DE GRUYTER OPEN

*Folia Oeconomica Stetinensia*
DOI: 10.1515/foli-2015-0025

WYDZIAŁ NAUK EKONOMICZNYCH I ZARZĄDZANIA
UNIWERSYTET SZCZECIŃSKI

# THE INFLUENCE OF PROFITABILITY RATIOS AND COMPANY SIZE ON PROFITABILITY AND INVESTMENT RISK IN THE CAPITAL MARKET

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**Received 28 October 2014, Accepted 30 June 2015**

## Abstract

A study was conducted of 15 food companies listed on the Warsaw Stock Exchange. The profitability of companies was measured by: return on assets (ROA), return on equity (ROE) and return on sales (ROS). Investment risk was measured by standard deviation and semi-deviation. The main objective of the study was to examine whether the average level and variability of selected indicators of profitability are reflected in the average level and the variability of returns on the capital market. An additional aim was to examine whether the size of the company affects the profitability and risk of investment in stocks as well as the average value and the volatility of profitability ratios. A positive correlation between the average value of the profitability ratios (ROA and ROS) and the average rates of return on the capital market was identified. Similarly, companies with higher volatility and semi-volatility of profitability ratios were simultaneously characterized by larger fluctuations in rates of return on the stock market. Studies have shown that the size of the company is negatively correlated with the risk of stock market investments and the volatility of profitability ratios.

**Keywords:** profitability ratios, ROA, ROE, ROS, market value, risk, semi-variance, profitability of investment, risk free rate.

**JEL classification:** G11.

## Introduction

Investors use fundamental, technical and portfolio analysis tools to choose investment options on the capital market. It is assumed in the fundamental analysis that share prices are closely linked to the economic and financial standing of a company. Portfolio analysis examines the risk of investment in the shares of listed companies. The risk is assessed mainly by means of measures of variability or semi-variability. Methods have also been proposed which combine elements of portfolio and fundamental analysis (Tarczyński, 2002). In such methods, one model covers the risk using measures of statistical dispersion or Sharpe's single index model approach or fundamental information in the form of financial ratios.

This study has reduced the fundamental analysis of companies to an analysis of their profitability ratios. Earning profit is the main reason why companies conduct their business activities (Gabrusiewicz, 2014: 296). Profitability is measured by means of return on assets (ROA), return on equity (ROE) and return on sales (ROS). It has been considered whether the return on investment in shares is associated – in a longer perspective, for example, several years – with the profit earned by a company. Another issue considered in the study is the risk of stock market investments in the context of conventional and downside risk measures. A question arises to what extent fluctuations of share prices are associated, in the long run, with changes in the profitability of a company? Does the risk, associated with the activities of a company, expressed, *inter alia*, by variability over time of the profit it earns, affect the risk incurred by investors and by those who buy the shares of a specific listed company. The considerations are based on data for food companies listed on the Warsaw Stock Exchange.

A recent study conducted by Maskun (2012) analysed the effect of liquidity and profitability ratios on the prices of food companies listed on the capital market in Indonesia. The study revealed a statistically significant negative correlation between *ROA* and share prices on the stock exchange in Jakarta, whereas *ROE* had no statistically significant influence on those prices. In the study which applies to the construction sector on the Warsaw Stock Exchange, Wawrzyniak and Bartóg used a wide range of financial data to predict the rates of return for companies in the construction industry noted on the Warsaw Stock Exchange. *ROE* and *ROS* profitability ratios have been proven to have a significant impact on the forming of the rate of return of shares. Ahsan (2013) examined the use of *ROE* in a stock portfolio selection. He noted that this ratio alone can be used to generate portfolios with above-average rates of return, especially for emerging markets. In the research on the Bucharest Stock Exchange, the variation of changes in market capitalisation was found as the leading variable in explaining the

variation of stock returns (Stancu, Stancu, 2014). However, in this case, *ROE* and *ROA* had no statistically significant influence on the rates of return. In other research on the Bucharest Stock Exchange it has been found that the financial information regarding the companies, profitability and indebtedness have a significant influence on the market value (Jaba et al., 2013).

A negative correlation has been observed between company size and the risk of investment in its shares (Banz, 1981; Reinganum, 1981). Sekuła (2013) pointed out in a study conducted for the Warsaw Stock Exchange that small companies ran higher risks compared to companies whose market capitalisation is higher, but at the same time the profit earned was smaller. The question arises whether the size of a company also affects the variability of profitability ratios of the company.

In the Warsaw Stock Exchange study conducted by Czapkiewicz and Skalna (2011), it was found that during the bear market, investment portfolios constructed of small firms achieved higher rates of return with simultaneous higher risk in comparison to portfolios constructed of big firms.

