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## CROSS-SECTORAL DETECTION OF THE RETURN ON EQUITY DETERMINANTS BASED ON THE 7-FACTOR DUPONT MODEL

### Abstract

**Background:** The basis for the research was the assessment of the financial data results of several companies listed on the Warsaw Stock Exchange, directly collected from the EMIS database as well as said companies' websites, during the horizon from 2008 until 2017.

**Research purpose:** The main objective of the paper was to use the 7-factor DuPont model to calculate the cross-sectoral detection of the fundamental determinants of Return on Equity (RoE) of several companies listed on the Warsaw Stock Exchange operating in the industrial sector, the consumer goods sector, and the trade and services sector, as of the 8<sup>th</sup> of December 2018. The researchers hypothesised that there would be cross-sectional differentiation of RoE elements, as each of them are elements of the 7-factor Du Point model.

**Methods:** The paper analysed selected descriptive statistics of every component of the 7-factor DuPont model, used the version of the Pearson correlation coefficient that closely follows the t-distribution in order to examine correlations between individual components of the DuPont model and return on equity, and constructed an Ordinary Least Squared (OLS) model assessing the impact of the seven components of the DuPont model in the period  $t$  on the surveyed companies' RoE in the period  $t$ .

**Conclusions:** The hypothesis was that cross-sectoral difference of RoE elements would be found according to the DuPont model. However, the evidence disproved the hypothesis, suggesting that the Capital Multiplier was the leading factor shaping the level of RoE in the companies, and with the Capital Multiplier also expressing a negative correlation of moderate strength to companies' RoE.

**Keywords:** Return on Equity, equity, RoE determinants, DuPont model.

**JEL classification:** G32, M41

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## 1. Introduction

According to one of the leading approaches in finance (financial analysis), a potential investment, a potential investment should be treated as acceptable when it meets the fundamental condition that the capital expenditures involved contribute to the duplication of value for owners<sup>1</sup>. Such an approach complies with the assumptions of the Shareholders Value Approach, according to which the main objective of a company should be to duplicate benefits for owners, who are the only interest group whose intentions are not divergent from those of other stakeholders<sup>2</sup>. One of the key criteria for assessing the assumptions of the this theory is the analysis of company profitability, in particular in terms of Return on Equity (RoE), which is considered to be the most important measure from the owners' point of view<sup>3</sup>. Therefore, a thorough analysis of the RoE determinants invested by the owners, is of extreme importance in. Equity performs a number of important functions in company<sup>4</sup>, with both the purely economic function for the company to run smoothly as well as guaranteeing their interests are the most important from the shareholders' point of view.

The fundamental return on equity, if it could be found, would be crucial in assisting investors' decisions. In order to find it, a cross-sectional detection of its fundamental elements according to the DuPont model was proposed, with data being companies listed on the Warsaw stock exchange over the last ten years. Then, the specific research hypothesis to further refine the method.

Descriptive statistics facilitated the cross-sectoral comparative analysis of RoE determinant differentiation within the analysed sectors. Next, the nature and the strength of the relationships between the individual components of the 7-factor DuPont model and RoE were identified by applying the Pearson correlation coefficient. The study then concludes with an evaluation of the identified RoE generators within a single-equation linear regression model.

<sup>1</sup> **F.D. Arditti**, *Risk and the Required Return on Equity*, The Journal of Finance 1967/22/1, p. 19.

<sup>2</sup> **A. Rappaport**, *Creating Shareholder Value. A Guide for Managers and Investors*, The Free Press, New York 1986, p. 65.

<sup>3</sup> **M. Krajewski**, *Modele analityczne jako systemowe narzędzia oceny działalności gospodarczej przedsiębiorstw*, Annales Universitatis Mariae Curie-Skłodowska 2010/44, p. 691.

<sup>4</sup> **A. Sajnog**, *Funkcje i cele podwyższenia kapitału zakładowego w spółkach akcyjnych*, Acta Universitatis Lodzianis. Folia Oeconomica 2013/278, pp. 56–58.

7-factor The research intends to contribute to the current topic of cross-sectoral analysis of RoE determinants within enterprises, and which still contains uncertainties within several areas, the identification of which may a solution to the problems of formulating and implementing the financial strategy focused on maximizing value for the owners.

## 2. The multidimensional nature of equity as the fundamental criterion of making ownership decisions

Attempts to precisely identify the concept of profitability may be considered difficult to achieve due to the complexity and diversity of the categories determining this term. Additionally, the importance and role of profitability in the management of an enterprise is viewed in different ways, providing further difficulties. Moreover, there may be some contradictions in the interpretation of the word ‘profitability’ itself, as it is most often identified with the phenomenon of achieving earnings and multiplying the wealth of capital owners<sup>5</sup>. L. Bednarski indicates that profitability can be treated in a situation of generating both positive and negative financial results<sup>6</sup>.

