependent Variable: PERU_GENERAL_INDEX
Method: Least Squares
Date: 03/07/22 Time: 20:11
Sample: 2/02/2015 3/04/2022
Included observations: 1782

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MINING_INDEX	3.675096	0.067264	54.63686	0.0000
D1	-58.10333	8.213237	-7.074353	0.0000
D2	46.92282	6.719316	6.983273	0.0000
D3	145.4543	8.079210	18.00352	0.0000
D5	-94.47529	9.013488	-10.48155	0.0000
D6	-140.7796	8.950232	-15.72915	0.0000
C	389.0119	12.13893	32.04665	0.0000

R-squared	0.880523	Mean dependent var	1197.359
Adjusted R-squared	0.880119	S.D. dependent var	208.7273
S.E. of regression	72.26935	Akaike info criterion	11.40260
Sum squared resid	9270574.	Schwarz criterion	11.42415
Log likelihood	-10152.71	Hannan-Quinn criter.	11.41056
F-statistic	2180.236	Durbin-Watson stat	0.020795
Prob(F-statistic)	0.000000		

Table 3 shows the regression model adjusted with dummy variables, in order to correct the structural changes reflected in Figure 14. On the other hand, the Dickey Fuller augmented and Phillips Perron statistical tests are calculated, at 5% and 10% on the residuals, which indicate the presence of stationarity, thus leading to the conclusion that the variables of the new model cointegrate, that is to say that there is a long-term relationship between the variables analyzed.

Table 4 *Unit root test*

	Prueba ADF				Prueba Phillpis Perron			
	t-Statistic	1%	5%	10%	t-Statistic	1%	5%	10%
Residuos	**-3.046493**	-3.433849	-2.86959	-2.567573	**-3.285933**	-3.433819	-2.862959	-2.567573

Consequently, the estimated cointegration relationship is:

PERU_GENERAL_INDEX = 3.675*MINING_INDEX - 58.103*D1 + 46.922*D2 + 145.454*D3 - 94.475*D5 - 140.779*D6 + 389.011

As can be seen, the variables analyzed have a long-term relationship, associated to this cointegration relationship, the study evaluates if there is an error correction model (ECM), for which the residuals will be incorporated to the model lagged one period.

Figure 15 *Error correction model*

Dependent Variable: PERU_GENERAL_INDEX
Method: Least Squares
Date: 03/07/22 Time: 20:13
Sample (adjusted): 2/03/2015 3/04/2022
Included observations: 1781 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MINING_INDEX	3.674954	0.009656	380.5698	0.0000
D1	-56.14760	1.181740	-47.51264	0.0000
D2	48.07975	0.964622	49.84312	0.0000
D3	143.1368	1.159863	123.4084	0.0000
D5	-95.85660	1.293966	-74.07972	0.0000
D6	-138.8367	1.284898	-108.0527	0.0000
C	388.1052	1.744792	222.4364	0.0000
RESIDUOS_LP(-1)	0.989708	0.003408	290.4047	0.0000

R-squared	0.997539	Mean dependent var	1197.481
Adjusted R-squared	0.997529	S.D. dependent var	208.7227
S.E. of regression	10.37483	Akaike info criterion	7.521124
Sum squared resid	190840.6	Schwarz criterion	7.545762
Log likelihood	-6689.561	Hannan-Quinn criter.	7.530224
F-statistic	102666.5	Durbin-Watson stat	1.964779
Prob(F-statistic)	0.000000		

Figure 15, shows the ECM, in which the parameter $\beta 7 = 0.989$ is positive, the variable Yt-1 is below its equilibrium value, so it will begin to increase in the next period until restoring the equilibrium value. On the other hand, the coefficient of the residual of the ECM model measures the speed of convergence to equilibrium of the cointegrated model in the long term. Therefore, β7 indicates that the speed of convergence to equilibrium of the long term cointegrated model is quite acceptable. The stabilization of the model over time is quite fast. The Y variable adjusts quickly to the short-run changes experienced by the MSI.

The fit of the error correction model associated with the cointegration relationship is as follows:

PERU_GENERAL_INDEX = 3.674*MINING_INDEX - 56.147*D1 + 48.079*D2 + 143.136*D3 - 95.856*D5 - 138.836*D6 + 388.105 + 0.989*RESIDUOS_LP (-1)

DISCUSSION

With the results obtained and after the corresponding analysis, the results achieved by other authors who studied the relationship and influence of prices and mining stocks on the profitability of stock exchanges were reviewed. The context of the research, the year of study, the methodology applied and the place of origin of the study were taken into account.

At the international level, there is agreement with the research of Fonseca Ramírez y Santillan Salgado (2018) who report that the prices and yields of mining commodities have a certain short and long term correlation with the prices of Mexican mining shares, where in periods of financial instability a high variability is obtained according to the applied correlation DCC (p. 25). In this study it was found that the behavior of mining stocks has a high correlation with the IGBVL in the long term.

