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## EXCHANGE RATIO DETERMINATION AND SHAREHOLDERS' WEALTH FOR MERGERS OF COMPANIES AT WARSAW STOCK EXCHANGE\*

*This article focuses on the profitability of mergers for shareholders, taking into account the share exchange ratio. The share of benefits for shareholders of merging parties depends on the value of the share exchange ratio, so this coefficient is crucial in merger transactions. The Larson-Gonedes exchange ratio determination model can support the negotiating parties during a merger transaction, it can also help in the mergers' ex post assessments. The aim of this study is to determine whether in the case of transactions that took place in Poland shareholders of merging companies gained on those transactions. The results of the analysis carried out on the sample of Polish companies are similar to the results obtained for Western markets.*

*Keywords:* exchange ratio determination, mergers, acquisitions, shareholders' wealth, the Larson-Gonedes model.

*JEL Classification:* G34.

Лешек Червонка

## ВИЗНАЧЕННЯ КОЕФІЦІЄНТА ОБМІНУ АКЦІЙ ТА КАПІТАЛУ АКЦІОНЕРІВ ПРИ ЗЛИТТІ КОМПАНІЙ, ЯКІ КОТИРУЮТЬСЯ НА ВАРШАВСЬКІЙ ФОНДОВІЙ БІРЖІ

*У статті розглянуто прибутковість злиття компаній для акціонерів з урахуванням коефіцієнта обміну акцій. Рівень прибутку акціонерів обох учасників злиття залежить від величини коефіцієнта обміну акцій, тому цей коефіцієнт має вирішальне значення в операціях злиття. Модель Ларсона-Гонедеса для визначення коефіцієнта обміну акцій може бути використана при переговорах сторін у ході операції зі злиття, вона також може допомогти у визначенні оціночної вартості після злиття. Визначено, чи отримують прибуток акціонери компаній, що об'єднуються, за даними Польщі. Результати аналізу, проведеного на виборці з польських компаній, аналогічні результатам, отриманим для західних ринків.*

*Ключові слова:* визначення коефіцієнта обміну, злиття, поглинання, прибуток акціонерів, модель Ларсона-Гонедеса.

*Форм. 12. Табл. 6. Рис. 3. Літ. 11.*

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## ОПРЕДЕЛЕНИЕ КОЭФФИЦИЕНТА ОБМЕНА АКЦИЙ И СОСТОЯНИЯ АКЦИОНЕРОВ ПРИ СЛИЯНИИ КОМПАНИЙ, КОТИРУЮЩИХСЯ НА ВАРШАВСКОЙ ФОНДОВОЙ БИРЖЕ

*В статье рассмотрена прибыльность слияния компаний для акционеров с учетом коэффициента обмена акций. Уровень прибыли акционеров обоих участников слияния зависит от величины коэффициента обмена акций, поэтому этот коэффициент имеет решающее значение в операциях слияния. Модель Ларсона-Гонедеса для определения коэффициента обмена акций может быть использована при переговорах сторон в ходе сделки по слиянию, она также может помочь в определении оценочной стоимости после слияния. Определено, получают ли прибыль акционеры объединяющихся компаний. Результаты анализа, проведенного на выборке из польских компаний, аналогичны результатам, полученным для западных рынков.*

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*Ключевые слова:* определение коэффициента обмена, слияния, поглощения, прибыль акционеров, модель Ларсона-Гонедеса.

**Introduction.** The share exchange ratio is very important in merger transactions. The share of benefits for shareholders of merging parties depends on the value of the coefficient.

As a consequence of a merger 4 situations may occur:

- 1) owners of both companies benefit from the merger;
- 2) owners of the acquiring company lose, owners of the acquired company gain;
- 3) shareholders of both companies lose;
- 4) owners of the acquiring company gain and owners of the acquired company lose.