The multi-dimensional nature, and subsequent multiple definitions, of the term profitability is particularly noticeable in the financial literature. The profitability of an enterprise is sometimes interpreted as its ability to generate earnings<sup>7</sup>, efficiency of operation<sup>8</sup>, or an appropriately calculated financial result that can be expressed in either absolute or relative values<sup>9</sup>. Non-Polish literature, on the other hand, indicates that profitability of a company is first and foremost:

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<sup>5</sup> **S. Newberry**, *Reporting Performance: Comprehensive Income and its Components*, Abacus 2003/39/3, p. 327.

<sup>6</sup> In the case of generating positive financial results, we talk about profitability, whereas in the case of losses, there is evidence of negative return. Compare: **L. Bednarski**, *Analiza finansowa w przedsiębiorstwie*, PWE, Warszawa 2007, p. 87.

<sup>7</sup> **W. Dębski**, *Teoretyczne i praktyczne aspekty zarządzania finansami przedsiębiorstwa*, Wydawnictwo Naukowe PWN, Warszawa 2013, p. 286.

<sup>8</sup> **M. Kędzior**, *Zależność rentowności przedsiębiorstw od czynników mikroekonomicznych, makroekonomicznych i instytucjonalnych w wybranych państwach Unii Europejskiej*, Wydawnictwo Uniwersytetu Ekonomicznego w Krakowie, Kraków 2016, p. 106.

<sup>9</sup> **S.R. Preißler**, *Betriebswirtschaftliche Kennzahlen: Formeln, Aussagekraft, Sollwerte, Ermittlungintervalle*, Oldenbourg Wissenschaftsverlag GmbH, München 2008, p. 12.

- a measure of its ability to generate revenue and control costs<sup>10</sup>;
- a premise for the growth of the entity<sup>11</sup>;
- a determinant of the proper functioning of the entity<sup>12</sup>; and
- an indicator of financial effectiveness expressed in terms of profitability ratios<sup>13</sup>.

The last definition includes the need to estimate profitability ratios that do not have predefined normative values, around which they should oscillate, because they should be compared with the values characteristic for specific sectors<sup>14</sup>. It is also common to state that the higher the profitability ratios, the better the financial standing of the analysed company<sup>15</sup>. Moreover, the lack of using any financial indicators in the analysis of a company's financial standing is considered one of the main reasons for the eventual failure and bankruptcy of entities<sup>16</sup>. The importance of monitoring the financial condition of companies is therefore especially noteworthy<sup>17</sup>.

It should also be emphasized that both owners and potential investors, when engaging their capital in various types of undertakings, require certain outcomes, for example in the form of profit. This means that, in light of the information provided, the RoE level, which can be presented in the form of the following equation, should be the focus of capital providers' attention<sup>18</sup>:

<sup>10</sup> **K. Berman, J. Knight, J. Case**, *Financial Intelligence, Revised Edition: a Managers Guide to Knowing What the Numbers Really Mean*, Harvard Business Review Press, Massachusetts 2013, p. 79.

<sup>11</sup> **A. Damodaran**, *Return on Capital (RoC), Return on Invested Capital (RoIC) and Return on Equity (RoE): Measurement and Implications*, July 2007, <http://ssrn.com/abstract=1105499>, pp. 1–69.

<sup>12</sup> **D. Davies**, *The Art of Managing Finance*, McGraw-Hill, New York 1992, p. 9.

<sup>13</sup> **S.H. Penman**, *An Evaluation of Accounting Rate-of-return*, *Journal of Accounting, Auditing & Finance* 1991/6, p. 233–255; **B. Clark**, *Managerial Perceptions of Marketing Performance: Efficiency, Adaptability, Effectiveness and Satisfaction*, *Journal of Strategic Marketing* 2005/8/1, p. 5.

<sup>14</sup> **T. Dudycz, W. Skoczylas**, *Sektorowe wskaźniki finansowe za rok 2009 i ich porównywalność*, *Rachunkowość* 2011/4, p. 51.

<sup>15</sup> **A. Pieloch-Babiarz, A. Sajnog**, *Analiza fundamentalna. Standing finansowy i wycena przedsiębiorstwa*, Wydawnictwo UŁ, Łódź 2016, p. 99.

<sup>16</sup> **S.S. Meech**, *Financial Standards*, *The University Journal of Business* 1925/3/2, pp. 171–187; **L. Gaskill, H. Van Auken, R. Manning**, *A Factor Analytic Study of the Perceived Causes of Small Business Failure*, *Journal of Small Business Management* 1993/31/4, pp. 18–31; **L. Lauzen**, *Small Business Failures Are Controllable*, *Corporate Accounting* 1985, Summer, pp. 34–38.

