



---

## Market risk and expected minimum return of the chemical substance and product manufacturing sector: Period 2011 – 2020

## Riesgo de mercado y rentabilidad mínima esperada del sector de fabricación de sustancias y productos químicos: Período 2011 – 2020

Luis Tonon-Ordóñez

*Universidad del Azuay, Cuenca, Ecuador*

[ltonon@uazuay.edu.ec](mailto:ltonon@uazuay.edu.ec)

<https://orcid.org/0000-0003-2360-9911>

Estefanía Cevallos-Rodríguez

*Universidad del Azuay, Cuenca, Ecuador*

[ecevallosr@uazuay.edu.ec](mailto:ecevallosr@uazuay.edu.ec)

<https://orcid.org/0000-0001-8238-2337>

Luis Pinos-Luzuriaga

*Universidad del Azuay, Cuenca, Ecuador*

[lpinos@uauzay.edu.ec](mailto:lpinos@uauzay.edu.ec)

<https://orcid.org/0000-0002-3894-8652>

Iván Orellana-Osorio

*Universidad del Azuay, Cuenca, Ecuador*

[ivano@uazuay.edu.ec](mailto:ivano@uazuay.edu.ec)

<https://orcid.org/0000-0001-6279-2734>

Recepción: 06/07/2022 | Aceptación: 14/10/2022 | Publicación: 31/10/2022

---

### Cómo citar (APA, séptima edición):

Tonon-Ordóñez, L., Cevallos-Rodríguez, E., Pinos-Luzuriaga, L., y Orellana-Osorio, I. (2022). Market risk and expected minimum return of the chemical substance and product manufacturing sector: Period 2011 - 2020. *INNOVA Research Journal*, 7(3.1), 26-37.

<https://doi.org/10.33890/innova.v7.n3.1.2022.2125>

## Resumen

Risk and profitability are two interdependent aspects in business activity: a certain level of risk must be assumed to achieve greater profitability. The Capital Asset Pricing Model (CAPM) is one of the most widely used models in practice to determine the required return on an investment in a financial asset based on the risk assumed. There are various models and statistical tools that seek to predict financial risk. In the present research work, the market risk and expected minimum return in the chemical substance and product manufacturing sector (CIIU C20) were determined through accounting information. The data was obtained from the Superintendency, Securities and Insurance and corresponded to the period 2011-2020, and the results were analyzed in periods of 5 years, in order to know the variations that occur between the different periods. For the analysis of this sector 3.756 observations (376 companies per year on average) were considered in the period. In addition, a total of 513.895 observations were considered as a market. In the CAPM, the passive rate of the Central Bank of Ecuador was considered as the risk-free rate. In addition, for market performance, an adjusted ROE was calculated for all companies in the corporate sector in Ecuador. The unlevered and levered Beta coefficient obtained in the 5 periods analyzed is greater than 1, that is, it is considered a risky sector. The minimum expected yield of the sector fell from 12,15% in the 2011-2015 period to 4,98% in the 2016-2020 period. The results indicate that the results indicate that chemical substance and product manufacturing sector has a better performance than the market as a whole, since it has a higher performance than required. Considering the high level of uncertainty that currently exists, determining market risk is an important tool to support entrepreneurs and other stakeholders in making decisions.

