Financial Analysis Of Bond And Stock Issuance In The Ecuadorian Stock Market

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Abstract

The objective of this research work is to prepare a study of stock market products through financial models that allow the investor to obtain simulations of efficient investment portfolios for good decision-making at the time of asset acquisition. The analysis management reflects the comparison of stocks and bonds in the stock exchange of Guayaquil and Quito, using the Markowitz models, SHARPE index model, and arbitration pricing model that independently and jointly evaluates these securities, being the better model to evaluate portfolios with the information of the stock market the Markowitz model, which evaluates a group of assets, considers more analysis factors so it does not only depend on the money that the investor expects to invest and ear but on others additional risks that are not controlled

Keywords: Financial model, Markowitz, arbitrage pricing, SHARPE

INTRODUCTIOn

In some countries, the stock market is an investment alternative for SMEs companies and individuals who wish to finance themselves with an option to increase their capital, but in the case of the Ecuadorian stock market, it is considered untapped by local and foreign investors, which is why only last year the transfer of shares reached 67.5 million dollars, equivalent to 0.9% of the total of securities and securities traded on the stock exchange of Guayaquil and Quito, of more than $ 7 billion [1]

On the contrary, countries such as Brazil have part of the Latin American stock market trading in euros on the Madrid Stock Exchange, under the Latibex platform, which began operating with five companies in 1999 and now has about thirty securities and expects to become the third stock market in Latin America by capitalization, only surpassed by the stock exchanges of Mexico and Sao Paulo[2]

Meanwhile, elsewhere in Latin America, there has been the integration of the stock market with control, government, and self-regulatory bodies, which access the same rules and financial instruments and services, and integrations in their stock exchanges, such as the cases of Chile, Colombia, and Peru, which make up the Latin American Integrated Market (MILA) [3]

This phenomenon is due to various explanations, among which stand out interests created from idiosyncrasy when investors demand large margins through speculative behavior, rather than that of an investor to the low incentive on the part of the companies to make their operations transparent in the case of those that do not yet participate in the stock market, interests created from organizations involved in the market through financial intermediation and disintermediation, the low interest on the part of SME companies to obtain other sources of financing, the scarce stock market culture, the insufficient information provided on securities [4]

Among the implicit factors, are the fact that securities houses have varied operating costs, companies due to lack of knowledge about other ways of obtaining financing, the short life of SME companies which according to Marcelo Lebendiker president of TEC park has a high mortality rate during the first 3 years of life stands out [5]

The limited offer of stock market products, in addition to insufficient information in economic and financial portals about the stock market in Ecuador, they prefer not to risk creating shares of their company, nor to invest in other sectors. The corporations with the greatest presence on the stock market are large or multinational companies such as Holcim, Tonisa, Corporación La Favorita, or Banco de Guayaquil that hope to achieve greater liquidity to continue expanding.

, that few companies show interest in having an involvement within the stock market to obtain benefits, and that country there are still not adequate conditions that allow this means of investment and financing mechanism to be more attractive, according to Méndez [6] states that:

Domestic companies prefer to manage solely or mostly with their capital, due to the little information and means of consultation for investors who desist from being interested in investing in this market by not having a scenario that indicates significant profitability or that exceeds the invested value, as for the few securities that are acquired by the local investor, these currently present the problem of having low liquidity, as well as little breadth in external investment issues such as the stock market [6]

It is also considered, that SME companies represent 99% of the total number of companies incorporated in the country according to the Report of the Institute of Statistics and Census, [7] economic and tax incentives have been implemented to allow them to develop according to the National Secretariat of Planning and Development [8], it is expected that there will be an increase in smaller scale financial products aimed at SME companies and small investors, which do not have values greater than 1000 to 5000 dollars to invest in a package of shares.

For this reason, the stock market has become limited to certain investors who are willing to assume high risks such as the loss of value of the securities acquired added to the economic instability of the country, the short life of SMEs companies where the main problem is related to financing, cash flow, and planning, in addition, the financial information of the stock market is limited to the Statistical Yearbooks of the Stock Market, volume indexes and financial performance [9]

Institutions that manage venture capital funds as an alternative to their financing, unlike those that grow in line with the industry, support that macroeconomic indicators are positive based on their contribution to the economy. Therefore, for a potential investor, factors such as legal security, political stability of the country, and foreign investment attraction programs are important [10]

The objective of the research is to elaborate an analysis of stock market products through financial models that facilitate the investor to minimize the risk of investment portfolios and to obtain efficient portfolio simulations for decision-making.