<sup>17</sup> **C. Firer**, *Driving Financial Performance Through the DuPont Identity: A Strategic Use of Financial Analysis and Planning*, *Financial Practice and Education* 1999/9/1, pp. 34–45; **J.O. Horrigan**, *Some Empirical Bases of Financial Ratio Analysis*, *The Accounting Review* 1965/40/3, pp. 558–568.

<sup>18</sup> **S.M. Avdalović**, *Impact of Firm Specific Factors on Profitability of Industrial Grinding Companies*, *Economics of Agriculture* 2018/65/2, pp. 493–501.

$$RoE = \frac{EAT}{\bar{E}},$$

where:

$EAT$  = Earnings After Taxes,

$\bar{E}$  = Average Equity<sup>19</sup>.

When applying the category of net financial result, certain problems may result from the fact that, for example, an increase in this ratio may not be dictated by an improvement in the efficiency of operations in the enterprise, but by a consequence of decreased tax rates. In order to avoid these type of anomalies, it may be appropriate to apply a different financial category in the numerator of the equation than the net financial result, such as the result of sales, operating result or gross financial result.

The analysis of a company's profitability based on the classic RoE formula provides an opportunity for a different interpretation in the circumstances of a negative value in the numerator and/or denominator. Three different scenarios are possible:

- 1) negative net financial result with positive equity value,
- 2) negative net financial result with negative equity value,
- 3) positive net financial result with negative equity value.

In the first situation, the company's negative return is indicated, since the involvement of equity contributes to the generation of a negative financial result. Such dependence can be referred to as a negative return or financial loss ratio, which coincides with a decrease in the book value of equity. However, if a negative net financial result and negative value of equity occur at the same time, this means negative depreciation of equity value, more specifically that financial loss creates and/or increases negative equity value. The last scenario, achieving a positive financial result with a negative equity value, may pose difficulties in interpreting the RoE ratio. Some authors suggest that this ratio should not be calculated at all<sup>20</sup>, while it should be stressed that increasing or decreasing changes in the financial loss and negative equity value are reflected in the scale and degree of non-profitability of the analysed entity, enabling the evaluation of its weaknesses and bankruptcy risks.

<sup>19</sup> The inclusion of RoE using average level of equity in the denominator eliminates the methodological error of comparing the value of equity expressed on the balance sheet data (static data) with the net financial result of the entity (stream data) presenting the result of the entity's whole year activity. Moreover, any other financial category can be used in the numerator.

<sup>20</sup> **M. Marcinkowska**, *Ocena działalności instytucji finansowych*, Wydawnictwo Difin, Warszawa 2007, p. 264.

### 3. Measurement of Return on Equity using expanded forms of the DuPont model

Using the synthetic RoE ratio in the form of the relation of the net financial result to the average value of equity does not create sufficient conditions to detailed interpretation of the phenomena that determine the value of this indicator. Decomposition of RoE, meaning breaking down the RoE ratio into composite elements, may be a solution to this problem, as such a procedure enables quantifying the mutual relations of partial measures and the identification of key determinants affecting the analysed values in both *ex post* and *ex ante* terms. The DuPont (DuPont System of Financial Control)<sup>21</sup> model, which integrates data from company financial statements into synoptic measures of its performance, is considered the most frequently used tool for analysing the factors determining RoE<sup>22</sup>.

The original version of the DuPont model was worked out by F. Donaldson Brown in 1918 and described the Return on Assets (RoA) ratio as the product of Return on Sales (RoS) and Total Assets Turnover (TAT). This model was presented in the form of following equation<sup>23</sup>:

In the 1970s, maximizing ownership benefits was identified as one of the generally acceptable financial objectives<sup>24</sup>. This led to a change in the basic assumptions regarding the design of the DuPont model and at that time the focus was on the analysis of profitability of equity rather than assets. Therefore, a 3-factor model was developed, which introduced an additional element into the analysis in the form of Capital Multiplier (CM). The 3-factor DuPont model was described by the following formula:

$$RoA = RoS \times TAT.$$

G. Boyd claimed that this approach presented an inadequate reflection of financial leverage's impact on RoE. This imperfection was caused by the fact that net

<sup>21</sup> **T.J. Liesz, S.J. Maranville**, *Ratio Analysis Featuring the DuPont Method: An Overlooked Topic in the Finance Module of Small Business Management and Entrepreneurship Courses*, Small Business Institute Journal 2008/1, p. 18.