**Palabras claves:** CAPM; Beta; market risk; expected return; chemical substances and products.

## Abstract

Riesgo y rentabilidad son dos aspectos interdependientes en la actividad empresarial: se debe asumir un cierto nivel de riesgo para lograr una mayor rentabilidad. El modelo de valoración de activos de capital (CAPM) es uno de los modelos más utilizados en la práctica para determinar la rentabilidad exigida en una inversión en un activo financiero en función del riesgo asumido. Existen diversos modelos y herramientas estadísticas que buscan predecir el riesgo financiero. En el presente trabajo de investigación se determinó, a través de información contable, el riesgo de mercado y rendimiento mínimo esperado en el sector de fabricación de sustancias y productos químicos (CIIU C20). La data fue obtenida de la Superintendencia, Valores y Seguros y correspondió al periodo 2011-2020, y se analizaron los resultados en periodos de 5 años, para de esta manera, conocer las variaciones que se presentan entre los distintos periodos. Para el análisis de este sector se consideraron 3.756 observaciones (376 empresas por año en promedio) en el periodo. Además, se consideraron como mercado un total de 513.895 observaciones. En el modelo CAPM se consideró como tasa libre de riesgo la tasa pasiva del Banco Central del Ecuador y como rendimiento de mercado un ROE ajustado del total de empresas del sector societario del Ecuador. El coeficiente Beta desapalancado y apalancado obtenido en los 5 periodos analizados es superior a 1, es decir, que se considera un sector riesgoso. El rendimiento mínimo esperado del sector se reduce de 12,15% en el periodo 2011-2015 a 4,98% en el periodo 2016-2020. Los resultados indican que el sector de fabricación de sustancias y productos químicos tiene un mejor desempeño que el mercado en conjunto, ya que posee un rendimiento mayor al exigido. Si se considera el alto nivel de incertidumbre existente actualmente, determinar el riesgo de mercado es una herramienta importante para apoyar en la toma de decisiones a los empresarios y otros grupos de interés.

**Keywords:** CAPM; Beta; riesgo de mercado; rendimiento esperado; sustancias y productos químicos.

## Introduction

In finance, one of the concerns that investors have is the level of investment risk, since the loss or profit depends on it (Brenes, 2019). Risk and profitability are two interdependent aspects in business activity: a certain level of risk must be assumed to achieve greater profitability (Solomon & Muntean, 2012). The interdependence between financial markets, especially during turbulent times such as the COVID-19 crisis, has led to an unprecedented proliferation of studies on market dynamics (Al-Nassar & Makram, 2022). For Wong and Chirinos (2016), market risk is called the probability of variations in the price and position of some asset of a company, this refers to the risk of possible loss of value of an asset associated with fluctuations and variations in the market. Considering the level of uncertainty in the world, investment decisions are based on expectations about its future value. In this context, risk models become an important tool for investors and other stakeholders in decision making.

There are various models and statistical tools that seek to predict financial risk. In this research, it is proposed to calculate the market risk through the accounting Beta coefficient and minimum expected return through the Capital Asset Pricing Model (CAPM) applied to the manufacturing sector of chemical substances and products (ISIC-C20). On the basis of the above, the research question arises: What is the market risk and minimum expected return of the chemical substance and product manufacturing sector?

The study is divided into sections. In the second section, the literature review and theoretical framework are exposed, where concepts about market risk are explained, as well as the main investigations related to the subject. The third section explains the applied methodology, as well as a brief description of the data used. The fourth section presents the results; and finally, the main conclusions and discussions of the study are exposed.

## Literature review

Market risk, according to Mejia et al. (2005), is associated with economic changes in a country due to internal or external factors; this risk is not diversifiable. The CAPM model links the market risk that all companies have and the expected return of a certain security or portfolio (Vitoria et al., 2020), and is one of the most widely used financial models to determine the market price and the appropriate risk measure for an individual asset or portfolio (Breedon et al., 1989; Pereiro, 2010; Cartes, 2012; Támara et al., 2017; Chang and Galindo, 2018; Ruíz et al., 2021). This model was developed by Sharpe (1964), Lintner (1965), and Mossin (1966), and its objective was to estimate the profitability of financial assets or portfolios based on their risk through the Beta  $\beta$  coefficient. This indicator represents the risk of an asset or portfolio in relation to the market.

The CAPM is simple, intuitive and based on a solid economic theory (Vendrame et al., 2018), from which new proposals have emerged. Apergis and Rehman (2018) investigated the