The declared aim of a merger is to make all participating parties benefit. However, it is possible that one of merging firms has shares of the second entity, in an amount sufficient to vote for a merger. Then, the merger can be voted through even if the target's shareholders lose, at the expense of the shareholders of the acquiring company. To avoid such situations, firms are required to obtain an opinion of an independent auditor on a merger plan. However, the possibility of deliberate efforts leading to a situation in which one of the companies lose, whilst the other gains cannot be completely excluded. The situation in which 2 merging companies lose is not rational economically, and can only occur as a consequence of the transaction, whereas ex ante benefits from the merger were expected. The aim of this study is to determine whether in the case of transactions that took place in Poland shareholders of merging companies gained from those transactions.

The research was based on the analysis of the results of the Larson-Gonedes exchange ratio determination model. If the transaction is economically beneficial, and improves the return on equity of joining companies, the share of benefits among the shareholders of the acquiring and target companies depends on the share exchange ratio. Depending on the distribution of shares in the new entity, all shareholders or only one of the parties will benefit. Therefore, the share exchange ratio is of paramount importance for merger transaction. The time scope of the analysis is the first decade of the XXI century.

**The theoretical aspects of the determination of the relevant share exchange ratio.** The model approach of determining the share exchange ratio was developed by Larson and Gonedes (1969) and Yagil (1987). The starting point of the Larson-Gonedes model is to determine the minimum and maximum share exchange ratios, which are acceptable to the shareholders of the acquiring and target companies, which can be defined as the product of the price/earnings ratio and earnings per share of companies:

$$P_1 = PE_1 \times EPS_1; \quad (1)$$

$$P_2 = PE_2 \times EPS_2, \quad (2)$$

where  $P_1$ ,  $P_2$  – prices, respectively, of the acquiring company 1 and the target company 2;  $PE_1$ ,  $PE_2$  – price/earnings ratios for companies 1 and 2;  $EPS_1$ ,  $EPS_2$  – earnings per share for companies 1 and 2.

Thus, the share prices are defined as the value of price/earnings ratio multiplied by the value of earnings per share. The authors assume that the price/earnings ratio

takes into account investors' expectations as to the future growth of profit of the company. Under this assumption, the current decline in income may result in only a slight decrease in the share price if investors believe that future profits of the company will grow significantly. This situation increases the price/earnings ratio. The expected price of the shares after the merger depends on the expected value of the price/earnings ratio after the merger, the combined profits of 2 companies and the number of shares, which is the number of shares of the acquiring company and the shares issued in exchange for shares of the target company, the number of which is equal to the number of target's shares, multiplied by the exchange ratio:

$$P_{12} = PE_{12} \times \frac{E_1 + E_2}{S_1 + S_2 \times ER}, \quad (3)$$

where  $P_{12}$  – expected price of the shares after the merger;  $PE_{12}$  – expected value of price/earnings ratio after the merger;  $E_1$  – profit of the acquiring company;  $E_2$  – profit of the acquired company;  $S_1$  – the number of shares of the acquiring company;  $S_2$  – the number of shares of the acquired company;  $ER$  – the share exchange ratio.

From the shareholders' point of view it is important that the merger does not reduce the wealth of shareholders, but rather increases it. For the shareholders of the acquiring company, this condition can be written as:

$$P_{12} \geq P_1. \quad (4)$$

Substituting dependencies on the value of shares and the expected value of the coefficient of price/earnings ratio to the condition that ensures that the shareholders of the acquiring company at least do not lose, the equation can be obtained:

$$PE_{12} \times \frac{E_1 + E_2}{S_1 + S_2 \times ER} = PE_1 \times EPS_1, \quad (5)$$

which after transformation gives the maximum value of the share exchange ratio, which does not result in the loss of wealth by the shareholders of the acquiring company as a result of business combination:

$$ER_1 = \frac{PE_{12} \times (E_1 + E_2) - PE_1 \times E_1}{PE_1 \times E_1 \times (1/S_1) \times S_2}. \quad (6)$$

In other words, this indicator shows the maximum number of shares of the acquiring company, which may be issued in exchange for one share of the target company, so as not to cause a decline in the wealth of shareholders of the acquiring company.

