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RESEARCH ARTICLE

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AN APPLICATION OF THE TODIM METHOD IN BRAZILIAN FINANCIAL MARKET SHARE

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ABSTRACT

Many people believe that it is important to just set aside money to guard against possible future financial damage. However, they end up missing opportunities to earn income with the money saved. By using the money saved in applications that earn interest, corrections or other forms of remuneration, the individual turns savings into investment. The Brazilian financial and capital markets have the capacity to offer and distribute a variety of alternatives and products to investors, and the search for profitable capital available for investment grows gradually, in most situations, by increasing the income of the Brazilian population, and the capacity for internal savings. The purpose of this paper was to use a methodology to assist in the selection of the best stocks in the financial market to invest in 2020, according to several vehicles of the Brazilian capital market. The TODIM Decision Multicriteria Support Method was used, which serves as a tool for data ordering. The analyzed information followed qualitative and quantitative criteria, consolidated through spreadsheets explaining items of performance, quality and ordering in the generation of sensitivity analyzes to support investment decisions. The paper has shown that to build a portfolio investment with adequate planning to support the decision is the best choice to do.

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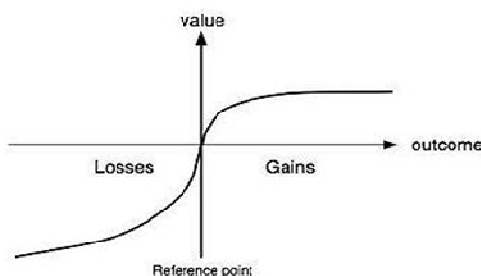
INTRODUCTION

With the fall in interest rates, inflation and a more liberal political and economic trend, investments such as fixed income and securities linked to SELIC and IPCA (Brazilian interest rates) have not brought a significant return as before, according to VALOR INVESTE, Clear and INFOMONEY brokers. Thus, investors will have to look for new alternatives to maximize their portfolios. For this reason, the search for greater returns has grown, necessarily by investment fund managers, consultants, investment advisors and even individual investors with some expertise in the financial market. Credit, equity and multimarket funds will benefit from this movement; the allocator will have to deepen the knowledge about new classes of investments if he does not want to continue with low income financial assets. To invest in products that bring greater returns, the individual is subject to the risk of financial losses and, in order to obtain satisfactory returns, it is necessary that the investor seeks its suitability to the risks and analyzes the best companies, both from a qualitative and quantitative point of view. For this, the actions of certain companies were chosen as an object of study using management tools that help in a technical way to choose between two or more financial assets for the composition of a portfolio investment. The composition of the portfolio may result from random and independent decisions, or it may be the product of planning. In this way, a study that applies a methodology based on a Multicriteria Decision Support Method, can assist the investor in evaluating alternatives and making good decisions. With the Stock Exchange breaking records in 2019, several stocks skyrocketed and became expensive to invest. As a result, the question of which variable asset to invest in has grown. The main engines of growth of a company and that facilitate in the choice to invest a certain stock are: gain of participation in the market, optimization of costs, growth of the sector and favorable political-economic scenario, as Clear and Infomoney brokers. It was necessary to understand that there is no risk-free return. And this risk is associated with the level of uncertainty regarding the future of the investment. Therefore, the greater the degree of uncertainty, the greater the level of expected return and vice-versa.

In spite of this, looking for a portfolio suited to the profile, which includes more risky assets and others that are safer, in order to dilute the risks and increase the expected return is the most ideal way to obtain considerable returns with a little more security. The TODIM method was used to select the best stocks within a universe of assets chosen by the authors of this article. This was developed to assist the decision maker by modeling his preferences and also to generate an ordering (ranking) of the alternatives. The TODIM method (acronym in Portuguese for interactive and multicriteria decision making) is a multicriteria procedure that has received attention from the scientific community for many years.

THEORETICAL DEVELOPMENT: Multicriteria Decision Aid is an area of Operational Research used to carry out the selection, classification or ordering of solution alternatives in a decision-making process, which allows, in addition to considering quantitative criteria for evaluating these alternatives, also to consider qualitative criteria. Multicriteria Decision Support (MDA) methods are applied in cases where, in the presence of multiple criteria, it seeks to select, order, classify or describe alternatives, (Roy & Bouyssou, 1993; Romero, 1993; Vincke, 1989), depending of the problem addressed. This paper has applied the TODIM method to evaluate the performance of the shares of a group of companies listed on the Brazilian stock exchange through the criteria of return, liquidity, rating and volume traded. The Multicriteria Method "Interactive and Multicriteria Decision Making" (TODIM), by Gomes and Lima (1992), was developed to assist the decision maker in solving decision problems, through the ordering of alternatives.