role of investor sentiment in asset pricing and illustrated that the CAPM captures rational investor behavior. Cenesizoglu and Reeves (2018) proposed a conditional version of the capital asset pricing model, which more effectively explains the cross section of expected returns. With respect to studies carried out in Latin America, Botello and Guerrero (2021) assessed the risk of investors based on accounting information, before and after the International Financial Reporting Standards (IFRS), in credit institutions in Colombia. Santos et al. (2019) proposed a conditional Asset Pricing Model for the evaluation of Brazilian funds. Sandoval et al. (2015) carried out an investigation on the degree of integration of the stock markets of Chile, Colombia and Peru before and after the implementation of the Integrated Latin American Market (MILA); the authors used as a basis a conditional version of the international CAPM. Wong and Chirinos (2016) carried out an investigation on the relevance of the NPV-CAPM to assess family businesses with a sample of 147 businesses in Peru in order to guarantee the application of the CAPM and its validity for the valuation of shares in the Latin American Integrated Market. Firacative (2015) comparatively studied the stock markets of Colombia, Chile and Peru applying the model and obtaining the parameters of each of the assets of a sample of a base period. Poquechoque (2020) makes an estimation of the Beta coefficient calculation for companies listed on the Bolivian Stock Exchange, who indicates that it is a systematic risk indicator used in investments worldwide, and unfortunately it has not been calculated and therefore not used in Bolivia.

In Ecuador, an investigation was carried out with the purpose of demonstrating that the CAPM model with some adjustments can be used in economies in developed countries, that is, in countries that have underdeveloped stock markets (Villagómez, 2014). Another research that can be highlighted in Ecuador was developed by Valverde and Caicedo (2020), who calculated the Betas by applying the CAPM to recognize the profitable influence of 35 companies linked to the Ecuadorian stock market during the period 2014-2019. Pines et al. (2021) carried out an investigation to calculate the minimum expected return for the manufacturing sector of other non-metallic mineral products in Ecuador through accounting financial information.

## Methodology

The research is quantitative with an explanatory scope. For the analysis of the chemical substance and product manufacturing sector 3.756 observations (376 companies per year on average) were considered in the 2011-2020 period. In addition, a total of 513.895 observations were considered as a market. The provinces of Guayas, Pichincha and Azuay had the largest number of observations (41,85%, 40,42% and 5,17% respectively). The financial information was obtained from the Superintendence of Securities and Insurance Companies (2021) and companies were eliminated according to the authors' criteria: companies without financial information or that did not present activity. Table

**Table 1** shows the subsectors that make up the sector under analysis.

**Table 1**

*Classification of the chemical substance and product manufacturing sector*

<b>ISIC</b>	<b>Description</b>
C201	Manufacture of basic chemicals, fertilizers and nitrogen compounds, and plastics and synthetic rubber in primary forms
C2011	Basic chemical manufacturing
C2012	Manufacture of fertilizers and nitrogen compounds.
C2013	Manufacture of plastics and synthetic rubbers in primary forms
C202	Manufacture of other chemicals
C2021	Manufacture of pesticides and other chemical products for agricultural use
C2022	Manufacture of paints, varnishes and similar coating products, printing inks and fillers
C2023	Manufacture of soaps and detergents, cleaning and polishing preparations, perfumes and toilet preparations
C2029	Manufacture of another chemical products NCP
C203	Manufacture of artificial fibers
C2030	Manufacture of artificial fibers

Source: Superintendency of Companies, Securities and Insurance (2021)

### **Calculation methodology**

The market risk was determined by means of the Beta coefficient, in addition, the minimum expected return was calculated by means of the *CAPM*, which basically indicates that the expected return of an asset is equal to the risk-free rate plus a premium for the risk. The risk premium is the difference between the market return and the risk-free rate, multiplied by the level of risk represented by the Beta coefficient. The model is formulated as follows:

$$E(R_i) = R_f + \beta_i * (E(R_m) - R_f) \quad (1)$$

Where:

- $E(R_i)$  = Minimum expected return on security i.
- $R_f$  = Yield of the risk-free security.
- $E(R_m)$  = Expected return on the market portfolio.
- $\beta_i$  = Measure of systematic risk.

The calculations were made in periods of 5 years in order to analyze existing variations in the levels of risk and return. In addition, unlevered Betas were used, since interest and taxes were not considered to calculate the yield. In the calculation of the Beta coefficient an adjusted ROE was used, as shown in formula 2:

$$ROE_{adjusted} = \frac{\text{Utilidad operativa (sin impuestos)}}{\text{Patrimonio inicial}} \quad (2)$$

In the results of the Beta coefficient, it should be considered that:

- Negative Beta: A Beta coefficient less than 0 indicates an inverse relationship to the market.
- Beta equal to zero: the asset has no risk.
- Beta equal to 1: represents the volatility of a representative market index.
- Beta greater than 1: reflects a higher volatility than that of the market.

