Intensity and Extensity of Firm Development and Dynamic Dupont Analysis

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Abstract:

The paper introduces two types of indicators that can extend financial (ratio) analysis. The first ones are dynamic intensity and extensity parameter that show if a firm develop in intensively or extensively and count impact of intensive and extensive factors. The second type contains indicators extending DuPont analysis about counting how the change of Profit Margin, Total Assets Turnover and Leverage Factor affects change Return on Equity. Both types of indicators concentrate on firm development and they are able indicate whether a firm develop in the right direction. They can be easily count using basic firm data founding in balance sheet, profit and loss statement or cash flow statement.

Key Words: financial (ratio) analysis, dynamic intensity and extensity parameter, DuPont analysis and its dynamic

JEL Classification: D24, G32, L25.

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1. Introduction

Financial analysis of companies is a theoretical, but mainly a practical discipline comprising various more or less coherent analyses essential for effective company management. This paper completes the financial analysis and adds the analysis of intensity development, and makes an addition to the Du Pont model of Return on Equity (ROE). The analysis of intensity development is important in terms of evaluation of innovative efforts and competitiveness. For a company to be successful over a long period of time, it must innovate. This means that company management must be based on intensive factors. From this point of view, a company needs simple parameters showing if it is developing intensively or extensively. This paper introduces such parameters and analyses their possibilities. The addition to the Du Pont model is based on its dynamisation. The actual model evaluates how return on equity is affected by Profit Margin, Total Assets Turnover and Leverage Factor. We will show in this paper that, in terms of company development, it is good to know how these parameters change over time and we propose our own parameters that are able to do so. All the parameters mentioned herein can be used for all types of companies. In case of small and medium-sized enterprises, the parameters have the advantage that they are not demanding, in terms of the input data, they can be easily calculated and their interpretation is not time demanding and brings much valuable information.

The methodology used herein has been derived from principles that were originally developed for national economy. The paper is organised as follows: first, literature focusing on financial analysis and the Du Pont model are discussed. This is followed by theoretical starting points, the actual methodology for intensity development analysis of companies and parameters dynamising the Du Pont model. These parameters have been used for an analysis of the development of the Jan Becher – Karlovarská Becherovka joint stock company for the period from 2008 to 2012. The methodology and factual findings are summed up in the conclusion.

2. Literature review

Many texts, e. g. (Fridson, & Alvarez, 2011; Tracy, 2012; Maynard, 2013) are devoted to the topic of financial and ratio analysis, which our paper develops. Financial analysis is usually understood as process of evaluating businesses, projects, budgets and other finance-related entities to determine their suitability for investment. Typically, financial analysis is used to analyze whether an entity is stable, solvent, liquid, or profitable enough to be invested in. When looking at a specific company, the financial analyst will often focus on the income statement, balance sheet, and cash flow statement. The key part of financial analysis is ratio analysis that is based on line items in financial statements like the balance sheet, income statement and cash flow statement; the ratios of one item – or a combination of items - to another item or combination are then calculated. Ratio analysis is used

to evaluate various aspects of a company's operating and financial performance such as its efficiency, liquidity, profitability and solvency.

Financial analysis is often used as a tool which has been developed over a long period of time (for the history of the development see, e.g., (Bhattacharya, 2007)), and which has its own fixed procedures and does not need any major modifications (Liapis *et al.,* 2013). Less attention is paid to its limitations, alternatively the options of its further development. In terms of its limitations, (Parrino, Kidwel & Bates, 2011) and (Brigham & Houston, 2013) state that financial analysis does not sufficiently take into consideration the issue of risk or size of the initial investment or future earnings. (Kane, 1997) shows that some financial analysis values can be distorted in a period of recession. In terms of its expansion (Giacomino & Mielke, 1993) propose including nine cash flow-based ratios into the analysis. (Nissim & Penman, 2001) strive to make a correlation between financial analysis and equity valuation. (Anantadjaya, 2011) describes the use of ratio analysis as a tool for employee evaluation. Overall, the issue of how a company achieves sales revenue, profit and other data which serve as basis for ratio analysis is left behind. What causes changes in ratio analysis values is also not sufficiently explored.

