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Abstract of the thesis dissertation  
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## **A methodical modification of the Gordon Growth Model as a non-classical approach to stock price forecasting**

The main purpose of the dissertation was to develop a methodical procedure to modify the classic form of the Gordon Growth Model, which resulted from the need to improve the efficiency of stock price forecasts. The basis for the modification was the proposal of using nonparametric methods, aimed at optimising stock price forecasts, leading to increased opportunities for practical use of the Gordon Growth Model. An attempt to expand the current state of knowledge about the Gordon Growth Model on the Polish capital market was complemented by considerations of the German, French and American stock market and the assessment of its suitability for investors as a tool supporting long-term investment decisions.

Pursue the main objective of the dissertation required the achievement of set partial objectives, which were divided into theoretical and cognitive objectives and application goals. For theoretical and cognitive purposes include:

1. Evaluation of the sources of limited effectiveness as regards cognitive values of selected discount models on the stock market;
2. Formulation of generalised regularities regarding the theory and dividend policy on the Polish stock market;
3. Determining the impact and usefulness of selected nonparametric statistical methods on improving forecasts and return rates of shares.

In turn, the following were classified for:

1. Evaluation of concurrence of valuations based on the Gordon Growth Model with their subsequent stock prices;
2. Empirical verification of the modified mismatch factors in the Gordon Growth Model proposed in the dissertation.

The next step closer to the realisation of the presented research goals was the formulation of hypotheses, which then were tested. The main research hypothesis reads that the use of nonparametric statistical methods – i.e. the bootstrap method and permutation tests - for methodical modification of the classic form of the Gordon Growth Model, leads to more accurate valuation of shares.

In order to confirm or falsify the main hypothesis, partial hypotheses were constructed:

1. Irregularity in the payment of dividends by companies listed on the stock exchanges (especially in previous years) contributes to the disruption of the effectiveness of the classic Gordon's concept, and thus prevents its correct application;
2. The saturation degree of the stock market with companies which regularly paying out dividends is a measure of its maturity.

Pursuing to achieve the assumed goals and verify the hypotheses, a comprehensive critical-postulative analysis of domestic and foreign literature was made. The dissertation also used comparative analysis and deductive reasoning. In turn, empirical data were examined using statistical data analysis (quantitative analysis) by Microsoft Excel, and the necessary simulations and procedures were developed in R programming language, in a package for statistical analyses of R-CRAN. The whole of the reflections and the illustration of the relationships were complemented by tabular and graphic methods, as well as a synthesis of theoretical and empirical considerations.

The content of the dissertation consists of five chapters containing elements of the theory, research methodology and their results. Basically, it can be assumed that the first three chapters have an epistemological character, while the other two - methodological-empirical.

The first chapter presents the essence of the dividend as one of the basic forms of cash back for the shareholder and a key element of the share valuation in the discount models. The most important concepts and indicators were identified and precisely discussed in terms of both theoretical and historical background. Next, the theories of dividend payments for shareholders were exhaustively analysed and a variety of discount models were characterised, with particular emphasis on Gordon's Growth Model philosophy.

The second chapter of the dissertation was devoted to the analysis of the issue of the effectiveness of share valuation using the Gordon Growth Model which was understood as an analysis of stock prices of selected companies on the Polish, German, French and American markets, and then comparing them with valuations resulting from the model in order to verify its practical utility. Referring to the stock exchange data, the author assessed the usefulness

of the Gordon Growth Model for investors as a tool supporting the making of long-term investment decisions.

The third chapter focuses on the recognition and elimination of mismatch factors in the Gordon Growth Model for companies from the WIG20 and WIGdiv, DAX, CAC40 and DJIA indexes. The research from the second chapter has been extended through the use of classical statistical analysis. Resigning from full compliance with the restrictive assumptions of the Gordon Growth Model, the analysis introduced the basic measure of the quality of the fit of the model, so-called coefficient of determination ( $R^2$ ). Furthermore, a significance analysis of regression parameters was carried out, what in some cases resulted in setting of the intrinsic value of the stock, which was then compared with the market price. Share valuation was also carried out using the Gordon Growth Model based on data from financial statements for companies from the Polish stock market. In addition, the results of the simulation were presented according to the authorial transaction system constructed for the needs of the trial, based on the Gordon Growth Model, which simplifies and supports decision making by the investor.

