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Wyższa Szkoła Zarządzania i Bankowości w Krakowie

Zbigniew Dresler
The School of Banking and Management in Krakow
zdresler@gmail.pl

APPLICATION OF OPERATING LEVERAGE IN COMPANY PROFITABILITY ANALYSIS

Introduction

Company profitability is generally perceived as the achievement of positive financial results that are the difference between the total income from all types of company's operations and the total costs that are incurred from the acquisition of the income. In this meaning, profitability is the crucial and basic objective of any economic activity.

Apart from that basic target, profitability plays other significant roles[1]:

- measures company effectiveness,
- is the financing source of company development,
- is the basis for the motivational systems of managing staff.
- is the source of public revenue.

Thus, profitability analysis is one of the most important areas of financial analysis.

Profitability level can be given in terms of value (e.g. the amount of profit) or indexes, i.e. in the form of the relation of the financial result (calculated in various ways) to an economic value with which the financial result is closely connected. The value in question may be the income from the operations, income costs, resource (assets) used in business operations or the equity that facilitated the purchase of necessary resources.

The basic method to investigate and analyze the result is the so called factor analysis, which aims at the determination of the impact on the level of the result, and particularly on its changes (in comparison to the level achieved in the previous period or to the level planned) of the following three factors: the volume of sales (measured in appropriate physical units of measure), sales prices and the unit costs of manufacturing and sales. The application of operational leverage in profitability analysis supplements and supports factor analysis.

The explanation of the idea and mechanism of operational leverage can be found in most handbooks in finance, accounting and company economics. However, it is difficult to gain

[1] More in: Z. Dresler (ed.), *Rentowność przedsiębiorstw w Polsce,* Wydawnictwo Uniwersytetu Ekonomicznego w Krakowie, Kraków 2014.

knowledge on how to take advantage of operational leverage in a practical assessment of company profitability from books on financial analysis. The aim of the article is to present the application possibilities of this instrument in company profitability analysis.

1. The mechanism of operational leverage

Economic activity of companies involves costs. For the sake of management, there is a need to keep a record of costs which is referred to as a cost accounting. It is usually a partially separated information subsystem within the accounting records system whose basic task is to provide information on costs.

There are several types of cost accounting. The most common and the eldest is the so called cost by type accounting, in which costs are accounted by arbitrarily determined types. Cost accounting by function is another type. However, costs are also divided into fixed and variable ones. In this case, the criterion is the relation between the change in costs and the change in the volume of production (sales). Variable costs are the costs that change together with the change in production volume. As a rule, they change proportionately to the change in production volume, while fixed costs – within a certain range of production volume – remain constant. As a result, when production volume changes, only a part of the costs change. Consequently, they are regarded as variable costs and the other costs remaining unchanged are accounted as fixed costs. If, after some time, e.g. one year, the production volume increases in relation to the previous year, the increase of the total cost (the sum of the variable and fixed costs) rises to a lesser degree than the production. Thus, the financial result, as the difference between a higher value of income (from the sales) and the total cost, increases to a higher degree than the income. Such a situation is referred to as the operational leverage effect.

On the other hand, if the production decreases in relation to e.g. the previous year, the variable costs drop to a degree that is comparable to the decrease in production value, while fixed costs remain on the same level. As a result, the total of all costs decreases to a lesser degree than the income from sales. Consequently, the financial result, as the difference between the income from sales and the total production costs, will decrease to a higher degree than the production value. Such a situation is referred to as the operational risk.

In the literature on the subject, when discussing the mechanism of operational leverage, a significant difference as regards the division into fixed and variable costs can be observed. Some authors relate the division to the structure of assets. It is worth presenting a few comments on that issue.

According to J.Ostaszewski and T.Cicirko ….*the level of operating leverage depends on the share of fixed assets in total assets and on the volume of sales* and they say that …..*the higher the share of fixed assets in total assets, the higher the level of operating leverage and, consequently, the degree of operational risk*[2].

A.Rutkowski expresses a similar opinion: *the implementation of operating leverage is perceived as such development of fixed costs that they replace variable costs with the aim of obtaining a rapid increase in profits at the increase of sales. Particular relations between fixed and variable costs are reached by the selection of the asset structure*[3].