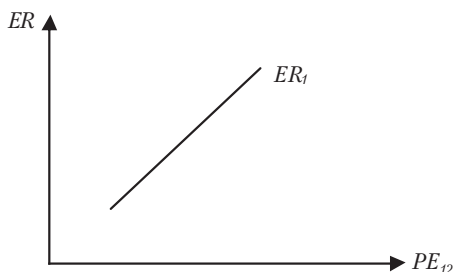
The maximum value of the exchange ratio is a function of the expected value of the price/earnings ratio, as the other components of this function are at any given time constant and derived from the financial statements of both companies.

Determination of the first and second derivatives of this function allows to explore its shape. The first and the second partial derivative of the function  $ER_1$ , with respect to  $PE_{12}$  are as follows:

$$\frac{\partial ER_1}{\partial PE_{12}} > 0 \text{ and } \frac{\partial^2 ER_1}{\partial (PE_{12})^2} = 0, \quad (7)$$

which means that the function  $ER_1$  is an increasing function and linear (Figure 1), the maximum value of the share exchange ratio acceptable to the shareholders of the

acquiring company increases with the expected price/earnings ratio after the merger.



Source: Own compilation based on: Larson and Gonedes (1969).

**Figure 1. The maximum exchange ratio for the shareholders of the acquiring company as a function of the expected value of the price/earnings ratio**

Thus, if due to a merger investors would consider that with the current earnings, the company deserves a higher valuation (e.g. due to the expected synergies from the merger), the shareholders of the acquiring company would be willing to make a share exchange with the shareholders of the acquired company on less favourable terms. This would result in no loss of wealth for the shareholders of the acquiring company.

A similar analysis of the profitability of exchange of shares by the shareholders of the acquiring company can be made to the shareholders of the acquired company. The condition that must be satisfied so that the shareholders of the target company after the merger do not lose is:

$$P_{12} \geq \frac{P_2}{ER}. \quad (8)$$

The wealth of the shareholder of the acquired company will increase (or at least remain unchanged), if the value of his share of the combined company will be higher than (or equal to) the value of shares delivered in exchange for shares of the acquiring company. This will happen if the price of the shares after the merger will be higher than the price of shares of the target company divided by the exchange ratio, which corresponds to the share price of the acquiring company, which in proportion to his ownership of the current shares, shareholder of the acquired company will get. After substituting to the condition that ensures that the shareholders of the acquired company will not lose, dependencies describing the  $P_{12}$  and  $P_2$  the following equation is obtained:

$$PE_{12} \times \frac{E_1 + E_2}{S_1 + S_2 \times ER} = \frac{PE_2 \times EPS_2}{ER}, \quad (9)$$

which after the rearrangement shows the minimum value of the share exchange ratio, that does not result in the loss of wealth of target's shareholders:

$$ER_2 = \frac{PE_2 \times EPS_2 \times S_1}{PE_{12} \times (E_1 + E_2) - PE_2 \times E_2}. \quad (10)$$

Thus, this indicator shows the minimum number of shares of the acquiring company that can be accepted by the shareholders of the acquired company in exchange for one own share, because that would not worsen their situation.

Determination of the first and second partial derivative allows to know the shape of the function  $ER_2$ :

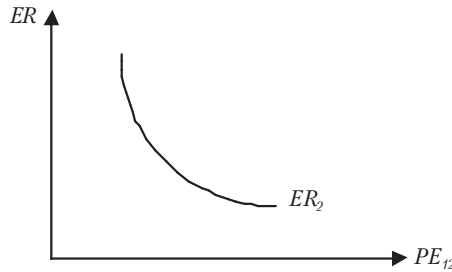
$$\frac{\partial ER}{\partial PE_{12}} > 0, \tag{11}$$

which means that the  $ER_2$  function is a decreasing one, so the reduction of the number of the acquiring company's shares that target's shareholder receives for his shares, may be accepted only if it will be offset by the expected increase in price/earnings ratio after the merger.