The aim of the study was to examine whether the average level and variability of selected profitability ratios is reflected in the average level and the variability or return on investment on the stock exchange market. In an additional objective, the study was to examine whether the size of a company affects the profitability and risk of stock exchange investments and the profitability ratios.

## 1. Profitability ratios

Generating a profit is the main goal of the existence of a company in the long term. Earning a profit is the main goal of the owners and company management (Gabrusiewicz, 2014: 296), so an analysis of the profitability of stock exchange companies can be an important aspect considered by stock exchange investors. Assessment of the profitability of a company is made on the basis of financial profitability ratios. The ratios measure economic effectiveness. A profitability analysis is one of the major issues in a ratio analysis. In this study, the profitability of a company was analysed in three aspects, concerning return on assets (ROA), return on equity (ROE) and return on sales (ROS).

The return on assets is calculated from the formula:

$$ROA = \frac{net\ income}{total\ assets} \tag{1}$$

*ROA* provides information about how effectively a company's assets are being managed. A high return on total assets can be achieved provided the size and structure of the assets are adapted to the specific nature of the company's activities (Gabrusiewicz, 2014: 311).

*ROE* is particularly important to shareholders because it shows the return on equity engaged in a company, which is shown in the formula:

$$ROE = \frac{net\ income}{shelholders'\ equity} \tag{2}$$

This ratio is a synthesis of many other financial ratios, which is shown in Du Pont's model of analysis (Zelek, 2003: 92). A high value of the ratio indicates the good standing of the company. From the point of view of stock exchange investors, the high value of the ratio improves the attractiveness of a stock exchange company by such aspects as expectations of a large dividend. It is good when *ROE* exceeds the average market interest rate (Tarczyński, 2002: 105).

The return on sales, also referred to as net profit margin, provides information about the net profit on sales, which is described by the formula:

$$ROS = \frac{net\ income}{sales} \tag{3}$$

This ratio is the best measure used to make comparisons of a company with the industry within which it operates. In practice, a relationship becomes manifest in which capital-intensive branches of industry, with a long operational cycle, engaging large working capital, are characterised by lower profitability than those which employ highly qualified personnel and in which the operational cycle is short (Sierpińska, Jachna, 2004: 196). The return on sales is largely associated with the market situation, because it affects sales and prices (Gabrusiewicz, 2014: 300).

## 2. Semi-variance as a measure of downside risk

Variance and standard deviation are conventional measures of risk in the theory of finance. They measure the dispersion of a variable around the expected value. These measures are still commonly used, although downside risk measures are increasingly widely used. Semi-variance, together with other lower partial moments and value at risk, which is a quintile risk measure, are currently the most frequently used measures of semi-variability.

Markowitz proposed semi-variance, which is the mean of deviations below a certain specified level, as a downside equivalent of variance (Markowitz, 1959):

$$ds_i^2(l) = \frac{\sum_{t=1}^{m} d_{it}{}^2(l)}{m-1} \tag{4}$$

where:

$$d_{it}(l) = \begin{cases} 0 & \text{dla} \quad z_{it} \geq l \\ z_{it} - l & \text{dla} \quad z_{it} < l \end{cases},$$

$z_{it}$ – the rate of return of the *i*-th listed company during the *t*-th period,

$ds_i^2(l)$ – semi-variance of the *i*-th listed company,

$m$ – the number of time units,

$l$ – the level determined by the investor.

If the rate of return set by an investor is risk-free and it changes from period to period, then the equation produces semi-variance for a risk-free rate of return ( $dS_i^2(f)$ ). When calculating semi-variance for a risk-free rate of return, a different point of reference is taken in each period, according to the formula:

$$dS_i^2(f) = \frac{\sum_{t=1}^{m} d_{it}{}^2(f)}{m-1} \tag{5}$$

where:

$$d_{it}(l) = \begin{cases} 0 & \text{dla} \quad z_{it} \geq z_{ft} \\ z_{it} - z_{ft} & \text{dla} \quad z_{it} < z_{ft} \end{cases},$$

$z_{ft}$ – risk-free rate of return in the *t*-th period.

Originally, semi-variance was determined for a time series of rates of return of stock exchange investments. However, the measure can be used for any variable in a temporal, cross-sectional or panel approach. Semi-variance in this study will be used to determine semi-variability of the profitability ratios. The mean value of a ratio for an industry in a quarter, according to the formula:

$$dS_i^2(R) = \frac{\sum_{t=1}^{m} d_{it}{}^2(\bar{R}_t)}{m-1} \tag{6}$$

where:

$$d_{it}(\bar{R}_t) = \begin{cases} 0 & \text{dla} \quad z_{it} \geq \bar{R}_t \\ z_{it} - \bar{R}_t & \text{dla} \quad z_{it} < \bar{R}_t \end{cases},$$

$\overline{R}_t$ – mean profitability ratio in the *t*-th period,

was taken as the point of reference against which deviations will be calculated.