Two other authors should also be mentioned. According to D.Dziawgo and A.ZAwadzki *operating leverage is related to asset structure and its optimal application. It reflects the degree to which the assets are applied in company's operations*[4]. M.Bojańczyk is of the same opinion: *Operating leverage results from company cost structure and these result from the structure of assets*[5].

The authors of the above statements do not explain what they mean by the asset structure and what relation between the asset structure and the structure of fixed and variable costs they have in mind. However, it can be assumed that – when writing about the asset structure – they mean the division to fixed and current assets, and –as regards the dependence of the cost structure on the asset structure – it can be concluded that fixed assets generate fixed costs while current assets generate variable costs. Here a question arises whether the (fixed, variable) cost structure is similar to the asset structure. There is no empirical research that would prove such point. If companies run fixed and variable cost accounting, such relations could be easily determined. However, due to the lack of such data, an attempt can be made to apply statistical figures concerning industrial companies to present actual relationships between the share of fixed costs in the costs of industrial production and the share of fixed assets in total assets.

According to GUS (Central Statistical Office of Poland) [6], by the end of 2013, the gross and net values of fixed assets in industrial companies amounted to 987 billion zlotys and 532 billion zlotys, respectively. As the GUS statistics do not provide figures regarding the fixed assets depreciation rate for industrial companies, the article uses the average depreciation rate

[2] J. Ostaszewski, T. Cicirko, *Finanse spółki akcyjnej*, Difin, Warszawa 2005, p. 149.
[3] A. Rutkowski, *Zarządzanie finansami*, PWE, Warszawa 2007, p. 169.
[4] D. Dziawgo, A. Zawadzki, *Finanse przedsiębiorstwa. Istota, narzędzia, zarządzanie,* Stowarzyszenie Księgowych w Polsce, Warszawa 2011, p. 45.
[5] M. Bojańczyk, *Finanse przedsiębiorstwa,* Wydawnictwo SGA, Warszawa 2012, p. 63.
[6] Cf. *Rocznik statystyczny Rzeczypospolitej Polskiej 2014*, GUS, Warszawa 2014, Dział XXV. *Inwestycje. Środki trwałe.*

in the calculation. According to the chart of depreciation rates[7], annual depreciation rates for the basic groups of fixed assets used in industry were as follows: buildings - 2.5%, machinery and most common devices - 10%, cars - 20%, computer sets - 30%. As the two first groups were the dominating fixed assets in industry, the average rate of 8% was accepted in calculating depreciation. Thus, as depreciation is calculated from the gross value of fixed assets, the value of depreciation in industry in 2013 equaled 79 billion zlotys (8% of 987 billion zlotys)

The annual value of production costs in industrial companies amounted to 1301 billion zlotys so the share of depreciation in the costs was 6.1%. With the assumption that the value of total assets in industry at the end of 2013 was 1137 billion zlotys, the share of net fixed assets in total assets was 47%. Thus, the share of fixed assets, which generate the main fixed cost, i.e. the depreciation, is many time higher than the share of depreciation in total costs. Even considering that apart from depreciation there are other fixed costs related to fixed assets, it is difficult to admit that the asset structure determines the cost structure.

2. Measurement of the impact of operating leverage

When describing the mechanism of operating leverage, one should explain the issue of the measurement of the impact of changes in operational profit in relation to the change in production (sales). Here a ratio is used that is referred to as DOL (degree of operating leverage), which is a percentage relation of the change in the earnings from sales to the percentage change in sales value, i.e.

$$DOL = \frac{\text{percentage change in earnings from sales}}{\text{percentage change in sales value}}$$

The ratio can be interpreted as follows: if DOL equals 2.0, it means that the increase in sales value (e.g. 12%) resulted in a double increase in the result from sales (by 24%). Thus, it can be concluded that the impact of operating leverage depends on the cost structure, or – to be more precise – on the share of fixed costs in total costs[8]. The higher the share of fixed costs , the higher the degree of operating leverage and the impact of the leverage. In contrary situations, the higher share of variable costs, the lower the degree of operational level (or risk)

[7] Cf. Act of 15 February 1992 on corporate income tax, integrated text, Journal of Laws 2014, item 851, Enclosure 1.

and the impact of the leverage. In an extreme case when there are no fixed costs, the leverage and operational risks do not occur.

