

Study of the Algerian Stock Exchange Volatility According to the Capital Asset Pricing Model over the period 2020 - 2024

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Abstract:

This study uses the beta coefficient derived from the capital asset pricing model, which aims to improve the trade-off between return and systematic risk, as it is possible to know the returns of stocks compared to the systematic risks of the stock, To discern the shares movements of the companies listed on the Algerian Stock Exchange over the period 2020-2024 compared to the systematic risks, the beta coefficient was calculated using the historical returns method for the five companies' shares. It was found that the value of beta for all companies is less than one, which indicates that the volatility of the returns of all securities of the five companies (Saidal, Biopharm, AOM Invest, El Aurassi Hotel, and Alliance Assurances) is less than the market volatility. Thus, market risks are greater than these companies' shares risks. Moreover, we also found that the volatility of returns of Biopharm and Alliance Assurances is in the same trend as the market volatility, while the volatility of returns of the other companies (Saidal, AOM Invest, and El Aurassi Hotel) is opposite to the market trend.

Keywords: Algerian Stock Exchange, model CAPM, beta coefficient, and volatility of returns.

Jel Classification Codes : L53 ; L78 ; M00.

Résumé:

Cette étude utilise le coefficient bêta dérivé du modèle d'évaluation des actifs financiers, qui vise à améliorer le compromis entre le rendement et le risque systématique, car il est possible de connaître les rendements des actions par rapport aux risques systématiques de l'action. Pour discerner les mouvements des actions des entreprises cotées à la Bourse d'Alger durant la période 2020-2024 par rapport aux risques systématiques, le coefficient bêta a été calculé en utilisant la méthode des rendements historiques pour les actions de cinq entreprises. Il a été constaté que la valeur du bêta pour toutes les entreprises est inférieure à un, ce qui indique que la volatilité des rendements de toutes les valeurs mobilières des cinq entreprises (Saidal, Biopharm, AOM Invest, El Aurassi Hôtel et Alliance Assurances) est inférieure à la volatilité du marché. Ainsi, les risques de marché sont supérieurs aux risques des actions de ces entreprises. De plus, nous avons également constaté que la volatilité des rendements de Biopharm et d'Alliance Assurances suit la même tendance que la volatilité du marché, tandis que la volatilité des rendements des autres entreprises (Saidal, AOM Invest et El Aurassi Hôtel) est opposée à la tendance du marché

Mots clés : Bourse Algérienne, modèle CAPM, le coefficient bêta, et la volatilité des rendements

Jel Classification Codes : L53 ; L78 ; M00.

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I. Introduction

In Following the emergence of portfolio theory by Harry Markowitz, the capital asset pricing model CAPM was devised by Sharpe in 1964, developed by Lintner in 1965, Mossin in 1966, and then Black in 1972. This model is based on a mathematical equation that includes one independent variable, which is used to evaluate investments and estimate their expected return.

The CAPM model is a tool for measuring the required return when evaluating a specific investment and the systematic risks accompanying it, as it links the return of a specific stock to the return of the financial market. This model led to the emergence of beta coefficient for measuring risk. It measures the response of the return of a specific financial asset to market return.

Given the importance of knowing the fluctuations that occur in the shares of companies listed on the Algerian Stock Exchange, by following the companies listed over the last five years, we found five listed companies: Saidal (SAI), Biopharm (BIO), El Aurassi Hotel (AUR), AOM Invest (AOM), and Alliance Assurances (ALL).

Based on the contribution of beta coefficient in terms of determining the volatility of these companies' securities, the problem of the study is embodied in the following main question:

How responsive are the returns of shares of companies listed on the Algerian Stock Exchange to the variances occurring in the Algerian market over the period 2020-2024?