Instead of semi-variance, its root, referred to as standard semi-deviation, can be used in analyses.

## 3. Characterisation of data and empirical results

The study was conducted for 15 food companies listed on the Warsaw Stock Exchange. Share prices from the period of 1.01.2008–30.06.2014 were taken for analysis. Companies which were quoted uninterruptedly during this period were taken for analysis along with quarterly financial statements available from the period between Q4 2007 and Q1 2014. Data from the periodical reports are made available to investors after a delay of nearly a quarter, so a quarter's shift was applied in the study between the fundamental data considered and the market share prices. The time series of quarterly rates of return and profitability ratios: *ROA*, *ROE* and *ROS* were determined for every company. Subsequently, the mean ratios ($\overline{\text{ROA}}$, $\overline{\text{ROE}}$, $\overline{\text{ROS}}$), standard deviation (S(ROA), S(ROE), S(ROS)) and standard semi-deviation (dS(ROA), dS(ROE), dS(ROS)) were calculated for each company. Semi-deviation for a profitability ratio was determined in relation to the ratio in a specific quarter. Distribution parameters were also calculated for the quarterly rates of return of each stock exchange company: mean rate of return ($\overline{z}$), standard deviation of a rate of return (S(z)) and semi-deviation of a rate of return against a risk-free rate (dS(f)). This gave cross sectional data, with different stocks as the items under consideration. This provided the basis for calculations of Pearson's correlation coefficient for the parameters of rates of return distribution, parameters of distribution of different profitability ratios and the company size (MV), which are shown in Tables 1–3.

Table1. Correlations between parameters of distribution of rates of return, parameters of distribution of *ROA* and the company size

| | $\overline{\text{ROA}}$ | S(ROA) | dS(ROA) | $\overline{z}$ | S(z) | dS(f) | MV |
|---|---|---|---|---|---|---|---|
| $\overline{\text{ROA}}$ | 1 | | | | | | |
| S(ROA) | –0.5983 | 1 | | | | | |
| dS(ROA) | –0.8062 | 0.9488 | 1 | | | | |
| $\overline{z}$ | 0.5618 | –0.2297 | –0.3486 | 1 | | | |
| S(z) | –0.6256 | 0.4993 | 0.5896 | –0.1647 | 1 | | |
| dS(f) | –0.6561 | 0.5035 | 0.5942 | –0.4166 | 0.9333 | 1 | |
| MV | 0.6853 | –0.1080 | –0.3264 | 0.1383 | –0.7293 | –0.6814 | 1 |

Source: author's calculations.

There is a positive correlation of a medium level between the mean *ROA* of the companies under study and the rates of return on investment in their shares. Moreover, there is a positive correlation between the variability and semi-variability of return on assets and stock exchange investment risk; its strength is greater than for the semi-deviation. There is also a slight negative correlation between the semi-variability of *ROA* and the company's size.

There is a low correlation between the mean *ROE* for the companies under study and the mean return on investment in their shares, as well as between the variability of *ROE* and the variability of return on stock exchange investments. On the other hand, there is medium correlation between the semi-variability of return on assets and downside risk of stock exchange investment. As for *ROA*, there is also a negative correlation between the semi-variability of the ratio and the company size for *ROE*.

Table 2. Correlation between the distribution of return rate parameters, *RIE* distribution parameters and company size

| | $\overline{ROE}$ | S(ROE) | dS(ROE) | $\bar{z}$ | S(z) | dS(f) | MV |
|---|---|---|---|---|---|---|---|
| $\overline{ROE}$ | 1 | | | | | | |
| S(ROE) | –0.3784 | 1 | | | | | |
| dS(ROE) | –0.6966 | 0.9266 | 1 | | | | |
| $\bar{z}$ | 0.1200 | –0.2683 | –0.2277 | 1 | | | |
| S(z) | –0.7390 | 0.1808 | 0.4335 | –0.1647 | 1 | | |
| dS(f) | –0.6621 | 0.1819 | 0.3961 | –0.4166 | 0.9333 | 1 | |
| MV | 0.8071 | 0.0989 | –0.2385 | 0.1383 | –0.7293 | –0.6814 | 1 |

Source: author's calculations.