For the sake of the analysis of the operating leverage mechanism, the following assumptions were accepted. The comparison will concern two companies which in the base year (t_1) had similar sales revenues, cost of revenue and earnings from sales, while their cost structure differed. The share of fixed and variable costs in the total costs of company A was 20% and 80%, respectively, while in company B the share was 70% and 30%. In order to conduct the analysis of the problem, two alternatives for the sales value change in t_2 were assumed. Alternative I - both companies experience a sales increase by 10%; alternative II – in both companies there is a decrease in sales by 10%. The impact of these changes on the levels of cost and earnings from sales is given in tables 1 and 2.

Table 1. Degree of operating leverage at sales increase by the structure of production costs

Specification	Company A			Specification	Company B		
	year t_1	year t_2	change (%)		year t_1	year t_2	change (%)
Sale revenue (in PLN)	200 000	220 000	+10.0	Sale revenue (in PLN)	200 000	220 000	+10,0
Cost of revenue:	190 000	205 200	+ 8.0	Cost of revenue:	190 000	195 700	+3,0
-fixed (20%)	38 000	38 000	-	-fixed (70%)	133 000	133 000	-
-variable (80%)	152 000	167 200	+ 10.0	-variable (30%))	57 000	62 700	+10,0
Profit from sales	10 000	14 800	+ 48.0	Profit from sales	10 000	24 300	+143.0
DOL			**4.8**	**DOL**			**14.3**

Source: Author's research

Table 2. Degree of operating leverage at sales decrease by the structure of production costs

Specification	Company A			Specification	Company B		
	year t_1	year t_2	change (%)		year t_1	year t_2	change (%)
Sale revenue (in PLN)	200 000	180 000	-10.0	Sale revenue (in PLN)	200 000	180 000	-10.0
Cost of revenue in t_1 :	190 000	174 800	- 8.0	Cost of revenue in t_1:	190 000	184 300	-3.0
-fixed (20%)	38 000	38 000	-	-fixed (20%)	133 000	133 000	-
-variable (80%)	152 000	136 800	- 10.0	-variable (80%)	57 000	51 300	- 10.0
Profit from sales	10 000	5 200	- 48.0	Profit from sales	10 000	-4 300	-143.0
DOL			**4.8**	**DOL**			**14.3**

Source: Author's research

Czy na pewno ma tu być in t_1 ? (poszcz. lata są w kolumnach obok)

According to figures in table 1, the 10% increase in sales revenue resulted in an almost 5 times higher (by 48%) growth in the earnings from sales in company A. DOL amounted to

4.8, while the same increase in sales in company B caused an over 14 times higher growth of the profit from sales (by 143%). The difference in the growth rate of the result from sales at the same increase in sale revenue results from a different cost structure that causes a different increase in total costs. In company A, the 20% share of fixed costs resulted in the fact that – at the increase in the sale revenue by 10% - the total cost went up to a less degree (by 8%) and, consequently, there was a higher increase in the earnings from sale. On the other hand, the 20% increase in the sale revenue in company B resulted in an only 3% growth of costs due to a substantial share of fixed costs which remained on the same level.

A further analysis of the mechanism of operating leverage makes it possible to differentiate another factor that affects it impact. The factor is the base (for t_1) level of sales profitability measured by ROS (return on sales) index, which is neglected in the literature on the subject. The dependence is as follows: the higher base level of ROS index, the lower DOL. On the other hand, the lower ROS index, the higher DOL. In order to illustrate this phenomenon more clearly, a simple example is given in tables 3 and 4.

