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THEORETICAL AND EMPIRICAL UNDERPINNINGS REGARDING STOCK MARKET FORECASTS AND PREDICTIONS

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Abstract: Current theories support an inverse relationship between the expected return on investment and the associated risk. The DCF valuation method highlights the fact that the value of the company is given by the ratio between the excess cash (at the numerator) and the risk assimilated by the capitalization rate (at the denominator). The modern portfolio theory MPT considers that the proportion of recommended securities is on a parabola in mean-variance space, the risk being assimilated to uncertainty. Practitioners assess the target and the risk (take profit/stop loss) based on the methods of technical analysis. We appreciate that these theories are divergent from each other, disconnected and therefore difficult to unify. Our approach, based on the probabilities associated with each level of future quotations, eliminates the disadvantages of current theories. The answer found is to try to establish as realistically as possible what the chances are that, over a certain period of time, a title will have a certain quotation (or be in a certain range). For reasons somewhat similar to those of sports betting, the conclusion that emerges from the article is that this approach, if well developed, gives superior results to those currently used. In subsequent studies, forecasting methods are to be developed, because we consider them the most important in the investment process.

Keywords: Valuation; Modern Portfolio Theory; Technical and Fundamental Analysis; Financial Bets; Target Probability.

JEL Classification: G11, G17, D53.

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1. Introduction

Any stock investment involves a *valuation*. No investor/speculator should set out without considering an estimate of the value of the security, whether theoretical or practical, scientific or profane, analytical or empirical. Or, at least, its tendency to increase or decrease. Therefore, valuation theories should be an important part of stock market life.

Once the investment is made, following it is essential. The analysis of the evolution of stocks/indices is related to *stock market theories*. Their role would be to set the time of entry/exit, to predict the change in the value of the shares, or at least to warn when the trend is about to change.

Once all this has been completed, the investor would like to know how it would be advisable to manage the available amounts and how to distribute them across various securities, sectors, markets available. This is the subject of *portfolio theories*, which seeks the logic behind how investments should be allocated.

It would be expected that the three major categories of theories that have implications for stock market investments/speculations will be closely linked. In reality, however, the connections between them are extremely fragile, each field having its own development, almost independent of the others (Turcaș, 2019).

In this article, we will analyze minority investments/stock market speculations. For the majority shareholder or for the one who wants to take full control of the company, the following considerations may not be correct. However, the latter must be regarded as a special investor, as the amount considered by him may not, in fact, have anything to do with the stock price.

The purpose of this article is to analyze the main theories of valuation, as well as stock market theories in order to observe their strengths and weaknesses. Also, in addition to the theoretical approach, this article presents and analyzes the concrete way of unifying these theories in practice, through empirical studies and based on the probabilities associated with future quotations.

The aim of this article was to build practical and empirical examples to support practitioners in eliminating the disadvantages of the main contemporary theories, through an approach similar to that of sports predictions.

The structure of this article is as follows: the first section is an introductory part in which the motivation of the topic, the purpose of the research and its objectives are presented. The second part addresses, from a theoretical perspective, certain important aspects of the literature such as the main approaches in valuation, stock market theories, portfolio theories but also the links between theories and aspects of unification of these theories. The third part is the empirical part of the study that addresses issues such as the importance and necessity of stock market forecasts and approaches to financial forecasts, the probability and benefits of probabilistic

forecasts, and finally a practical example. The last section of the article contains the conclusions and final considerations of the addressed issues.

2. Theoretical underpinnings and the current state of the art

2.1. Approaches in Valuation

Company valuation is a global, continental and national standardized process (IVSC, 2020), (TEGoVA, 2020), (ANEVAR, 2020). There are three main approaches:

- *The cost approach,* which sums up the market value of the assets. It is based on the principle that no investor will pay more for an asset than its replacement/substitution cost. It reflects the value of the company's past and present business and should be an important milestone for the majority of sellers.
- *The income approach* determines the value of the asset according to the profit it is expected to bring to the investor. The logic is that investing in a company is riskier than in AAA-rated government bonds. Therefore, the investor expects to be rewarded with a gain (the company's profit, paid or not in the form of dividends), in direct relation to the taken risk. It is an overview of the company's evolution and is a benchmark for the buyer, whether he is the majority shareholder (decision maker) or not. The scenario-based method develops multiple cash flow forecasts, which are then weighted by their probability of occurrence.
- *The market approach* compares the valuated company with similar ones (such as dimensions, field of activity, results, etc.), whose value/quotation is known. If you want to buy/sell the listed securities, the transaction will be made at market value, regardless of whether or not it has a correspondent in the reality of the company. Therefore, the quotation value is the only current benchmark for minority transactions.