Prospect Theory: The prospect theory emerged from the joint research work of two Israeli psychologists, Daniel Kahneman and Amos Tversky, and was first published in 1979 by Kahneman and Tversky. The objective of the research was to evaluate human behavior during decision-making and in situations of risk. These two psychologists observed that, in situations involving gains, there is a tendency for human beings to be more conservative in relation to risk, that is, people prefer to opt for a smaller gain, which is safe, than to run the risk of obtaining a greater gain. On the other hand, in situations that involve losses, people are more likely to take risks, that is, they prefer to take the risk of greater losses (if there is a possibility of not losing anything) than accepting a lower risk, although it is safe. Prospect theory uses the value function to explain aversion and risk propensity. This function has the shape of "S", represented in figure 1.



Source: Gomes, Araya e Cariganano (2004)

Figure 1. Reaction scheme of synthesis of ibuprofen derivatives through esterification reaction

The concave curve above the horizontal axis represents the gains, and below the horizontal axis, the convex curve represents the losses. The concave part represents risk aversion in the face of gains, while the convex part represents risk propensity when it comes to losses.

Todim Method: The TODIM method uses comparisons of pairs between decision criteria, having technically simple and correct resources to eliminate possible inconsistencies arising from these comparisons. It also allows judgment values to be executed on a verbal scale, using a hierarchy of criteria, fuzzy value judgments and making use of interdependent relationships between alternatives. The TODIM method can be verified in Gomes, Araya and Carignano, (2004). In all applications of the TODIM method, the value function created from problem data has the same format as the value function of the Prospect Theory. The theory of the TODIM method can be verified in Gomes, Araya and Carignano, (2004). In all applications of the TODIM method, the value function created from problem data has the same format as the value function of the Prospect Theory. The TODIM Method, in its formulation, has as some of the objectives, according to Gomes, Araya and Carigna (2007), the process of building a solution to a problem involving the TODIM Method has a constructivist approach, as it is an interactive process, involving both the analyst and the decision-makers and multiple representations of the problem. According to Galvão (2014) and Gomes et al., (2013), the basic concepts of the method are: Definition of a set of alternatives, criteria and weights. The criteria are the elements that guide the analysis and comparison of alternatives according to the objectives that are intended to be achieved. The weights are the importance that the decision makers express about alternatives and criteria. In the multicriteria context, losses and gains are defined as differences between the weights of the alternatives (their performances) in terms of a particular criterion.

Multicriteria Decision Support is the field of Operational Research used when it is desired to carry out selection, classification, ordering, or description of alternatives that could solve a decision problem, in the simultaneous presence of quantitative and qualitative criteria Llamazares (2018). Gomes and Lima (1992) elaborated a way of associating the foundations used by the Perspective Theory to the environment that characterizes Multicriteria Support to Decision. Consider a set of n alternatives to be classified in the presence of m quantitative or qualitative criteria. To determine the weight of the criteria, the TODIM method suggests the use of a matrix of comparison of pairs of criteria. The Saaty scale (1990) is used to construct this matrix. However, criteria weights can also be obtained through a rating scale, that is, through a direct evaluation on a given scale. As, however, all pairs comparison matrices may contain some inconsistencies, resulting from the violation of transitivity, the TODIM method has a feature that, while respecting the judgment values that lead to the initial matrix, corrects them systematically, eliminating occasional inconsistencies. Once the comparison of the corrected matrix of the pair of criteria was constructed, the application of the TODIM method proceeds in the direction of obtaining the weights of the criteria, using the following two stages: (i) the values are added throughout each column of the corrected matrix; (ii) the reciprocal values of these values are calculated; (iii) each of these reciprocal is divided by the sum of the reciprocal: the values obtained in this way will be the weights of the criteria. After defining these criteria weights, experts are asked to estimate for each of the qualitative criteria c , the contribution of each alternative i to the objective associated with the criterion. This method requires that the values of the evaluations, of the criteria in relation to the alternatives, numeric and normalized. Therefore, the qualitative criteria evaluated on a verbal scale are transformed into a cardinal scale. The evaluations of the quantitative criteria are obtained through the performance of the alternatives in relation to the criteria.