To answer this problem, we relied on the beta coefficient to measure the volatility of the shares of the five companies listed on the Algerian Stock Exchange, derived from the capital asset pricing model. Therefore, we will first address the theoretical aspect of the model, the concept of the beta coefficient and the meaning of the values it can take. Secondly, we will move on to the applied aspect in which we will address the companies listed on the Algerian Stock Exchange over the period 2020-2024 and calculate the returns on their securities. Then calculate the degree of sensitivity of the returns on their securities compared to market returns.

II. Capital Asset Pricing Model CAPM:

II.1 Definition

It is a model used to analyse the relationship between expected return and risk (Fama, 2004, p 18). The risk that the model relies on is systematic risk or market risk. Thus, risks that impact all securities as a result of a common economic, political, social factor or else, since they affect the economy as a whole, such as wars, inflation, depression, etc. Therefore, these risks are on all securities and cannot be avoided by using diversification.

The required return according to this model consists of two main parts:

- Risk-free return being the minimum return that can be achieved without significant risk, such as in the case of Treasury bills.
- Risk premium considering the investment yields a return greater than the risk-free return. This premium is achieved as the investor accepts to bear the risks.

II.2 The Model Mathematical Formula: it is written as follows (Xu, 2021, p 21):

$$R_i = RF + \beta(R_m - RF)$$

It can be written in the form:

$$R_i = RF(1 - \beta) + \beta R_m$$

Whereas:

R_i : Equity return rate

RF : Risk free return rate

R_m : Market return rate is the average of the stock price rates in the market under study.

β : The degree of sensitivity of a stock's return to the market return (the stock's beta)

Indeed, the model gives the systematic risks great importance in influencing the returns of securities and neglects unsystematic risks, as systematic risks can be reduced by using portfolio theory in diversifying its securities.

Systematic risk is measured using β coefficient whose values range from negative to positive, whereas (Fama, 2004, p 25) :

$$\beta = \frac{Cov(R_i, R_m)}{\sigma^2(R_m)}$$

If $\beta > 1$: The return on the security will be less volatile compared to the return on the market portfolio.

If $\beta = 1$: The return on the security will fluctuate up and down according to the volatility of the portfolio's returns in the market.

If $\beta < 1$: The return on the security will be more volatile compared to the return on the market portfolio.

The table below shows the relationship between market return and stock return:

Table (01): The relationship between market return and stock return

Beta		Notes	
2	$\beta > 1$	The stock moves in the same trend as the market	Strong market response
1	$\beta = 1$		Same market response
0.5	$\beta < 1$		Half market response
0	$\beta = 0$	The stock is not affected by market movement	
-0.5	$\beta < 1$	The stock moves in the opposite trend of the market movement	Half market response
-1	$\beta < 1$		Same market response
-2	$\beta < 1$		Poor market response

Source: Literature review method.

The market beta is always equal to one, because the covariance of the market portfolio with itself is equal to the variance of the market portfolio, and all other beta values are considered by comparing them to this value of 1, that can be positive or negative. Most betas fall between 0.5 and 2. The return of a stock with a beta value of 0.5 is expected to vary by half the variation of the market portfolio, and so on.

II. 3 Model Assumption (shapiro, p 05):

- The investor evaluates financial portfolios on the basis of two variables: return and risk. He accordingly distributes the potential return in a normal distribution.
 - The investor's goal is to obtain the highest return. If he chooses between two portfolios that are identical in all respects except for the return, he will choose the portfolio with the highest return.
 - Financial assets are divisible, meaning that an investor can buy any quantity of securities, regardless their size.
 - The market consists of a group of investors, each of whom tries to avoid risk and maximize the expected benefit during the same period, by reducing the variance during the same period.
 - The investor can lend and borrow based on the risk-free return rate, which is the same for all investors.
 - The market is efficient. Information reaches investors quickly and cost-free.
 - Investors have similar and homogeneous expectations. They have the same perception of the expected return and standard deviations of the securities traded.
- 1- No taxes on profits and no transaction costs.