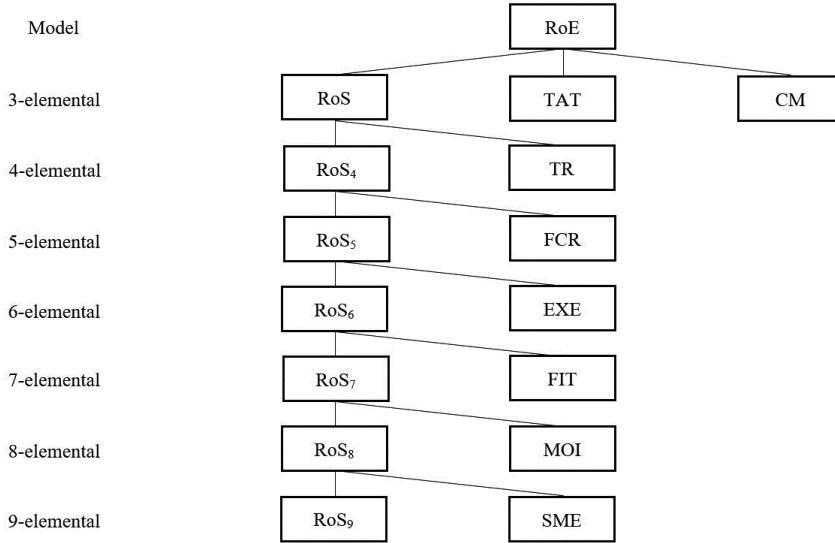
<sup>22</sup> **J.G. Siegel, J.K. Shim, S.W. Hartman**, *The McGraw-Hill Pocket Guide do Business Finance. 201 Decision-Making Tools for Managers*, McGraw-Hill Inc., New York 1992, pp. 268–270; **S.C. Isberg**, *Financial Analysis with the DuPont Ratio: A Useful Compass*, Credit & Financial Management Review 1998, Second Quarter, pp. 1–4.

<sup>23</sup> **R.G. Blumenthal**, *Tis the Gift to be Simple: Why the 80-year-old DuPont Model Still has Fans*, CFO Magazine 1998/1, pp. 1–3.

<sup>24</sup> **L.J. Gitman**, *Principles of Financial Management*, Addison Wesley Publishers, Boston 2000, p. 15.

earnings included debt interest costs, which reduced the level of RoS and created a financial leverage structure<sup>25</sup>. However, many variations of the original DuPont model were developed over the years, which eliminated the imperfections of the previous versions and were described by a different number of factors (see Figure 1).

FIGURE 1: *Pyramidal analysis of RoE based on different DuPont models*



where:

RoS<sub>4</sub> – Gross Return on Sales (EBT/S),

TR – Tax Return (EAT/EBT),

RoS<sub>5</sub> – Return on Sales before interest and taxes (EBIT/S),

FCR – Fixed Charge Rate (EBT/EBIT),

RoS<sub>6</sub> – Return on Sales before extraordinary interest and taxes (EBIXT/S),

EXE – Extraordinary Events ratio (EBIT/EBIXT),

RoS<sub>7</sub> – Return on Sales on the level of earnings on operations (EOP/S),

FIT – Financial Items (EBIXT/EOP),

RoS<sub>8</sub> – Return on Sales on the level of earnings and sales management (ESM/S),

MOI – Miscellaneous Operational Items (EOP/ESM),

RoS<sub>9</sub> – Return on Sales on the level of earnings of goods sold (EGS/S),

SME – Sales and Management Expenses (ESM/EGS).

Source: own research based on **W. Sibilski**, *Zmodyfikowane modele DuPont do analizy rentowności polskich przedsiębiorstw*, Zeszyty Naukowe Uniwersytetu Szczecińskiego 2013/786, Szczecin, pp. 257–268.

<sup>25</sup> **G.M. Boyd**, *Some Suggestions for a “New and Improved” DuPont Model*, Journal of Financial Education 1989, pp. 29–32.

The impracticality of the 3-factor model was solved by decomposing RoS into Gross Return on Sales (RoS<sub>4</sub>) and Tax Return (TR), while the subsequent modification, i.e. the 5-factor model, was created by decomposing RoS<sub>4</sub> into two analytical factors, i.e. Return on Sales before interest and taxes (RoS<sub>3</sub>) and Fixed Charge Rate (FCR). The presentation of the determinants of Return on Equity in this way demonstrated, first and foremost, the impact of foreign-capital interest on a company's profits<sup>26</sup>.