After evaluating the alternatives in relation to all the criteria, the evaluation matrix is obtained, where the values are all numeric. The values are then normalized. This normalization is performed for each criterion, obtaining a matrix in which all values are between zero and one, called a partial desirability matrix, as shown in Table 1.

Table 1. Partial desirability matrix

Alternatives	Criteria					
	1	2	...	J	...	M
1	w11	w12	...	w1j	...	w1m
2	w21	w22	...	w2j	...	w2m
...
I	wi1	wi2	...	Wij	...	Wim
...
N	wn1	Wn2	...	Wnj	...	Wnm

Source: Gomes, L.; Machado, M.A.S; Rangel, L. (2013)

After assigning the criteria weights and normalizing them, it is necessary to calculate the partial dominance matrices and the final dominance matrix. It is now accepted that any of the criteria m can be considered a reference criterion r; this can, for example, be identified as the criterion of greatest weight. Thus, wrc represents the rate of substitution of the criterion under analysis c in relation to the reference criterion r. The use of the substitution rate makes it possible to bring all the comparison measures by performance pairs to the same scale. The measure of dominance of each alternative i over each alternative j, now incorporated into the Prospect Theory, is given by equation 1:

Equation 1. Dominance of each alternative

Source: Gomes, Araya e Carignano (2004)

$$\delta(i, j) = \sum_{c=1}^m \Phi_c(i, j), \quad \forall(i, j)$$

Where:

Equations 1a,1b e 1c.

Source: Gomes, Araya e Carignano (2004)

$$\Phi_c(i, j) = \begin{cases} \sqrt{\frac{a_{rc}(w_{ic} - w_{jc})}{\sum_c a_{rc}}} & \text{se } w_{ic} - w_{jc} > 0 & (1a) \\ 0 & \text{se } w_{ic} - w_{jc} = 0 & (1b) \\ -\frac{1}{\theta} \sqrt{\frac{(\sum_c a_{rc})(w_{jc} - w_{ic})}{a_{rc}}} & \text{se } w_{ic} - w_{jc} < 0 & (1c) \end{cases}$$

- $\delta(i, j)$ represents the measure of dominance of alternative i over alternative j;
- m** is the number of criteria;
- c** is any criterion, for $c = 1, \dots, m$;
- a_{rc} is the rate of substitution of criterion c for criterion r;
- w_{ic} e w_{jc} are, respectively, the weights of alternatives i and j in relation to criterion c;
- θ is the loss mitigation factor

The factor $\Phi_c(i, j)$ represents the contribution portion of criterion c to $\delta(i, j)$, when alternative i is compared with alternative j. If the value of $w_{ic} - w_{jc}$, is positive, it represents a gain for the function $\delta(i, j)$ and therefore the expression of $\Phi_c(i, j)$ is the equation (1a). If $w_{ic} - w_{jc}$ is null, $\Phi_c(i, j)$ is the equation (1b), and if $w_{ic} - w_{jc}$ is negative, $\Phi_c(i, j)$ is represented by equation (1c). After calculating the various partial dominance matrices, one for each criterion, the final dominance matrix is obtained, $\delta(i, j)$, by the sum of the elements of the different matrices. The final dominance matrix is then normalized, using equation 2, to obtain the global value for each alternative. Each calculated number should be interpreted as a measure of overall convenience or utility, desirability or global utility, or simply, as the value of a specific alternative. The ordering / classification of alternatives originates from the ordering of their respective values.

Equation 2. Global value for each alternative

Source: Gomes, Araya e Carignano (2004)

$$\xi_i = \frac{\sum_{j=1}^n \delta(i, j) - \min \sum_{j=1}^n \delta(i, j)}{\max \sum_{j=1}^n \delta(i, j) - \min \sum_{j=1}^n \delta(i, j)} \quad (2)$$

Therefore, the TODIM method determines, based on the preferences expressed by a decision maker or a group of decision makers, a choice, by ranking all alternatives. By changing such a set of preferences, a new result can be achieved. A sensitivity analysis should be considered by assessing not only the implications if the loss mitigation factor is changed, but also, depending on the purpose, the criteria weights, the reference criterion or the evaluation of the alternatives. By changing this set of preferences, it is possible to achieve a new result, through a sensitivity analysis.