Therefore, the research evaluated financial models applicable to bond and stock portfolios to obtain the best model that delivers efficient portfolios, for which a comparative analysis will be made between the results of these methods.

METHODOLOGY

It is considered of utmost importance that every portfolio manager, advisor, or financial analyst has an adequate basis to carry out investment operations or get involved in the stock market through one or a group of financial assets. For this reason, several quantitative investment methodologies were developed to help investment decision-making through a more sophisticated, methodical, and complete analysis than the patterns that govern the current stock market, for buying or selling positions, depending on the side in which the participating company or person is.

For this reason, this research began with bibliographic and field research on which the current situation of the Ecuadorian stock market and how the profitability generated by buy-sell transactions is calculated for investors and companies that want to create investment portfolios. Subsequently, the research maintains a quantitative approach in which four models were proposed, to apply the best of them resulting in an increase of investment in a stock market with very few

participants that have an active presence; and that also attract secondary consequences such as the improvement of market conditions and the generation of new sources of employment.

While, the study was of an exploratory type, having as its objective to examine a topic or research problem given that it has been little studied and the review of the literature demands to extend this study to the Ecuadorian stock market; therefore, it did not formulate research hypotheses, besides it is of experimental type when proposing models that determine implications or consequences on the analysis of the portfolio returns. Therefore, this research is based on three financial models which are Markowitz, the Sharpe Index model, and the Arbitrage Pricing model.

First, the Markowitz model based on the rational behavior of the investor, in which the investor expected to make profits and deny losses, was raised [11]. For this study, the Markowitz matrix was incorporated to calculate the profitability and risk of the portfolio, and its consequent analysis through the least squares linear regression model [12] of efficient portfolios for companies that have securities in the Guayaquil and Quito Stock Exchange.

The second model studied was the Sharpe index model which worked with correlation coefficients, return, variance-covariance, and the linear regression model using matrices to analyze the portfolio return. Finally, the third model evaluated is the Arbitrage Pricing model which established more factors such as country risk, unemployment, and inflation, risk-free rate; which analyzes the expected return considering more additional factors that compose the risk of an investment portfolio.

Using the models applied, the impact at the moment of evaluating stocks and bonds with one security or the other was examined, in which the lowest and highest value of each security was also taken into account. To subsequently perform a comparative analysis and issue an objective evaluation of the best model.

Analysis Unit
- Analysis of information from BVG and BVQ databases.
- Population: BVG and BVQ stocks and bonds.
- Sample: 5 shares of the BVQ and BVG and 1 bond that is currently registered and circulating in both stock exchanges [13] according to what was mentioned if the population is small and accessible we will work with the total
- Years analyzed: 2015-2019
- Scope: private and public companies registered in the BVG and BVQ.

Procedure
- For this study should consider:
- Research the current situation of the Ecuadorian stock market.
- Establish tools that help to obtain numerical data on stocks and bonds present in the stock exchanges of Guayaquil and Quito during 2015-2019.
- Identify the variables that make up the financial models applicable to the analysis of stocks and bonds.
- Perform a comparative analysis between the financial models exposed to determine the one that delivers the best results to create efficient portfolios with minimum risk.

The analysis was based on the collection of information from the databases of the securities available in the Quito and Guayaquil stock markets, and with this, financial models applicable to this type of market were proposed for the creation of different combinations of efficient portfolios, The models applied were the least squares linear regression model under the Markowitz scheme as a base, through which it is expected to obtain returns above the stock market index adjusted to the risk, Sharpe Index and the APT model for the creation of optimal portfolios with low or null risk, of which a comparative analysis between the results of their financial products is used.

RESULTS

Application of the Markowitz model

Firstly, the returns of each asset comprising the portfolio were obtained and changes were made to improve the results,

to apply this method to optimize the portfolio. It should be noted that authors such as Dickinson, Thornton, and Graves considered that portfolio management should maximize the value of the portfolio, provide a balance, and support business strategies. It should also employ tools to detect the risk and rewards of each project's investments [13].

Therefore, an attempt was made to obtain the best possible return on the assets in the portfolio compared to other portfolios of similar risk [14]. Markowitz makes it easier to obtain expected returns and expected volatility per portfolio and asset, in addition to reducing risk, and thus to propose a correlation in its business decisions to buy and sell securities in the stock market.

As previously proven, the securities and securities of the stock market of Guayaquil and Quito during 2019 are classified and analyzed to evaluate their risk and return to create optimal portfolios. We start by sorting the data of the chosen stocks and bonds. The following steps are followed [15].