3. Material and Methods

3.1 Dynamic intensity and extensity parameters as indicators of a firm´s development

A company's performance can be monitored using the relation between its inputs and output. Output can be expressed in the form of total revenue or some other suitable indicator that reflects the company's nature (e.g. revenue from sales of goods, or revenue from sales of company's products and services -). Inputs can be expressed as total costs or some other suitable cost indicator—costs of goods sold, costs associated with the company's production, etc. The quotient of revenues (*TR*) and costs (*TC*) represents efficiency *Ef*, which shows the revenue per unit of costs invested.

$$Ef = TR / TC \qquad\qquad (1)$$

Statement (1) can be used to count a dynamic statement for the development of total revenue:

$$I(TR) = I(Ef) \cdot I(TC) \qquad\qquad (2)$$

Statement (2) shows how the change (index) of revenue is affected by change of efficiency and change of costs. The dynamic intensity or extensity parameters which are deriving from this statement (for details see e. g. (Cyhelský, Mihola, & Wawrosz, 2012) are following:

The dynamic intensity parameter:

$$i = \frac{lnI(Ef)}{|lnI(Ef)|+|ln\ (I(TC)|} \qquad (3)$$

and the supplementary dynamic extensity parameter:

$$e = \frac{lnI(TC)}{|lnI(Ef)|+|lnI(TC)|} \qquad (4)$$

The dynamic intensity parameter tells how much intensive factors (it means some forms of innovations) affect firm development. Similar is valid for the dynamic extensity parameter that shows how extensive factors (it means change of inputs) affect firm development. All possible situations regarding the relation between extensive and intensive factors on the one hand and output (sales revenue) on the other hand are described in Table 1.

Table 1. Effect of changing extensive and intensive factors on the change in output

	Extensive factors	Intensive factors	Output (sales revenue)	Value of parameters e; i
1.	Increase	Constant	Increase	$e = 1, i = 0$
2.	Constant	Increase	Increase	$e = 0, i = 1$
3.	Increase at the same rate as intensive factors	Increase at the same rate as extensive factors	Increase	$e = 0.5, i = 0.5$
4.	Increase at a higher rate than intensive factors	Increase at a slower rate than extensive factors	Increase	Both parameters positive, $e > i$
5.	Increase at a slower rate than intensive factors	Increase at a higher rate than extensive factors	Increase	Both parameters positive, $i > e$
6.	Increase; their growth rate is higher than the decline rate of intensive factors	Decline; their decline rate is lower than the growth rate of extensive factors	Increase	e positive, i negative, $e > |i|$
7.	Decline; their decline rate is lower than the growth rate of intensive factors	Increase; their growth rate is higher than the decline rate of extensive factors	Increase	e negative, i positive, $i > |e|$
8.	Increase; their growth rate is the same as the decline rate of intensive factors	Decline; their decline rate is the same as the growth rate of extensive factors	Do not change (stagnate)	$e = 0.5, i = -0.5$
9.	Decline; their	Increase; their	Do not	$e = -0.5, i = 0.5$

	decline rate is the same as the growth rate of intensive factors	growth rate is the same as the decline rate of extensive factors	change (stagnate)	
10.	Decline; their decline rate is higher than the growth rate of intensive factors	Increase, their growth rate is lower than the decline rate of extensive factors	Decline	e negative, i positive, $i < |e|$
11.	Increase, their growth rate is lower than the decline rate of intensive factors	Decline; their decline rate is higher than the growth rate of extensive factors	Decline	e positive, i negative, $e < |i|$
12.	Decline at a higher rate than intensive factors	Decline at a lower rate than extensive factors	Decline	Both parameters negative, $|e| > |i|$
13.	Decline at a lower rate than intensive factors	Decline at a higher rate than extensive factors	Decline	Both parameters negative, $|e| < |i|$
14.	Decline at the same rate as intensive factors	Decline at the same rate as extensive factors	Decline	$e = -0.5$, $i = -0.5$
15.	Decline	Do not change	Decline	$e = -1$, $i = 0$
16.	Do not change	Decline	Decline	$e = 0$, $i = -1$

Source: Authors' research and calculation.