Table 3. Correlations between parameters of the distribution of rates of return, parameters of distribution of *ROS* and the company size

| | $\overline{ROS}$ | S(ROS) | dS(ROS) | $\bar{z}$ | S(z) | dS(f) | MV |
|---|---|---|---|---|---|---|---|
| $\overline{ROS}$ | 1 | | | | | | |
| S(ROS) | –0.0729 | 1 | | | | | |
| dS(ROS) | –0.5222 | 0.8702 | 1 | | | | |
| $\bar{z}$ | 0.6315 | –0.0681 | –0.3027 | 1 | | | |
| S(z) | –0.3554 | 0.6301 | 0.7019 | –0.1647 | 1 | | |
| dS(f) | –0.4242 | 0.5963 | 0.6924 | –0.4166 | 0.9333 | 1 | |
| MV | 0.5366 | –0.2201 | –0.4000 | 0.1383 | –0.7293 | –0.6814 | 1 |

Source: author's calculations.

There is a medium-level correlation between the mean *ROS* of the companies under study and the mean rates of return achieved from investments in their shares. Also, there is

a positive correlation between variability and semi-variability of return on sales and the risk of stock exchange investments. There is also a negative correlation between the variability and semi-variability of *ROS* and the company size, with the correlation being stronger for the semi-variability.

For all the profitability ratios under consideration, the higher their semi-variability, the higher the downside risk of stock exchange investments. Noticeably, there is a reverse correlation between the stock exchange risk and the company size. The bigger the company, the lower the variability and semi-variability of its rates of return.

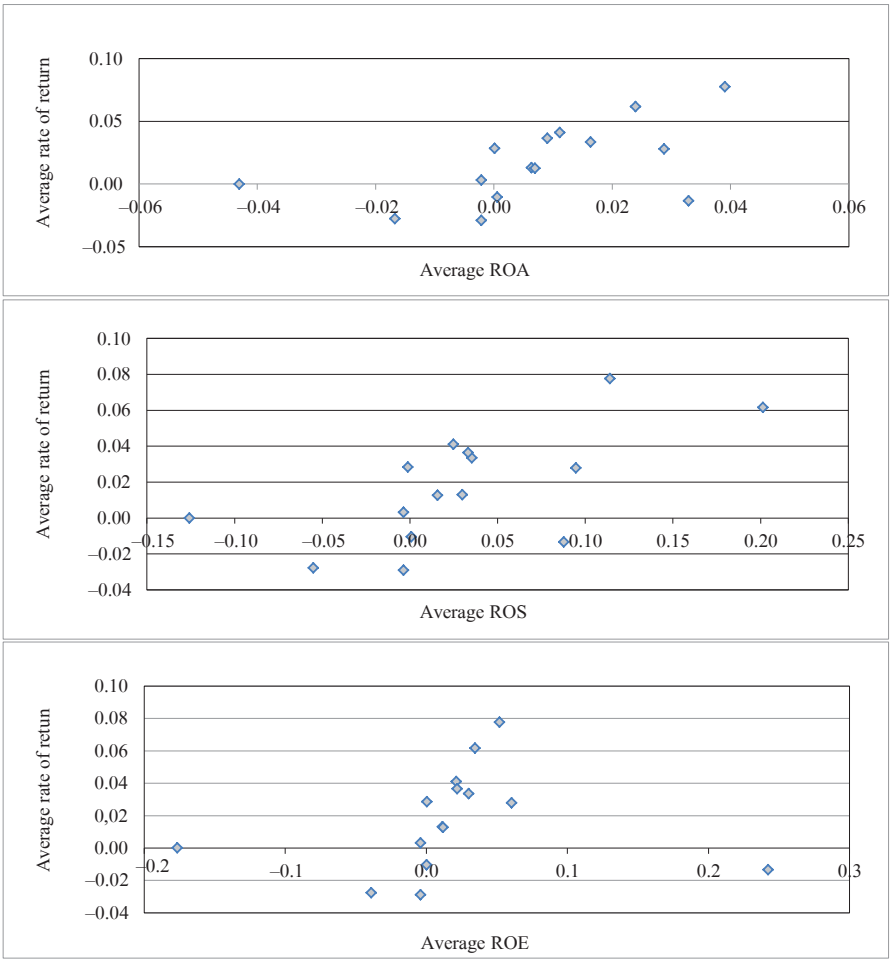


Fig. 1. The average profitability of investments in stocks in the context of the average value of the profitability ratios

Source: prepared by the author.

