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Automatização do Modelo Rojo de Análise Fundamentalista

Automation of the Rojo's model of fundamental analysis

[TRADUÇÃO INGLESA]

WESLEY DELALIBERA

CASCAVEL/PR

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Dissertation presented in partial fulfilment of the requirements for the degree of **Master of Science in Administration** in the Department of Administration, Western Paraná State University.
Dissertation Supervisor: Dr. Claudio Antonio Rojo

Dissertação apresentada ao Programa de Pós-Graduação em Administração (PPGAdm) – Mestrado Profissional da Universidade Estadual do Oeste do Paraná, como requisito parcial para obtenção do grau de **Mestre em Administração**.
Orientador: Dr. Claudio Antonio Rojo

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Cascavel, 19 de abril de 2023

DEDICATION

I dedicate this work primarily to my parents for all the investment in my education, effort and encouragement they have given me throughout life, laying the necessary foundation for me to face all the challenges to date. In particular, my beloved mother, who left a gigantic void in our family, but also a very rich legacy of wisdom, humility, perseverance and grit, which propels us to be the mirror of her greatness.

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And finally, to my advisor, Professor Claudio Antonio Rojo, for the experience of participating in a discipline taught in English, for the dynamic and rich way in which he conducts his classes, and for the orientation, which culminated in the development of this work.

RESUMO

Delalibera, Wesley (2023). Automatização do Modelo Rojo de Análise Fundamentalista (Dissertação). Programa de Pós-Graduação em Administração (PPGAdm), Universidade Estadual do Oeste do Paraná – UNIOESTE, Cascavel, PR, Brasil.

Esta dissertação teve como objetivo desenvolver um produto técnico de modo a automatizar o modelo de Rojo (2014) de análise fundamentalista, para auxiliar investidores a iniciar suas próprias análises de investimento de longo prazo no mercado de ações brasileiro. Por meio de pesquisa realizada com investidores que obtiveram retornos acima da média do mercado, Rojo (2014) coletou as cinco principais variáveis utilizadas como critérios por esses investidores para iniciar uma análise de oportunidades de investimento no mercado de ações. A construção da ferramenta, objeto deste trabalho, tem como base principal o modelo Rojo (2014) e, de forma complementar, os demais autores e trabalhos desenvolvidos sobre o tema. Esta pesquisa pode ser classificada como uma pesquisa aplicada, caracterizando-se como descritiva. Em relação a abordagem, trata-se de uma pesquisa qualitativa, uma vez que emprega um modelo específico desenvolvido pelo autor. O produto técnico foi desenvolvido utilizando-se do programa Excel e utiliza uma base de dados histórica para verificar quais ações listadas na bolsa brasileira atendem às variáveis e condições estabelecidas, atribuindo-se pesos e exibindo como saída uma lista de ações ordenadas pela somatória desses pesos. A base de dados utilizada pela ferramenta foi extraída de múltiplas fontes gratuitas, como: Comissão de Valores Mobiliários, *Google Finance*, *Yahoo Finance* e site www.fundamentus.com.br. O download da ferramenta pode ser realizado através do endereço: https://bit.ly/AF-PRODUTO-TECNICO.

Palavras-chave: mercado de ações; análise fundamentalista; indicadores fundamentalistas; indicadores de mercado; bolsa de valores;

ABSTRACT

Delalibera, Wesley (2023). Automation of the Rojo's model of fundamental analysis (Dissertation). Post-Graduate Program in Management (PPGA), State University of Western Paraná – UNIOESTE, Cascavel, PR, Brazil.

This dissertation aimed to develop a technical product in order to automate Rojo's (2014) model of fundamental analysis, to help investors start their own long-term investment analysis in the Brazilian stock market. Through research conducted with investors who obtained returns above the market average, Rojo (2014) collected the five main variables used as criteria by these investors to initiate an analysis of investment opportunities in the stock market. The construction of the tool, object of this work, is based mainly on the Rojo model (2014) and, in a complementary way, the other authors and works developed on the subject. This research can be classified as an applied research, characterized as descriptive. Regarding the approach, it is a qualitative research, since it employs a specific model developed by the author. The technical product was developed using the Excel program and uses a historical database to verify which shares listed on the Brazilian stock exchange meet the established variables and conditions, assigning weights and displaying as output a list of actions ordered by the sum of these weights. The database used by the tool was extracted from multiple free sources, such as: Securities and Exchange Commission, Google Finance, Yahoo Finance and website www.fundamentus.com.br. The tool can be downloaded through the address: https://bit.ly/AF-PRODUTO-TECNICO.

Keywords: stock market; fundamental analysis; fundamental indicators; market indicators; stock exchange;

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LIST OF ABBREVIATIONS AND ACRONYMS

AC: Current Assets

AF: Fundamental Analysis

AFF: Fundamental Financial Analysis

AT: Total Assets

B3: Brazil, Stock Exchange and Counter (B3 S/A)

CVM: Brazilian Securities and Exchange Commission

DY: Dividend Yield

IBGE: Brazilian Institute of Statistical Geography

IFPR: Federal Institute of Paraná

IGPM: General Price Index - Market

INEG: Negotiability Index

JCP: Interest on Own Capital

LC: Current Liquidity

EPS: Earnings Per Share

LS: Dry Liquidity

MB: Gross Margin

MBR: Market-to-Book Ratio

P/E: Price divided by Net Income per share

P/VPA: Price divided by Equity Value per share

P/C: Price/Cash Flow

PC: Current Liabilities

PCT: Participation of the Capital of third parties

PFCP/PFT: Short-Term Financial Debt Ratio Total Financial Debt

POLS: Pooled Ordinary Least Squares

ROA: Return on Assets

ROE: Return on Equities

ROI: Return on Investment

SMLL: Small Cap Index

VarLL: Change in the Triennial Average of Net Income

VM: Market Value

VPA/P: Share Book Value Ratio/Price

SUMMARY

1   INTRODUCTION

In order to obtain returns above those obtained in fixed income investments, the Brazilian population has sought to diversify its investments, entering the stock market (B3, 2020). In the first quarter of 2022, Brasil, Bolsa e Balcão (B3 S/A) found, through a document based on its customer base, a significant increase in the number of individuals who started their first investments in shares. According to the document's data, between 2011 and 2017, the number of individual investors remained practically stable, around 500,000 investors. However, as of 2018, the number of investors has grown exponentially, jumping to 4.3 million in February 2022 (B3, 2022).

According to the projections of the Brazilian population made by the Brazilian Institute of Geography and Statistics (IBGE), despite the significant increase of individual investors in the Brazilian stock market in recent years, the number of these investors in relation to the Brazilian population is only 2% (IBGE, 2023). In developed countries, where the population has better access to knowledge, the percentage of individuals who invest directly in stocks reaches 50% of the population (Lueders, 2008). According to studies by Cardozo, Modesto, Magalhães, Fonseca and Policarpo (2019), 42% of the Brazilian population saved their savings and made investments in some financial product in 2018. From these data, it is evident that there is the possibility of an even greater growth in the number of investors in the Brazilian stock market, based on the democratization of access to applications through financial education.