They concur with Bouri, Jain, Biwal y Roubaud (2017) and their study on cointegration and nonlinear causality between gold, oil and Indian stock market, who argue that there are cointegration relationship and positive impact of gold and oil volatilities on Indian National Stock Exchange (NSE) volatilities, these two commodities are highlighted to have predictive power of implied volatility of Indian stock market (pp. 205-206). This study validated the cointegration of mining stocks, based on the main minerals, with the profitability of the Peruvian stock market, represented by the Lima Stock Exchange (LSE).

The results of the studies carried out in Mexico and India support what was demonstrated in this research. Through a proprietary econometric model, it was possible to prove the influence and cointegration of variables that support an existing and significant relationship between mining stocks and the LSE in the short and long term.

In the research of Azar and Chopurian (2018) on the Commodity Indices and Stock Markets of the six Gulf Cooperation Council (GCC) member countries, the authors note that, with the exception of oil, commodity indices are poorly correlated with GCC stock markets (pp. 141-142). While in these countries there is a direct effect of oil on their stock markets, the same is not true for other minerals, as is the case with copper and gold for our country's stock market.

At the national level, there is a strong agreement with Gomero (2017), in his study on the volatility of mining commodities and their economic impact in Peru. In an analysis of 10 years of study, the author cited argues that the country's export activity is largely explained by mining exports, where the percentage variation of the price of copper has a 63.5% correlation with GDP, and sees its price stability affected by the uncertainty of global markets (pp. 98-99). In this research, the correlation between mining stocks and the profitability of the LSE was validated, which is another way of proving the great contribution of the national mining activity to Peru's economic growth.

The study by Lizarzaburu et al. (2021) on the risk of insolvency and return of shares of some mining companies listed on the LSE, the authors argue that there is enough statistical information to assert that the market premium is an influential variable in the performance of the assets and profitability of the shares of mining companies that one can acquire. This result complements what was demonstrated in the present study, because it argues how to avoid the risk of insolvency and aspire to the profitability of mining shares, which in turn, would be contributing to the general profitability of the stock market as reviewed in the study.

In summary, there was agreement with previous research conducted in different countries around the world, with greater coincidence with some of them, which shows that the country context can affect these variables to different degrees, mainly according to its traditional minerals and the composition of its stock markets.

Conclusions

• Mining shares, represented by the Mining Stock Index, have a significant correlation and influence on the Lima Stock Exchange General Index, which represents the Peruvian stock market, that is, the financial assets corresponding to mining companies influence and explain to a great extent the behavior of the LSE's profitability.

• Mining stocks and the profitability of the LSE are variables that maintain an equilibrium relationship in the long run, the presence of a unit root is ruled out and it is confirmed that the time series is stationary, therefore, the existence of stationarity allows to prove that the variables cointegrate.

• The cointegrated model of mining stocks and LSE profitability allows to know that the speed of convergence to sustain the equilibrium adjusts efficiently, the adjusted correction model supports the stabilization of the variables over time, that is, mining stocks maintain a significant relationship with LSE profitability that adjusts rapidly over time.

References

[1] Aboura, S., & Chevallier, J. (2015). Volatility returns with vengeance: Financial markets vs. commodities. Research in International Business and Finance, 33, 334–354. https://doi.org/10.1016/j.ribaf.2014.04.003

[2] Adams, Z., & Glück, T. (2015). Financialization in commodity markets: A passing trend or the new normal? Journal of Banking and Finance, 60(1), 93–111. https://doi.org/10.1016/j.jbankfin.2015.07.008

[3] Akkoc, U., & Civcir, I. (2019). Dynamic linkages between strategic commodities and stock market in Turkey: Evidence from SVAR-DCC-GARCH model. Resources Policy, 62(January), 231–239. https://doi.org/10.1016/j.resourpol.2019.03.017

[4] Aumeboonsuke, V. (2021). Commodity prices and the stock market in thailand. International Journal of Energy Economics and Policy, 11(1), 34–40. https://doi.org/10.32479/ijeep.10298

[5] Azar, S. A., & Chopurian, N. A. (2018). Commodity indexes and the stock markets of the GCC countries. Arab Economic and Business Journal, 13(2), 134–142. https://doi.org/10.1016/j.aebj.2018.08.001

[6] Bolsa de Valores de Lima. (2020). Alianza S&P/BVL. https://s3.us-east-1.amazonaws.com/site.documents.cdn.prod.bvl.com.pe/Presentación_de_los_índices_SPBVL.pdf

[7] Bouri, E., Jain, A., Biswal, P. C., & Roubaud, D. (2017). Cointegration and nonlinear causality amongst gold, oil, and the Indian stock market: Evidence from implied volatility indices. Resources Policy, 52(February), 201–206. https://doi.org/10.1016/j.resourpol.2017.03.003

[8] Chinhamu, K., Huang, C. K., Huang, C. S., & Hammujuddy, J. (2015). Empirical analyses of extreme value models for the South African mining index. South African Journal of Economics, 83(1), 41–55. https://doi.org/10.1111/saje.12051