The following should apply for successful companies (details can be found in (Mihola, Wawrosz, & Kotěšovcová, 2015)): their output and consequently their profits are increasing over time, while this growth is caused mainly by intensive factors. In general, companies should aim at ensuring a positive parameter of intensity, while maximizing its value in the long run. We understand that in many areas crucial innovations have already been realized a long time ago, and current innovations are only marginal compared to such crucial ones; consequently, the dynamic parameter of intensity cannot come near the value of 1 in the case of a successful company, where production (output) and sales revenue are increasing. However, it is still true that this parameter should be positive. A negative value of this parameter in the long term (for three years or more) signals that the company is in difficulty.

Our classification demonstrates that a company's profit may be positive and increasing even though the value of parameter i is negative. This situation is shown in row 6 of Table 1 and we called it extensive and de-intensive growth—the decline

in intensive factors is offset by an increase in extensive factors. Similarly, the situation shown in row 8 is also dangerous, as intensive factors are declining, but extensive factors are increasing at the same rate, thereby offsetting the decline in intensive factors. In this case, the company's output does not change. This may cause the company's management to become complacent, believing that everything is in order. Neither extensive and de-intensive growth, nor extensive offsetting are sustainable on a long-term basis. Sooner or later, the company will hit the input barrier and be unable to outweigh or offset the decline in intensive factors, a situation which may even result in its dissolution. The two situations described above clearly demonstrate that profit alone is not sufficient as a company performance indicator.

Other situations described in Table 1 may also be alarming, such as:
- the situation in row 1, with an increase in extensive factors only;
- the situation in row 4, especially if the value of dynamic extensity parameter is in long run much higher rate than the value of dynamic intensity parameter.

These situations represent a risk that the company will, sooner or later, also hit the barrier to further expansion of inputs, i.e., it will not be able to generate further growth in the existing manner.

A decline in intensive factors (a negative dynamic intensity parameter) is a signal that output may fall, with a subsequent decline in the company's profit. Row 11 of Table 1 shows the situation where the growth in extensive factors cannot offset the decline in intensive factors, rows 12 and 14 show a decline in both intensive and extensive factors, while row 15 describes a decline in extensive factors and no change in intensive factors. All these situations adversely affect the company's output. A firm should pay the attention to all above mentioned dangerous or alarming situations and try such steps increasing value of the dynamic intensity parameter.

3.2 DuPont analysis and its dynamic

DuPont analysis examines the Return On Equity (*ROE*) analyzing profit margin, total asset turnover, and financial leverage. It was created by the DuPont Corporation in the 1920s. Its main conclusion says that a company can earn a high return on equity if: 1. It earns a high profit margin and/or 2. It uses its assets effectively to generate more sales (revenues) and/or 3. It has a high financial leverage. The DuPont formula for *ROE* (it means profit divides shareholder´s equity) is:

$$ROE \ = \ PM \cdot TAT \cdot LF \qquad (5)$$

Where: $\quad PM = Profit\ Margin = \dfrac{Profit}{Revenues} = \dfrac{EP}{TR} \qquad (6)$

$$TAT = Total\ Asset\ Turnover = \frac{Revenues}{Total\ Assets} = \frac{TR}{TA} \quad (7)$$

$$LF = Leverage\ Factor = \frac{Total\ Assets}{Sharholders\ Equity} = \frac{TA}{SE} \quad (8)$$

The *ROE* value changes over time. For companies it is advisable to know how the change in Profit Margin, Total Assets Turnover and Shareholder Equity affects the change. The impact of the change shows what a company should be focusing on if the *ROE* value develops favourably or unfavourably, and what the strong and weak points of the company are. The parameters showing the impact of the change in Profit Margin on ROE ($im(PM) = im(\frac{EP}{TR})$) are as follows:

$$im(\frac{EP}{TR}) = \frac{lnI\left(\frac{EP}{TR}\right)}{|lnI\left(\frac{EP}{TR}\right)|+|\ln\left(I\left(\frac{TR}{TA}\right)|+|\ln\left(I(\frac{TA}{SE})|\right.\right.} \quad (9)$$