The leveraged Beta coefficient was also calculated. According to Martínez et al. (2014) , the leveraged Beta coefficient of the stock ( $\beta_{levered}$ ) can be calculated as a function of the Beta without leverage ( $\beta_{unlevered}$ ) and the debt ratio (D/E).

$$\beta_{levered} = \beta_{unlevered} * [ 1 + ((1 - T) * \frac{D}{E}) ] \quad (2)$$

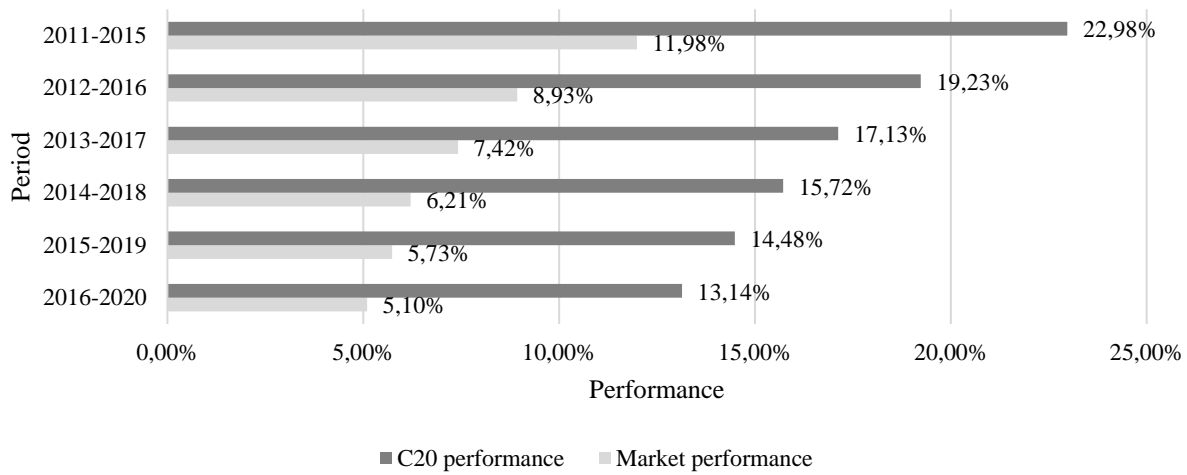
## Results

### *Market performance ( $R_m$ )*

To determine market performance, the adjusted ROE of all companies in the corporate sector of Ecuador was used. Figure 1 shows a decreasing trend; in the period 2011 - 2015 the highest return is given (11,98% and 22,98% respectively), while in the last period the lowest (5,10% and 13,14% respectively). As can be seen, the performance of the C20 sector is higher than that of the market as a whole.

### **Figure 1**

#### *Market performance ( $R_m$ ) and sector C20*

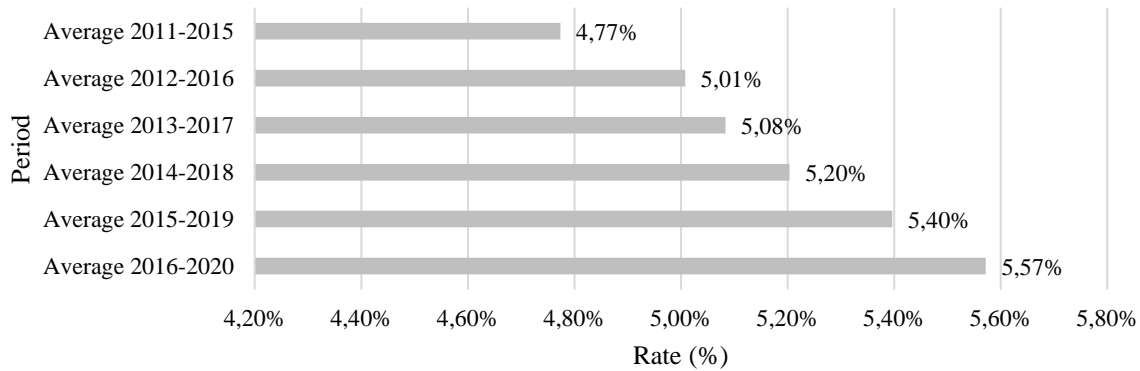


Source: Superintendency of Companies, Securities and Insurance (2021)  
 Free rate ( $R_f$ )