> 1)   To calculate the yield of each share, the yield of each share was calculated by the variation of the price of each security concerning the previous month.
> 2)   Based on the yields of each share, ratios were found for the following selection, for which the formula was applied: =AVERAGE (Rx1:Rx32), thus obtaining a yield over time for each company.

Table 1

Expected stock returns

Table 1. Expected stock returns

	San Carlos	Holcim	Cerveceria Nacional	Banco Guayaquil	Magisterio	Corporación Favorita
Aug-19	0,00%	0,00%	1,06%	4,94%	0,47%	-1,21%
Jul-19	0,00%	-3,33%	-5,55%	-8,99%	0,47%	-0,40%
Jun-19	-2,99%	0,00%	0,00%	-7,29%	0,47%	-2,35%
May-19	-4,29%	0,00%	-2,18%	-4,00%	0,47%	4,08%
expected return	-0,74%	-0,07%	1,03%	1,67%	-0,01%	0,000018%

3) Subsequently, calculate the variance using the average of each return compared to their differences, then square and finally multiply by the probability of occurrence.

4) Then, calculate the standard deviation as a measure to calculate the average annual risk of each company, using the formula: =DESVEST (Rx1:Rx32)

Using the standard deviation he calculates the risk of these assets.

5) As Markowitz works with annual values, the 2 previous parameters are multiplied by 12 or by the root of twelve in the case of the standard deviation, since it is squared. To obtain an average annual return and average annual risk respectively.

According to what can be observed, the highest return is in the stock of the bank of Guayaquil followed by the Cerveceria Nacionaly, and the worst return is given by the San Carlos sugar mill. It should also be considered that the lowest risk is in the magisterio bonds which maintain a unique value during each year, and the highest risk as well as delivering a considerably good return is in the bank of Guayaquil, but if compared to the risk, the stock is far from being considered safe.

6) Then, I combine risk and return, to calculate the coefficient of variation, dividing: average risk / average return, to assume a cv% risk.

Obtaining the highest risk the shares of the bank of Guayaquil, followed by the Cerveceria Nacionaly representative to the returns that this portfolio has; therefore one stays with the shares that deliver better returns to continue with the analysis (magisterio, Cerveceria Nacional, y and bank of Guayaquil).

7) The covariance and correlation between the 3 investment portfolios that deliver the best returns are obtained, to find how related these portfolios are to form an efficient portfolio. Using a comparison between two assets of the portfolio as

indicated in the table, applying the formula COVAR (Asset1; Asset2)

Subsequently, calculate the correlations between the assets using the CORREL formula (Asset1; Asset2) or the Data Analysis option in Excel. This formula is made up of the covariance divided by the product of the standard deviations.

8) The beta of each stock or bond is calculated to indicate its systematic risk and vulnerability concerning other securities. And it is calculated by a linear regression slope =SLOP ($Stock market returns $, Rx32), finding the vulnerability to the environment.

9) The coefficient of variation is calculated to make a comparison between risk and return, and then the performance coefficient to obtain the portfolios with the best returns.

Table 2

Investment portfolio performance

Table 2. Investment portfolio performance

	San Carlos	Holcim	Cerveceria Nacional	Banco Guayaquil	Magisterio	Corporación Favorita
Variation of.	-1,36	-4,99	2,19	2,60	-37,32	0,03
Performance	-0,73	-0,20	0,46	0,38	-0,03	34,73

Considering as the best portfolios that deliver the best performance are the ones formed by Cervecería Nacional and Banco de Guayaquil, which have 0.46 and 0.38 in their performance.

10) Of the most profitable assets, a portfolio analysis of two assets is performed, in which the expected return of the portfolio and its portfolio risk is calculated, for which it is considered to invest 50% of its capital in each of the two shares of the portfolio.

Table 3

Results of equations to find optimal portfolios

Table 3. Results of equations to find optimal portfolios

	Cerveceria Nacional	Banco Guayaquil
W stock Cerveceria Nacional	50%	
W stock Banco Guayaquil	50%	
Expected portfolio return		16,79%
Portfolio risk		41,34%
Portfolio Performance		42,06%

Based on these answers, combinations are made in the portfolio to minimize the portfolio risk and increase its performance. Through the maximization of the variable using a solver to obtain the stock in which it should invest the most. Simplifying the model, to keep the best stocks whose correlation was obtained to form a portfolio, it is obtained that they are not correlated and therefore comply with the diversification principle. As for the best options to buy the shares of Cervecería Nacional and Banco de Guayaquil, it is recommended to buy mostly those of Cervecería Nacional and 8% of shares of Banco de Guayaquil, because with this combination a performance of 45% was obtained for the portfolio. It also indicates that both stocks meet the minimum return established for each one of them, but they are far from obtaining a high return as a whole. In this case, solving using SOLVER, the portfolio risk is minimized to 16.66% by conforming the portfolio with 92% shares of the Cerveceria Nacionaly and 8% shares of the bank of Guayaquil.