The difficulty of the novice investor in valuing the shares is justified by the complex and dynamic environment of the market, in which the traded assets are influenced by several variables (Dias, 2016). In 2020, B3 published a survey aimed at identifying the factors that motivate the investment decisions of individual investors. The following question was asked: "How does the process of choosing and analyzing investments occur?". The sample indicated that 39% of investors use digital influencer analytics, 23% use structured analytics from specialized companies, 20% follow guidance from friends, family or advisors, and 18% use other forms or perform no analysis at all (B3, 2020).

For small investors in the stock market, financial education becomes an essential tool for the management of their personal finances, contributing to the formation of their savings and access to new investment modalities, such as investment in stocks (Wisniewski, 2011). In order to mitigate the risks of this type of

investment, successful investors need to be able to perform their own analysis and get a sense of whether they are buying a cheap or expensive stock (Lueders, 2008).

To qualify for investment analysis, the retail investor may use stock investment analysis methodologies. Among the most well-known and used stock market analysis methodologies, fundamental analysis is indicated for the analysis of long-term investment opportunities (Kumar & Sandhu, 2013). It is essential that the investor knows and studies certain financial indicators, in order to support their buying and selling decisions (Lueders, 2008). Knowledge in accounting and the willingness and effort to learn this science, as well as read and analyze financial statements, are requirements for the successful investor to choose stocks on their own (Buffett & Clark, 2010).

B3 currently has 471 listed companies with shares available for purchase and sale, and these can be classified as to their size (B3, 2022). The largest and most liquid companies, that is, those that have a high daily trading volume, are called blue chips. Smaller, low-liquidity companies are called small caps. While blue chip stocks attract investors much more and are analyzed with a much greater frequency, small caps, because they bring greater uncertainty and risks, are companies neglected by investors and can offer a growth potential not yet glimpsed (Rojo, 2014). In B3 about 85% of the shares are considered small caps, that is, around 400 companies that are often neglected by the market present opportunities to be discovered.

The high number of companies to be analyzed through the fundamental indicators represents a challenge for individual investors, since there is no free tool in the market that consolidates the financial data of all of them. Although the calculations are not complex, they require time and willingness of the investor to collect the data and make a comparative analysis between companies in the same sector (Lueders, 2008).

Among the researches carried out by renowned authors that stand out in the literature, Rojo (2014) consolidated the main fundamentalist variables used by investors recognized for obtaining above-average returns in the stock market. Rojo's fundamental analysis model uses five variables, indicated by investors as the main ones to be used in an initial analysis. However, the use of the model can become complex for the individual investor due to the high number of companies and variables that need to be analyzed and compared.

1.1   SEARCH PROBLEM

The negligence on the part of individual investors in making investment decisions on the Brazilian stock exchange highlights the existing problem in the criteria used for investments in shares, considered high-risk. According to research conducted by B3, the vast majority of investors have based their investments on third-party recommendations.

The systematization model of Rojo (2014) and the research developed by Honório and Rojo (2021) demonstrate the success of fundamentalist variables as strategies used by financial analysts consecrated in the market in search of investment opportunities in stocks. The use of Rojo's (2014) model makes the analysis of fundamental variables and the comparison between companies viable, allowing the individual investor to start his own analysis of stock investment in the long term.

However, the use of a methodology such as fundamental analysis requires the investor a vast knowledge, which can discourage them when faced with the amount of data to be analyzed and compared. The investor needs to look for charts, the company's accounting, competitor data, economic variables, among other information, in order to carry out their own investment analysis. The high number of companies on the Brazilian stock exchange makes this work challenging and time-consuming, which can result in the loss of the window of opportunity for investment in a given stock (Kobori, 2011).

1.1.1   Research Question

This research seeks to answer the following problem: how to automate the Rojo (2014) model of fundamental analysis, in order to assist investors in the search for long-term investment opportunities for the Brazilian stock market?

1.2 OBJECTIVES

1.2.1 General

Develop a technical product that automates the Rojo (2014) model of fundamental analysis, with the objective of assisting in the search for long-term investment opportunities for the Brazilian stock market.

1.2.2 Specific

a) Research models of fundamental analysis, through the findings of research conducted in the international and national market;
b) To describe the systematization model of small caps stock analysis elaborated by Rojo (2014).

2 THEORETICAL AND PRACTICAL BACKGROUND

2.1 FUNDAMENTAL ANALYSIS

There are two types of analysis considered for stock valuation: technical analysis and fundamental analysis. Technical analysis, according to Fama (1965), allows establishing the right time to invest, considering that the historical behavior of stock prices in the past tends to occur in the future. These trends are determined by a set of economic, monetary, political, and psychological forces. Through models and rules based on prices and volumes traded, a vast typology of charts is used as an instrument for predicting trends in stock values (Kumar, Mohapatra & Sandhu, 2013).

Fundamental analysis (FA) is based on the fact that the intrinsic value of a stock security depends on the potential future return of that security (Fama, 1965). The PA aims to identify the causes that explain the variations in stock prices, and, for this, some variables can be analyzed, such as quality of management, prospects for the company's sector of activity, economy, profitability of the company, indebtedness, liquidity, growth of the company, among others (Lemes Junior, Rigo & Cherobim, 2002; Miranda & Alves, 2018). Sophisticated investors, through fundamental analysis, use past historical financial information to devise profitable investment strategies. The investor should use information from present and past financial statements, as well as industry data and macroeconomic data (Piotroski, 2005).

The initial relevant studies on fundamental analysis date back to 1934, with the publication of "Security Analysis" by Benjamin Graham and David Dodd (Greenwald, Kahn, Bellissimo, Cooper & Santos, 2004). This work addressed the use of fundamental analysis with concepts such as discount in relation to equity value, margin of safety, competitive advantages, high dividends (DY) and low multiples of Price over Profit (P/E). This new philosophy of investment analysis was termed value investing and was later discussed in works by Fisher (1958), Fama and French (1992) and Lakonishok, Shleifer and Vishny (1994) (in Battisti & Creta, 2019).

According to the philosophy of value investing, the margin of safety is the difference between what is paid and the intrinsic value, that is, the current value indicated must be higher than the market price. The motivation for having a margin of

safety is to make predictions about the future irrelevant. The way to ensure a margin of safety is to obtain a profit/price ratio less than or equal to the prevailing rate. Several studies have shown that securities with a lower price/book value ratio (P/VPA), price/earnings (P/E), price/cash flow (P/C), or higher dividend/price ratio (DY) offer higher returns (Battisti & Creta, 2019).

In a complementary way, Fisher (1958) developed the thesis that an investor who analyzes companies that are growing will have more returns than investors who analyze only the value accumulated by companies, even if they do not correspond to growth expectations. In the approach of Fama and French (1992), Graham's criteria are used to classify the "value" of companies, considering that those with lower P/VPA and low market capitalization have a higher rate of return than companies with high P/VPA and higher market capitalization. Thus, they developed the hypothesis of what is now called the risk compensation hypothesis, which establishes a relationship between risk and return on investments in stocks. This hypothesis suggests that, in an efficient market, investments with higher risk tend to have higher returns to compensate investors for the greater risk taken (Fama & French, 1992).