Table 3. Degree of operating leverage at sales increase by the level of sales profitability

Specification	Company A			Specification	Company C		
	year t_1	year t_2	change (%)		year t_1	year t_2	change (%)
Sales revenue (in PLN)	200 000	220 000	+10.0	Sales revenue (in PLN)	200 000	220 000	+10.0
Cost of revenue:	190 000	205 200	+ 8.0	Cost of revenue:	180 000	194 400	+8.0
-fixed (20%)	38 000	38 000	-	-fixed (20%)	36 000	36 000	-
-variable (80%)	152 000	167 200	+ 10.0	-variable (80%)	144 000	158 400	+10.0
Profit from sales	10 000	14 800	+ 48.0	Profit from sales	20 000	25 600	+28.0
ROS	5.0%	6.7%	+34%	ROS	10%	11.6	+16.0
DOL			**4.8**	**DOL**			**2.8**

Source: Author's research

Table 4. Degree of operating leverage at sales decrease by the level of sales profitability

Specification	Company A			Specification	Company C		
	year t_1	year t_2	Change (%)		year t_1	year t_2	change (%)
Sales revenue (in PLN)	200 000	180 000	-10.0	Sales revenue (in PLN)	200 000	180 000	-10.0
Cost of revenue:	190 000	174 800	- 8.0	Cost of revenue:	180 000	165 600	-8.0
-fixed (20%)	38 000	38 000	-	-fixed (20%)	36 000	36 000	-
-variable (80%)	152 000	136 800	-10.0	-variable (80%)	144 000	129 600	-10.0
Profit from sales	10 000	6 000	- 40.0	Profit from sales	20 000	14 400	-28.0
ROS	5.0%	3.3%	-34.0%	ROS	10%	8.0%	-20.0%
DOL			**3.4**	**DOL**			**2.0**

Source: Author's research

In the base year, companies A and C are similar as regards the levels of sales and cost structures but their profitability levels, measured by operating profit, are different. The

profitability in company A and C amounts to 5% and 10%, respectively. At the production growth of 10%, DOL is 4.8% in company A and 2.8 in company C (table 3). Thus, at a lower base profitability level (in comparison to e.g. the previous year), DOL is higher, while at a higher profitability level , DOL is lower (2.8).

In both cases, DOL goes down if sales decreases; however, this does not change the general rule of the inverse relation between profitability level and DOL.

Such relation , which is rarely recognized, (and which does not occur only between the level of fixed costs and the impact of DOL) is crucial in the implementation of the leverage in financial analysis and in company management. This issue will be discussed in the further part of the article.

The presented examples make it possible to formulate the following conclusions that are helpful in financial analysis:

1) DOL is not constant for a given company. It changes in time, together with the changes in the value of production and the level of profitability. For example, if the production value increases every year, then – in line with the relations between the changes in production value and in costs – the share of variable costs increases and the share of fixed costs decreases. As a result, DOL goes down. This fact should be emphasized as one can sometimes encounter recommendations for companies to be aware of their DOL for the sake of the facilitation of planning the result for the next year[9].

2) In the course of the analysis of the earnings from sales in e.g. company A in table 1, when at the 10% growth of sales, the profit from sales went up by as much as 48%, the credit should not go to the Board *because it could reduce the increase of costs to 8%, while the sales increased by 10%* . The example indicates that it is not the result of the Board's decisions but the consequence of the operating leverage mechanism. On the other hand, in a reverse situation as given in table 2 (when the sales decreased), the Board of company A should not be blamed *for decreasing the profit from sales by 48% at the decrease of sales by only 10%.*

3) If - when analyzing two (or more) companies (as in table 2) - the profit from sales in company B is three times higher than in company A at an equal increase of sales, it will be unjustified to conclude that company B is managed

[9] *The knowledge of DOL makes it possible to forecast the value of operating profit for a given volume of sales and the increase in sales* – A. Rutkowski, op.cit., p. 172.

significantly better as the difference is caused mainly by the mechanism of the operating leverage, which results from the fact that in one of the companies fixed costs are the dominating ones[10].

3. Practical issues regarding the implementation of operating leverage in company profitability analysis

In this part of the article the mechanism of operating leverage is illustrated by company X. It is a non-public joint stock company operating in food sector. Table 5 presents a simplified profit and loss account for 2011-2014.

Considering the value of sales, the company is large and it has a growing dynamics of sales every year. A significant part of its sales revenue comes from exports. It is a profitable company on an average and fairly stable level.

