LEVERAGE RATIOS IN THE STOCK SELECTION PROCESS ON THE WARSAW STOCK EXCHANGE. ANALYSIS BETWEEN 2001 AND 2011

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Abstract

The process of a portfolio optimisation is preceded by a stock selection. The paper is concentrated on using the synthetic measure of development in the stock selection process. The synthetic measure of development proposed by Zdzisław Hellwig is one of the methods of linear arrangement. It enables the classification of companies in relation to the set variables. In case of the paper the set variables are financial ratios. The purpose of the paper is to choose which set variables: financial ratios describing each area of company activity or leverage ratios should be used in order to point out stocks for the portfolio. Companies are divided into five quantile portfolios due to their position in the ranking that is constructed on the base of the synthetic measure of development. The synthetic measure of development is computed using given set variables. The author uses data of companies listed on the Warsaw Stock Exchange between 2001 and 2011. The rankings and portfolios are built separately for each year. As a result, it can be stated that the third portfolio of the ranking constructed on the base of leverage ratios is better than any portfolio constructed on the base of all chosen financial ratios.

Key words: financial ratios, stock selection, synthetic measure of development

JEL Code: C38, G11, G32

Introduction

The stock selection is an important part of a portfolio construction. There are many methods that allow to choose stocks and one of them is the method based on the synthetic measure of development. The synthetic measure of development (SMD) was proposed by Hellwig (Hellwig, 1968). It is used in a lot of areas when the object is described by many variables. Tarczyński is the first one who proposed using the SMD in order to construct securities portfolio on account of their financial strength (Tarczyński, 1994). He introduced the notion

of the TMAI that is Taxonomic Measure Attractiveness of Investment. Tarczyński and Łuniewska examined in details the possibility of using the TMAI (Tarczyński & Łuniewska, 2003). They use the chosen financial ratios as the set variables. Węgrzyn proposed to use financial ratios that describe each of four areas of a company activity[1] as a set variables for the synthetic measure of development (Węgrzyn, 2013a). Węgrzyn also proposed to include dynamics of financial ratios measured by the relative growth rate (Węgrzyn, 2013b). Moreover, Węgrzyn studied if it is possible to select stocks for the portfolio using only profitability ratios and their dynamics instead of ratios that describe each area of companies' activity (Węgrzyn, 2013b).

The accounting-based market anomalies like other anomalies are against the market efficiency hypothesis. However, Fama points out that the long-term return anomalies tend to disappear with changes in technique (Fama, 1998). After all, it does not change that there are a lot of researches that try to find new anomalies or study already known. One of them was discovered by Hirshleifer et al., this anomaly is related to net operating assets (NOA) and it can be used in order to predict future returns (Hirshleifer, Hou, Teoh & Zhang, 2004).

The purpose of the article is to point out the better set of variables (between two sets that are compared) that can be used in order to construct profitable quantile portfolio on the base of the synthetic measure of development. In the first set there are financial ratios that are describing each of four areas of a company activity. Whereas, in the second set there are leverage ratios. The SMD is computed on the base of each set of variables separately. Then, companies are linear arranged by the value of the SMD. As the result, companies are selected to one of five quantile portfolios by the position in the ranking. The structure of quantile portfolios is not optimised. Performances of quantile portfolios are compared with the performance of well-diversified proportional portfolio that contains all analysed companies. The study is performed in the period between 2001 and 2011 for companies listed on the Warsaw Stock Exchange in Poland.

The purpose of the article is not to construct optimal portfolios that lie on the efficient frontier. Such portfolios can be constructed on the base of Markowitz portfolio theory (Markowitz, 1952). During the construction of Markowitz's optimal portfolio, many constraints can be taken into account. There are many methods that can be used in order to include the constraint, one of them are genetic algorithms (Soleimani, Golmakani & Salimi,

[1] Four areas of companies' activity are measured by profitability ratios, turnover ratios (asset utilisation and efficiency ratios), liquidity ratios and leverage ratios.

2009). Moreover, Sroczyńska-Baron points out the possibility of using the game theory in order to construct the optimal portfolio (Sroczyńska-Baron, 2013a; Sroczyńska-Baron, 2013b).