The approach of Lakonishok et al. (1994) reinforces Graham's "value" strategies, demonstrating that these strategies offer higher returns due to investors' behavioral biases and weaknesses that affect their judgment. Thus, value stocks are undervalued in relation to their fundamentals, while glamour stocks are overvalued. The authors state that these biases and weaknesses can be exploited in the long run, obtaining superior returns (Lakonishok et al., 1994).

It is important to note that the philosophy of value investing has its focus on the data of the company in which one is analyzing to invest. However, there are other variables that can influence the price variation of a stock, such as macroeconomic data (Bernardelli, Bernardelli & Castro, 2017). When the analysis is done through macroeconomic data, looking for long-term movements, this type of analysis is called **top-down** and is more practiced by financial institutions. In this type of analysis, the initial focus is on the economy as a whole, funneling to the analysis of a specific sector and, finally, the analysis of a specific company (Graham & Dodd, 1934). The **bottom-up** analysis occurs in the opposite way, giving priority to the behavior and expectations of each company, being more used by individual investors (Graham & Dodd, 1934). The research of Rojo (2014), which is the basis for the construction of the technical

product resulting from this research, focuses on the use of fundamentalist variables extracted through the bottom-up method.

In the next section, the research that validated the use of fundamentalist variables empirically in the stock market will be addressed, both in the international and national markets: dissertations, papers presented at conferences and seminars and scientific articles by Qualis A. The choice of not limiting the time period was made, in order to contemplate the largest number of scientific articles that have a great relationship with this study.

2.2 STUDIES THAT VALIDATED THE USE OF FUNDAMENTALIST VARIABLES

In the studies by Costa Jr and Neves (2000), the authors experimentally verified how the variables market value (VM), price/profit ratio (P/E) and book value ratio of the share/price (VPA/P) explained the average profitability of 117 shares of the Brazilian stock exchange in the period from 1987 to 1996. The authors' work gains relevance through the analysis of fundamentalist variables in the Brazilian market in a period of economic instability, with high levels of inflation. From the construction of several portfolios in function of the variables researched and using multiple regressions (SUR method), the results found by the authors showed that the fundamental variables that stand out the most are the MV and VPA/P, in relation to the beta of the Brazilian market. In addition, the authors conclude that portfolios composed of stocks with a low P/E ratio tend to perform better than those with a high P/E. That is, the variable P/E has a negative relationship with profitability, while the variable VPA/P has a positive relationship with profitability.

Dos Passos and Pinheiro (2009) set up three stock portfolios based on the philosophy of value investing, with the objective of verifying the applicability of Graham's (1973) assumptions, using historical series from 1994 to 2000 and 1994 to 2005. The portfolios were assembled following the guidelines of the book "The Intelligent Investor" (Graham, 1973), which include the need of having:
   a) Growing Profits;
   b) Leadership in the sector;
   c) Attractive multiples (P/E and P/VPA); and

d) Good discount on paper, the so-called margin of safety.

The filters used in the research were modeled after the following requirements of Graham (1973):

a) Constant profit without any loss throughout the series;
b) Average annual growth provided by paper should exceed 5%;
c) The result of the multiplication between P/E and P/VPA should be less than 22.5 at the time of purchase;
d) Net revenue above 500 million on the date of purchase;
e) Net debt to equity could not exceed 50% at the time of purchase;
f) Payment of dividends at least in the year prior to the investment;
g) The current liquidity must be greater than 1.0 at the time of purchase.

The results obtained by dos Passos and Pinheiro (2009), through the simulation of empirical portfolios created from Graham's ideas, confirm the applicability of these filters to the context of the Brazilian stock market. Although the returns obtained were not higher than investments in Fixed Income in the period, such as the Direct Treasury, the portfolios obtained returns of up to three times above the Ibovespa.

Testa's (2011) research analyzed the applicability of Graham's strategies in the Brazilian context. The empirical study simulated a stock portfolio formed from Graham's adapted criteria in the period from 2002 to 2010. The portfolio of shares generated obtained profitability adjusted to the IGPM 190% higher than the Ibovespa index and 370% higher than the Selic rate. The criteria used for the formation of the portfolio were:

a) **Business size**: annual net revenues greater than or equal to R$ 300 million in 2002;
b) **Good financial situation**: current ratio (AC/PC) greater than or equal to 1 in 2002;
c) **History of dividends**: payment of dividends in 2002;
d) **Profit growth**: minimum growth of at least 30% between 2002 and 1995;
e) **Moderate P/E**: share price at the close of 2002 cannot be more than 15 times the earnings per share in the year 2002;
f) **P/E times moderate P/VPA**: The product of P/E by P/VPA should not exceed 22.5.

Similarly, Palazzo, Savoia, Securato and Bergmann (2018) tested the selection of stocks in the Brazilian market using the ideas of Graham (1973), for the period from 2005 to 2015. The following filters were used:

a) **Revenue**: large companies with revenues exceeding three hundred million reais;

b) **Current** liquidity: companies with current liquidity above the market median;

c) **Uninterrupted profits**: companies that have remained profitable in the last five years were selected;

d) **Dividend payment history**: those that pay dividends or that were able to make profits;

e) **Annual earnings per share** growth: annual earnings growth, at a minimum annual rate of 2.66%;

f) **Price/earnings ratio (P/E):** should be compared with the nominal yield offered by risk-free fixed income securities, at the time the value of 5.63 was obtained;

g) **Price-equity value (P/VPA): companies with P/VPA** greater than 1.00 were selected, as long as their P/E x P/VPA multiple was not higher than 7.00;

h) **Additional liquidity filter**: selected the most liquid companies.

Palazzo et al. (2018) conclude that the use of all filters brought a higher return to the Ibovespa index. The most relevant filters are: "current liquidity" and "uninterrupted profits". The filters that did not change the composition of the portfolios, and that could be removed, are: "billing" and "price/profit ratio". The filters "dividend payout history," "annual earnings per share growth," and "P/VPA," when removed, generated better portfolios in terms of risk-adjusted returns.

In a sample composed of 78 assets, de Almeida and Sales (2020) analyzed 36 financial and accounting indicators to verify which ones best explained stock returns in the period from 2009 to 2018 in the Brazilian market. First, the adequacy of the application of the panel data model with fixed or random effects was verified through the POLS (Pooled Ordinary Least Squares) model. Subsequently, the panel data model with fixed effects was applied. The results showed nine variables as the best predictors of stock returns: Triennial Average Variation of Net Income (VarLL), Price Average Earnings Index (P/E), Short-Term Financial Debt Index Total Financial Debt

(PFCP/PFT), Dry Liquidity (LS), Total Assets (TA), Current Liquidity (LC), Price Equity Value Per Share Index (P/VPA), Earnings Per Share (EPS) and Return Over Assets (ROA). Of the nine variables, five of them (VarLL, P/L, AT, LC and P/VPA) are present in Graham's filters (1973), reaffirming the author's fundamentals for the Brazilian market.