A modern paper, which explains the application of valuation standards, is the one approached in the specialized studies of (Fazzini, 2018).

2.2. Stock Market Theories

The first hurdle in applying these approaches to the valuation of listed securities arises when we need to differentiate between the value of shares and the value of the company as a whole.

The market approach refers only to the value of the traded minority shares, not to the value of the company. The value defined by the stock exchange price of the shares does not represent the value of the company. The number of shares multiplied by the stock quotation is called the market capitalization, precisely to avoid confusion with the market value of the issuer.

The connection between the two values can be given by discounts or can be explained by stock market exuberance/panic if the market evolves rapidly. For the valuation of the company as a whole, it is possible to apply discounts/premiums (Pratt, 2009), respectively to consider the synergy in case of takeovers/mergers (Whitaker, 2012), (Garzella & Fiorentino, 2017).

The application of discounts is increasingly controversial, the synergy is known only to the buyer who makes the take-over, and stock market changes in periods when there are no announcements about the issuer or important market news in general, are simply logically inexplicable.

Thus, analysts, brokers and most investors/speculators have two types of views on stock market analysis:

- *Technical analysis*, in its most well-known version through graphical analyzes of the course, is based on the hypothesis that prices move in waves (trends), thus being possible to predict the evolution based on patterns, indicators and oscillators. There are thousands of platforms that offer, free or for a fee, graphical representations of stock quotes and that provide various graphical methods, designed to help the investment/divestment decision. We believe that the analysis must start from the overview (main trends) and then lead to the momentary movements (minor trends).
- *Fundamental analysis* consists of processing the issuer's financial data and economic considerations. The main methods are top-down (framing the company in the macro-environment) or bottom-up (analysis of the company, followed by its economic environment), and the link with stock quotations are given by stock indicators, the best known being Price Earning Ratio, Price / Book Value and Dividend Yield (Calhoun, 2020), (Coulon, 2020), (Rossi & Forte, 2016).

The two theories seem to be contradictory and are rarely used simultaneously by analysts. In our opinion, behavioral analysis is just as important (Cartwright, 2018), (Chen, 2016), especially in times of boom/crisis (herd behavior).

With the increase in the volume of automated trading, a series of modern theories are making their place in the stock markets: machine learning, game theory, neural networks, genetic algorithms, etc. In our opinion, these models are also an adaptation of statistical approaches, at a much higher level of finesse.

2.3. Portfolio Theories

Almost exclusively, they are based on statistical methods. The explanation lies in the fact that neither the above-mentioned theories can be unified into a unitary concept, from which to result what weight should be given to each security in a portfolio, nor the criteria on which its construction should be based.

A first attempt to systematize the portfolio problem was the famous *The Intelligent Investor*, revised and republished (Graham, 1976), much praised by Warren E. Buffett. The principle of investing in stocks and bonds in varying proportions depending on the phases of the market remains valid, but it becomes far too poor for the multitude of financial products offered to the public today.

The most well-known approach to in-stock selection is Modern Portfolio Theory, MPT. Based on the paradigm *«do not put all eggs in one basket»* (Fabozzi & Pachamanova, 2016), the theory proposes the selection of stocks based on the indifference curve (efficient border) drawn between profitability (return) and risk (variance). It is a purely statistical method, which requires the prediction of future quotations (including the correlation between securities - a problem not solved theoretically or empirically). Studies conducted in this regard are particularly representative (Elton, 2014), (Altăr, 2002), (Schulmerich, Leporcher, & Eu, 2015).

Paradoxically, the method most respected by theorists (MPT) is very close as a basis of the data used (stock quotes) to the most disregarded method by theorists (technical analysis - considered far too empirical and subjective in academia).