The Central Bank of Ecuador (2021) was considered as the risk-free rate . Figure 2 shows the values:

**Figure 2**

*Risk-free rate (  $R_f$  )*



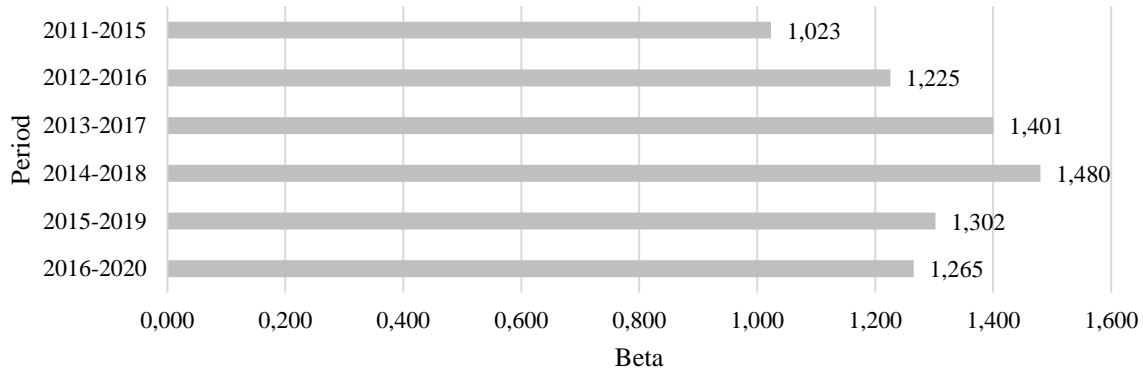
Source: Superintendency of Companies, Securities and Insurance (2021)

*Beta coefficient (  $\beta$  )*

The Beta coefficient of the C20 sector is greater than 1 in the 6 periods analysed, which means that companies in the chemical substance and product manufacturing sector are riskier than the market as a whole. If the last period, 2016-2020, is considered, for each percentage point that the performance of companies in Ecuador varies, the performance of companies in the C20 sector will vary 1,265%.

**Figure 3**

*Beta coefficient of sector C20*

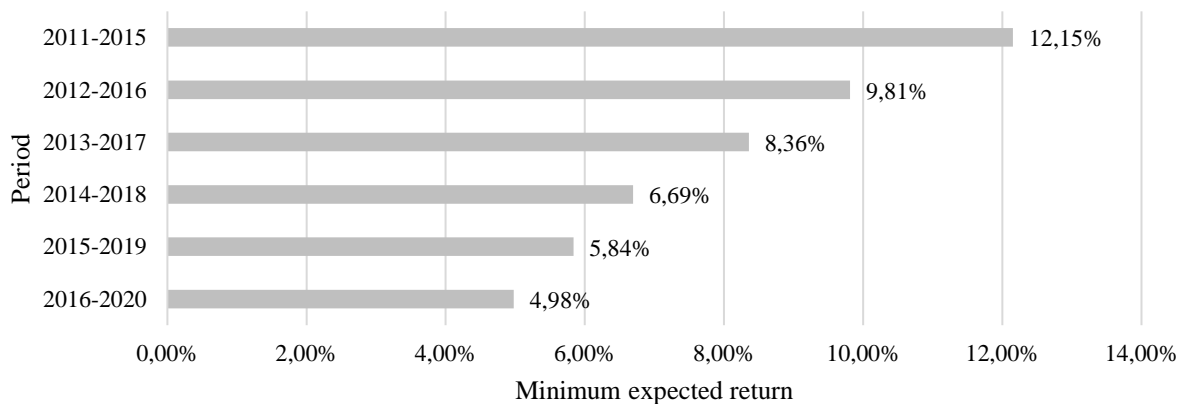


Source: Superintendency of Companies, Securities and Insurance (2021)

The minimum expected return of the C20 sector shows a decreasing trend, a value mainly influenced by the risk premium, which is lower, since the market return decreases over time.