In the research of Tavares and Silva (2012), 23 traditional economic-financial indexes were selected to investigate whether the fundamental financial analysis (AFF) was able to segregate the best and the worst investment alternatives in the Brazilian stock market. The analysis was carried out in the fiscal years 2005 (132 companies), 2006 (126 companies) and 2007 (136 companies). Through the application of the minimum chi-square rule and discriminant analysis, the authors concluded that it is possible to accept the hypothesis that the AFF is able to predict changes in the company's value, assisting in investment decisions.

The research of Malta and Camargos (2016) sought to identify variables of fundamental and dynamic analysis that explained the stock return of 67 non-financial stocks of the IBrX100 index of the Brazilian stock exchange, in the period from 2007 to 2014. Among the 19 variables analyzed, the authors concluded that eight of them had explanatory power of the stock return. Of these, four are linked to efficiency/profitability: gross margin (MB), return on assets (ROA), on equity (ROE) and on investment (ROI); one is linked to indebtedness: third-party capital participation (PCT), and three are linked to market indicators: market liquidity (INEG), earnings per share (EPS) and market-to-book ratio (MBR).

Holloway and Laes (2013) identified, through a sample of equity fund managers in the Brazilian market, which fundamental variables are used to determine stock portfolios. The variables found were: earnings per share, high return on assets (ROA), high gross margin, company size and stock liquidity. These managers indicated that the only variable that influenced the moment of purchase was the P/E. In addition, it was found that all the funds surveyed that use value investing obtain a return above the Ibovespa index, presenting lower risk. The research pointed out in the following paragraphs gain greater relevance because they have already addressed the model developed by Rojo (2014), applying the fundamentalist variables.

Marques (2017) proposed a practical strategy to support the investment decision in small cap stocks, using fundamental variables, technical analysis, scenario simulation and fuzzy logic (de Souza & Rojo, 2010). The analysis was carried out in

the civil construction subsector during the period from 2009 to 2017 for the fundamental analysis, and from August to November 2017 for the technical analysis. The fundamentalist variables of Rojo (2014) were combined with fuzzy logic to select stocks with more promising buy signals, that is, stocks with a greater trend of future appreciation.

Giraldi (2019) developed a guiding flowchart for decision-making in stock market investments, based on the investor's profile: conservative, moderate or aggressive. The step by step includes the definition of the investor profile, the identification of the relevant fundamental variables of each stock and the analysis of these actions based on the variables, with weights assigned according to the method proposed by Rojo (2014). This work gains relevance by providing a predetermined guide for the selection of stocks based on fundamental variables and appropriate to the needs of different investor profiles.

Honório and Rojo (2021) developed a study with the objective of validating Rojo's (2014) proposal, using a simulated portfolio of small caps stocks and weights for each variable used as a filter. The sample of actions used was based on the Small Cap Index (SMLL), with the research period between 2006 and 2010, in order to select the stocks with the best score. For the selection of actions, 17 stocks from the financial sector were excluded, 36 actions without complete data in the period and another 7 actions that did not present information on all variables. Table

Table 1 presents the filters and weights used in the study:

Table 1

Variables, criteria and weights

Variable	Criterion	Weight
P/E	Positive and below the industry average?	1
Net Debt	Negative?	1
Profit	Positive in every year for the last five years?	0,5
Profit	Growing in the last five years?	0,5
Revenue	Growing in the last five years?	0,5
Revenue	Growth Greater Than the Industry Average?	0,5
Dividends (DY)	Have you paid in every year for the last five years?	0,25
Dividends (DY)	Growing in the last five years?	0,25
Dividends (DY)	Average last five years greater than 3%	0,25
Dividends (DY)	Average last five years greater than 5%	0,25

Note. Adapted from Honório and Rojo, 2021.

The return of the portfolio simulated by Honório and Rojo (2021) was measured in two years, 2019 and 2020. Table Table 2 presents the comparison of the returns between different investments verified in relation to the simulated portfolio:

Table 2

Comparison of profitability between different investments

Investment	Profitability 2011 to 2019	Profitability 2011 to 2020
Wallet	262%	223%
100% CDI	132%	138%
Savings	84%	95%
Ibovespa	74%	79%

Note. Adapted from Honório and Rojo, 2021.

The authors concluded that, even in a turbulent period, with the fall of stocks affected by the Covid-19 pandemic, the simulated portfolio with the variables of the model developed by Rojo (2014) and the weights proposed by Honório and Rojo

(2021) obtained a higher yield than fixed income investments, the Ibovespa and other non-selected SMLL shares.

Analyzing the mentioned works, it can be affirmed that there is no consensus among the authors on which variables have greater relevance, within the fundamental analysis, for the selection of stock portfolios that guarantee returns above the market average. Rojo and Hoss (2011) state that there is no exact and efficient formula to predict the market and, if it existed, as soon as it were known by the public and put into practice, it would lose its efficiency, because it would lose the sense of exclusivity.

In turn, Almeida and Sales (2020) suggest that for investors who have difficulty determining the ideal values of fundamentalist variables, they should use the recommendations of Graham (1973). The historical analysis with the use of fundamental variables for the choice of stocks in the Brazilian market, although not a guarantee of future returns, presents in the literature strong indications of its validity.

2.3   ROJO'S MODEL

The systematization proposed by Rojo (2014), originated in his postdoctoral research, culminated in the publication of the book "Investment in small caps shares: scenarios of the Brazilian market". One of the objectives of this research was to obtain, from investors with a history of profitability higher than the Ibovespa, the five main variables used to start an investment analysis in the stock market.

The first phase of the research consisted of sending a questionnaire to investors, with the objective of validating the research instrument. In the second stage, using a non-probabilistic sample, the questionnaire was sent to 511 individual investors from the office of a brokerage in Cascavel, Paraná, resulting in a data collection of 52 respondents, of which 50 completed the questionnaire. The objective of the questionnaire was to select specialists who met the following research criteria: individual investor; makes their own analyses, whether graphist or fundamentalist; invests in small caps shares; obtains a higher result than the Ibovespa and investors who accept to participate in the Delphi rounds. Figure

Figure 1 illustrates the stages of conducting the research.