II. 4 The Model Use:

The capital asset pricing model can be used for:

- Calculating the cost of capital for common stock, where the required rate of return on stocks by investors is the cost of capital for common stocks from the point of view of the company issuing this stock.
- Determining real stock prices.
- Evaluating investment in securities considering the required rate of return calculated through these models as a discount rate by which the net present value and the internal rate of return are calculated.

III. Development of Companies Listed on the Algerian Stock Exchange over the period 2020-2024:

Several international reports described the Algerian financial market as a semi-emerging market, as the stock exchange activity was confined to limited subscription operations for some Algerian companies. Some of which are public and others are private. These companies belong to sectors of pharmaceutical industry, hotels, insurance and food industry. Companies that have been present during the last five years are represented in the following table:

Table (02): Development of Number of Companies Listed over the period 2020-2024

Year	Number of companies listed on the Algerian Stock Exchange	Rate of companies' number increase
2019	6 companies (SAIDAL, El Aurassi Hotel, Alliance Assurances, NCA Rouiba, Biopharm, AOM Invest)	/
2020	6 companies (SAIDAL, El Aurassi Hotel, Alliance Assurances, NCA Rouiba, Biopharm, AOM Invest)	0
2021	5 companies (SAIDAL, El Aurassi Hotel, Alliance Assurances, Biopharm, AOM Invest)	-0.16
2022	5 companies (SAIDAL, El Aurassi Hotel, Alliance Assurances, Biopharm, AOM Invest)	0
2023	5 companies (SAIDAL, El Aurassi Hotel, Alliance Assurances, Biopharm, AOM Invest)	0
2024	6 companies (SAIDAL, El Aurassi Hotel, Alliance Assurances, Biopharm, AOM Invest, CPA Bank)	0.2

Source: Prepared by the researcher based on data from the Algerian Stock Exchange

We note, from the table above, the small number of companies listed on the Algerian Stock Exchange for the period under study. There were only 6 companies for the period from 2020 to 2024. We note a decrease by six companies from the total number of companies registered on the Algerian Stock Exchange since its entry into operation in 1998. 11 companies were registered in that year (Eriad Setif, Saidal, Sonatrach, El Aurassi Hotel, Algérie Télécom, Sonelgaz, Air Algérie, DAHLI SpA, NCA Rouiba, Biopharm, AOM Invest). Yet, only 6 companies were registered in 2020. They decreased to 5 in 2021 due to the exit of Rouiba Company, to return in 2024 to six following the entry of the Algerian Popular Credit Bank CPA.

If we follow the development of registered companies over the period 2020-2024, we find that there are 5 companies that were registered throughout the period, represented by the public pharmaceutical company Sidal, active in the pharmaceutical industry, the private joint-stock company Alliance Assurances, active in the insurance sector, AOM Invest, specialized in studying the development and exploitation of tourism projects related to mineral water stations, El Aurassi Hotel, active in the field of services, and Biopharm, active in the pharmaceutical industry. Each of them will be discussed in detail below:

– **El Aurassi Hotel Management:**

El Aurassi Hotel was opened in 1975. It operated under the supervision of the Ministry of Tourism and Culture. The Ministry managed the establishment via the National Company for Tourism and Hotels “SONATOUR” until 1977, the National Company for Tourism & Hotel “ALTOUR” until 1979, the National Office for Conferences and Seminars “NCCB” until 1983. In that year, within the framework of the organizational restructuring process, the hotel was described as a socialist establishment that led to the creation of the Hotel Management Establishment EGH. In 1991, the hotel amended its legal status and became a public economic establishment under the form of a joint-stock company with a capital of 40 million DZD. Its social name became El Aurassi Hotel Management Corporation. In 1995, the hotel was placed under the supervision of the Holding Company for Services, the State being its sole shareholder.