Analogical indicators expressing the impact of change in Total Assets Turnover ($(im(TAT) = im(\frac{TR}{TA})$)) and in Leverage Factor ($(im(LF) = im(\frac{TA}{SE})$)) on ROE are as follows:

$$im(\frac{TR}{TA}) = \frac{lnI\left(\frac{TR}{TA}\right)}{|lnI\left(\frac{EP}{TR}\right)|+|\ln\left(I\left(\frac{TR}{TA}\right)|+|\ln\left(I(\frac{TA}{SE})|\right.\right.} \quad (10)$$

$$im(\frac{TA}{SE}) = \frac{lnI\left(\frac{TA}{SE}\right)}{|lnI\left(\frac{EP}{TR}\right)|+|\ln\left(I\left(\frac{TR}{TA}\right)|+|\ln\left(I(\frac{TA}{SE})|\right.\right.} \quad (11)$$

The absolute sum of the values of all impact ratios is 100. The methodology presented herein analyses in detail what affects return on equity in companies. The respective data is vital, in particular, for owners but also for parties that might be potentially interested in investing in the company equity, for creditors and other persons.

4   Results and Discussion

The parameters mentioned above (both dynamic parameters of intensity and extensity, and the parameters of the impact on changes in *ROE)* will be demonstrated in this part using a Czech company, Karlovarská Becherovka, a world famous manufacturer of alcoholic beverages. The analysis will be carried out for 2008 – 2012. Jan Becher – Karlovarská Becherovka a.s. company falls into the category of small and medium-sized enterprises; in 2013 the average number of employees was 151 (the European criterion is 250), the turnover in 2013 reached 48 million Euro (the European criterion MSP is 50 mil EUR). The data were taken from the company annual reports.

4.1 Analysis of dynamic parameters of intensity and extensity of Karlovarská Becherovka

First, we will focus on dynamic parameters of intensity and extensity. All input and calculated analytical parameters are shown in Table 2. Input data are represented by company sales revenue (*TR*) and cost (*TC*) (in mil. CZK). The data is used to calculate profit (*EP*) and effectiveness (*Ef*). The table also includes dynamics of the development of profit, sales revenue, costs and effectiveness (using the rate of growth) which is used to calculate parameters of intensity and extensity. The last column in the table shows the average year on year values.

Table 2. Analytical data of Jan Becher – Karlovarská Becherovka, a.s.

	2008	2009	2010	2011	2012	2012/2008
TR	1,327	1,411	1,310	1,318	1,209	1,315
TC	1,100	1,269	1,145	1,109	1,067	1,138
EP	227	142	166	209	142	177
Ef	1,206	1,112	1,145	1,188	1,133	1,156
G(EP)		-37%	17%	26%	-32%	-11%
G(TR)		6%	-7%	1%	-8%	-2%
G(TC)		15%	-10%	-3%	-4%	-1%
G(Ef)		-8%	3%	4%	-5%	-2%
i		-36%	22%	54%	-55%	-67%
e		64 %	-78%	-46%	-45%	-33%

Source: Annual reports of Karlovarská Becherovka and own calculations

The development of company revenue in the five monitored years slightly fluctuated. The difference between the biggest sales in 2009, exceeding 1.4 billion CZK, and in 2012 when they dropped to 1.2 billion CZK, is 200 million CZK. This fact is also reflected in the fluctuation in profit and effectiveness. The rate of growth of sales revenue *G(TR)* often changes the plus-minus sign. The average value of the rate of growth is negative and insignificant for all monitored parameters, apart from profit G*(EP),* which has dropped by 11% year on year on average. These facts have been significantly reflected in the development of intensity of the analysed company. The average intensity for the monitored period is – 67 % and extensity– 33 %, which means that both factors affected the decline in sales revenue and profit in this period. The most favourable seems to be the year 2011, when the biggest rate of profit growth was accompanied by intensity of 54% and a decline in costs, which was reflected in negative extensity of -46 %. An even bigger decline in costs, which was reflected in an even more significant negative extensity of -78 %, occurred in the

previous year, i.e., in 2010, when intensity was 22%. 2009 and 2012 seem to be problematic, showing the biggest decline in profit of 142 million CZK.