Figure 1

Research steps 1, 2, and 3
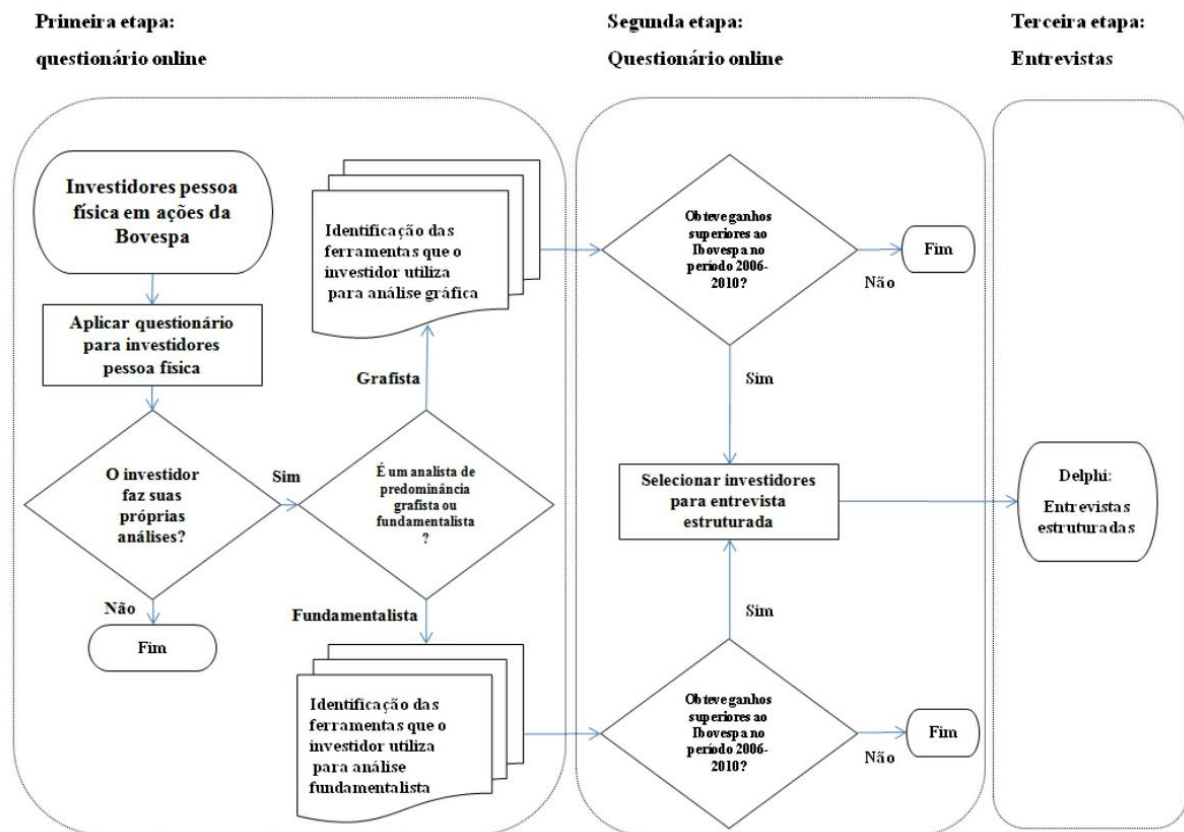
Note. Source: Retrieved from "Investment in small caps stocks: scenarios of the Brazilian market", 2014.

The Delphi method was used in the third stage of the research in order to find consensus among the group of selected investors: which investment analysis tools are considered critical variables to make projections of long-term scenarios (20 years) for investments in small caps stocks. In the first Delphi round, participants freely and objectively indicated which tools they believed were ideal for analyzing small-cap stocks over the long term. The first Delphi round resulted in 15 critical investment variables, as shown in Table

Table 3.

Table 3

List of tools

Tools for analyzing investment in small caps stocks in the long term (20 years), in the view of participating investors
Share price
Long-term positive chart history
Average volatility
Coincident resistance and support
Favorable trend lines
Liquidity of the stock
Indebtedness
Share price ratio to profit and equity
EVA
Dividends
Future Vision / Manager
Above the competition / Heated sector / Sales growth
Government influences
Growing profit history 5 years

Note. Source: Retrieved from "Investment in small caps stocks: scenarios of the Brazilian market", 2014.

The 15 variables indicated in the first Delphi round were compiled and sent to investors with the following question: "Among all the critical variables cited by the other investors, experts in investing in small caps that make up the panel, reflect on the information received and point out the five critical variables of greatest importance in the projection of investment scenarios with a term of 20 years, and sort by importance,

placing 5 for the most important, 4 for important, 3 for medium importance, 2 for little importance, and 1 for the least important."

Table Table 4 shows the investors' responses to each critical variable, totaling the weight of each variable:

Table 4

Delphi Second Round Result

Critical Variables	Second Round Responses				Total Weight
	The	B	C	D	
Share price					
Long-term positive chart history			5		**5**
Average volatility			4		**4**
Coincident resistance and support			3		**3**
Favorable trend lines					
Liquidity of the stock				5	**5**
Indebtedness	5	2			**7**
Profitability					
Share price-to-earnings and equity ratio	2	5			**7**
EVA					
Dividends	3	4	3	1	**11**
Future Vision / Manager		1	1		**2**
Superior Competition / Heated Industry / Sales Growth	4		2	2	**8**
Government influence	1				**1**
Growing profit history 5 years		3	4		**7**

Note. Source: Retrieved from "Investment in small caps stocks: scenarios of the Brazilian market", 2014.

The third Delphi round was held to obtain consensus on the five most voted variables in the second stage. The experts were given the top five critical variables, with the following question: "Is it possible for an individual to do their own analysis and start projecting scenarios for long-term investments in small-cap stocks?". All experts agreed that Table Table 5 presents the five most important critical variables to be able to start the analysis of investments in small caps stocks in the long term (20 years).

Table 5

Delphi Third Round Result

Critical Variables	Weight assigned by the panel
Indebtedness	7
Share price-to-earnings and equity ratio	7
Dividends	11
Outpacing the Competition/Heated Industry/Sales Growth	8
Growing profit history 5 years	7

Note. Source: Retrieved from "Investment in small caps stocks: scenarios of the Brazilian market", 2014.

From the findings of Rojo (2014) and in a complementary way with the works found in the literature, a technical product was developed and will be presented in the next chapters. It is a tool for the average investor to evaluate and make comparisons between the companies of the Brazilian stock exchange (B3), in order to start a process of investment analysis in the stock market.

3 RESEARCH METHOD AND TECHNIQUES OF TECHNICAL PRODUCTION

3.1 RESEARCH DESIGN

This work can be classified, as to its nature, as an applied research, since it aims to develop a technical product based on specific knowledge. In relation to the objectives of the research, it is characterized as descriptive, as it focuses on obtaining, describing, manipulating and analyzing fundamentalist variables, without interfering in their behavior (Kothari, 2019). Regarding the approach to the problem, it is framed as a qualitative research, since it employs a specific model developed by Rojo (2014), to automate the search for investment opportunities (Chih-Pei & Chang, 2017).

The data used in the tool are obtained in real time for the calculation of the variables P/E and P/VPA and historical data are used for the variables of Debt, Profit, Revenue and Dividends. By using temporal fundamentalist indicators, the research universe has a longitudinal characteristic, since for some variables it is necessary to obtain historical data of up to five years. The data obtained for structuring the tool have secondary data classification, since they have already been collected previously by another source (Malhotra, 2011).

The research universe for the implementation of the tool is composed of all the shares listed on the Brazilian stock exchange, classified by the sector in which they operate. Shares of companies in judicial reorganization, companies in the financial/banking sector and actions that have inconsistencies in their data were excluded from the analysis.

The tool chosen for the development of the technical product was Microsoft Excel® 2019, version 2302. This choice is justified by the familiarity that the author has with the software and by the lack of time for the development of an application or website on the internet. The tool is available for downloading at: https://bit.ly/AF-PRODUTO-TECNICO.