CASE STUDY: Therefore, the TODIM method determines, based on the preferences expressed by a decision maker or a group of decision makers, a choice, by ranking all alternatives. By changing such a set of preferences, a new result can be achieved. A sensitivity analysis should be considered by assessing not only the implications if the loss mitigation factor is changed, but also, depending on the purpose, the criteria weights, the reference criterion or the evaluation of the alternatives. By changing this set of preferences, it is possible to achieve a new result, through a sensitivity analysis. As described in the introduction to this paper, the drop in interest rates has attracted investors with less risk aversion to their investments. The possibility of high long-term gains, and other possible benefits such as dividends, for example, there is a tendency to seek new alternatives to make portfolios more profitable. Investing in stocks can be an excellent way to increase wealth. For long-term investors, stocks are a good investment, even during periods of market volatility - a slowdown in the stock market like the one we saw this year due to the coronavirus pandemic, for example, simply means that many stocks are for sale.

The database collected was a selection of ten (10) existing shares on the Brazilian Stock Exchange and listed with their respective analysis on the electronic platform <https://www.fundamentus.com.br/>.

The selection followed the criterion of choosing the best shares to invest in 2020 according to banks, brokers, distributors, financial magazines and electronic websites. The main sources of information on what would be the best actions to invest in 2020 were:

- **Banks:** Banco do Brasil, Bradesco, Itaú BBA and BTG Pactual.
- **Fund Administrators:** BTG Pactual Asset, Safra Investimentos, Santander Asset. BNY Mellon Serviços Financeiros, Bradesco Asset Management and Itaú.
- **Financial intermediaries:** Credit Suisse Hedging Griffo CV, Liquidity DTVM, XP Investimentos CCTVM, Clear Corretora and Rico Investimentos.
- **Magazines and Electronic Sites:** Infomoney, THE CAP, EU QUERO INVESTIR!, HC Investimentos, FUNDAMENTUS INVISTA CONSCIENTE, OS MELHORES INVESTIMENTOS, VALOR INVESTE.
- After this filter, the universe of assets collected, was reduced to ten (10) shares listed on the Stock Exchange. In this paper, the first set of n alternatives to be ordered in the presence of m quantitative and qualitative criteria are the actions of the selected companies. From the information, four variables were selected that impact the stock purchase decision as criteria to be used in the implementation of the TODIM Method. Finally, there was an ordering of the set of ten actions using the previous criterion based on the TODIM methodology.

Criteria: From the authors' points of view with the readings and analyzes of the sources of information mentioned above, four (4) relevant criteria were obtained from the source FUNDAMENTUS INVISTA CONSCIENTE for this analysis:

C1 – Return Rate: Quantitative criterion that indicates the profit from an investment of the expected return on the asset. The return can be defined as the gain or loss resulting from an investment, for a fixed period of time. The return rate in percentage points of the last twelve months was considered for analysis, done on 18th, December, 2019. **C2 - Interval** (difference between the maximum rate and the minimum rate of the interval of the last fifty two weeks). Quantitative criterion that is an indicator of liquidity risk. The definition of liquidity risk is the inability to liquidate a position in a timely manner Galvão (2014). This definition incorporates the time dimension to the concept of liquidity risk.

C3 – Rating: Qualitative criterion that is an indicator of credit risk. Figure 2 shows the score associated with the asset's rating. This table shows the equivalence of credit risk rating among the six main international credit rating agencies. For example, an asset with an AAA rating, which is the highest rating, receives a score of 4. The credit risk rating activity (rating) assists investors in decision making.

Figure 2. Valoration criterion C3 – Rating

	4		3		2		1			
Austin	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-
Fitch	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-
Lopes Filho	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-
Moody's	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3
S&P's	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-
SR	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-

Source: GALVÃO, 2014

C4-Traded Volume: Quantitative criterion that considers the value of the average volume traded on the financial market for each selected share. Based on the Fundamentus platform already mentioned, the period available for collecting the average volume of shares traded was the last two months according to the period analyzed on December 18, 2019.

Alternatives: In this case study, ten shares of the stock exchange were evaluated by the criteria mentioned in the methodology section of this paper. In order to better understand the meanings of the ten (10) codes that will be presented, it is necessary to understand the difference in terms of the types of actions chosen for the analysis. Preferred shares, represented by the acronym PN, give the right to receive dividends from the company with priority, but do not provide the right to vote. Common shares, represented by the acronym ON, give their holder the right to vote at a meeting and to receive, non-preferentially, dividends from the company. The letters refer to the issuing companies of the action, represented by 4 characters before an enumeration.