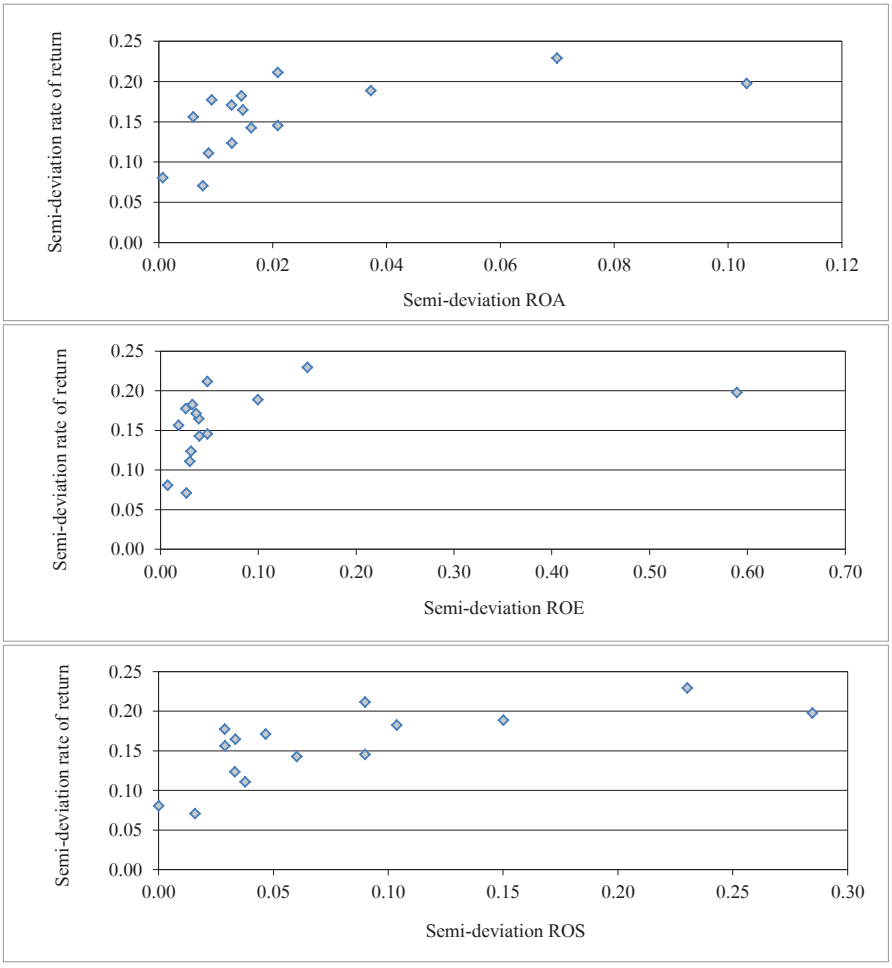


Fig. 2. The downside risk of investments in stocks in the context of the semi-variability of profitability ratios

Source: prepared by the author.

An analysis of Figure 1 shows that companies with higher than average profitability ratios also had higher profitability of investment in their shares.

Similarly, there is a positive correlation for the risk measured as a semi-deviation of rates of return and semi-variability of profitability ratios, which is shown in Figure 2.

For all the profitability ratios under consideration, the higher their semi-variability, the higher the downside risk of stock exchange investments. Noticeably, there is a reverse correlation

between the stock exchange risk and the company size. The bigger the company, the lower the variability and semi-variability of its rates of return.

## Conclusions

The size of a company is positively correlated with the mean profitability ratios. The strongest correlation is observed between the size of the company and *ROE*. The size of the company does not affect the mean rate of return on investment in the shares of construction companies. Variability and semi-variability of rates of return is lower for bigger companies. The semi-variability of profitability ratios is also lower for bigger companies; this is less marked for variability measured by standard deviation. This means that the business risk is higher for small companies than for big ones.

There is a positive correlation between profitability ratios for food companies and the rates of return on investment in their shares. The strength of the correlation is small for *ROE*. Rates of return on investment in shares in the long term are most affected by the profitability of sales.

There is a noticeable correlation between the semi-variability of profitability ratios of listed food companies and the downside risk of investment in shares of such companies. Food companies with high variability of return on equity and return on sales also had high variability of rates of return on the capital market. The downside risk of investments in shares was most affected by the semi-variability of ROS. This means that investors should expect large deviations of rates of return below risk-free rates of return for companies whose profitability of sales was much below the average level for the industry in different quarters. Moreover, the risk of stock market investments measured by standard deviation was linked most closely to the variability of *ROS*.

This study has shown that the profitability of sales of food companies listed on the Warsaw Stock Exchange clearly affects the mean rates of return and the risk incurred by investors.

This is also proof – at least for the industry in question – that what happens on the capital market is largely affected by the profit earned by the company.

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