3.2 DATA COLLECTION PROCEDURES

Considering that the tool is available for free, it is necessary to obtain data from different free sources for use in the technical product. The data and variables used include: list of companies, sector of operation, number of shares, equity, share price, calculation of the P/E indicator, calculation of the indicator (P/VPA), net debt, profit, revenue, dividends paid and calculation of the DY. The collection, manipulation and processing of data is carried out both manually and automatically.

The list of companies available on the Brazilian stock exchange, as well as their respective sectors of activity, are obtained from the B3 website. The shares available in the tool include preferred shares and common stock. The inclusion of new companies in the Brazilian stock exchange will occur in the tool every three months. The display of a stock in the tool depends on getting the share price through Google Finance. If it is not possible to get the price of any share, by eventual Google error, it will not be displayed in the tool.

For the calculation of the P/E and P/VPA variables it is necessary to obtain the share price in real time. Among the available options, it was decided to get the stock price through Google Finance because it is a free tool. Thus, the collection of the stock price is done by a real-time connection of the Excel software with Google Finance. The P/E and P/VPA update occurs every 20 minutes, since it is in this time period that Google Finance updates the stock price.

The Dividend Yield (DY) variable, which uses historical data of up to five years, is calculated based on dividends and interest on equity (JCP) obtained from the www.fundamentus.com.br website and the historical share price obtained from Yahoo Finance. The dividends paid and JCP, which are the basis for calculating the current DY, are updated in the tool every quarter. The variables net debt, profit and revenue, which also use historical data of up to five years, are obtained through the website of the Brazilian Securities and Exchange Commission (CVM), and are updated every quarter. Due to the high amount of data and the need for manipulation for adjustments and removal of inconsistencies, at each data collection, treatments on the tool are performed through software developed by the author, using the Python programming language.

In the next chapter the technical product developed is presented, with a detailed presentation of each defined variable, the exclusions and relevant information

that the investor needs to know about the tool, as well as the justifications behind the author's choices regarding the logic of the technical product.

4   ANALYSIS OF RESULTS

4.1   THE TECNICAL PRODUCT DEVELOPED

The development of the technical product object of this work was based mainly on the systematization proposed by Rojo (2014) and the research of Honório and Rojo (2021), supporting itself in a complementary way in the other researches mentioned in this work. The tool that was developed aims to help the investor to start the investment analysis process, reducing the time that would be necessary to consult the historical data of the variables and the companies that have shares available on the Brazilian stock exchange.

It is important to note that the tool does not aim to define a definitive list of stocks, but rather to provide a basis for the investor to start their own analyses. In addition to the variables contemplated in the tool, the investor should check other factors that can affect the future value of a stock, as well as check their own investor profile (conservative, moderate or aggressive) and their investment objectives (Giraldi, 2019). It is up to the investor to perform a detailed analysis and then make their own investment decision.

In the sequence, the tool is described, its operation, the data used to feed the inputs, the possibilities and possible variations in its use, as well as other complementary details.

In a summarized way, the tool uses a historical database to verify which shares listed on the stock exchange meet the established variables and conditions, assigning them weights (grade) and displaying as output a list of stocks ordered by the sum of these weights. In other words, the conditions of each variable were defined for the evaluation of the roles. If an action satisfies the condition of a particular variable, that action will receive a previously established weight of that variable.

Table

Table 6 includes the ten variables that the tool uses for analysis and comparison of stocks and companies, as well as the respective authors who addressed these variables in their work:

Table 6

Variables and authors

Variables	Authors
1. P/E: is positive and below the industry average	Honório & Rojo (2021) De Almeida & Sales (2020) Palazzo et al. (2018) Rojo (2014) Holloway & Laes (2013) Passos & Pinheiro (2009) Da Costa Jr & Neves (2000)
2. Net debt: it is negative in the last year	Honório & Rojo (2021) Rojo (2014) Passos & Pinheiro (2009)
3. Profit: is positive in all years (up to 5 years) 4. Profit: percentage of positive growth (up to 5 years) 5. Profit: percentage of growth higher than the industry average (up to 5 years)	Honório & Rojo (2021) Palazzo et al. (2018) Rojo (2014) Passos & Pinheiro (2009) Graham (1973)
6. Revenue: percentage of positive growth (up to 5 years) 7. Revenue: percentage of growth higher than the industry average (up to 5 years)	Honório & Rojo (2021) Rojo (2014) Graham (1973)
8. Dividends: Paid in all years (up to 5 years) 9. Dividends: Percentage of positive growth (up to 5 years) 10. Dividends: Average greater than 5% (up to 5 years)	Honório & Rojo (2021) Palazzo et al. (2018) Rojo (2014) Passos & Pinheiro (2009) Graham (1973)

Note. Source: Survey Data, 2023.

The following is a practical example of the dynamics of the tool in relation to the variables: for the variable "positive P/E and below the industry average" all actions are analyzed to verify which of them have a positive P/E and P/E lower than the average of the sector of that company. Only companies that meet this condition receive the established weight, while the others have not computed the weight of this criterion. The same procedure is performed for the ten variables defined in Table

Table 6. As a final result, the sum of all weights is calculated and the list of actions is ordered by this sum. In this way, it is possible to visualize which actions met the greatest number of variables and conditions established.

Although the variable P/VPA is indicated in the work of Rojo (2014), it was not used in the simulation of Honório and Rojo (2021). Thus, it was also decided to not include it in the treatment of tool weights. However, because it is a relevant variable, it is presented in a column in the output table of the tool. This will allow the P/VPA variable to be used as a decision criterion by the investor, as suggested by Graham

(1973), Fama and French (1992), Battisti and Creta (2019) and Almeida and Sales (2020).

Regarding the values of the weights of the variables, the ones present in the work of Honório and Rojo (2021) were chosen, as shown in Table Table 7. However, these values can be changed at the discretion of the investor, and the values "0.25", "0.50", "0.75" and "1" can be assigned. The possibility of changing the weights of each variable gives dynamism to the tool and flexibility to the investor's perception.

Table 7

Variables and weights

Variables	Weights
1. P/E: is positive and below the industry average	1
2. Net debt: it is negative in the last year	1
3. Profit: is positive in all years (up to 5 years)	0,5
4. Profit: percentage of positive growth (up to 5 years)	0,5
5. Profit: percentage of growth higher than the industry average (up to 5 years)	0,5
6. Revenue: percentage of positive growth (up to 5 years)	0,5
7. Revenue: percentage of growth higher than the industry average (up to 5 years)	0,5
8. Dividends: Paid in all years (up to 5 years)	0,25
9. Dividends: Percentage of positive growth (up to 5 years)	0,25
10. Dividends: Average greater than 5% (up to 5 years)	0,25

Note. Source: Survey Data, 2023.

The tool's input screen is represented in Figure
Figure 2 below. The weights of each variable are indicated in area "D" of the figure, and it is possible to change them through the arrows indicated in area "E". The investor may exclude from the analysis any variable that he considers to be irrelevant, by disabling the check boxes, according to area "C". The eventual change in the values of the weights suggested by Honório and Rojo (2021) and exclusion of some variable, lacks empirical studies, however, it was decided to bring this possibility to the investor. If the investor changes the weights and variables, but wishes to return to the values indicated by Honório and Rojo (2021), there is a button for such a procedure, which is in the "H" area of Figure
Figure 2.