The development of the company in the monitored period was affected mainly by two events. In 2010 the rate of sales growth *G(TR)* dropped by 7%, which was caused by a rapid increase in tax on alcohol from January 2010. Another major decline in the rate of sales growth *G(TR)* of 8% and the related decline in profit *G(EP)* of 32% were caused by the methanol affair in September 2012 The essence of affair was that illegally produced spirits caused death and wealth problems of its costumers what caused decline in demand including demand of legally produced spirits. The above mentioned factors were also reflected in the average extensive and intensive growth, which was negative in the monitored period.

4.2 Impact ratio of ROE – Karlovarská Becherovka

A Du Pont analysis of the company will be carried out in this part, in addition to a calculation of the impact of changes on all three parts of the analysis (i.e., impact of the change on Profit Margin, impact of the change on Total Assets Turnover and impact of the change on Leverage Factor) which affects the *ROE* parameter. All input and calculated analytical parameters are shown in Table 3, which adopts some of the source data from Table 2.

Table 3. Du Pont analysis of development of Karlovarská Becherovka, a.s.

	2008	**2009**	**2010**	**2011**	**2012**	**2012/2008**
EP	227	142	166	209	142	177
TR	1,327	1,411	1,310	1,318	1,209	1,315
TA	1,364	1,539	1,531	1,763	1,098	1,459
SE	992	1,133	1,111	1,326	657	1,044
ROE=EP/SE	0.23	0.13	0.15	0.16	0.22	0.17
PM=EP/TR	0.17	0.1	0.13	0.16	0.12	0.13
TAT = TR/RA	0.97	0.92	0.86	0.75	1.1	0.9
LF =TA/SE	1.37	1.36	1.38	1.33	1.67	1.4
G(ROE)		-45%	19%	5%	37%	-22%
G(PM)		-41%	26%	25%	-26%	-9%
G(TAT)		-6%	-7%	-13%	47%	3%
G(LF)		-1%	1%	-4%	26%	5%
im(PM)		-88%	73%	57%	-33%	-54%
im(TAT)		-10%	-22%	-34%	42%	18%
im(LF)		-2%	5%	-9%	25%	28%

Source: Annual report and own calculations

Table 3 shows that in 2009 the decrease in the rate of growth of return on equity (ROE) of 45% was caused by 88% by a decline in Profit Margin, by 10% by a decline in Total Assets Turnover and only by 2% by a decline in Leverage Factor. The increase in ROE in 2010 of 19% was caused by the 73% increase in Profit Margin, on the other hand, Total Assets Turnover had a negative impact of 22% and the change in Leverage Factor had a positive impact of 5%. Similarly, we can analyse years 2011 and 2012. The average rate of ROE growth in 2008 - 2012 was negative, namely – 22 %. The biggest impact on the decline in the rate of growth of ROE is the Profit Margin parameters, by 54%, another major impact is represented by the Leverage Factor, 28%, and finally by the Total Assets Turnover, 18 %.

Conclusion

Two new methodologies for examining company development were outlined in this paper. The first one is the methodology of examining intensive and extensive parameters of development that was used for national economy in the past; however, it can also be used for companies. This use shows that despite the fact that the requirements in terms of information and computing are low, only the sales revenue and costs of the relevant company are needed, however, significant analytical conclusions can be made on the basis of the examination. The advantage of the proposed parameters is time comparability, which is also a suitable comparison tool. The parameter of intensity (*i*) shows the impact of intensive (qualitative) factors on the final development of sales, which are demonstrated in the change of effectiveness. The parameter of extensity (*e*) shows the impact of extensive development (of costs) on the development of sales revenue. Company management and other parties have information showing if a company is developing intensively or extensively.

The second methodology extends the Du Pont analysis of the *ROE* indicator by adding an analysis of the impact of the individual components of this parameter (Profit Margin, Total Assets Turnover and Leverage Factor) on the overall changes in *ROE*. The advantage of this methodology is its ability to quantify the rate of growth or decline of individual parameters so that the overall impact reaches 100%. This was achieved by taking a logarithm of the impact of development of individual parameters. Even in this case the impact clearly shows the cause of changes in the ROE parameter over time and provides information about which factors the company should focus on if it wants to achieve the most favourable values of the parameter.

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