[9] De la Rosa, C., Ordóñez, A., Cabrera, C., & Berroterán, V. (2021). Estadística multivariada aplicada a la clasificación de empresas que cotizan en la Bolsa Mexicana de Valores. Revista Mexicana de Economía y Finanzas, Nueva Época, 16(1), 1–15. https://doi.org/10.21919/remef.v16i1.452 (Recibido:

[10] Fonseca Ramírez, A., & Santillan Salgado, R. J. (2018). Incidencia de la volatilidad de los precios de los minerales en la volatilidad de los precios de las acciones de la industria minera en México (2008-2015). Economía Coyuntural, 3(4), 3–30. http://www.scielo.org.bo/scielo.php?script=sci_arttext&pid=S2415-06222018000400003&lng=es&nrm=iso&tlng=es

[11] Gaytán Alfaro, E., Mendoza Sánchez, M., & Vargas Sánchez, J. (2018). Minería y encadenamientos productivos en México: Un estudio comparativo empleando modelos estatales de insumo producto. Economía Coyuntural, 3(2), 1–31. http://www.scielo.org.bo/scielo.php?script=sci_arttext&pid=S2415-06222018000200002&lang=es

[12] Gomero, N. (2017). Volatilidad de los commodities mineros y su incidencia en la economía nacional. Quipukamayoc, 25(48), 91–100. https://doi.org/10.15381/quipu.v25i48.13999

[13] Horna, I. E. (2020). Perspectivas del financiamiento corporativo y el mercado de valores del Perú. Retos, 10(19), 135–152. https://doi.org/10.17163/ret.n19.2020.08

[14] Huertas, E. (2016). Bolsas de Valores: Rentabilidad y Riesgo. Anales Científicos, 77(2), 184–192. https://doi.org//10.21704/ac.v77i2.626

[15] Jain, A., & Biswal, P. C. (2016). Dynamic linkages among oil price, gold price, exchange rate, and stock market in India. Resources Policy, 49(1), 179–185. https://doi.org/10.1016/j.resourpol.2016.06.001

[16] Johnston, J., & Dinardo, J. (2002). Métodos de Econometría. México, México (Vicens Vives).

[17] Landa, Y. (2017). Renta extractiva y la minería del cobre en el Perú. Problemas Del Desarrollo, 48(189), 141–168. https://doi.org/10.1016/j.rpd.2017.04.007

[18] Lizarzaburu, E. R., Burneo, K., & Berggrun, L. (2021). Risk of Insolvency and Return of Shares: Empirical Analysis of Altman's Z-Score in the Peruvian Mining Sector Between 2008-2018. Revista Universidad y Empresa, 23(40), 1–33. https://doi.org/10.12804/revistas.urosario.edu.co/empresa/a.8558

[19] Maghyereh, A. I., Awartani, B., & Bouri, E. (2016). The directional volatility connectedness between crude oil and equity markets: New evidence from implied volatility indexes. Energy Economics, 57(1), 78–93. https://doi.org/10.1016/j.eneco.2016.04.010

[20] Matute, G., Covri, D., & Castillo, Y. (2021). Incidencia de la actividad minera en el desarrollo social de la parroquia Chumblín del cantón San Fernando. ConcienciaDigital, 4(1.2), 422–445. https://doi.org/10.33262/concienciadigital.v4i1.2.1608

[21] Ordu, B. M., & Soytaş, U. (2016). The Relationship Between Energy Commodity Prices and Electricity and Market Index Performances: Evidence from an Emerging Market. Emerging Markets Finance and Trade, 52(9), 2149–2164. https://doi.org/10.1080/1540496X.2015.1068067

[22] Shabbir, A., Kousar, S., & Batool, S. A. (2020). Impact of gold and oil prices on the stock market in Pakistan. Journal of Economics, Finance and Administrative Science, 25(50), 279–294. https://doi.org/10.1108/JEFAS-04-2019-0053

[23] Sutomo, S., Wahyudi, S., Pangestuti, I. R. D., & Muharam, H. (2020). The determinants of capital structure in coal mining industry on the Indonesia Stock Exchange. Investment Management and Financial Innovations, 17(1), 165–174. https://doi.org/10.21511/imfi.17(1).2020.15

[24] Thakolsri, S. (2021). Modeling the relationships among gold price, oil price, foreign exchange, and the stock market index in Thailand. Investment Management and Financial Innovations, 18(2), 261–272. https://doi.org/10.21511/imfi.18(2).2021.21

[25] Torres, E., & López, M. (2017). Auge minero y desindustrialización en América Latina. Revista de Economia Institucional, 19(37), 133–146. https://doi.org/10.18601/01245996.v19n37.07

[26] Villa, E., & Gomero, N. (2019). Las Exportaciones Mineras, Los Impuestos Directos E Indirectos Y Su Incidencia En La Recaudación Tributaria Del Gobierno Central: 2017 -2019. Quipukamayoc, 27(54), 37–46. https://doi.org/10.15381/quipu.v27i54.16521

[27] Wooldridge, J. (2010). Introduccion a la econometria un enfoque moderno. Madrid, España (Cengage Learning).