2.4. Links between Theories

For a rational investor, it is important to make the connection between all these theories, in order to estimate, weight, track and capitalize on stock securities. It is immediately clear that this task is more difficult than would be expected.

Valuation from an income-based approach considers that the value of a business is given by the income it can bring to financiers: shareholders and banks. The standards (ANEVAR, 2020), (IVSC, 2020), calculate the value of the company by converting future cash flows into a current, up-to-date value. No valuation approach is based on the forecast of future quotations, regardless of the method used for this forecast. Thus, a major logical discrepancy arises: we valuate the shares in order to know in which securities to invest, but we select the portfolio based on forecasts regarding their stock market evolution, forecasts that were not part of the valuation approaches.

The only link between valuation theories and those of capital markets is given by the use of stock market indicators/multipliers. But this approach is a circular reference: It is considered that the market price reflects the value of the company → other companies are evaluated on this basis → it is thus confirmed that the value of the indicator is relevant. The problem is that the value of the indicator is one of market perception, instead of a realistic, scientific one. The whole logical chain will thus be affected, the companies will be evaluated not at the intrinsic value, but at the value perceived by the market participants (which may be random or even profane).

2.5. Unification of Theories

I concluded that valuation approaches, as defined by current standards, do not help much in the investment decision. We can apply stock indicators to establish probable quotes, but we have no clue about the range in which they should be located.

Portfolio theories start from future results and the correlation between the titles, expected.

No explanation of how the forecast would be made. Therefore, the technical analysis alone can give indications of entry/exit, it can explain some momentary movements, but detached from the fundamental analysis it can explain neither the order of magnitude of the price nor its inscription on major, dominant trends.

Both the income approach in valuation, and especially the Discounted Cash Flow (DCF) method, and the Modern Portfolio Theory (MPT) start from the idea that the stock market investment must take into account the return and risk. It's just that they are defined differently by the two theories, are calculated on disjoint logics and do not relate to the stock market theories frequently used by market participants.

In the next section, we will place ourselves in the situation of a minority investor/speculator, who aims to evaluate various securities, to decide the investment portfolio and the strategy to follow.

3. Research methodology and empirical results

3.1. The Need for Stock Market Forecasts

The need for forecasts on the stock market is imminent: significant results cannot be obtained, either as an investment or as speculation, if the evolution of the quotations cannot be predicted.

It could be argued that a number of strategies could be applied passively or actively, without the concern of predicting the future evolution of the stock market/title. In our view, this assertion is not supported.

It is easy to see that financial markets have a long-term growth trend. Therefore, the strategy to buy and maintain the investment (buy & hold) should pay off in the long run. But the upward multi-year trend reveals a multitude of times when declines have been recovered after a long time, sometimes over the years. (drawn with horizontal lines in Figure 1). Psychologically and even institutionally (related to the performance criteria of fund managers, established on the basis of stock quotes) it is difficult to resist large market declines (represented by descending vertical arrows). Therefore, the buy-and-hold strategy is not unbeatable and must at least be adapted and checked periodically.