**Figure 4**

*Minimum expected return of the C20 sector*



Source: Superintendency of Companies, Securities and Insurance (2021)

By applying formula 3, the leveraged Beta coefficient was obtained, and by applying formula 1, the minimum expected return was obtained: (See Table 2 and Table 3)

**Table 2**

*Summary of market risk calculations*



Period	Debt share	Equity participation	Tax rate
2011-2015	32.50%	67.50%	35.04%
2012-2016	32.97%	67.03%	38.71%
2013-2017	33.61%	66.39%	41.17%
2014-2018	33.79%	66.21%	43.79%
2015-2019	34.42%	65.58%	46.66%
2016-2020	34.48%	65.52%	46.65%

Source: Superintendency of Companies, Securities and Insurance (2021)

**Table 3**

*Summary of market risk calculations*

Period	Levered Beta	CAPM
2011-2015	1,343	14.46%
2012-2016	1,595	11.26%
2013-2017	1,818	9.33%
2014-2018	1,905	7.12%
2015-2019	1,666	5.96%
2016-2020	1,620	4.81%

Source: Superintendency of Companies, Securities and Insurance (2021)

Table through the CAPM.

**Table 4** presents a summary of the market risk calculations, in addition to the minimum expected return obtained through the CAPM.

**Table 4**

*Summary of C20 Sector Market Risk Calculations*

Period	Unlevered Beta	CAPM 1	Levered Beta	CAPM 2
2011-2015	1,023	12,15%	1,343	14,46%
2012-2016	1,225	9,81%	1,595	11,26%
2013-2017	1,401	8,36%	1,818	9,33%
2014-2018	1,480	6,69%	1,905	7,12%
2015-2019	1,302	5,84%	1,666	5,96%

---

2016-2020	1,265	4,98%	1,620	4,81%
-----------	-------	-------	-------	-------

---

Source: Superintendency of Companies, Securities and Insurance (2021)

### Conclusions and discussion

When an agent accumulates monetary surpluses or wealth there are three alternatives: keep these surpluses with the certainty that they are under his control, but an opportunity cost would be incurred; take these resources to a deposit in the financial system with which an interest or yield would be received; and invest those resources in an asset in the stock market and obtain a return that can be fixed or variable (Alvares et al., 2004). This last alternative, however, implies a certain level of risk, which must be managed in order to reduce it. Why it takes more risk? The answer lies in the fact that the investor expects a higher return when it increases and a lower return when it decreases. In this context, Poquechoque (2020) asserts that without a systematic risk indicator investments in general become riskier.

In this investigation, in order to determine the market risk and the expected minimum return of the chemical substance and product manufacturing sector the CAPM was used, which is widely accepted and considered of great importance in the financial area (Ramírez & Serna, 2012; Támara et al., 2017; Botello & Guerrero, 2021; Grant et al., 2021); furthermore, the model forms the theoretical basis underlying the most common approach to estimating the level of the cost of capital (Binz, 2020).

In developing countries, risk assessment is a complicated issue because the financial markets are smaller and have incipient development, in addition, it must be considered that these economies are volatile and, therefore, productive projects will be riskier (Botello & Guerrero, 2021). Unlike developed markets, little information is available in emerging markets, and they are also subject to frequent regime changes with reversals in fiscal, monetary, and trade policies (Chang & Galindo, 2018). At present, the little development of the Ecuadorian stock market makes the operational functions inefficient, due to the fact that stock negotiations are not listed within the same Stock Exchange (Valverde & Caicedo, 2020). Considering this scenario, the calculation of an accounting Beta is proposed in this research based on financial information obtained from the Superintendency of Companies, Securities and Insurance (2021).

The Beta coefficient corresponds to the portion of the asset's risk that is correlated with the general market risk. In this case, the correlation that exists between the manufacturing sector of chemical substances and products and the market, represented by the total number of corporate companies in Ecuador, is studied. Obviously, when intervening in the market or the economy as a whole, this portion of risk cannot be avoided through diversification. With respect to the use of accounting Betas, deficiencies must be considered. Tamara et al. (2017) assert that this approach has three problems: earnings in companies tend to be smoothed with respect to the underlying value of the company, which produces a biased Beta coefficient, companies have non-operational factors that can influence earnings from the accounting point of view, and the consolidation period of accounting profits is carried out quarterly and/or annually, which implies regressions with few observations.