The value of the second partial derivative depends on the values of parameters of the function  $ER_2$ :

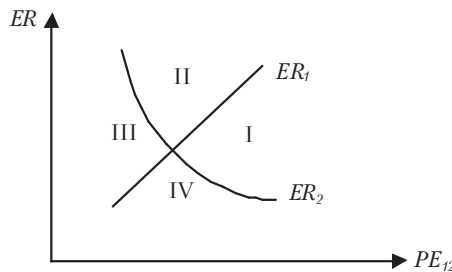
$$\frac{\partial^2 ER_2}{\partial (PE_{12})^2} \begin{cases} > 0, \text{ when } PE_{12} \times (E_1 + E_2) > PE_2 \times E_2 \\ = 0, \text{ when } PE_{12} \times (E_1 + E_2) = PE_2 \times E_2. \\ < 0, \text{ when } PE_{12} \times (E_1 + E_2) < PE_2 \times E_2 \end{cases} \tag{12}$$

The analysis of these relationships shows that the second partial derivative is positive, so the function of  $ER_2$  is convex (Figure 2), because the transaction would not be economically justified if the combined value of business units would be equal to or even lower than the value of one of the components of the combination.



Source: Own compilation based on: Larson and Gonedes (1969).

**Figure 2. Minimum exchange ratio for the shareholders of the target company as a function of the expected value of the price/earnings ratio**



Source: Own compilation based on: Conn and Nielsen (1977).

**Figure 3. Areas of merger profitability for shareholders of the acquiring and the acquired companies**

Drawing 2 functions: the minimum and maximum exchange ratio in one coordinate system makes it possible to observe 4 areas of merger profitability (Figure 3):

I – the area under the  $ER_1$  and above the  $ER_2$  curve, where shareholders of both companies gain.

II – the area above the curve of the  $ER_1$  and  $ER_2$  curve, in which shareholders of the acquiring company lose and owners of the acquired company gain.

III – the area above the curve of the  $ER_1$  and under the  $ER_2$  curve, in which shareholders of both companies lose.

IV – the area under the  $ER_1$  and  $ER_2$  curves, in which the acquiring company's owners gain, while owners of the acquired company lose (Larson and Gonedes, 1969).

**Literature review: empirical results of the share exchange ratio determination model for mature stock markets.** The presented Larson-Gonedes (1969) model was highly acclaimed, both theoretically (Lev, 1970; Gonedes and Larson, 1971) and empirically (Conn and Nielsen, 1977; Conn, 1980; Cooke et al., 1994; Bae and Sakthivel, 2000). The Larson-Gonedes theoretical model was used for empirical studies by Conn and Nielsen (1977). Conn and Nielsen conducted the study on the sample of 131 mergers in 1960–1969 for the companies listed at New York Stock Exchange or American Stock Exchange. The companies in the sample were listed at the stock exchange at least one year prior to the merger, to find the mutual relation between values of companies before the period when the valuation was influenced by information on the merger. As the expected price of the new entity  $P_{12}$  was taken the price of the acquiring company for the periods: the merger announcement period, the merger completion moment and a month after the merger. The results are presented in Table 1 – in order to be comparable with the results of other authors, the results are presented as a percentage.

**Table 1. Percentage of mergers in different areas of the merger profitability for the price  $P_{12}$  from the month of merger announcement, merger completion and one month after the merger**

The period of the price $P_p$	Area I	Area II	Area III	Area IV
Announcement	60	27	9	4
Completion	55	27	15	3
After one month	51	30	14	5

Source: Own compilation based on Conn and Nielsen (1977).

The data in Table 1 indicate that if the price of a new, combined company was the same as the price from merger announcement period, then the transaction would be profitable for both parties in 60% of the cases. Other 40% of the cases are situations in which only one party gains or both parties lose.