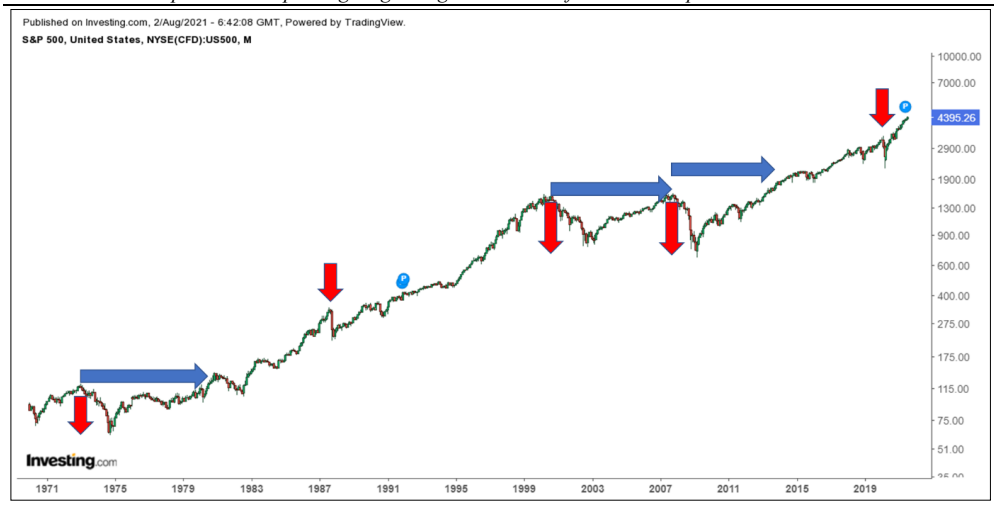

Figure 1 Long periods in which the course recovered the decline
Source: S&P 500 chart drawn on investing.com.

There could be a more active investment strategy, based on changing position if the market fluctuates strongly, based on the intersection of mobile media, or Point and Figure charts (Figure 2). On major strong trends the tactic works (long series of X's for long positions, respectively 0's for short positions). But the strategy is not useful in frequent trend changes or in (undecided) trading markets. However, these periods are common in liquid markets.

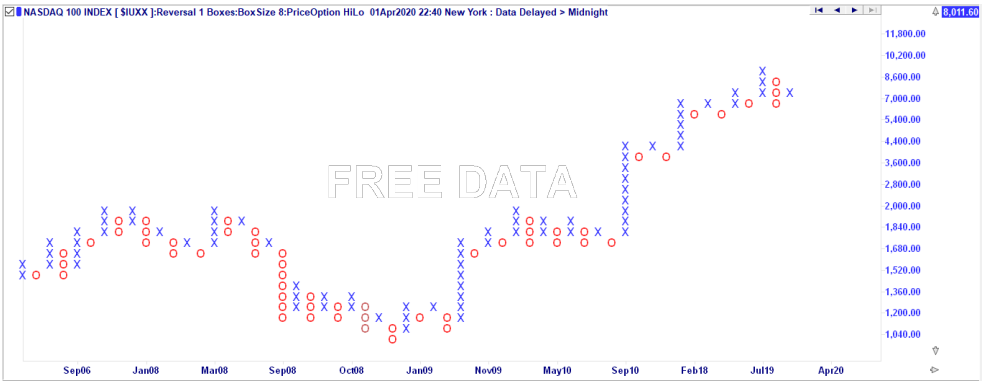

Figure 2 Point and Figure chart for Nasdaq 100
Source: Own processing based on data available at incrediblechart.com.

The graph built on the data of the American market (multpl.com) shows how much the market is influenced by another important element in the valuation, by comparison, the PER (Price Earnings Ratio). In periods when it varies greatly, the evolution of the market is more important than the results of the issuer. During periods of calm, the fundamentals in the formation of the quotation predominate. Therefore, it is not enough to follow the issuer, it is also necessary to follow the market in its overall evolution. Even in calm periods, a variation of the PER between 5 and 25 means a difference of 5 times the share price, at the same results of the issuer.

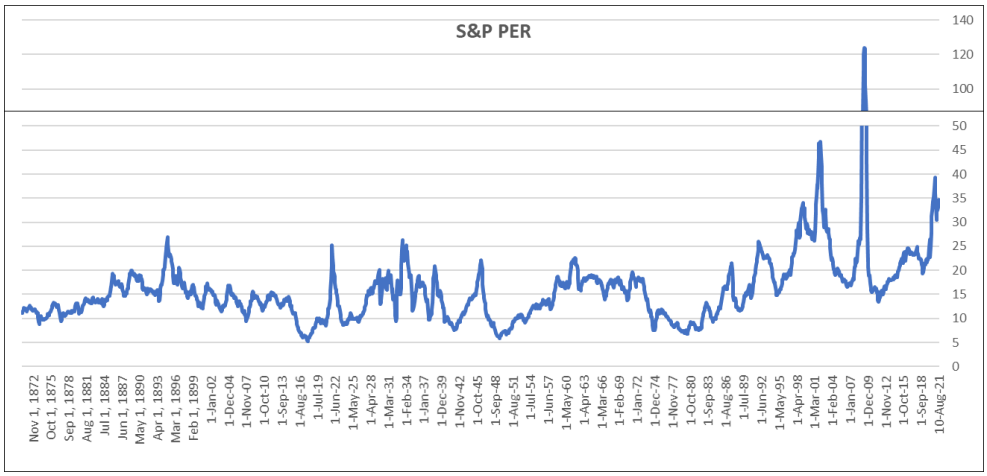

Figure 3 Evolution of the PER indicator for the S&P 500
Source: Graph made in Excel. Data were taken from https://www.multpl.com/s-p-500-pe-ratio.