When starting the investigation of the operating leverage of this company (and any other), the analyst encounters the first problem: the lack of information on cost structure divided to fixed and variable costs. No economic entity provides such information in its financial statement as such cost keeping is not conducted and cannot be given in a statement. However, it is obvious that an ambitious financial analyst that knows the investigated company well would be able to estimate the value of these types of costs (through itemized records) on the basis of long-term monitoring of changes in the main types of costs in relation to the changes in sales. As regards the company in question, considering the area of its activity, it can be concluded that its operations are dominated mainly by variable costs that are connected with the use of raw and production materials. Such opinion can be also justified by a very insignificant share of depreciation cost in total costs, and such type of costs is usually given as an example of fixed cost in the literature on the subject that discusses operating leverage. It should be also pointed out that the depreciation in the entity under investigation increases significantly every year. It is evident that in the investigated years the value of the sales revenue in current prices increased by 94% and the value of depreciation by 72%. Consequently, it cannot be stated that depreciation is a fixed cost.

[10] In order to prove the correctness of such a conclusion one should recall the economic problems of 1990s, particularly to the situation of such companies as PKP (Polish Railways) or LOT airlines where fixed costs dominate. The emergence of PKP's new competitors, such as road freight and passenger transport, resulted in a substantial decrease in sales which was not accompanied by a similar decrease of costs because of a significant share of fixed costs. This generated high losses. The same result was observed in LOT, where fixed costs are dominant.

Table 5. Analytical profit and loss account of company X in 2011-2014 (in thousands PLN)

No.	Specification	2011	2012	2013	2014
1.	**Net revenue on sales**	**888 058.2**	**1 045 493.3**	**1 376 507.0**	**1 722 573.0**
2.	**Cost of production and sales**	**852 452.0**	**1 007 824.1**	**1 317 177.2**	**1 668 153.0**
	including depreciation	14 920.2	18 149.4	20 194.3	25 682.1
3.	**Profit on sales (1-2)**	**+35 606.2**	**+37 669.2**	**+59 329.8**	**+54 420.0**
4.	Other operating revenue	3 050.2	5 714.4	5 211.1	5 587.1
5.	Other operating expenses	2 559.1	2 858.5	2 942.2	6 249.1
6.	**Other operating profit**	**+491.1**	**+2 855.9**	**+2 268.9**	**-662.0**
7.	Financial revenue	2 035.7	2 631.4	555.0	849.0
8.	Financial expenses	4 844.0	5 571.1	9 206.5	13 7789.0
	including interest payable	4 844.0	5 571.1	7 454 4	12 194.0
9.	**Profit on financial operations**	**-2 808.3**	**-2 939.7**	**-8 651.5**	**-12 930.0**
10.	Extraordinary profits	-	3 900.0	-	-
11.	Extraordinary losses	-	117.1	-	-
12.	Extraordinary profit and loss balance	-	+3 782.9	-	-
13.	**Gross profit (loss) (3+6+9+12)**	**+33 289.0**	**+41 368.3**	**+52 947.2**	**+41 489.0**
14.	Income tax	6 671.6	8 371.7	9 731.8	4 168.0
15.	**Net profit (loss) (13-14)**	**+26 617.4**	**+32 996.6**	**+43 215.3**	**+37 321.0**
16.	Sales profitability (%)	4.0	3.6	4.3	3.2
17.	Gross profitability (%)	3.7	4.0	4.9	2.4
18.	Net profitability (%)	3.0	3.2	3.1	2.2

Source: Author's research based on the profit and loss account of company X

Table 6 presents investigation results of operating leverage in the analyzed company for a four-year period.