1 Synthetic measure of development

The synthetic measure of development is one of the methods of linear arrangement. It enables the classification of companies in relation to the set variables (Hellwig, 1968). In case of companies' analysing, the value of the SMD points out the financial strength of companies (Tarczyński & Łuniewska, 2003). The SMD for a given company is computed as follows (Tarczyński & Łuniewska, 2003):

$$TMAI_i = 1 - \frac{d_i}{d_0}, \tag{1}$$

Where,

d_i – Euclidean distance between the company and the model object given by the formula:

$$d_i = \sqrt{\sum_{j=1}^{m} \frac{1}{m} \cdot \left(z_{ij} - z_{0j}\right)^2}, \tag{2}$$

z_{ij} – value of the j^{th} variable for i^{th} company (after standardisation)

z_{0j} – value of the j^{th} variable for the model object:

$$z_{0j} = \max_{j=1}^{m}\left(z_{ij}\right), \tag{3}$$

d_0 – the norm that guarantees the value of TMAI between 0 and 1:

$$d_0 = \max\left(d_{0j}\right). \tag{4}$$

As it can be noticed from the equation (2), it is assumed that each financial ratio has the same weight in the synthetic measure of development.

Variables (financial ratios) are divided into stimulants and destimulants. Stimulants are those financial ratios for which an increase is assessed positively. Whereas destimulants are those financial ratios for which an increase is assessed negatively. Then variables (both stimulants and destimulants) are standardised.

2 Financial ratios

In the study, the following financial ratios are used:

A. Profitability ratios:

- ROE – return on equity (Jerzemowska, 2006),
- ROA – return on assets (Jerzemowska, 2006),
- ROS – return on sales (Jerzemowska, 2006),
- Mzbs – gross profit on sales (Jerzemowska, 2006),
- Mzop – operating profit on sales,
- Mzb – gross profit margin,

B. Liquidity ratios:

- Wpb – current ratio (Jerzemowska, 2006),
- Wps – quick ratio (Jerzemowska, 2006),
- Wpp – acid test (Jerzemowska, 2006),
- RGS – operating cash flows on sales,
- RGZ – net profit on operating cash flows,

C. Asset turnover ratios (activity ratios or efficiency ratios):

- RA – asset turnover in days,
- RNal – receivables conversion period (in days) (Jerzemowska, 2006),
- RZap – inventory conversion period (in days) (Jerzemowska, 2006),
- Cop – operating cycle (in days) ,
- RZob – payables conversion period (in days) (Jerzemowska, 2006),
- CKG – Cash Conversion Cycle (Jerzemowska, 2006),
- RMO – current assets turnover in days (Jerzemowska, 2006),

D. Financial leverage ratios (debt ratios):

- Szo – debt ratio,
- WPM – equity to fixed assets,
- WOZ – sum of depreciation and financial costs to net profit (Jerzemowska, 2006),
- WPZ – current liabilities to sum of annual interest expense and depreciation,

3 Data and Assumptions

In the study, the nonfinancial companies that are listed on the WSE between 04.2001 and 04.2012 are included. They are included, in the end of March for a given year, in one of the

following indexes: WIG20, mWIG40[2] or sWIG80[3]. From among such companies the following are excluded:

- banks, insurances companies and lease companies,
- companies included in the following sectors: finance or finance–other,
- companies for which there is no full financial statements for two preceding years[4],
- companies that in the balance sheet (that is used in order to compute financial ratios) have negative value of the shareholders equity,
- companies that in the income statement (that is used in order to compute financial ratios) have value of revenues from sales equal to zero.

As the result in the consecutive years there are between 95 and 118 companies qualified for the study. The number of companies qualified for the study in a given year is shown in the Tab. 1.

Tab. 1: The number of companies qualified for the study in the consecutive years

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Number of companies	96	95	97	102	108	105	106	113	117	118	116

Source: Own study.

For each company qualified for the study in a given year the financial ratios described in the section 2 are computed. In order to compute the financial ratios the financial statements for a previous year are used. It means that historical values of financial ratios are used. However, as Barczak points out, it is possible to forecast values of the financial statement using Grey Models (Barczak, 2013a; Barczak 2013b). As a result forecasted financial ratios are achieved.

The values of financial ratios are used to the construction of the SMD. Two synthetic measures of development are computed, the first one (called TMAI) is computed on the base of all financial ratios presented in the section 2. The second one (called TMAI_L) is computed on the base of leverage ratios that are presented in the section 2 D.

Each SMD is used in order to conduct a linear arrangement of the companies separately for each year. In case of the first one the ranking is called TMAI. While in case of

[2] If there was not an index mWIG40 then an index midWIG is used.
[3] If there was not an index sWIG80 then an index WIRR is used.
[4] In the study are used financial statements from the following data bases prepared by the Notoria Serwis: 1(39)/2003, 3(45)/2004, version 18.30 may 2010, version 20.50 march 2012.

the second one it is called TMAI_L. The position of the company in each ranking separately allows to assign it into one of five quantile portfolios in the following way:

- into the first portfolio, 20% of companies with the highest position are put,
- into the second portfolio, the next 20% of companies with the highest position are put that are not included in the first portfolio,
- into the third portfolio, the next 20% of companies with the highest position are put that are not included in the first or second portfolio,
- into the fourth portfolio, the next 20% of companies with the highest position are put that are not included in the first or second or third portfolio,
- into the fifth portfolio, the remaining companies are put.