Although the previous models were the expression of a relatively detailed analysis of factors shaping the level of Return on Equity, W. Sibilski further decomposed the 5-factor model by four subsequent levels, creating the 9-factor DuPont model in 2013<sup>27</sup>. Such a procedure may be considered as a premise for an in-depth cause-and-effect analysis; however, at present the use of the 9-factor model for research on some enterprises is considered practically impossible or at least controversial<sup>28</sup>. It therefore seems appropriate to use the following modified 7-factor DuPont model, which provides more insight to financial analysis than 5- or 6-factor DuPont model and can be presented by the equation below:

$$RoE = RoS_0 \times SME \times MOI \times TAT \times FCR \times CM \times TR,$$

which, in more analytical terms, can be described as:

$$RoE = \frac{EGS}{S} \times \frac{ESM}{EGS} \times \frac{EOP}{ESM} \times \frac{S}{TA} \times \frac{EBT}{EOP} \times \frac{\overline{TA}}{\overline{E}} \times \frac{EAT}{EBT}.$$

An analytical presentation of the determinants of Return on Equity in the form of the 7-factor DuPont model should provide sufficient information about the parameters shaping the value of RoE in individual sectors.

<sup>26</sup> G. Hawawini, C. Viallet, *Finance for Executives*, South-Western College Publishing, New York 1999, p. 362.

<sup>27</sup> W. Sibilski, *Zmodyfikowane modele DuPont do analizy rentowności polskich przedsiębiorstw*, Zeszyty Naukowe Uniwersytetu Szczecińskiego 2013/786, Szczecin, pp. 27–268.

<sup>28</sup> Due to the changes in the Accounting Act introduced in 2016, companies are not obliged to publish information regarding the realized result of extraordinary events in their financial statements. In addition, EBIT is sometimes defined in the Polish literature as operating profit, which would be a duplication of the EOP parameter in this paper.



#### 4. Determinants of Return on Equity on the basis of the 7-factor DuPont model

Many studies in the literature address Return on Equity as well as the factors shaping it, which are contained in many variations of the DuPont model. As the results of research conducted by J. Duraj and A. Sajnog show, Return on Sales and, to a lesser extent, Capital Multiplier have the biggest influence on the RoE ratio<sup>29</sup>. W. Skoczylas and A. Niemiec demonstrate that the leading parameters defining the rate of Return on Equity are primarily RoS and TAT<sup>30</sup>, whereas S.A. Ross, R.W. Westerfield and B.D. Jordan underline the importance of the said three elements at the same time<sup>31</sup>. Other authors of the non-Polish literature, such as A. Rappaport, consider only TAT to be a fundamental determinant of RoE<sup>32</sup>. When analysing the determinants of Return on Equity of a company, one should pay attention to the results of studies by R. Zahidura and M. Rubela, who proved that an increase of CM contributes to the duplication of RoE<sup>33</sup>. Furthermore, V. Burja and R. Mărginean show that a positive relationship exists only among RoE, RoA and RoS, whereas a negative correlation exists between CM and RoE<sup>34</sup>. The results of studies conducted by I. Ignat and L. Feleaga appear interesting, proving the lack of correlation between the value of Return on Equity and the number of years of a company's presence on the market<sup>35</sup>. In his study, K. Hak-Seon pointed out the significant positive correlation between RoE and RoA, RoS and DE<sup>36</sup>.

<sup>29</sup> **J. Duraj, A. Sajnog**, *Rentowność kapitału własnego giełdowych spółek przemysłowych*, Wydawnictwo UŁ, Łódź 2011, pp. 109–114.

<sup>30</sup> **W. Skoczylas, A. Niemiec**, *Czynniki wzrostu wartości spółek giełdowych w świetle badań empirycznych – podejście deterministyczne*, **J. Duraj** (ed.), *Wartość przedsiębiorstwa – z teorii i praktyki zarządzania*, Wydawnictwo Novum, Płock 2004, pp. 151–152.

<sup>31</sup> **S.A. Ross, R.W. Westerfield, B.D. Jordan**, *Essentials of Corporate Finance*, McGraw-Hill Publishing Co., New York 1999, pp. 130–141.

<sup>32</sup> **A. Rappaport**, *op. cit.*, p. 43.

<sup>33</sup> **R. Zahidur, M. Rubel**, *Deconstruction of ROE: An Implementation of DuPont Model on Selected Bangladeshi Trade Banks*, *International Journal of Economics and Financial Research* 2019/5/5, p. 169.

<sup>34</sup> **V. Burja, R. Mărginean**, *The Study of Factors that may Influence the Performance by the DuPont Analysis in the Furniture Industry*, *Procedia Economics and Finance* 2014/16, pp. 213–223.

<sup>35</sup> **I. Ignat, L. Feleaga**, *The Role of IT in the Logistics Sector: The Impact of DuPont Model on the Profitability of IT Companies*, *LogForum* 2019/15/2, pp. 191–203.