Codes with end 4 indicate that paper is a preferred share. The type of asset traded with the number 11 is normally used for BDRs (Brazilian Deposit Receipts), that is for shares of foreign companies traded on the Brazilian stock Exchange and for Units, that are papers composed of more than one asset, but bought and sold as a unit. A Unit can be composed of several combinations of different types of actions. Banco Inter, for example, trades Units in the Brazilian stock market, under the code BIDI11. The following are the ten (10) actions chosen with their respective codes and descriptions:

- **ECOR3** - Ecorodovias is one of the main infrastructure and logistics operators in Brazil. There are expectations for growth and major infrastructure projects in progress.
- **JBSS3** - JBS returned to the list of most recommended stocks because it is the preferred slaughterhouse of analysts, who believe that the company is operating soundly and with lower governance risks.
- **PETR4** - One of the actions most recommended by analysts is PETR4, the preferred one by Petrobras. And it could not be otherwise, since the company is one of the largest in the world in the oil sector. Petrobras' current management shows great capacity to dispose of projects that did not make sense to the company and to focus efforts where the oil company is a reference.
- **VALE3** - In 2020, the ore market should continue to be in deficit, pushing prices above the average, which tends to bring good results for the company. Vale is suggested by analysts because of the recent appreciation of ore in the international market and the greater demand from China for higher quality ore.
- **MGLU3** - Magazine Luiza's shares are among the most talked about in the market. The company has grown above the average for the consumer sector and continues to show important developments, with gains in market share, which indicates that the good results should continue in the coming periods.
- **RENT3** - Localiza has one of the best corporate governance practices and is listed on the Stock Exchange in the new market segment. In addition, the company has shown a fast pace of growth and profit and leadership in its field.
- **ITUB4** - The position of largest private bank in Brazil makes Itaú's shares one of the most indicated by analysts. After all, the bank's positioning within the sector makes Itaú comfortable to take advantage of the resumption of credit in Brazil. In addition, the bank has a lot of available capital, which allows the institution to invest in more interesting projects for shareholders.
- **B3SA3** - The potential for diversification of B3's revenue, the Brazilian Stock Exchange, in addition to the company's monopoly in the segment, are the main justifications for the constant presence of B3SA3 shares among the recommended portfolios.
- **BIDI11** - Inter bank was one of the most talked about companies throughout 2019, considering the Small Caps listed on the Brazilian Stock Exchange. BIDI11 shares were launched in 2018 and have become great opportunities for investors.
- **BBAS3** - Brasil's bank latest operating results have exceeded market expectations, showing a continuous recovery in the quality of the loan portfolio, in addition to efficient control of administrative expenses and growth in service revenue.

RESULTS AND DISCUSSION

Considering the set of ten alternatives to be ordered in the presence of the four quantitative and qualitative criteria, it was possible to create Table 2, obtained from the valuations of the alternatives in relation to the criteria, representing a complete evaluation of the alternatives studied in the analysis in relation to the selected criteria.

Table 2. Performance of alternatives

Alternatives	Criteria			
	Return rate (%)	Interval	Rating	Traded Volume
ECOR3	59.81	7.16	3	45.963.300
JBSS3	110	21.9	1	390.654.000
PETR4	36.43	10.41	1	1.615.080.000
VALE3	4.1	14.56	1	857.543.000
MGLU3	126.71	29.35	4	605.653.000
RENT3	72.13	20.12	4	219.854.000
ITUB4	11.66	6.57	2	784.042.000
B3SA3	82.89	24.65	4	419.625.000
BIDI11	11.72	21.76	1	218.026.000
BBAS3	17.02	12.06	1	626.135.000

Source: Authors

The ECOR3 action can be taken from this table as an example, with the following informations:

- **Return rate:** 59.81% - rate of return obtained in the last twelve months.
- **Interval:** 7.16 – difference between maximum and minimum trading rates in the past fifty two weeks.
- **Rating:** 3 – AAA credit note awarded by Standard & Poor's Agency (according to evaluation by figure 2 – Valoration of Criterion 3, received a score equal to 3).
- **Traded Volume:** R\$45.963.300 – average real value traded in the last two months.