Figure 2

Technical Product Input Screen

Note. Source: Developed by the author, 2023.

Graham suggests a five-year historical analysis, but the tool allows this period to be reduced to up to two years, which makes it possible to compare shorter periods. On the input screen of the tool this change can be performed as indicated in area "A" of Figure

Figure 2. The Rojo model (2014) was developed based on small *caps* actions, however, in this study, it was decided to include both small and large companies. This decision is justified by the fact that the variables used in Rojo's study do not differ from other research and Graham's ideas.

In addition to the possibility of changing the weights, variables and period, the input screen allows the investor to indicate the percentage of Dividends that is used to calculate the average, among a variation between 1% and 10%, according to the arrow indicated in the "G" area of Figure

Figure 2. By default, the value is 5%, which can be considered an optimal value (Rojo, 2014). Finally, the input screen of the tool has the "List Papers" button, which

returns the list of papers sorted by their respective Notes. Being presented next, in detail, the source of the data, the criteria and the variables used in the tool.

The list of actions that the tool analyzes was obtained through the B3 website, which returned a total of 49,892 papers. Of these, only the papers of Brazilian companies and with common or preferred shares, shares with final 3, 4, 5, 6, 7 and 8 shares were selected, reducing the total number of shares to 524. Of the total of 524 papers, 448 papers remained, after excluding papers that presented some inconsistencies: 65 papers of companies that did not have active listing in Google Finance, 5 companies that did not have complete data in the CVM, 3 companies in judicial reorganization, 2 companies with pending IPO and 1 company that had been incorporated by another. Of the total of 448 papers, 43 companies in the financial segment were excluded, leaving 405 companies to be analyzed.

According to B3, companies can be classified according to their economic sector (broader classification), subsector and segment (narrower classification). Thus, for the variables that compare a company with other companies that belong to the same group, the classification by segment was used, since this classification allows comparing companies that have similar core activities.

The **first variable** defined and calculated is the ratio between share price and earnings per share – P/E, shown in Figure Figure 3.

Figure 3
Calculation of the P/E variable

P/E = Share Price / Net Income per share

Note. Source: Damodaran, 2006.

The P/E variable is used to indicate the time it takes for the investor to recover his investment. This means that the lower the P/E value, the faster the investor will have the invested amount back. Companies that have a P/E between 6 and 10 are considered fairly-priced companies, while companies with a P/E above 10 are considered expensive and those with a P/E below 5 are considered opportunities. Thus, within a specific sector, the lower the P/E (positive), the better (Damodaran, 2006; Lueders, 2008; Cerbasi, 2013).

Damodaran (2006) points out that it is usual to use the net income in the last fiscal year for the calculation, however, one can use the last 12 months in order to have a more recent value. Thus, the last 12 months are used to obtain an updated value of the variable, which is described in the tool as "1. P/E: Positive and below the industry average?" All companies have their P/E calculated with the current price of their paper. In the case of companies with a loss, the P/E ratio will return negative and these companies are not considered for the calculation of the sector average (Damodaran, 2006). After calculating the P/E of each paper and the industry average, only companies that present a positive P/E and below the industry average receive the score for the weight established for this variable.

It is important to observe some peculiar situations in the use of this variable and that should be a reason for the investor's attention. In industries where there is only one company with a positive P/E, no company will receive a score. In industries where one or more companies have a very high P/E, the industry average will eventually be skewed, which can lead to the scoring of several companies. As this indicator is widely used in investment decision making, it is displayed for all stocks in the output table of the tool.

The **second variable** used, net debt, can be obtained by the difference between gross debt and cash flows, as shown in Figure Figure 4 (Damodaran, 2012). If a company's net debt is negative, this is considered a positive sign (Rojo, 2014).

Figure 4
Calculation of Net Debt

Net Debt = Gross Debt - Cash

Note. Source: Damodaran, 2012.

Companies that have a high degree of indebtedness increase their chances of bankruptcy in times of crisis. In addition to the difficulties faced in operating activities in these periods, the company still needs to bear financial expenses, which can negatively impact its operating profits and decrease the time to deal with possible adversities (Lueders, 2008). In the tool the variable is described as "2. Net Debt:

Negative in the last year?", and all companies have their net debt calculated, receiving the weight score only the stocks that had negative net debt in the last year.

The **third**, **fourth** and **fifth defined variables** are related to the net income of companies. The profit or loss calculated can be called shareholder profit, because net income is the final amount that will be added to the company's equity or distributed in the form of dividends (Martins, Gelbcke, Santos & Iudícibus, 2013). Net income is earned by gross revenue subtracted from operating costs and expenses, as shown in Figure Figure 5 (Hoss, 2019).

Figure 5
Calculation of Net Income

Net Income = Gross Revenue - Costs - Expenses

Note. Source: Hoss, 2019.

To assess whether the company has remained profitable in all the last five years, the variable was included: "3. Profit: in all the years in the last five years?" (Graham, 1973). Companies that have robust rates of increase in revenue and profit have strong evidence that this growth will continue to happen (Lueders, 2008). The weight of the score of this variable is only computed for companies that present profit in all years of the selected period.

The absolute value of profit in a given year has no practical significance. Therefore, it is vitally important to check the evolution of the history of this profit, to determine if there is an uptrend (Buffett & Clark, 2010). The variable "4. Profit: % Positive Growth in the last five years?" was added for this check. The weight of the score of this variable is computed only when the company has positive growth in the selected period. Companies that do not present profits calculated in a given year do not receive the score for this variable.

Damodaran (2006) warns that it is important to compare the growth rates of a company with the market average. To this end, the following variable was added: "5. Profit: % growth higher than the industry average in the last five years?". The calculation of the industry average is considered only for companies that have data available within the selected period. Thus, the weight of the score of this variable is only computed if the company has growth above the industry average. The investor

should be aware as there are sectors where companies with negative growth tend to distort the degree of growth of the sector downwards.

In order to allow analyses in shorter periods, the variable "3. Profit: in all the years for the last five years?" may have its period changed to up to the last 12 months. The variables "4. Profit: % Positive Growth in the last five years?" and "5. Profit: % growth higher than the industry average over the past five years?" may have their period changed to the last two years.

Still seeking to analyze the growth of the company, the **sixth** and **seventh variables** analyze the net revenue of the companies. Net revenue is obtained by the sum of all sales of a company in a year deducted from deductions, rebates and taxes, according to Figure Figure 6 (Martins et. al., 2013).

Figure 6
Calculation of net revenue

Net Revenue = Sales Revenue - Deductions - Rebates - Taxes

Note. Source: Martins et. al., 2022.