However, the ex post analysis of the real stock prices after mergers indicates that only a half of the mergers were profitable for shareholders of both companies. Moreover, in the area III there was an increase in the number of cases greater than 50%, which means that, taking into account the share exchange ratio and the share price of the merged company, shareholders of both companies lost on the transaction.

Next research based on the Larson-Gonedes model is Cooke, Gregory and Pearson's analysis of mergers of the UK firms in 1984–1988, the sample size was 95 companies. The results shown in Table 2, like those in Table 1, are presented in percentage form.

**Table 2. The percentage of mergers in different areas of profitability for the price  $P_{12}$  from the month of merger completion and one month after the merger**

The period of the price $P_{12}$	Area I	Area II	Area III	Area IV
Completion	73	17	6	4
After one month	71	18	6	5

Source: Own compilation based on Cooke et al. (1994).

As in Conn and Nielsen (1977), in Cooke et al. (1994) the largest share belongs to the transactions in which both parties gain (type I). The next share of mergers is that the shareholders of the target gain (area II). Prevalence transactions from I area is vast, however, as noticed by Cooke et al. (1994), such a situation may be the result of stock market prosperity, resulting in an increase or decrease in share prices. Therefore, they analysed these transactions adjusting prices by the stock market index (Table 3).

**Table 3. The percentage of mergers in different areas of the profitability for the price  $P_{12}$  from the month of merger completion and one month after the merger**

The period of the price $P_{12}$	Area I	Area II	Area III	Area IV
Completion	47	37	11	5
After one month	49	33	14	4

Source: Own compilation based on Cooke et al. (1994).

Adjusting stock prices by the stock market index resulted in changing of the number of mergers that could be classified to the area I, which dropped by less than half, while the number of the transactions in the areas II and III has doubled. Still the share of mergers in which shareholders of both parties gain was the greatest but such transactions were not in the majority and predominance above the transactions in which targets' shareholders gain and shareholders of the acquiring companies lose strongly decreased. The obtained results were consistent with the results by other authors using the event study method, indicating that on average shareholders of the acquired companies gain and shareholders of the acquiring companies at least do not lose (Jensen and Ruback, 1983).

Among the Larson-Gonedes model applications Bae and Sakthivel's research can also be mentioned, based on 162 mergers at the US market in 1981–1994, the results of which are presented in Table 4.

**Table 4. The percentage of mergers in different areas of the profitability for the price  $P_{12}$  from the month of announcement and the month of merger completion**

The period of the price $P_{12}$	Area I	Area II	Area III	Area IV
Announcement	53	28	15	4
Completion	49	28	19	4

Source: Own compilation based on Bae and Sakthivel (2000).

Bae and Sakthivel's results are very similar to the results in Table 3, obtained by Cooke et al. (1994). Moreover, in all the presented analyses a similar pattern can be seen – the maximum number of transaction qualifies for area I, then II, less for area III, and the smallest number is in the area IV. On the other hand, even though the number of the transactions in area I is the largest, the number of cases when only one party or no one gains is also great, often as large as the group of transactions that



resulted in profits. Amongst the transactions where one of the parties lose, of particular note is the number of transactions in which the acquiring company's shareholders lose, and the shareholders of the acquired company gain.

The results can confirm the earlier cited hypothesis that in merger transactions shareholders of the acquired companies gain, and shareholders of the acquiring company at least do not lose on these transactions. On the other hand, these results also show that often shareholders are excessively optimistic, and that is why plans do not coincide with the aftermath.

**Analysis of transactions in Poland basing on the Larson-Gonedes model.** The research based on the Larson-Gonedes model was conducted on the sample of merger transactions involving companies listed at the Warsaw Stock Exchange. The number of these transactions was obviously far less than for the most developed stock markets such as London or New York. The time scope of the analysis is the first decade of the XXI century, the period when the Warsaw Stock Exchange had already entered the period of maturity, compared with the first decade of its existence. Between 2001–2010 the number of mergers made through the exchange of shares with a special merger share issue, in which the 2 sides were companies listed on the Warsaw Stock Exchange, and one of them was excluded from trading after the merger amounted to 12. The list of companies participating in mergers was established on the basis of the WSE Factbooks. Share prices and WSE Index are derived from the archive of the service GPWInfoStrefa. Additional verification of share prices was based on the data from the website [www.bossa.pl](http://www.bossa.pl).