Implementation of The Todim Method: In order for the implementation to proceed correctly, we must normalize the 'Interval' criterion by its inverted values, because for this criterion, it is preferable to have its value minimized. For the other criteria, it was performed the standard normalization, which follows the maximum value of each alternative.

Then, the numerical values in the matrix cells are normalized, this means that throughout each column, the largest numerical value is equal to one, which was done by dividing each value by the highest value in the corresponding column. The normalized performance matrix is called the partial desirability matrix, presented in Table 3. The evaluation of alternatives according to each criterion, presents a complete evaluation of the actions studied in the analysis in relation to the selected criteria. It also contains the normalized value of that assessment, which is fundamental for the implementation of the TODIM method.

Table 3. Partial desirability matrix

Alternatives	Criteria			
	Return rate(%)	Interval	Rating	Traded Volume
ECOR3	0.47202	0.91760	0.75000	0.02846
JBSS3	0.86812	0.30000	0.25000	0.24188
PETR4	0.28751	0.63112	0.25000	1.00000
VALE3	0.03236	0.45124	0.25000	0.53096
MGLU3	1.00000	0.22385	1.00000	0.37500
RENT3	0.56925	0.32654	1.00000	0.13613
ITUB4	0.09202	1.00000	0.50000	0.48545
B3SA3	0.65417	0.26653	1.00000	0.25982
BIDI11	0.09249	0.30193	0.25000	0.13499
BBAS3	0.13432	0.54478	0.25000	0.38768

Source: Authors

The method proceeds with the formation of a peer comparison between criteria. It is presented in table 4, the weight of each of the criteria used in the analysis.

Table 4. Criteria and Standard Weights

Criteria	Standard Weights
Return rate(%)	0.2303
Interval	0.2720
Rating	0.3014
Traded Volume	0.1962

Source: Authors

The next step is to identify, as a reference criterion, the criterion of greater weight. Defined the reference criterion, the replacement rates (trade-off) of this criterion are calculated in relation to the normalized weights (Table 5).

Table 5. Replacement rates

Criteria	replacement rates
C1	0.764
C2	0.902
C3	1.000
C4	0.651

Source: Authors

Results Of Ordination Of The Share Portfolio: Implementing the mathematical formulation of the TODIM Method (Gomes and Lima. 1992), it was calculated the partial dominance matrices $\Phi c(i, j)$, one for each specific criterion. After calculating the four matrices of partial dominance for the four criteria, the final dominance matrix $\delta(i, j)$, is obtained, by the sum of the elements of the rate of return, interval, rating and traded volume matrices. The application of the TODIM method results in a global normalized value for each alternative presented in table 6. The ordering of the alternatives, obtained through the normalized global value of each alternative is also present in this table 6.

Table 6. Final values and ordering

Alternatives	Global value	Normalized global value	Ordering
MGLU3	-4.8614	1.0000	1
B3SA3	-9.5042	0.7247	2
PETR4	-9.6220	0.7177	3
ITUB4	-9.9390	0.6989	4
RENT3	-12.0094	0.5761	5
ECOR3	-12.6472	0.5383	6
JBSS3	-16.6937	0.2983	7
BBAS3	-18.9854	0.1624	8
VALE3	-21.0118	0.0422	9
BIDI11	-21.7237	0.0000	10

Source: Authors

Many investors do not use an adequate management tool to make a decision when choosing between two or more assets in a technical way. They focus only on profitability and forget the risks and other criteria inherent in the asset. Analyzing the final result, with the listed shares, it was found that the MGLU3 common stock, from retail company Magazine Luiza, was recommended as the most suitable stock to compose the portfolio, according to the four criteria chosen by the authors. This fact is explained by the higher values that this asset has in the three criteria that seek to maximize the investment decision and have a high value in the four criteria. For example: comparing the MGLU3 common share with the BIDI11 share, issued by Inter bank, which was the least indicated, it was found a better performance of Magazine Luiza's share in all criteria. Although the performance of the MGLU3 common stock for the interval criterion is greater than that of the BIDI11 share. This criterion indicates a minimizing decision, the difference between the values of the two shares in this criterion is very small, and it was not enough to change the ordering when comparing the criteria together.

Sensitivity Analysis: One of the methods of analyzing the sensitivity of the TODIM method is from the variation of the loss mitigation factor value (Gomes et al. 2013). In any decision model, it is important to check the sensitivity level of the preferred alternative, in the face of changes in the value judgments issued by the decision maker (Gomes; Araya; Carignano. 2004). The sensitivity analysis measures the impact of changes in the preferences of the manager / investor and evaluate the variations in the results of the alternatives chosen by changing the values and / or weight of the criteria, the performance of alternatives, for example.