Analyzing the above, we consider that the investment in the stock market is not reasonable without having forecasts on its evolution, obviously corroborated with the company's results.

3.2. Financial Forecasts

The standards (ANEVAR, 2020), (IVSC, 2020), consider that the value of a company results from the conversion of future cash flows into a current, up-to-date value. Because there is no certainty that the predictions are correct, a scenario-based method is recommended. *«For example, probability-weighted expected cash flows incorporate expectations regarding all possible outcomes and are not dependent on any particular conditions or events.»*

Applying the principle, suppose we have found a method of estimating the future course of security, correlated with the probability of occurrence of that quotation

(Figure 4). We wonder how this information, considered credible, could help the investment strategy.

Figure 4 Stock market forecasts, accompanied by the probability of fulfillment. Informative graphic
Source: simulated, explanatory graphic.

We will first analyze what it would mean for a brokerage firm to display such quotations, similar to sports betting. We will then determine whether this approach adds logic to stock market investments, prudence or portfolio construction.
Let s_i be the sum invested in bet i, having the quotation c_i and the probability of achieving p_i. The mathematical conditions are $\sum p_i=1$ (”no Dutch book”) and $\sum s_i=1$ (normalization).
The value of the absolute win is $s_n c_n$, where n is the winning bet (variant).
The probable value of the win S is obtained as the average of the potential winnings, weighted with the probability of each bet: $S=\sum s_i c_i p_i$.
If the quotations are probabilistically correct, then $c_i=1/p_i$. In this case, the probable win is 1 (the amount invested), no matter how you bet: $S = \sum s_i c_i p_i = \sum s_i \frac{1}{p_i} p_i = \Sigma s_i = 1$. In fact, this is also the reasoning of the brokerage house, which awards its long-term profit by quoting so that $\sum p_i>1$ (usually 105%÷115%).

3.3. Probability of Forecasts

Although not useful to brokerage houses, a realistic prediction of the probabilities of the evolution of securities would be extremely useful for investors. We do NOT

yet have a well-developed forecasting system. But a few considerations are welcome.

The probabilities we are talking about are obviously subjective (Balakrishnan, Koutras, & Politis, 2020). In fact, the whole reasoning was built on the betting model, which cannot be based on experimental probabilities. It is also not excluded the application of Bayesian models in the reassessment of probabilities according to events that have already happened (Grover, 2013), (Tijms, 2019).

First, the forecasts for a number of days in the future do not have a distribution similar to the daily variations. The simplest way to prove this is that a daily random walk distribution (Lawler & Limic, 2010), of rectangular shape, leads to a binomial statistical distribution in a few days.

We also have no evidence that the trial is of the Markov type. To be a Markovian process, future stochastic (random) values depend only on the state of the system at the beginning of the analysis (Privault, 2018). However, technical analysts (Robert D. Edwards, 2019) look a long way back, judging graphs as far back as years ago. It is debatable whether events (variations of the course) that took place, say, before 1990, still have any influence on the decision of post-pandemic investors. Or if the multiannual chart of the S & P500 index has any relevance, considering that the component companies have changed, their weight shifted, corporate operations have taken place, dividends have been distributed, shares have been repurchased. However, analysts' recommendations are followed by investors/speculators, especially if they are convergent. Thus, the predictions can be confirmed, thus generating self-confidence in the technical analysis. But it starts from the assumption that the random walk hypothesis is wrong, otherwise, any explanations or attempts at prediction would be useless.