Regarding the results obtained, the Beta coefficient of the C20 sector is greater than 1 in the 6 periods analyzed, only the period 2011-2015 presents a Beta close to 1 (1.023). These values indicate that companies in the chemical substance and product manufacturing sector are riskier than the market as a whole. When comparing the yields of each of the periods analyzed and the minimum expected yield obtained through the CAPM, the sector has a better performance since it has a higher yield than required, that is, value is created.

The results obtained will serve as a reference and support for business decision-making, as well as to know the level of demand of projects that are in the analyzed sectors. Among the implications and limitations of the research, it should be considered that the financial balances have an annual periodicity, which limits the number of variables that intervene in the study. In addition, the CAPM does not consider the special characteristics of micro and family businesses, as mentioned by Wong and Chirinos (2016) :non-monetary objectives, long investment periods, lack of diversification, among other factors, that distinguish this group of companies.

### Bibliographic References

- Al-Nassar, N. S., & Makram, B. (2022). The COVID-19 outbreak and risk–return spillovers between main and SME stock markets in the MENA region. *International Journal of Financial Studies*, 10(1). <https://doi.org/10.3390/IJFS10010006>
- Álvarez García, R. D., Ortega Oliveros, G. A., Sánchez Ospina, A. M., y Herrera Madrid, M. (2004). Evolución de la teoría económica de las finanzas: una breve revisión. *Semestre Económico*, 7(14), 105–127. <https://bit.ly/3D4pIwY>
- Apergis, N., & Rehman, M. U. (2018). Is CAPM a behavioral model? Estimating sentiments from rationalism. *Journal of Behavioral Finance*, 19(4), 442–449. <https://doi.org/10.1080/15427560.2018.1431885>
- Central bank of Ecuador. (2021). *Statistics* . <https://www.bce.fin.ec/>
- Binz, T. (2020). How do firm and market characteristics affect airports' Beta risk? *Competition and Regulation in Network Industries*, 21(3), 297–312. <https://doi.org/10.1177/1783591720941678>
- Botello, H., & Guerrero, I. (2021). CAPM model to assess the risk of investors based on accounting information before and after IFRS in Colombian banks. *Latticework*, 17(1), 122–135. <https://bit.ly/3MFBKA1>
- Breeden, D. T, Gibbons, M. R, & Litzenberger, R. H (1989). Empirical tests of the consumption-oriented. *The Journal of Business*, 44(2), 231–262. <https://doi.org/10.1111/j.1540-6261.1989.tb05056.x>
- Brenes, H. (2019). The beta coefficient ( $\beta$ ) as a measure of systematic risk: A demonstration that the value of the systematic risk of the market is equal to one. *REICE: Electronic Journal of Research In Economic Sciences*, 6(12), 1–20. <https://doi.org/10.5377/reice.v6i12.7473>
- Cartes, F.H.H. (2012). Empirical contrast of the CAPM in the Chilean stock market. *Ingeniare: Chilean Journal of Engineering*, 20(2), 255–266. <http://dx.doi.org/10.4067/S0718-33052012000200012>
- Cenesizoglu, T., & Reeves, J. J. (2018). CAPM, components of beta and the cross section of expected returns. *Journal of Empirical Finance*, 49, 223–246.