However, in line with the public authorities’ orientations towards total disengagement from the State, through various laws relating to total or partial privatization, El Aurassi Corporation was chosen by a decision of the National Council for State Contributions in 1998 to be listed on the stock exchange and to offer no more than 20% of its capital for public subscription. In 1999, its capital was opened up for sale by offering the equivalent of 20% of its capital. In 2000, fulfilling the acceptance conditions stipulated in the stock exchange rules; its capital bond was listed on the official quotation list . (Wasila, 2018 p151)

– **Alliance Assurances:** It is a joint-stock company with an initial capital of 500 million DZD, established in July 2005 by a group of national investors. Its

capital was raised to 800 million DZD in 2009. The year 2010 witnessed another raise in its capital to reach 2.2 million DZD for damage insurance activity. This raise was achieved by resorting to public savings. In November 2010, Alliance Assurances began raising its capital through public offering. The offering amount was 31% of its capital. In March 2011, having met the stipulated acceptance conditions, the capital bond of Alliance Assurances was included in the official quotation list (Wasila, 2018 p151)

– **Saidal Group:** The Algerian Central Pharmacy was established in 1969 by virtue of a presidential decree entrusting it with the task of enabling the State's monopoly on the import, manufacture and marketing of pharmaceutical products for human use. Within the framework of its production tasks, the pharmacy established El Harrach production unit in 1971. Moreover, it purchased in two stages, in 1971 then 1975, the Biotec and Pharmal units. Following the restructuring of the Algerian Central Pharmacy, its production branch became known as the National Company for Pharmaceutical Production. Its mission was to monopolize the production and distribution of medicines and similar and reactive substances, to supply the Algerian market in an adequate and regular manner. Later on, the company changed its name in 1985 to Saidal.

Following the implementation of the economic reforms of 1989, Saidal became a public economic institution with independent management and was chosen to be among the first national companies to obtain the status of a joint-stock company. In 1993, amendments were made to the company's articles of association, enabling it to participate in all industrial or commercial operations related to corporate purposes by establishing new companies or subsidiaries. In February 1999, Saidal Group opened its capital through a public offering for sale. The offering amount was 20% of the group's capital. In September 1999, having met the acceptance conditions stipulated in the stock exchange regulations; Saidal Group's capital bond was listed on the official quotation list (Wasila, 2018 p151)

– **Biopharm:** An Algerian Pharmaceutical Company. An industrial and commercial group that began investing in the pharmaceutical sector in the 1990s. Currently, it has a production unit according to international standards, and a

distribution network that includes wholesalers and pharmacies. After nearly two decades of intensive activity, Biopharm reached a stage that requires its restructuration. Its capital is estimated at 104,375,000.5 DZD, divided into 25,521,875 shares with a nominal value of 200 DZD/share. The group's shares (20%) were listed, for the first time, on the Algerian Stock Exchange in April 2016 (Kashroud., 2022 p224).

– **AOM Invest:** Established in 2011. AOM Invest is a company specialized in studying, developing and exploiting tourism projects in mineral water stations. It also collaborates with other international development centres. Moreover, it specializes in developing studies to build tourist destinations. The company was listed on the Algerian Stock Exchange in 2018. It is the only corporation among the small and medium companies to be listed due to the strict conditions imposed by the Algerian Stock Exchange, which are not usually available in small and medium companies, such as being a joint-stock company and opening its capital by 10% as a minimum on the day of listing on the stock exchange. In addition to publishing its financial statements for the past two years (Ben Amar, 2023 p 1067).