We have no possibility of martingale. The simplest example of such an approach is the bet on color at roulette, with doubling the amount in case of failure. (Komorowski, Landim, & Olla, 2012). Since in the end, the chosen color will still come out, the bettor will finally win, if he can afford enough rounds. (Because the invested amount is $\sum_{i=1}^{N} 2^{N-1} = 2^N - 1$, smaller than the gain from the favorable round N, worth 2^N). If binary betting almost invites to martingale, we do not see how the strategy for various statistical distributions could be applied.

We have no evidence that volatility in the evolution of securities profits is normally distributed. Not even in the short term. Therefore, the evaluation of options by the Black-Scholes-Merton theory (Hull, 2018) does not help to determine probabilities. As for practitioners, we have an obligation to consider (Buffett, 2008) knows what he is talking about: «*I believe the Black-Scholes formula, even though it is the standard for establishing the dollar liability for options, produces strange results when the long-term variety are being valued.*»

It can be argued that the time horizon of the forecast cannot be too long. Indeed, technical analysis gives results only on short intervals or on strong trend portions of charts. I doubt that DCF's forecasts in year 5 are much more realistic.

A question arises: what exactly should be probabilistically quoted. There are 3 options:

- The future course of security. It would be the preferred option by technical analysts, who, based on charts, patterns, indicators, and/or oscillators, express their opinion on price targets.
- The percentual increase/decrease would be the option of statisticians. However, given that the average of variations is not equal to the average variation, this calculation may be misleading for longer periods (for variations over 5%). For example, a 50% decrease is offset by a 100% increase; their average is not zero.
- Logarithmic quotations eliminate the disadvantage presented above, because $\ln(x_2) - \ln(x_1) = \ln\left(\frac{x_2}{x_1}\right)$. They are less used because they are not suitable for traditional portfolio settings, as opposed to percentage ones (where the total gain is the weighted sum of the earnings of the component securities).

3.4. Benefits of Probabilistic Predictions

The first advantage of correct probabilistic forecasts is that the investment recommendation is immediate.

The weighted potential gain formula is:

$$S = \sum \Delta x_i p_i \,, \tag{1}$$

where S is the amount won, Δx_i is the expected increase in the quotation and p_i is the probability of that increase, the summation being made after all predicted future quotations, so that $\sum p_i = 1$.

Therefore, the security that confers the highest S amount relative to the initial investment will be preferred.

Two related titles will have a similar statistical distribution of future courses.

The comparison between the American indices DJIA and S&P is eloquent in this respect. The graph is drawn in Excel (with Data Analysis utilities), based on statistical variations of indices within 20 days.

This finding has another advantage: the reciprocal is also true. Two correlated titles have similar probabilities of variation. The observation is important because it is enough to analyze a single issuer, and those strongly positively correlated will have similar probability distributions.