Table 6. Operating leverage account for company X in 2011-2014 (in thousands of PLN))

No.	Specification	2011	2012	2013	2014
1.	Net sales revenue	888 058.2	1 045 493.3	1 376 507.0	1 722 573.0
2.	Operating costs	852 452.0	1 007 824.1	1 317 177.2	1 668 153.0
3.	Profit on sales	+35 606.2	+37 669.2	+59 329.8	+54 420.0
Dynamics: previous year = 100,0					
4.	Net sales revenue	130.1	117.7	131.7	125.1
5.	Operating costs	127.4	118.2	130.7	126.6
6.	Profit on sales	272.5	105.8	157.5	91.7
7.	**DOL index**	**5.7**	**0.3**	**1.8**	**-0.3**

Source: Author's research based on the profit and loss account of company X

The figures in the bottom part of table 6 provide particularly significant information. Substantial variability of the DOL index is noticeable. It ranges from 5.7 to 0.3. These figures confirm the opinion presented above that the DOL index cannot be used in financial planning.

The value of the DOL index in 2011 and 2013 indicates on the existence of the operating leverage effect. The DOL index of 5..7 in 2012 means that the increase in sales profit was almost 6 times (5.7) higher than the increase in sales in that year. This was due to the fact that the costs of production and sales increased by 27.4% at the increase of the sales revenue of 30.1%. Also in 2013, the operating leverage effect occurred but was significantly weaker as the DOL index was 1.8. This was caused by the fact that the value of sales went up by 31.7% in comparison to the previous year, while the costs rose by 30.7%

In the two other years, the DOL index was less than 1.0 and amounted to 0.3 and -0.3 in 2012 and 2014, respectively. It is worth reminding that the DOL index at the level of 1.0 indicates that costs changed more significantly than the revenue from sales. The question arises whether such a situation means that the leverage occurred in the two years, while it did not in the other two.

Such situations as the one presented above certainly take place in many cases and in several years. It does not mean that operating lever sometimes functions and sometimes it does not. The leverage mechanism always functions as practically there is no possibility that there are only variable costs in a company. There is always some, even insignificant, share of

fixed costs. Thus, the lack of the leverage effect results from many disruptions that occur in reality. Here are the most important ones:

1) The records of revenue, costs and financial results are accounted in current prices. The lack of the leverage effect may be caused by different rates of change (growth) in prices that influence sales revenue and operating costs. For example, if sales prices rise more slowly than cost prices , the leverage effect may not occur or may be weaker. In such cases, the determination of a real leverage effect requires the calculation of the change (growth) rate of revenue and costs in fixed prices. After such transformations, the effect of operating leverage will be confirmed.
2) Similar disruptions may result from the change in currency rates. If a company exports its products or imports production components, the changes in currency rates between two periods distort the assessment of the revenue and/or costs in zlotys. Also in this case a calculation of the revenue and costs should be conducted in the periods under investigation at the same levels of currency rates.
3) The distortions in operating leverage may be caused by additional fixed costs that did not occur before, e.g. hiring a security service company, renovation in a given year (for example, the necessity to adjust technological conditions to EU requirements). This results in the increase in fixed costs over a proportional increase of total costs.
4) The distortions may be the result of a significant growth in depreciation related to putting into operation a new investment that will not generate a proportional revenue increase in a given year.

The above list includes only the most significant reasons of economic events that contribute to the distortion of the functioning of operating leverage. Some of them can easily be eliminated (e.g. single additional fixed costs), while other are more complicated and require troublesome calculations based sometimes on data that are not easily available (e.g. fixed prices of all components of operating costs)

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[6] Act of 15 February 1992 on corporate income tax, integrated text, Journal of Laws 2014, item 851, enclosure 1. Chart of annual depreciation rates

Abstract

The first part of the article presents issues concerning the controversies regarding the functioning of the operating leverage. Some statements presented in the literature on the subject concerning the mechanism of the leverage are challenged. They include opinions that cost structure divided to fixed and variable costs depends on company asset structure and that the impact of operating leverage depends only on the share of fixed costs in total costs with disregard of the fact that it also depends on the level of profitability measured by the relation of sales from profits to sales revenue. It also indicates on the limited possibilities to apply the leverage to financial planning, which is the result of the natural annual variability and not of the consistency of DOL index.

The basic part of the article presents the possibilities to apply operating leverage in the analysis of company profitability; however, the paper indicates that in practice the effects of the implementation of operating leverage may be distorted due to the variety of the direction and intensity of changes in prices, revenue and cost, currency exchange rates or the level of fixed costs.