The results of the analysis carried out on the sample of Polish companies are similar to the results obtained for Western markets in the aspect that most transactions qualify for area I, in which both parties gain (Table 5). However, in the second place in terms of the number of mergers of Polish companies are the transactions that can be qualified to area IV, in which shareholders of the acquiring companies gain. The analyses conducted at mature Western markets indicated that the second most common situation is the situation in which the target company shareholders gain, while the owners of the acquiring company lose.

**Table 5. Percentage of mergers in different areas of the merger profitability for the price  $P_{12}$  from the month of mergers announcement, merger completion and one month after the merger for Polish companies from the first decade of the XXI century**

The period of the price $P_{12}$	Area I	Area II	Area III	Area IV
Announcement	42	17	8	33
Completion	58	0	17	25
After one month	33,3	33,3	0	33,3

Source: Own compilation.

However, in the analysed period, share prices depended not only on the strategies and companies' behaviours. The stock market situation also had a significant impact on the valuation of shares. To make share prices independent from this effect (at least partially) the classification of the transactions to profitability areas was made after adjusting prices used in the model by the value of the stock market index (Table 6). The analysis of the results obtained in this way confirms the fact that most transactions can be classified into area I, and the second group, in terms of the num-



ber of mergers, are mergers from area IV. The mergers that could be qualified to area III did not occur, so there were no mergers that would be unprofitable for shareholders of both parties.

**Table 6. Percentage of mergers in different areas of the merger profitability for the price  $P_{12}$  from the month of mergers announcement, merger completion and one month after the merger, adjusting share prices by WSE Index**

The period of the price $P_{12}$	Area I	Area II	Area III	Area IV
Announcement	50	17	0	33
Completion	67	0	0	33
After one month	50	25	0	25

Source: Own compilation.

**Conclusion.** The Larson-Gonedes model was developed as a model that can be helpful in the process of negotiating the share exchange ratios. Merger negotiators, having estimated the benefits of the merger, and therefore the projected price of the combined company, could calculate how far they could go to the concessions in the negotiation process, so the shareholders of the company do not lose on the transaction.

But the model can also be used to ex post assessment of a merger. Thus, several authors have used it for conducting the analyses of mergers from the United States and Great Britain, obtaining similar results. According to the results of Conn and Nielsen (1977), Cooke et al. (1994) and Bae and Sakthivel (2000) in most transactions shareholders of both companies gain, then there are transactions in which only the shareholders of the acquired company benefit, there are fewer transactions in which all shareholders lose and the least is the category of mergers in which only the shareholders of the acquiring company gain. These results are consistent with the results of many studies, conducted by the event study method, which examines the abnormal returns and those analyses indicate that the shareholders of the acquired companies gain, while of acquiring companies at least do not lose.

The results of the analysis for transactions which took place in Poland indicate that, as the world's studies show, most transactions gave positive results for both parties of the merger. However, there is an inverted order in transactions which resulted in profits for only one side. Among Polish transactions a greater number of mergers that brought profit to shareholders of the acquiring company and less number of mergers that brought profit to shareholders of the acquired company can be observed. But this correlation cannot be the base to the conclusion that those relationships in Poland are different to that of other countries. The order of these categories can be impacted by a very small sample size, where a single transaction could change the order.

Conclusions from the analysis of Polish cases, unfortunately, cannot be as strong as the conclusions of foreign researches, because taking into account all share exchanges over a decade, in which the Warsaw Stock Exchange was already quite developed, these transactions were only a dozen. But what is very important, the conducted analysis indicates that at least half of the transactions resulted in profit for shareholders of both companies, which is consistent with the studies from other markets.

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