As the result five equipotent portfolios for each ranking are constructed. Each portfolio is bought during the last session in the first week of April a given year and sold during the last session in the first week of April next year. In each company 10 000 PLN is invested, quantity of stocks is rounded down to integer and it is constant during the investment period.

In the study the financial companies like banks, insurance companies and lease companies are not included. As the result, index WIG or any other index cannot be a benchmark. The benchmark portfolio (BP) is constructed like other portfolios. In the BP all companies qualified for a study in the given year are included. In each company 10 000 PLN is invested, quantity of stocks is rounded down to integer. The quantity of stocks is constant during the investment period.

Assessment of each portfolio is done by:

- average geometric rate of return for an eleven-years-period of investment (R_G),
- cumulated rate of return (R_{cum}),
- investment rate of return,
- a Sharpe ratio (Sharpe, 1966).

4 Results

There are investment rates of return for each constructed portfolio between 2001 and 2011 in the Table 2. In case of the TMAI ranking, the comparison of returns achieved by each portfolio with the return for the BP points out that the Portfolio 2 the most frequently gives the rate of return that is higher than the rate of return for the BP (that situation occurs 7 times during 11 years). Whereas, in case of the TMAI_L ranking that situation is for the Portfolio 3 (8 times during 11 years the Portfolio 3 gives higher rate of return than the BP). When returns

achieved by the Portfolio 2 of the TMAI ranking and the Portfolio 3 of the TMAI_L ranking are compared than it can be noticed that the Portfolio 3 of the TMAI_L ranking 8 times during 11 years gives higher rate of return than the Portfolio 2 of the TMAI ranking.

In the Table 3, there are cumulated rates of return and geometric average rates of return. In case of the TMAI ranking the Portfolio 2 gives the highest R_G, that is 8.1 pp[5] higher than the R_G for the BP. As the result, the R_{cum} for the Portfolio 2 is more than 2 times higher than it is for the BP. While, in case of the TMAI_L ranking, the Portfolio 3 gives the highest R_G, that is 15 pp higher than the R_G for the BP. As a consequence, the R_{cum} for the Portfolio 3 is nearly 4 times higher than it is for the BP. The comparison of the R_G for that two portfolios points out that the R_G for the Portfolio 3 in the TMAI_L ranking is higher than it is for the Portfolio 2 in the TMAI ranking by 6.9 pp.

Tab. 2: Investment rate of return for constructed portfolios

Year		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Benchmark portfolio (BP)		-12,7%	-5,6%	187,2%	15,7%	143,0%	82,5%	-28,2%	-54,7%	60,7%	6,7%	-23,4%
TMAI	Portfolio 1	-47,7%	-37,3%	**277,7%**	**25,0%**	123,2%	**106,0%**	-45,5%	-56,9%	42,4%	**27,5%**	-33,6%
	Portfolio 2	-25,8%	**-1,7%**	**193,1%**	8,2%	**343,3%**	**95,3%**	**-10,9%**	-57,2%	**82,9%**	**7,9%**	-27,4%
	Portfolio 3	**-5,9%**	-7,0%	147,9%	**26,0%**	88,0%	65,1%	**-26,3%**	**-54,1%**	**67,8%**	-7,2%	-29,8%
	Portfolio 4	**10,6%**	**7,1%**	**206,9%**	8,3%	67,2%	81,4%	-28,9%	**-54,4%**	51,9%	2,7%	**-15,6%**
	Portfolio 5	**4,6%**	**10,7%**	113,1%	11,5%	101,1%	64,5%	-29,2%	**-50,9%**	59,0%	3,7%	**-11,3%**
TMAI_L	Portfolio 1	-40,1%	-30,0%	**240,7%**	**21,7%**	110,9%	**98,8%**	-34,2%	-56,2%	**79,8%**	**29,7%**	-36,6%
	Portfolio 2	**-10,5%**	-20,7%	**234,6%**	14,9%	71,1%	**87,9%**	-29,6%	-55,6%	51,0%	-4,7%	-31,5%
	Portfolio 3	-14,8%	**5,4%**	**219,8%**	12,1%	**416,3%**	**107,8%**	**-13,8%**	**-52,2%**	**68,8%**	6,7%	**-22,9%**
	Portfolio 4	**0,2%**	**-3,5%**	115,9%	**27,5%**	74,7%	35,4%	-31,9%	**-52,6%**	49,2%	0,6%	**-10,6%**
	Portfolio 5	**1,2%**	**20,7%**	131,6%	2,3%	36,9%	**82,6%**	-31,2%	-56,7%	55,4%	1,8%	**-16,0%**

Bold font is used for values that are higher than they are for the benchmark portfolio.
Source: own study.