- 
- <https://doi.org/10.1016/j.jempfin.2018.10.002>
- Chang, A., & Galindo, H. (2018). (C)CAPM vs CAPM: Which model best reflects the performance of stocks in emerging markets? *IECOS Magazine*, 19, 19-35. <https://doi.org/10.21754/iecos.v19i0.1164>
- Firacative, E. F. (2015). *Aplicación del modelo CAPM para la valoración de acciones en el mercado integrado latinoamericano MILA*. [Tesis de Maestría, Universidad Nacional de Colombia]. <http://www.bdigital.unal.edu.co/46708/>
- Grant, A., Johnstone, D., & Kwon, O. K. (2021). How an idiosyncratic (zero-beta) risk can greatly increase the firm's cost of capital. *Australian Journal of Management*, 47(4). <https://bit.ly/3DemM1b>
- Lintner, J. (1965). The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets: a reply. *The review of Economics and Statistics*, 51(2), 222-224. <https://doi.org/10.2307/1926735>
- Martinez, C. E., Ledesma, J. S., & Russo, A. O. (2014). Calculating beta models to apply in Capital asset pricing model: the case of Argentina. *Managerial Studies*, 30(131), 200–208. <https://doi.org/10.1016/j.estger.2014.03.002>
- Mejia, S., Arias, A., Felipe, J., Villegas, F., & Alberto, J. (2005). Evaluation of financial risks in the Colombian electricity market. *Scientia Et Technica*, 27, 162–168.
- Mossin, J. (1966). Equilibrium in a Capital Asset Market. *The Econometric Society*, 34(4), 768–783. <https://doi.org/http://dx.doi.org/10.2307/1910098>
- Pereiro, L. (2010). The beta dilemma in emerging markets. *Journal of Applied Corporate Finance*, 22, 110–113. <https://doi.org/10.1111/j.1745-6622.2010.00307.x>
- Pinos, L., Reyes, M., Tonon, L., & Orellana, I. (2021). Application of the CAPM model to the manufacturing sector of other non-metallic mineral products in Ecuador: period 2009 - 2019. *INNOVA Research Journal*, 6(3.1), 131–150. <https://doi.org/10.33890/innova.v6.n3.1.2021.1806>
- Poquechoque, L. (2020). Beta coefficient calculation estimate for companies listed on the Bolivian Stock Exchange. *Perspectives Magazine*, 45, 61–84.
- Ramirez, A., & Serna, M. (2012). Empirical validation of the CAPM model for Colombia 2003-2010. *Echoes of Economics*, 16(34), 49–74. <https://doi.org/10.17230/ecos.2012.34.3>
- Sandoval, E., Vasquez, A., & Sabat, R. (2015). Integration of the stock markets of Chile, Colombia and Peru in the Latin American integrated market (MILA). *Innovate*, 25 (1Spe), 71–84. <http://dx.doi.org/10.15446/innovar.v25n1spe.53195>
- Santos, L., Fischberg, F., Cyrino, F., & Munoz, C. (2019). Conditional pricing model with heteroscedasticity: Evaluation of Brazilian funds. *RAE Magazine of Business Administration*, 59(4), 225–241. <https://doi.org/10.1590/S0034-759020190402>
- Sharpe, W. (1964). Capital asset prices: a theory of market equilibrium under conditions of risk. *The Journal of Finance*, 19(3), 425–442. <https://doi.org/10.1111/j.1540-6261.1964.tb02865.x>
- Solomon, D. C., & Muntean, M. (2012). Assessment of financial risk in firm's profitability analysis. *Economy Transdisciplinarity Cognition*, 15(2), 58–67.
- Superintendency of Companies, Securities and Insurance (2021). *Información portal*. <https://www.supercias.gob.ec/portalscv/>
- Tamara, A., Chica, I., & Montiel, A. (2017). Beta calculation methodology: Beta of assets, leveraged beta and beta corrected for cash. *Spaces*, 38(34), 15.
- Valverde, J., & Caicedo, F. (2020). Calculation of the betas of the capital asset pricing model as

- an indicator of profitability of companies linked to the ecuadorian stock exchange. *Science and Technology University*, 24(107), 79–87. <https://doi.org/10.47460/uct.v24i107.417>
- Vendrame, V., Guermat, C., & Tucker, J. (2018). A conditional regime switching CAPM. *International Review of Financial Analysis*, 56, 1–11. <https://doi.org/10.1016/j.irfa.2017.12.001>
- Villagomez, B. (2014). The risk measured through the CAPM model adjusted for emerging markets. *Economics and Business*, 5(1), 70.
- Vitoria, R., Bressan, A. A, & Iquiapaza, R. A. (2020). Do state-owned enterprises in Brazil require a risk premium factor? *Brazilian Business Review*, 17(5), 488–505. <https://doi.org/10.15728/bbr.2020.17.5.1>
- Wong, D., & Chirinos, M. (2016). Do the models based on the CAPM adequately value family businesses? *Innovate*, 26(61), 65–81. <https://doi.org/10.15446/innovar.v26n61.57167>