IV. Calculating Response of Shares of Companies Listed on the Algerian Stock Exchange to Market Return:

Before discussing the responsiveness of stock returns of companies listed on the Algerian Stock Exchange (Saidal, Alliance Assurances, AOM Invest, El Aurassi Hotel and Biopharm) over the period 2020-2024, we address the monthly returns development of these stocks over the period under study, and then compare them with return development of the Algerian market represented by Dz Index, as follows:

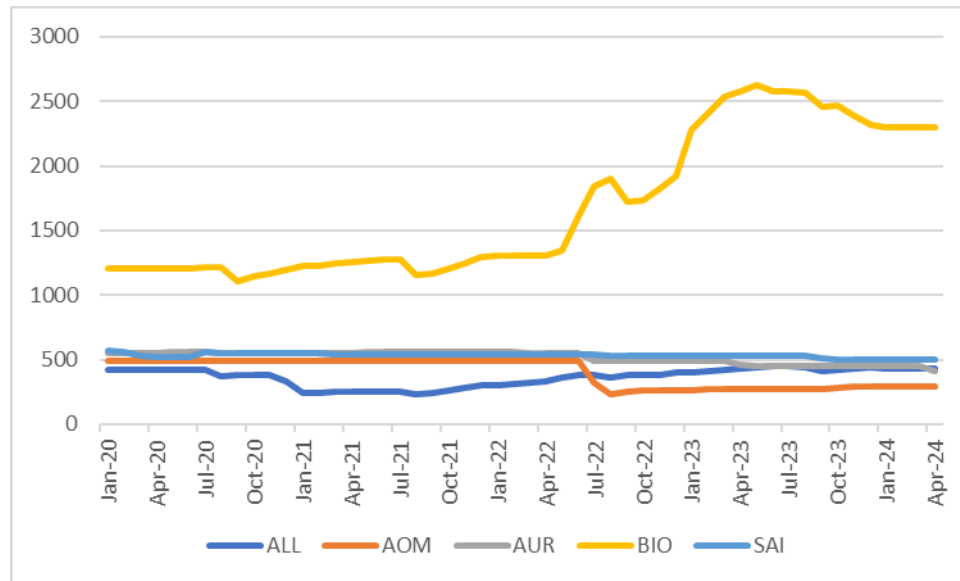
- Analysis of return rates development for the companies under study:

The returns on the shares of the five companies listed on the Algerian Stock Exchange over the period 2020-2024 were obtained using the following law:

$$R_i = \frac{Cour_{it} - Cour_{it-1}}{Cour_{it-1}}$$

Considering $Cour_{it}$ represents the return rate of the concerned corporation by calculating its return, which is a monthly average price. The data on the share prices of the five companies were obtained from the Algerian Stock Exchange on their website. The figure below shows returns development for the companies listed on the Algerian Stock Exchange over the period under study:

Figure 01: Returns development for the companies listed on the Algerian Stock Exchange over the period 2020-2024