Application of the SHARPE index model

1) First, the estimated risk-free rate = ((AVERAGE RETURN x TLR)/AVERAGE RISK) is obtained. The result indicates the percentage return paid for each 1% risk assumed on the risk-free rate.

Table 4

Estimated risk-free rates

Table 4. Estimated risk-free rates

	San Carlos	Holcim	Cerveceria Nacional	Banco Guayaquil	Magisterio	Corporación Favorita
Estimated risk-free rate	-21,21%	-5,78%	13,18%	11,10%	-0,77%	102,67%

Of which the best yields obtained for each 1% of risk are the shares of the Cerveceria Nacionaly, the bank of Guayaquil, and the teachers' union.

2) A combination of companies and bonds is made to create the matrices.

3) We start with a correlation matrix that combines the 2 stocks and 1 government bond and use the following formula =COEF.DE.CORREL (Rx: Rx; Ry: Ry). It is expected with this to obtain the correlation level of these securities and to consider the best ones for the formation of investment portfolios.

Table 5

Correlation of assets

Table 5. Correlation of assets

Correlation	Cerveceria Nacional	Banco Guayaquil	Magisterio
Cerveceria Nacional	1	2,57%	-0,08%
Banco Guayaquil	2,57%	1	1,07%
Magisterio	-0,08%	1,07%	1

As in the previous result, the best correlations are given by the stock of the bank of Guayaquil and the Cerveceria Nacionaly to create an efficient portfolio. However, as in Markowitz, the relationship is low, so it is better to build portfolios with these bonds and stocks independently.

4) The variances and covariances matrix is made using the diagonal, and the =DESVEST (Ex)*DESVEST (Ry)*correlation of the previous matrix is calculated. From this, in a separate sheet, a table has been created to manipulate and thus calculate the investment portfolios.

Table 6

Covariance and correlation calculation

Table 6. Covariance and correlation calculation

	Cerveceria Nacional	Banco Guayaquil	Magisterio
Cerveceria Nacional	1,94%	0,05%	0,00%
Banco Guayaquil	0,05%	1,94%	0,02%
Magisterio	0,00%	0,02%	1,94%

5) We include the ratios yield, variance, from =MMULT (MMULT (TRANSPORNER (PERCENTAGE1: PERCENTAGE:?) MATRIX (VAR.COVAR), (PERCENTAGE1: PERCENTAGE:?)) STANDARD DEVIATION : = RATIO (VARIANCE OF THE PORTFOLIO)- SHARPE:=(Rp-0.02/DVIATION)

It was obtained that its yield is 3.26% when 92% of brewery shares and 8% of Banco de Guayaquil shares are purchased, which is the less profitable of the two shares. Its portfolio risk is 23% for this portfolio, while its SHARPE indexes indicate that there is greater risk in the Banco de Guayaquil portfolio with 21.62% and in the brewery with a controllable 16.39%.

6) Finally, using the SOLVER analysis, the SHARPE index is maximized to obtain the maximum risk and yield of the portfolio, considering the risk-free rate.

Table 7

Portfolio optimization of the best two stocks - SHARPE

Table 7. Portfolio optimization of the best two stocks - SHARPE

	Cerveceria Nacional	Banco Guayaquil
W stock Cerveceria Nacional	89%	

W stock Banco Guayaquil	0%	
Expected portfolio return		0%
Portfolio risk		0%
Portfolio Performance		40,69%

For this model, a multiplication of variance and covariance matrices was performed, from which the best assets were obtained, which in this case are Cervecería Nacional and Banco de Guayaquil, for which the annual portfolio yield is 3.26% with a much higher risk of 23.91%, which implies that there is a negative risk hedge on both stocks. This implies that it is better to combine them in other portfolios or offer them independently considering their expected returns. Through the optimization analysis using SOLVER, it is obtained that the option to optimize this portfolio through this model was to buy only shares of the Cerveceria Nacionaly but not of Banco de Guayaquil to reduce its risk and increase the performance to 40.69%. In comparison with the Markowitz model, it is considered that the former gives a greater possibility of diversification in the case that it is applied to another set of bonds and stocks.