In this model the values can be changed without generating recalculation or rework, because the calculations are made automatically by the electronic spreadsheet prepared in Excel with the mathematical formulation of the TODIM Method (Gomes and Lima. 1992) and the result considering the changes, it is immediate. The sensitivity analysis was applied to the final result of the stock values by varying the weights of the most conflicting criteria when it comes to stock selection according to the reading of the researched magazines and websites.

We also made a change in the loss mitigation factor, using $q = 10$. In this case, it was assigned the following weights to the criteria:

- 40% for the rate of return because, in general, it is one of the first indicators that the investor analyzes to compose an asset portfolio;
- 30% for the volume traded because, the volume indicates the amount of purchase and sale negotiations made in relation to an asset in a given period of time and, because of this, this is an attribute that is directly related to the high liquidity of a share.
- 15% for range and rating, as these two criteria do not have an important decision-making power as the previous criteria.
- The result of the sensitivity analysis for the shares with the new weights and a loss mitigation factor equal to 1 is shown in Table 7.

Table 7. Result of the sensitivity analysis

Ordering of Alternatives	
MGLU3	1.0000
PETR4	0.7890
B3SA3	0.6680
ITUB4	0.6574
ECOR3	0.6467
RENT3	0.5540
JBSS3	0.3905
BBAS3	0.1672
VALE3	0.1485
BIDI11	0.0000

Source: Authors

Despite the variation in the weight of the four criteria, as well as in the loss mitigation factor, the preferences were maintained and the ordering of the actions was little changed. There was a change in the ordering of B3SA3 shares, issued by the Stock Exchange; PETR4, issued by Petrobrás and RENT3 shares, issued by the company Localiza Hertz and ECOR3, issued by EcoRodovias. Assets B3SA3 and RENT3 fell one position, and assets PETR4 and ECOR3 rose one position.

CONCLUSION

The purpose of this paper was to show how investors can use a stock portfolio that, as a way of making the equity profitable and using additional techniques, such as the method of supporting the TODIM decision multicriteria, they will be able to obtain more consistent results for decision making. The model based on the TODIM Method was adapted to the problem presented and the spreadsheets in Excel were easy to implement, using the mathematical formulations of the methodology, which confirms that the research objective has been achieved. After choosing the ten assets in the portfolio, it was verified the difficulty in the decision to buy the assets to build an investment portfolio. There are several criteria that are difficult to compare, both quantitative and qualitative, where investors need to exercise value judgments on some of them. Each financial market share has a risk rating, trading volumes, different liquidity and returns. Furthermore, it has to be considered the investor's personal characteristics in the selection process, for example, in relation to risk and return. For the pre-selection, it was necessary to determine some qualitative criteria for evaluation, and for choosing the most important stocks in the portfolio. It was used return expectations as criteria, an indicator of liquidity risk, a credit risk rating and the average monthly value traded.

The use of the method in a portfolio of differentiated products would also be very interesting, such as the addition of fixed income products, financial derivatives, indexes that replicate the stock exchange or the interest rate and inflation, for example.. Another important asset that could be added among the ten shares, would be the IBOVESPA, to see which stocks would return above or below the most important index on the Brazilian stock exchange. In the current financial market, there is already a range of technical tools for various types of products and used frequently for asset selection situations. The search for models that simplify the assembly and selection of individuals' portfolios is essential to increase the investment flow of individuals, directed to the Brazilian financial and capital markets. Therefore, this method was used to choose the best shares to invest in the financial market at the moment. The analysis of alternatives using the TODIM method led to an ordering of actions that was satisfactory and in accordance with the qualitative results obtained in the sources of this paper. In the case of valuation of the ten shares on the stock exchange, this method is able to help investors to evaluate the alternatives more clearly in relation to the defined criteria. This is a mathematical method that seeks to reflect in its results the preferences of decision-makers who know, according to different points of view, the multiple dimensions of the analyzed problem. Due to the characteristics and results of the method, it was considered that the use of this effectively assists the evaluation of the actions. In the field of finance, there are several investment possibilities and selection of mounting financial product portfolios. This means that this study serves only as a basis and guide for new research that follows the branch of the financial market.

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