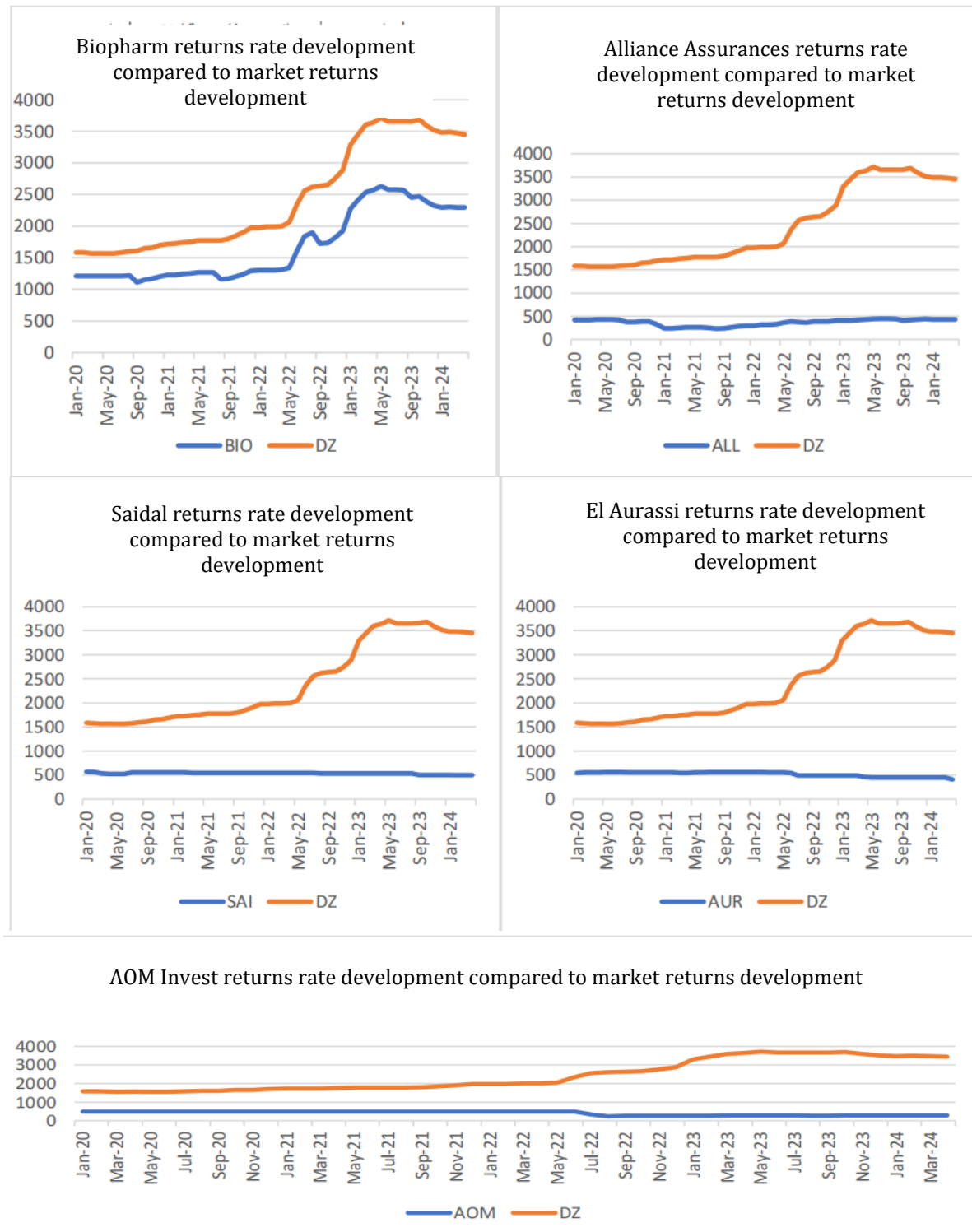
Source: Prepared by the researcher based on data from the Algerian Stock Exchange

– **Analysis of returns rate development for the five listed companies compared to market return:** The Algerian market return over the period 2020-2024 was obtained using the following law:

$$R_{dz} = \frac{Cour_{dzt} - Cour_{dzt-1}}{Cour_{dzt-1}}$$

Considering $Cour_{dz}$ represents the price of Dz index over the period P, which is a monthly average price. The data were obtained from the Algerian Stock Exchange. The figure below shows returns development for the companies listed on the Algerian Stock Exchange compared to market return development over the period under study:

Figure 02: Returns rate development for the five companies listed on the Algiers Stock Exchange compared to market returns development over the period 2020-2024



Source: Prepared by the researcher based on data from the Algerian Stock Exchange

Through the graphic curves in Figure (02), it is noted that the market returns development, or the Algerian Stock Exchange returns represented by the returns of Dzair Index, throughout the period 2020-2024, were higher than the development of all returns of the shares of listed companies. Their fluctuations were more than the returns fluctuations of the listed securities shares, except for the Biopharm' share returns which were similar to their fluctuations.