Application of the Arbitrage pricing model

This model takes as a basis the expected return of each of the assets in the portfolio to find the return of the stock and the portfolio, adding to these factors such as inflation, country risk, and unemployment. The same betas of these investments found in the Quito and Guayaquil Stock Exchange documents are applied.

1) The betas of each stock or bond are found.
2) The unemployment, inflation, and country risk indexes are found on the website of the Central Bank of Ecuador and the National Institute of Statistics and Census. And the ECUINDEX index on the investing.com page.

Table 8

Ecuador's unemployment, inflation, and country risk rates

Table 8. Ecuador's unemployment, inflation, and country risk rates

year	2015	2016	2017	2018	2019
unemployment rate	4,80%	5,20%	4,60%	3,70%	4,70%
annual inflation	3,38%	1,12%	-0,20%	0,27%	0,04%
country risk	1266,00	647,00	459,00	826,00	825,00

3) The average of each of the shares is obtained and a comparison is made with the Markowitz and SHARPE models.

Table 9

Results of the APT model

Table 9. Ecuador's unemployment, inflation, and country risk rates

APT	2015	2016	2017	2018	2019	Average (2015-2019)
San Carlos	9.712,14	8.352,39	9.347,48	9.204,18	9.228,49	9.168,94
Holcim	11.894,79	10.229,47	11.448,17	11.272,68	11.302,44	11.229,51
Cerv Nacional	9.494,15	8.164,95	9.137,68	8.997,61	9.021,37	8.963,15
Banco Gye.	14.514,20	12.482,20	13.969,25	13.755,12	13.791,43	13.702,44
Corp. favorita	8.293,63	7.132,48	7.982,23	7.859,86	7.880,62	7.829,76
magisterio	10.476,22	9.009,52	10.082,88	9.928,31	9.954,53	9.890,29

From the result, it can be observed that when obtaining the percentages corresponding to the portfolio, its best yields are Corporación Favorita at 29% and Cervecería Nacional at 13%. The return of the portfolio is 18% between the 4 years

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analyzed.

The arbitrage pricing model considers generalized leveraged betas obtained from information on the analyzed securities of the Guayaquil and Quito stock exchanges for each of the assets which are analyzed independently to find the most profitable for the investment portfolio. Therefore, by adding variables such as unemployment, country risk, and inflation, and the Ecuadorian stock exchange index ECUINDEX, which were multiplied by the respective beta of the stock, it was obtained that the best stocks to implement in the portfolio and with the best expectations for purchase and sale transactions are those of Cervecería Nacional with 13% and Corporación Favorita with 29.39%.

Table 10

Expected income from the APT model

Table 10. Expected income from the APT model

APT	Expected income
San Carlos	10,49%
Holcim	-9,79%
Cerv Nacional	13,03%
Banco Gye.	-26,07%
Corp. favorita	29,39%
magisterio	2,43%

The Arbitrage Pricing model formula in turn gives the possibility of extending the model and implementing more variables of analysis for future forecasts of portfolio movements, besides allowing the elimination of non-diversifiable errors to build a more solid portfolio. In this case, trying to create a market in equilibrium and with lower systematic risks [17].

Comparison between financial models

Taking the expected return as a basis for comparison, we obtain that the best yields are Banco de Guayaquil with 36% and Cervecería Nacional with 12% of the income generated. Performing this analysis against Markowitz, the yield of Banco de Guayaquil increases to 38% while that of the Cerveceria Nacionaly to 54%, so one of the options is to buy most of the portfolio in the Cerveceria Nacionaly. While in the Sharpe Ratio analysis, although both assets prevail, it is better to manipulate these assets independently or place them in other portfolios. The Arbitrage Pricing model considers in this case that the best assets in which to invest in these periods corresponded to food and beverages.

On the other hand, the Arbitrage Pricing model gives as a result that the best security in which to invest considering the high market profitability it generates is Corporación Favorita with profitability between those years of 29%, followed by the 13% that Cervecería Nacional would generate.