There are the Sharpe ratios for constructed portfolios in the Table 4. It can be noticed that the Sharpe ratio for the BP has positive value 6 out of 11 times. The Portfolio 2 in the TMAI ranking has higher value of the Sharpe ratio than it is for the BP in case of 4 years. While the positive values of the Sharpe ratio are studied, then the Portfolio 2 in case of 2 years has higher positive value of the Sharpe ratio than it is for the BP (the opposite situation

[5] pp – percentage points

is 3 times). The Portfolio 3 in the TMAI_L ranking has higher value of the Sharpe ratio than it is for the BP in case of 4 years. It should be noticed that the Portfolio 3 has no one time higher positive value of the Sharpe ratio than the BP.

Tab. 3: Cumulated rate of return and geometric average rate of return

	Benchmark portfolio (BP)	TMAI					TMAI_L				
		Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5	Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5
Cumulated rate of return	519%	201%	**1094%**	313%	510%	463%	310%	270%	**1978%**	272%	287%
Geometric average rate of return	16,2%	6,6%	**24,3%**	10,9%	16,0%	15,0%	10,8%	9,5%	**31,2%**	9,5%	10,0%

Bold font is used for values that are higher than they are for the benchmark portfolio.
Source: own study.

Tab. 4: The Sharpe ratio for constructed portfolios

Year		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Benchmark portfolio		-2,14	-1,49	4,54	0,55	3,53	2,33	-1,40	-2,85	2,48	0,17	-1,47
TMAI	Portfolio 1	-4,06	-3,01	4,06	**0,66**	2,28	2,08	-1,81	**-2,69**	1,14	**1,07**	-1,86
	Portfolio 2	-2,62	**-0,67**	3,58	0,09	2,59	2,20	**-0,58**	-3,07	**3,10**	**0,21**	-1,50
	Portfolio 3	**-1,45**	**-1,41**	3,69	**0,96**	**3,56**	2,08	**-1,14**	**-2,68**	**2,61**	-0,79	-1,82
	Portfolio 4	**-0,34**	**-0,23**	4,05	0,12	2,72	1,96	-1,68	-2,89	2,31	-0,14	**-1,10**
	Portfolio 5	**-0,71**	**0,04**	3,19	0,35	2,91	1,78	-1,48	**-2,32**	2,33	-0,06	**-0,74**
TMAI_L	Portfolio 1	-2,88	-2,06	3,35	0,53	2,24	2,19	**-1,40**	-2,99	**2,56**	**1,06**	-2,12
	Portfolio 2	**-1,72**	-2,17	4,40	0,43	2,47	**2,37**	-1,51	**-2,41**	2,13	-0,55	-1,76
	Portfolio 3	-2,23	**-0,34**	4,31	0,25	3,31	2,14	**-0,67**	**-2,74**	2,38	0,17	**-1,44**
	Portfolio 4	**-0,88**	**-1,02**	2,86	**0,98**	**3,83**	1,25	-1,53	**-2,71**	1,89	-0,31	**-0,77**
	Portfolio 5	**-1,13**	**0,78**	3,60	-0,24	1,80	1,98	-1,62	**-2,71**	2,14	-0,22	**-0,96**

Bold font is used for values that are higher than they are for the benchmark portfolio.
Source: own study.

The comparison of the Sharpe ratios for the Portfolio 2 in the TMAI ranking and the Portfolio 3 in the TMAI_L ranking points out that in case of 7 years the Sharpe ratio is higher for the Portfolio 3 in the TMAI_L ranking than it is for the Portfolio 2 in the TMAI ranking. However, when only positive values of the Sharpe ratio are concerned than there is no better

portfolio between the Portfolio 2 in the TMAI ranking and the Portfolio 3 in the TMAI_L ranking.

Conclusions

The article is an attempt to point out the set of financial ratios that should be used in the process of stock selection to the portfolio. Two sets of financial ratios are studied: all financial ratios (they are used in the construction of TMAI ranking) and leverage ratios (they are used in the construction of TMAI_L ranking). As a result, it can be stated that the Portfolio 3 in the TMAI_L ranking is the best one portfolio in terms of the average geometric rate of return and the Sharpe ratio than any other portfolio in the TMAI ranking. It means that the debt analysis is very important in the process of stock selection.

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