- Descriptive analysis of study variables:

Table(03): Descriptive statistics of study variables

	RALL	RAOM	RAUR	RBIO	RSIA	RDZ
MIN	233,4615	229	408,75	1110	499	1568,703
MAX	447	490	560	2631	568,8462	3715,122
AVERAGE	366,4013	399,4478	517,35	1678,495	534,6793	2428,416
STANDARD DEVIATION	70,60578	107,421	46,80327	550,9384	17,57484	831,1578
VARIANC	4889,308	11317,37	2148,421	297695,9	302,9351	677538,2

Source: Prepared by the researcher

IV. Calculating the shares beta for the five companies listed on the Algerian Stock Exchange over the period 2020-2024:

To calculate the systematic risk coefficient beta, the stock must have a historical period of listing in the market of not less than five years. If this condition is met, the degree of correlation between each of the stock return and the market return is calculated over this period. The aim of this is to measure the relationship between the degree of variance in the movement of the market return and the joint variance between the market return and the stock return. This was applied to the five companies listed on the

Algiers Stock Exchange (Saidal, Biopharm, AOM Invest, El Aurassi Hotel, and Alliance Assurances) during the period 2020-2024 as follows:

Table(04): Calculating the shares beta for the five companies listed on the Algerian Stock Exchange over the period 2020-2024:

	Saidal	Biopharm	AOM Invest	El Aurassi Hotel	Alliance Assurances
Covariance between stock return and market return	- 10670.8	445089.3	- 36200	- 80339.3	34218.62
Market Variation	677538.2	677538.2	677538.2	677538.2	677538.2
Beta coefficient	- 0,01575	0,656921	- 0,05343	- 0,11858	0,049533

Source: Prepared by the researcher based on data from the Algerian Stock Exchange

Having calculated the systematic risk coefficient beta for the five companies listed on the Algerian Stock Exchange (Saidal, Biopharm, AOM Invest, El Aurassi Hotel, and Alliance Assurances) over the period 2020-2024, it is clear that the beta value for all companies is less than one, which indicates that the volatility of all securities of the five companies is less than market volatility, i.e. market risks are greater than these companies' shares risks. The beta value for both Biopharm and Alliance Assurances is greater than 0, which indicates that the response of the two companies' securities is in the same trend as the market volatility, as beta value for Biopharm was 0.65, indicating that the volatility of Biopharm' securities returns is almost half market response, while beta of Alliance Assurances was 0.049, which is a value close to zero, indicating that the return on this company's stock is very weakly affected by the volatility occurring in the market returns. Nevertheless, we find the volatility of beta value for each of Saidal, AOM Invest, and El Aurassi Hotel, less than 0, which



indicates that the response of the three companies securities is opposite to market volatility trend, as beta value for El Aurassi Hotel was -0.11 which indicates that an increase in the market return by 1% led to a decrease in the stock return by 0.11%. Yet, beta values for each of Saidal and AOM Invest shares are -0.015 and -0.05 respectively, which indicates that the response of the volatility of the returns of Saidal and AOM Invest company securities is very weak to variables in the market return.

V. Conclusion:

Beta coefficient occupies a distinguished position in the stock market because it is one of the analysis tools that take into account the relationship between return and risk in securities and capital investments, in general. It is considered a direct indicator easy to understand without complications. But beta coefficient cannot be calculated for securities traded for less than five years. Thus, we were unable to calculate beta coefficient for the Algerian Popular Credit CPA Bank as it was recently listed on the Algerian Stock Exchange. It was calculated for the companies listed over the last five years, Saidal, Alliance Assurances, AOM Invest, El Aurassi Hotel, and Biopharm. It was concluded that the value of beta for all companies is less than one, which indicates that the volatility of the returns of all securities of the five companies (Saidal, Biopharm, AOM Invest, El-Aurassi Hotel, and Alliance Assurances) is less than the volatility of the market. Thus, market risks are greater than risks of shares of these companies. It was also concluded that the volatility of the returns of both Biopharm and Alliance Assurances is in the same trend as market volatility. While that of Saidal, AOM Invest and El Aurassi Hotel is against the market trend.

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