Through the SOLVER analysis, it was obtained that to minimize risk these assets can be offered in other portfolios or independently because together they do not build an efficient portfolio. Therefore, it could be considered that the best model to form efficient portfolios is the Markowitz model followed by the Sharpe index model and the Arbitrage Pricing model.
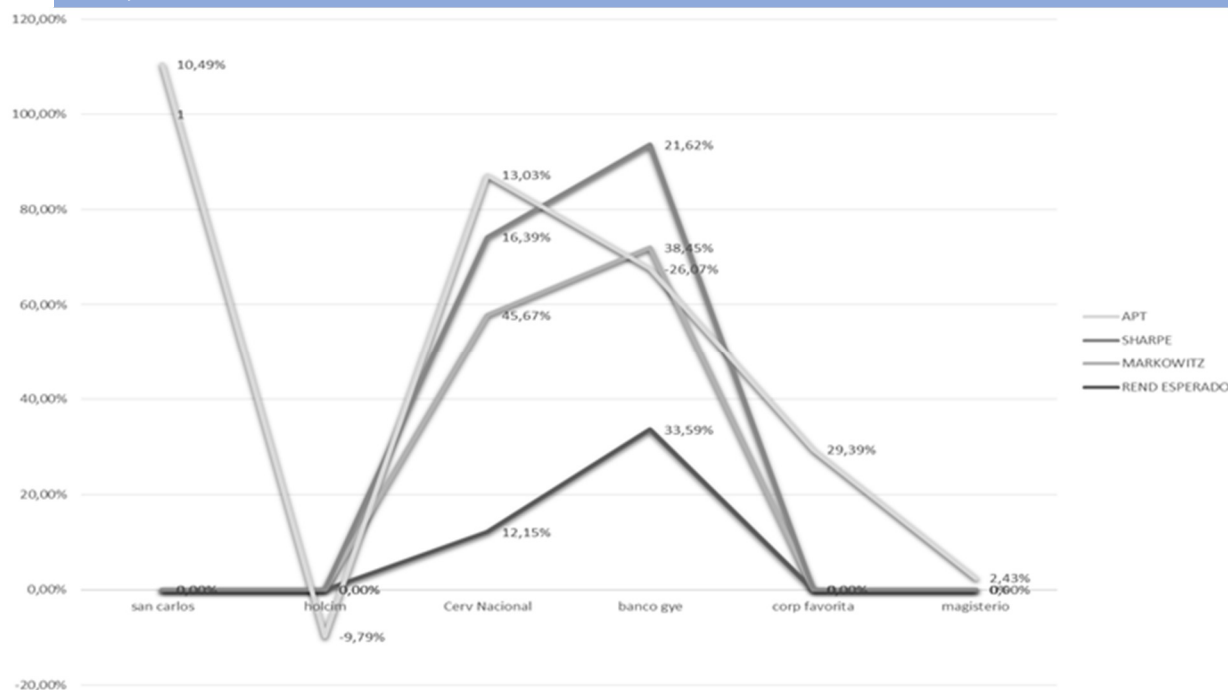
Figure 1. Comparison between financial models

CONCLUSIONS

It has been shown in various works related to portfolio diversification that there is a positive relationship between risk management and success in the formation of these asset pools, for which it is necessary to highlight 3 components that should help improve the analysis in future research such as organization, process, and culture [16]., to also take into account why an asset produces higher returns and others are discarded from the analysis.

Considering that in this study, the best model for its approach and the variables that interact within it, and is considered the most complete is the Markowitz model, The SHARPE model has a similar analysis but based on its variance-covariance matrices through which it obtains the performance of the portfolio with the best stocks or bonds chosen (in this case Markowitz and SHARPE agree that they are those offered by Banco de Guayaquil and the Cerveceria Nacionaly with a difference in profitability decrease of 29% for the Cerveceria Nacionaly and 16.8% for Banco de Guayaquil).

In the analysis of the 3 models, it was obtained that together these assets are not adequate to form efficient portfolios, therefore more parameters should be considered to choose the assets that will form the portfolio such as the risk rating of the securities, their financial statements, and the annual yields per asset independently. Therefore, it is recommended to form new portfolios with these investments independently. Use as many sections/subsections as you need.

The Arbitrage Pricing model is considered to be multifactorial, recognizing that several economic factors determine non-diversifiable or systemic risk [17]. In this case, we chose factors such as unemployment, inflation, and country risk, which are the most accessible data at present, leaving aside the non-systemic risk with which we would form efficient portfolios that are evaluated not only concerning their historical data but also to the possible profits generated in the future by way of dividends.

The analysis can be improved with a comparison of the APT model with another group of top-rated assets with the CAPM model because both serve to predict future returns, as long as the variables involved are expanded, APT includes its non-diversifiable risks, and CAPM has updated information on market returns for each asset.

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