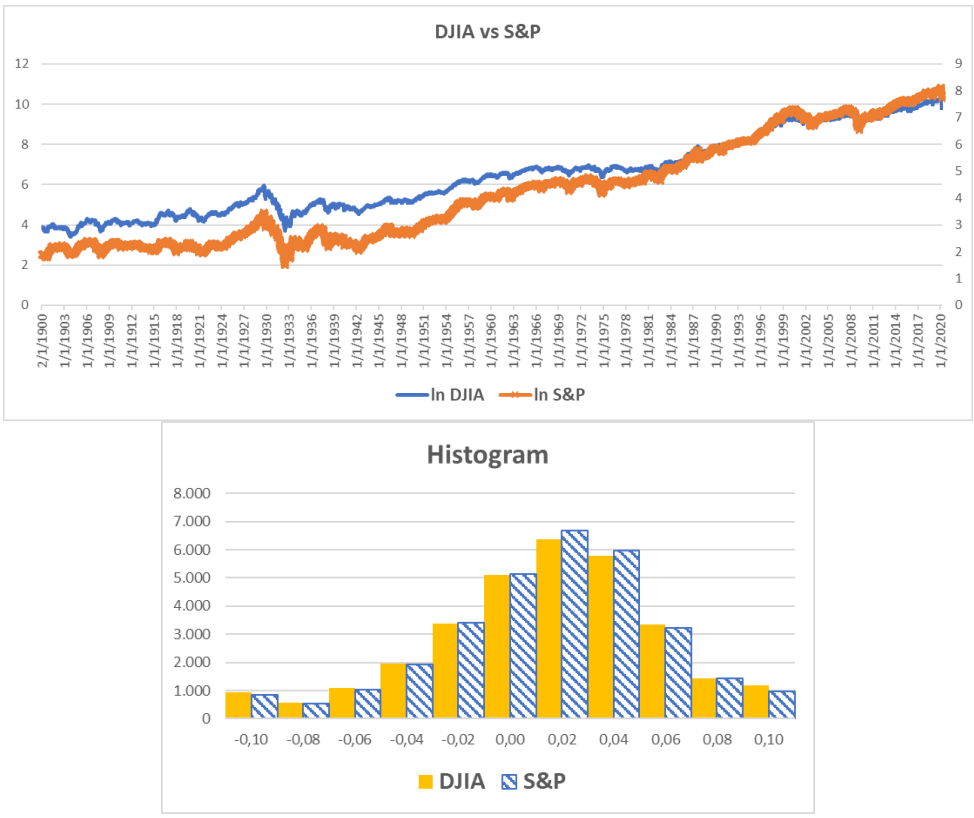

Figure 5 Similar Distributions for Related Titles
Source: Own processing in Excel based on data available on stooq.com.

3.5. Practical Implications

For the financial analyzes sent to the clients of the broker IFB Finwest SA (ifbfinwest.ro) we made the following probabilistic forecast of the evolution of the quotations for the issuer Antibiotice Iași, listed on BSE under the ATB ticker.

In our approach, we considered only one stock market indicator: PER. It is the best known, used and, in our opinion, the most rational. It describes the most natural return on investment: a share is expensive if it costs more than another that has the same profit.

The forecasts regarding the evolution of the stock price were made based on the estimation of the PER and the results (net profit, EPS) in the short term (until the next financial reporting of the issuer). The method was preferred to a DCF (Discounted Cash Flow) assessment, which can only be done with management

consultation and is recommended only when major events are expected in the company's life.

Subjective probabilities were used in the analysis, which can be defined as the degree of confidence. This is equivalent to the amount that a player would have been willing to invest in a YES or NO bet, with odds of 1. The probabilistic calculations were performed on forecast elements: EPS and PER, the result being adjusted according to the technical analysis. In principle, the final probabilities follow these rules:

· No Dutch book: additivity of independent probabilities;

· For extreme values (long tails) formal values will be provided: 10% for those in the predicted direction of evolution, 5% for the opposite evolution;

· A double probability means a double chance of achievement;

· Probabilities are subjected to the Bayesian process of recalculation, in case of reaching an intermediate target: if the evolution is in a certain sense, the probabilities are recalculated ascending in that direction.

Under these conditions, the statistical verification can be performed post factum on the same principles as the weather forecast: 40% chance means that in 40% of cases the forecast proved to be correct.

The forecasts were based on data known at the time of forecasting (end of March 2021):

Table 1 Historical Results of Antibiotice SA Iași

ATB	**2018**	**2019**	**2020**
Net Profit (mil. RON)	34,3	30,8	25,1
Number of shares (mil.)	671	671	671
Share price at end of year *	0,4870	0,5080	0,4860
EPS	0,051	0,046	0,037
PER	9,5	11,1	13,0
* Share price at date of analysis	29.03.2021		0,5050

Source: Own processing; data taken from the issuer's reports to BSE.

The first element is the forecast of future net profit, EPS. It depends mainly on the issuer, given that the market is relatively stable.

For ATB we predicted better growth chances, due to the growth trend of the pharmaceutical industry in pandemic conditions.

The PER does not depend on the issuer, only on the macro context: money availability, general sentiment, market trends, alternative investment options. In the case of ATB, its PER is quite low compared to the sector, so we are also optimistic about this factor.

In the table, the price forecasts depending on the variation of EPS and PER are:

Table 2 Share price according to EPS and PER

BSE Price		EPS		
		0,0336	**0,037**	**0,041**
PER	**12**	0,4032	0,4480	0,4928
	13	0,4368	0,4853	0,5339
	14	0,4704	0,5227	0,5749
	15	0,5040	0,5600	0,6160

Source: Own processing.