<sup>36</sup> **K. Hak-Seon**, *A Study of Financial Performance using DuPont Analysis in Food Distribution Market*, *Cullinary Science & Hospitality Research* 2016/22/6, p. 57.

Q. Saleem and R.U. Rehman proved that there is no correlation between RoE and the Current Ratio (CR)<sup>37</sup>.

It should also be noted that RoE – by analogy – is a measure reflecting the results of the company primarily in the short term, so excessive attention to this tool may lead to the failure to observe long-term growth opportunities that could provide value for the owners<sup>38</sup>.

## 5. Description of methodology and empirical results

### 5.1. Sample description and empirical methodology

The empirical research results refer to joint-stock companies listed on the Warsaw Stock Exchange, which as of 7 December 2018 belong to three of the sectors distinguished on the exchange i.e. the industrial sector, the consumer goods sector, and trade and services. The selection of these sectors was because these three sectors have the largest number of companies on the exchange, they are the most representative of the exchange overall, which ensured an appropriate degree of representativeness and comparability of the results of empirical research.

In order to achieve the objective of the study, a ten-year research period was assumed from 2008–2017, in order to be more robust to the determinants shaping RoE's vulnerability to companies' short-term fluctuation in their profits or losses. Apart from the assessment of capital groups' finance, an in-depth analysis covered annual, separate financial statements of the surveyed companies. Empirical data for the study were taken from the EMIS database and the websites of the analysed entities.

Out of the 159 total enterprises whose shares as of 7 December 2018 were not suspended<sup>39</sup>, 81 from the industrial sector, 52 from the consumer goods sector and 26 from the trade and services sector, respectively, for 157 entities in total. However, the final empirical research was performed on a group of 140 companies. In order to avoid extreme values of particular ratios, outlier pairs were removed from the data, and observations with negative equity value

<sup>37</sup> Q. Saleem, R.U. Rehman, *Impact of Liquidity Ratios on Profitability*, Interdisciplinary Journal of Research in Business 2011/1/7, pp. 96–98.

<sup>38</sup> T.E. Copeland, T. Koller, J. Murrin, *Valuation: Measuring and Managing the Value of Companies*, Wiley & Sons, New York 1996, p. 105.

<sup>39</sup> Companies whose shares were suspended include, among others: Izolacja Jarocin, Fenghua Soletech and Budopol-Wrocław.

and therefore negative relations between assets and equity were removed for the same reason<sup>40</sup>. The final research sample comprised 140 companies, including 77 from the industrial sector, 42 from the consumer goods sector and 21 from the trade and services sector. A total of 1225 observations were received.

The RoE in the examined sectors was calculated with the RoE ratio, using as the denominator the average value of equity calculated at the beginning and at the end of the accounting period and the nominator, the net financial result of company at the end of accounting period.

Three analytical and research dimensions were used to assess the determinants of ROE. First of all, the measures of selected RoE descriptive statistics and individual components of the 7-factor DuPont model were calculated. The second dimension included an analysis of the correlation between the individual components of the DuPont model and the RoE ratios, using the Pearson correlation coefficient, together with an assessment of the relevance of the measure by means of t-distribution. The main dimension assessing the determinants of RoE was oriented towards the use of a single equation linear regression model<sup>41</sup>, assessing the impact of the seven components of the DuPont model in the period  $t$  on the surveyed companies' RoE in the period  $t$ :

$$RoE_t = \alpha_0 + \alpha_1 RoS_{9t} + \alpha_2 SME_t + \alpha_3 MOI_t + \alpha_4 TAT_t + \alpha_5 FCR_t + \alpha_6 CM_t + \alpha_7 TR_t + \alpha_8 DEG_t + \alpha_9 SECTOR_t + \mu,$$

where:

DEG = binary variable, taking the value 1 in the case of a negative net financial result and a value of 0 in the situation of a positive net financial result,

SECTOR = binary variable, taking value 1 for the industrial sector and value 0 for the remaining sectors.

The rest of the indicators as mentioned in Figure 1 above.

This model considers the temporary asymmetry between favourable (profit) and unfavourable (loss) periods for the companies<sup>42</sup>. Thus, an artificial (binary) variable, DEG, of 1 for a negative net financial result and of 0 for a positive net financial result was introduced<sup>43</sup>. In addition, the model takes the dichotomous

<sup>40</sup> Observations of this type were made in such companies as: ABM Solid (for the years 2012–2017), Poznańska Korporacja Budowlana Pekabex (for the years 2013–2016), CD Projekt (for 2008).

<sup>41</sup> Panel data using the method of least squares were applied in the studies.

<sup>42</sup> S. Basu, *The Conservatism Principle and the Asymmetric Timeliness of Earnings*, Journal of Accounting and Economics 1997/24/1, pp. 3–37.