In order to verify if the revenue growth rate is increasing, that is, if there is an upward trend, the variable was defined: "Revenue: % of positive growth in the last five years" (Buffett & Clark, 2010). And seeking to value the companies that are with an advantage of revenue growth within their sector, the variable was defined: "Revenue: % of Growth greater than the average of the sector in the last five years" (Damodaran, 2006). For both variables it is possible to change the analysis period to up to two years.

Finally, the **last three variables** use the dividends paid for the evaluation of companies, through the *Dividend Yield* (DY) indicator. The calculation of the DY variable is the result of the relationship between the sum of annual dividends + JCP, paid per share, on the share price, as shown in Figure

Figure 7 (Cerbasi, 2013). The current day share price is used to calculate the DY of the last 12 months, while the closing price of the stock on the last day of the respective year is used to calculate the DY of previous years (Hooi, Albaity & Ibrahimy, 2015).

Figure 7

Calculation of Dividend Yield

DY = (Annual Dividends + Annual Interest) per share / Share price

Note. Source: Cerbasi, 2013.

The DY is one of the most important indicators to evaluate a company, since the constant payment of dividends can indicate its financial health (Lueders, 2008). Dividends should be growing, solid and uninterrupted over time, compatible with the price of the asset (Graham, 2016; Bazin, 2017). According to Edwards (2011), a DY above 3% can be considered good, and above 5% can be considered optimal (in Rojo, 2014). Based on these considerations, the following variables were defined: "8. Dividends: have you paid in every year for the last five years?", "9. Dividends: "% positive growth in the last five years?" and "10. Dividends: average over the last five years greater than 5%?". The first variable seeks to verify the constancy of payments made in the last five years, the second seeks to verify if the payment is increasing and the last one verifies if the average payment is at least 5%.

For the variable "8. Dividends: have you paid in every year for the last five years?" it is possible to reduce the period to up to the last 12 months. While for the variable "9. Dividends: "% positive growth in the last five years?" it is possible to reduce the period to the last two years. In the variable "10. Dividends: 'average over the last five years greater than 5%?'" it is possible to change the period to up to the last two years and also change the percentage of DY between 1% and 10%. These possibilities of changes in the periods and percentages of DY provide greater flexibility and dynamism, according to the perception of the investor.

As a result of all the filters cleared on the home screen, and after clicking the "List Papers" button, the tool will present an output table with all the actions, as shown in Figure Figure 8:

Figure 8

Technical Product Output Screen

Note. Source: Developed by the author, 2023.

The columns indicated in the green color of Figure Figure 8 represent:

a) **TICKER:** paper code for investment;

b) **COMPANY:** name of the company;

c) **SECTOR**: segment in which the company operates;

d) **P/E**: price over earnings for the last 12 months;

e) **P/VPA**: price divided by equity value per share;

f) **DY**: dividend yield of the last 12 months;

g) **PRICE**: share price obtained with a delay of up to 20 minutes;

h) **NOTE**: sum of the weights of the selected variables.

At the top of Figure Figure 8 it is possible to see the "Sector" filters. This functionality allows the user to select all sectors or only those sectors in which they want to perform their own analyses. After the "NOTE" column, the output table, Figure Figure 8will have ten more columns, which represent the Start screen variables. In order for the investor to visualize in a practical way which variables scored, the cells referring to each paper receive a different color. To view the fulfilled criteria on the home screen, the user simply positions the cursor over the header of these columns. Companies that did not score on a given variable display blank cells instead.

The tool will allow the investor to sort the output table in some ways, through buttons (arrows) in the header of the columns, which we describe below:

a) **TICKER:** will sort the table by the column "TICKER", alphabetically, ascending or descending;

b) **COMPANY**: will sort the table by the column "COMPANY", alphabetically, ascending or descending;

c) **SECTOR**: will sort the table by the columns "SECTOR", alphabetically, ascending or descending, column "NOTE", only in descending form, and column "P/E", only increasingly;

d) **P/E**: Will sort the table by the "P/E" column, either ascending or descending.

e) **P/VPA**: will sort the table by the column "P/VPA", in an ascending or decreasing way.

f) **DY**: will sort the table by the "DY" column, either ascending or descending.

g) **PRICE**: will sort the table by the "PRICE" column, in an ascending or decreasing way.

h) **NOTE**: Sort the table by the columns "NOTE", in an ascending or decreasing manner and "P/E", only in an ascending form;

Of all the forms of ordering, one can highlight the ordering by "NOTE" and by "SECTOR". Grading by NOTE allows the investor to focus their analysis on the companies that scored the highest. In case of a tie in the score, the table will undergo increasing ordering by the P/E indicator. Next, it will order each sector according to the highest "NOTE" and the lowest P/E. The different ways of ordering the table aim to allow the investor to view the results in different ways, seeking the diversification of his portfolio. The increase, in a diversified way, in the number of securities in a portfolio, promotes the reduction of risks, at a decreasing rate (Assaf Neto, 2006).

5 FINAL CONSIDERATIONS

This work sought to develop a technical product to automate the Rojo model (2014) in order to enable the analysis of actions in the Brazilian market. The logic of the developed tool is based mainly on the works of Rojo (2014) and Honório and Rojo (2021), and in a complementary way other scientific works developed by other authors.

The choice to use the Rojo model (2014) in the development of the tool was based on the innovative character of his research, which obtained the main perceptions of successful investors on how to start a fundamental investment analysis in the Brazilian stock market. The validation of the findings of Rojo (2014) was performed by Honório and Rojo (2021), who, through an analysis of the history of the Brazilian market, confirmed the validity of the proposed model. In this way, the specific objectives proposed were achieved in their entirety, culminating in the development of the tool that will enable the investor to start his own investment analysis in the long term.

It is important to note that the tool should not be seen by the investor as their only source of information, especially since this type of investment is a high-risk one. In addition, the eventual use of the tool is not professional, its database uses free sources available on the computer network, which may result in some inconsistencies and delays in the availability of data. It is recommended that the tool be used in a complementary way to what was proposed by Giraldi (2019), who developed a step-by-step guide for decision making in investments in the stock market, taking into account the profile of the investor, which can be conservative, moderate or aggressive.

This work presents a practical contribution with the development of a technical product with scientific basis, which has no similarity in the literature. The availability of the tool will contribute to the democratization and diversification of investments by the small investor, who can use it as a quick way to compare companies in the same sector.

However, a limitation found during the development of this work was the time available for completion, which made it impossible to create an application or website. The Excel tool, being a paid program, can limit the use of the technical product to only those who have a license to use.

For future studies, it is suggested the migration of the tool to an online platform, which would bring as a benefit the possibility of anyone with internet connection to have access to the tool. In addition, through an online platform the investor would have at hand updated data, not needing version management in search of more up-to-date data every quarter.

In addition, studies using the Rojo (2014) model combined with the findings of Palazzo et al. (2018), Testa (2011) and dos Passos and Pinheiro (2009), could be carried out with the objective of merging the variables indicated in the studies, validating the use of new variables. Subsequently, a complementary tool could be developed with the findings obtained.

Another possible approach would be the construction of a tool using the fundamentalist variables combined with fuzzy logic, to select the stocks with the best buy signals and future appreciation trend (de Souza & Rojo, 2010; Marques, 2017).

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