The fourth chapter of the dissertation presents one of the most popular nonparametric statistical methods in recent years, so-called the bootstrap method (in the thesis named as a non-classical approach I). The bootstrap method, representing simulation methods, was used to build a prognostic model and implemented in the Gordon Growth Model in order to optimise it and increase its efficiency in practical conditions. The research used a bootstrap point estimation to perform the share valuation procedure and bootstrap interval estimation, which contributed to the possibility of deepening the analysis creating new scenarios for creating a dividend policy. The results of the conducted surveys have been verified based on the actual stock prices on the stock exchange.

The last chapter of the dissertation focuses on permutation tests (in the thesis defined as a non-classical approach II), which lead to more precise results than classical statistical methods. Optimisation of Gordon's Growth Model parameters and the development of the test procedure allowed the author to make the valuation of the shares more realistic, which was then verified by comparison with the current market prices on the stock exchange.

As a result of the analysis, the following conclusions were drawn:

1. Effective estimation of the intrinsic value of stocks according to the classic form of the Gordon Growth Model based on historical data for all companies listed in the WIG20, WIGdiv, DAX, CAC40 and DJIA indexes is practically impossible, as the model is based on extremely rigorous assumptions regarding the dividend. In particular, it was visible

during periods of extreme situations and chaos on financial markets, when companies did not pay out dividends (lack of regularity) or paid lower than previously (problem with maintaining a steady growth rate of the dividend), concurrently destroying the whole valuation according to the Gordon's Growth Model;

2. The use of basic statistical analysis contributed to the identification and better understanding of how companies have created the dividend policy so far - analysis of the determination coefficient ( $R^2$ ), and to examine whether the dividends paid by individual listed companies from the WIG20, WIGdiv, DAX, CAC40 and DJIA indexes were statistically at a similar level - analysis of the significance of regression parameters;
3. Only for a few companies an almost perfect adjustment of the exponential growth model to the paid dividends was observed ( $R^2 > 0.9$ ), which means that from the statistic side it can be assumed that the companies met the restrictive term of Gordon Growth Model regarding maintaining a constant growth rate of the dividend in subsequent years. Thanks to this, it was possible to forecast future dividends for them in the context of various scenarios;
4. The analysis of the significance of regression parameters showed that the hypothesis that the dividends were at a similar level for: 97% of companies from the DJIA index, 87% of companies from the DAX index, 83% of companies from the CAC40 index and 55% of companies from the WIG20 and WIGdiv indexes should be rejected. On the other hand, the analysis indicated several companies for which there were a lack of foundation to reject the hypothesis, which allowed for the valuation of shares in accordance with a model of fixed dividend value. In addition, for the companies from the last group, an original transaction system based on the Gordon model was constructed, facilitating investors to make long-term decisions;
5. The dividend paid by individual companies on the Polish, German, French and American markets changed over time, but it was impossible to determine any regularity as it changed;
6. The historical analysis of dividends paid out showed the reliability and maturity of companies listed on the United States market in relation to other markets – especially to the Polish market;
7. Undervaluation by investors of companies paying dividends on the Polish stock exchange translates into negligence by managers of the issue of dividend policy, and even treating it as a minor and unaffected business entity. According to the author, this situation requires a change by modeling itself on the United States market, which would mean defining long-term strategies for the distribution of the financial result by local enterprises, which are the key to meeting the expectations of shareholders and the market. Thus, it is perfectly

reasonable to state that the degree of market saturation with companies systematically paying out dividends is a measure of its maturity;

8. For 16 out of 42 listed companies on the Polish stock exchange which were analysed, it was impossible to determine the intrinsic value of the stocks according to the Gordon Growth Model based on financial data from the financial statements for 2015, and for the next 16 companies the valuation was possible only in one of the options. It resulted mainly from failure to meet the key condition of the Gordon Growth Model, i.e.  $r > g$ ;
9. Non-classical statistical methods (bootstrap method and permutation tests) contributed to the optimisation of dividend assumptions and a better understanding of the relationships taking place in the Gordon Growth Model;
10. The bootstrap method was used to predict the next dividends (bootstrap point estimation) and to determine the scope of future dividend shaping (bootstrap interval estimation), which allowed for the correct valuation of shares in accordance with the Gordon concept in practice according to different scenarios;
11. Permutation tests contributed to the identification and appropriate grouping of companies taking into account their actual dividend policy. On the other hand, this analysis has led to the realignment of the share valuation, i.e. the optimisation of the Gordon Growth Model in practice.

According to the author, the research results obtained and presented in the dissertation they do not make it possible to falsify the hypotheses set, and thus constitute their corroboration. Moreover, it should be stated that the presented considerations and the results of empirical studies confirm the usefulness of using non-classical statistical methods as a methodical modification of the Gordon Growth Model. Therefore, the main objective of this dissertation was implemented.