<sup>43</sup> B.F. Braumoeller, *Hypothesis Testing and Multiplicative Interaction Terms*, International Organization 2004/58/4, pp. 807–820.

SECTOR variable into consideration, which includes the sectoral diversity of the surveyed companies. For this purpose, the analysed companies were divided into two groups – industrial and other – where the binary variable took the value of 1 for the industrial sector and 0 for the remaining sectors.

Computer program EViews 10 was used to perform the calculations.

## 5.2. Empirical research results

The empirical research results presented in Table 1 indicate that over the studied decade there was a difference in the value of net profit in relation to the average value of equity, as evidenced by both the minimum and maximum values of RoE (from  $-25.95$  to  $23.94$ ), as well as the standard deviation ( $1.37$ ), with the average of  $0.02$  and the median of  $0.07$ .

TABLE 1: *Descriptive statistics of RoE and its components in the 7-factor DuPont model*

Statistics	RoE	RoS <sub>g</sub>	SME	MOI	TAT	FCR	CM	TR
Mean	0.02	0.22	-0.77	1.40	1.12	1.13	2.56	1.15
Median	0.07	0.19	0.25	1.00	0.98	0.97	1.71	0.82
Maximum	23.94	1.01	104.42	158.19	4.94	229.69	332.90	210.83
Minimum	-25.95	-3.92	-386.00	-91.88	0.00	-247.56	1.00	-23.21
Std. Dev.	1.37	0.25	17.67	9.71	0.80	13.42	9.92	6.84
Observations	1205	1205	1205	1205	1205	1205	1205	1205

Source: own calculations.

The most insignificant differentiation in 2008–2017 was observed in the case of RoS on the level of earnings of goods sold (RoS<sub>g</sub>), which is confirmed by among others the calculated standard deviation of  $0.25$ . Based on basic statistical observation, the highest variability in the effects of SME and FCR should be underlined. The analysis of the average calculated ratios allows the indication that the only negative determinant of RoE was the effect of SME. The other drivers of RoE possessed positive arithmetic mean and median values. The highest average size of RoE generators was recorded for the CM ( $2.56$ ) and the effect of Miscellaneous Operational Items ( $1.40$ ).

The calculated Pearson correlation coefficients confirm the relationship between the RoE achieved by the companies concerned and the RoS<sub>g</sub>, SME, TAT and FCR ratios. However, in all cases these relationships were negligible (none at

all) and statistically significant only for  $RoS_9$  and TAT (see: Table 2). In turn, negative relations were recorded between RoE and the effect of MOI, CM and TR. On the other hand, only CM presented negative and moderate strength dependence. Further, CM was statistically significant at the confidence level of 0.01.

TABLE 2: *Correlation matrix*

Variables	RoE	$RoS_9$	SME	MOI	TAT	FCR	CM	TR
RoE	1.000							
$RoS_9$	0.099***	1.000						
SME	0.015	-0.043	1.000					
MOI	-0.030	0.007	-0.003	1.000				
TAT	0.054*	-0.137***	0.068**	-0.018	1.000			
FCR	0.061**	-0.020	-0.020	-0.004	-0.013	1.000		
CM	-0.458***	-0.048*	-0.015	0.014	0.024	0.005	1.000	
TR	-0.001	-0.021	-0.005	-0.004	-0.021	-0.004	-0.004	1.000

\*, \*\* and \*\*\* represent statistical significance at the 0.1, 0.05, and 0.01 levels.

Source: own calculations.

Multiple regression analysis assessed the single-equation economic model with one explanatory variable and nine response variables. The model revealed the impact directions of the main exogenous variables taken from the components of the 7-factor DuPont model, on the endogenous variable RoE were both positive and negative, and the estimated parameters were not in all cases statistically significant at the confidence level of 0.05 (see: Table 3). Considering only statistically significant values of the estimated parameters of the model, it may be stated that the RoE of the surveyed companies was positively influenced primarily by  $RoS_9$ , followed by TAT and the effect of FCR. It is undeniable that the only indicator that had a negative impact on the RoE was CM.

Considering the influence of additional control variables on the exogenous variable, it is worth emphasizing their differing impacts. The estimated values of the SECTOR variable indicated a positive impact, but at the assumed confidence level of 0.05, it turned out to be statistically insignificant, while in the case of the DEG variable, the situation was quite the opposite. The direction of the impact on Return on Equity was, firstly, negative and, secondly, statistically significant.