Considering the two factors analyzed as independent (the profit depends on the issuer's activity, the PER on the stock market sentiment and content), the compound probability is the product of marginal probabilities:

Table 3 Probabilities Considered for the Variation of EPS and PER

Probability		10%	30%	60%	**100%**
		0,0336	**0,0373**	**0,0411**	**EPS**
10%	**12**	1,00%	3,00%	6,00%	**100%**
40%	**13**	4,00%	12,00%	24,00%	
40%	**14**	4,00%	12,00%	24,00%	
10%	**15**	1,00%	3,00%	6,00%	
100%	**PER**	**100%**			

Source: Own processing.

Finally, the probabilities were ordered according to the predicted quotations and adjusted according to subjective assessments, based on the quotation history, the technical analysis, and the fundamental analysis.

Table 4 Probability of Stock Market Evolution and their Subjective Reconciliation

0,4032	1%	5%
0,4368	4%	
0,4480	3%	7%
0,4704	4%	
0,4853	12%	19%
0,4928	6%	
0,5040	1%	
0,5227	12%	36%
0,5339	24%	
0,5600	3%	27%
0,5749	24%	
0,6160	6%	6%
	100,0%	**100,0%**

Price	**Prob.**
< 0,44	5%
0,44 < < 0,48	10%
0,48 < < 0,52	15%
0,52 < < 0,56	40%
0,56 < < 0,60	20%
>0,60	10%
	100%

Source: Own processing.

The conclusion was: *«most likely a first price target is 0.56 RON / share. If it is reached, there are important chances to reach the target of 0.60 RON / share. The forecast must be revised when the issuer presents its new financial results»*.
Graphically, this result was represented as follows:

Figure 6 Graphic representation of the forecasts regarding the evolution of the ATB stock price
Source: graphic made on the bvb.ro website, annotated with the proposed probabilities.

The half-year results were published on 20.07.2021, as follows:

Table 5 Half Year Results S1 2021 (TTM = Trailing Twelve Month)

ATB	**2018**	**2019**	**2020**	**TTM S1 2021**
Net Profit (mil. RON)	34,3	30,8	25,1	25,2
Number of shares (mil.)	671	671	671	671
Share price at end of year *	0,4870	0,5080	0,4860	0,5500
EPS	0,051	0,046	0,037	0,038
PER	9,5	11,1	13,0	14,6
* Share price at date of analysis	29.03.2021		0,5050	

Source: Own processing; data taken from the issuer's reports to BSE (www.bvb.ro).

It is noted that both the PER (as anticipated) and the price increased so that the result was in line with the 40% probability forecast, increasing.
After centralizing a sufficient number of forecasts, it will be possible to draw conclusions on the correctness of the method and the accuracy of the way of establishing the probabilities.

Figure 7 Checking Predictions based on Probabilities
Source: Chart taken from bvb.ro, annotated with probabilistic forecasts.

4. Conclusions

For an investor/speculator, setting probabilities for various possible quotations in the future would be extremely useful:

- It would ease the investment decision.
- It would show/use the correlation between titles.
- It would elegantly solve the problem of risk (VaR has always shown its vulnerability in crisis cases).
- It would solve the return-risk investment decision nicely, without resorting to mathematical models lacking practical realism (such as risk = variance, or the risk included in the capitalization rate).
- There would be no need for forced justifications: the value of the company vs. market perception; determined internal cash flow vs. market capitalization rate; and so on. All the information is included in what matters: how much the future quotation will be and how much confidence we place in the forecast.

The most acute question remains: how can the probabilities of each future value forecast be rationally determined? Once it is clear that it would be beneficial to find them, we can confidently go in search of them. We will then respond to the

construction of portfolios by taking into account the practical correlations and analyze whether or not it is necessary to adapt the probabilities to the evolution of events (on the Bayesian model). Subsequently, this would be the most important point: how can we aggregate these probabilities so that we can generate the composite probability of a portfolio. We are also working on a new model for determining the value of European-type options, based on these probabilities.

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Author Contributions
The authors contributed equally to this work.

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