TABLE 3: *Results of panel ordinary least squares regression*

Variable	Coefficient	t-Statistic	Prob.
Intercept	4.356	11.602	0.000
RoS <sub>it</sub>	0.397	2.841	0.005
SME	0.000	0.164	0.870
MOI	-0.003	-0.944	0.346
TAT	0.132	3.065	0.002
FCR	0.005	2.252	0.025
CM	-0.068	-20.346	0.000
TR	0.000	-0.005	0.996
DEG	-4.486	-12.285	0.000
SECTOR	0.082	1.164	0.245
Adjusted R-squared			0.308
F-statistic			60.614
Prob(F-statistic)			0.000

Source: own calculations.

## 6. Conclusions

Return on equity should be perceived as a succession of many dependent and independent variables that affect entities across a variety of operations, investments and generic financial activities. Cross-sectoral detection of the RoE determinants based on the 7-factor DuPont model constitutes not only a prerequisite for better understanding, formularization, completion and control of financial strategies, but it also allows evaluation of implemented strategies' accuracy for market value maximization by various companies. Finance literature notes many attempts to construct a tool in which an objective and accurate way could present the validity of such goal. A classic 3-factor DuPont model should be mentioned as it uses three determinants of RoE, namely Return on Sales, Total Assets Turnover and Capital Multiplier. An expanded development of this model into the 7-factor formula seems to be reasonable, as it grants more holistic detection of dominant elements responsible for RoE formation.

The decomposition of the RoE ratio to the 7-factor DuPont model provides a significant amount of analytical information that allows for generalized conclusions to be drawn about constructs as well as destructors of the measure in specific environments.

A thorough analysis of the RoE sources of companies from the industrial sector, the consumer goods sector, and the trade and services sector proves that belonging to a specific sector, although it has a positive impact on RoE, is statistically insignificant, undermining the research hypothesis. It is worth noting that the analysed companies' RoE is most affected by the CM, as it is characterized by a negative correlation, but of a moderately strong nature. In contrast, the factor that contributes the most to RoE duplication is RoS on the level of earnings of goods sold  $RoS_0$ .

The literature generally claims that either TAT is the only leading determinant of RoE, or that RoS is the main carrier of RoE<sup>44</sup>. That the authors of those studies indicate a significant differentiation of factors shaping RoE only proves that the constructs of RoE are highly dependent on many variables and can be shaped in different environments. Nevertheless, the contribution of the paper specifically indicates that including additional elements in financial analysis may profit with better understanding of capabilities and frailties of the strategies of the company, or at least acknowledging the essence of the sector to which a specific enterprise belongs to, should provide to undertaking more successful investments. Therefore, an improvement of the 3-factor DuPont model to the 7-factor DuPont model is fully justified.

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## MIĘDZYSEKTOROWA DETEKcja DETERMINANT WSKAŹNIKA RENTOWNOŚCI KAPITAŁU WŁASNEGO NA PODSTAWIE 7-CZYNNIKOWEGO MODELU DUPONT

### Abstrakt

**Przedmiot badań:** Podstawę przeprowadzonych badań stanowiły wyniki finansowe badanych spółek, które zostały bezpośrednio zaczerpnięte z bazy EMIS i stron internetowych poszczególnych podmiotów oraz obejmowały dziesięcioletni horyzont czasowy, tj. od 2008 do 2017 r.

**Cel badawczy:** Zasadniczą intencję opracowania stanowiła międzysektorowa detekcja czynników warunkujących wielkość wskaźnika rentowności kapitału własnego w oparciu o 7-czynnikowy model DuPont spółek notowanych na GPW w Warszawie oraz wchodzących w skład sektora przemysłu, dóbr konsumpcyjnych oraz handlowo-usługowego wedle stanu na 8.12.2018 r. Ponadto, ustanowiono hipotezę konstytuującą międzysektorowe zróżnicowanie determinant 70-czynnikowego modelu DuPont.

**Metoda badawcza:** W badaniach wykorzystano analizę wybranych statystyk opisowych poszczególnych składników 7-elementowego modelu DuPont, zbadano korelacje między poszczególnymi składowymi modelu DuPont a współczynnikami rentowności kapitału własnego, przy użyciu współczynnika korelacji Pearsona wraz z oceną istotności tego miernika za pomocą statystyki, a także skonstruowano jednorównaniowy model regresji liniowej.

**Wyniki:** Zrealizowane badania podważyły podstawioną hipotezę badawczą, która zakładała międzysektorowe zróżnicowanie determinant RoE stanowiących elementy 7-czynnikowego modelu DuPont. Jako wiodący czynnik kształtujący wysokość rentowności kapitału własnego w badanych spółkach wskazano mnożnik kapitałowy, który wykazywał negatywną korelację o umiarkowanej sile względem wskaźnika rentowności kapitału własnego (RoE).

**Słowa kluczowe:** rentowność kapitału własnego, kapitał własny, determinanty RoE, model DuPont.