Incomes and Share Prices for Mining Companies in the Context of Raw Materials Prices

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Abstract

This paper is devoted to the study of the relationship between the prices of shares and generated income for the mining companies on the example of KGHM Polska Miedź S.A. and foreign company Rio Tinto. The paper consists of four parts. The first chapter is an introduction to this development, in which the purpose of the paper is described. The second part presents selected mining companies, and the correlations between prices of shares, incomes and prices of raw materials on the international markets (in the case of KGHM Polska Miedź S.A. the course of USD was taken into account). In the third part it was decided to conduct a multiple regression analysis (analysis of the progressive step regression) in order to determine the impact of each variable, firstly on share prices and secondly on incomes of selected mining companies. The last part is a summary of the analysis. The whole paper was concluded and a list of used literature listed.

Keywords: raw materials prices, share prices, mining companies, multiple regression

Introduction

The relation between incomes, share prices and raw materials' prices on international markets seems to be rather obvious. Together with growth of raw materials' prices, the incomes of mining plants should grow too what causes also growth of share prices because investors expect bigger profits and payment of dividend.

The purpose of this elaboration is to check relations between mentioned factors and by means of multiple regression method (step proceeding regression) to determine which of them and how much influence on forming share prices firstly and mining companies incomes secondly on the example of national company KGHM S.A. and foreign one – Rio Tinto. Data to analysis come from internet sites http://www.gurufocus.com and http://investingnews.com.

Incomes, shares and raw materials' prices

As it was mentioned in the introduction to the paper, the relation between share prices, raw materials' prices and values of generated incomes by mining companies is obvious. In this part of elaboration, it was decided to present these relations in aspect of share prices and incomes of the companies KGHM S.A. and Rio Tinto. Firstly, the company KGHM S.A. was taken into consideration.

KGHM S.A.

KGHM S.A. is one of the biggest producers of copper in the world. Basing on data for 2014 it is on 7th position (Table 1). Apart from it, the company generates Incomes from purchasing such precious metals as silver and gold. The influence of the USD course on the value of incomes of KGHM S.A.

Investors decisive to purchase shares of the company expect some benefits occurring from this situation (because of being owners of these securities). The basic one for big investor is the possibility of obtaining dividend from the elaborated profit and the other one (especially in case of smaller investors, usually speculating ones) potential growth of the share prices. For both cases the decisive thing is the possibility of generating bigger profits and in this way bigger incomes. Investors try to precede the events which will occur by forecasting potential profits (or incomes) of individual companies. The forecast, concerning potential benefits is also useful in case of shares of company KHM S.A. Table 2 presents the correlation between share price of KGHM S.A. and chosen factors on which potential investors can pay attention. These factors are: value of generated incomes, market prices of precious metals (copper, silver, gold) and course of USD. The correlation was verified for the equal periods, which are share price in certain quarter in comparison with the values of random variables in the same quarter. Table 2 concerns also move of share prices of 1, 2 quarters ahead.

As it occurs from the correlation results presented in Table 2, share prices of KGHM S.A. are strongly correlated with incomes, gold price and silver price. It is surprising that there is slight correlation between share prices and silver prices on

Tab. 1. The largest copper producers in the world for the year 2014 (source: personal elaboration)

Tab. 1. Najwięksi producenci miedzi na świecie za rok 2014 (źródło: własne)

Producer	Production [million of Mg]
Codelco	1.840
Freeport-McMoRan	1.470
Glencore	1.296
BHP Billiton	1.203
Southern Copper	0.665
Rio Tinto	0.636
KGHM Polska Miedz	0.506
Anglo American	0.504
Antofagasta	0.455
First Quantum Minerals	0.380

Tab. 2. Correlation coefficients between the different factors and share prices for subsequent transfers (source: personal elaboration)

Tab. 2. Współczynniki korelacji pomiędzy poszczególnymi czynnikami a cenami akcji dla kolejnych przesunięć (źródło: własne)

	n	$n+1$ quarter	$n+2$ quarter	$n+3$ quarter
Incomes	87.19%	91.16%	92.26%	87.40%
Copper prices	45.09%	52.50%	57.22%	47.92%
Gold prices	84.75%	86.18%	85.20%	81.23%
Silver prices	72.46%	75.78%	75.17%	67.27%
Course USD	37.80%	34.10%	28.50%	31.07%

world markets. It is also worthy to pay attention that in case of incomes, correlation grows when share prices are moved by 2 quarters. It occurs that investors forecast ("know") what financial results of KGHM S.A. are expected half of year before their announcement. So, current information (facts) are not decisive, but the forecasts about the future situation are.

Because the incomes influence in share prices of KGHM S.A. so the relation between incomes changeability and variation of individual random variables was examined (Table 3). The variables were course of USD and prices of precious metals on international markets (copper, silver and gold).

As it occurs from Table 3, the main factors that decide about changeability of incomes are prices of such raw materials as gold and silver. Similar-ly as in case of analysis of share prices in case of incomes, the values of copper prices and USD course are strongly correlated with variation of in-comes values.

Rio Tinto

Rio Tinto is also one of the main producers of copper in the world, however this enterprise pay attention mainly to iron ore production. The of-fer of Rio Tinto in comparison to KGHM S.A. is much wider. Apart from the materials mentioned above, the company produces also such materials as aluminium or coal (Fig. 1).

Similarly as in case of shares of KGHM S.A., in this case prices of Rio Tinto shares were com-pared to the factors which potentially can decide about changeability of share prices (Table 4).

Tab. 3. KGHM POLSKA MIEDŹ S.A. income correlation with individual variables (source: personal elaboration)

Tab. 3. Korelacja przychodów KGHM S.A. z poszczególnymi zmiennymi (źródło: własne)

Copper prices	68.43%
Gold prices	91.58%
Silver prices	84.52%
Course USD	24.38%

Tab. 4. The correlation of share prices with individual variables (source: personal elaboration)

Tab. 4. Korelacja cen akcji z poszczególnymi zmiennymi (źródło: własne)

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Incomes	94.63%
Iron prices	78.58%
Coal prices	88.22%
Aluminum prices	40.54%
Gold prices	75.77%
Copper prices	89.60%

Tab. 5. The correlation of incomes and raw materials prices (source: personal elaboration)

Tab. 5. Korelacja zmienności przychodów z cenami surowców (źródło: własne)

Iron prices	87.46%
Coal prices	92.01%
Aluminum prices	15.95%
Gold prices	81.74%
Copper prices	81.20%

Fig. 1. The main income sources for Rio Tinto for the year 2013 (source: http://www.gurufocus.com)

Rys. 1. Główne źródła przychodów dla Rio Tinto za rok 2013 (źródło: http://www.gurufocus.com)
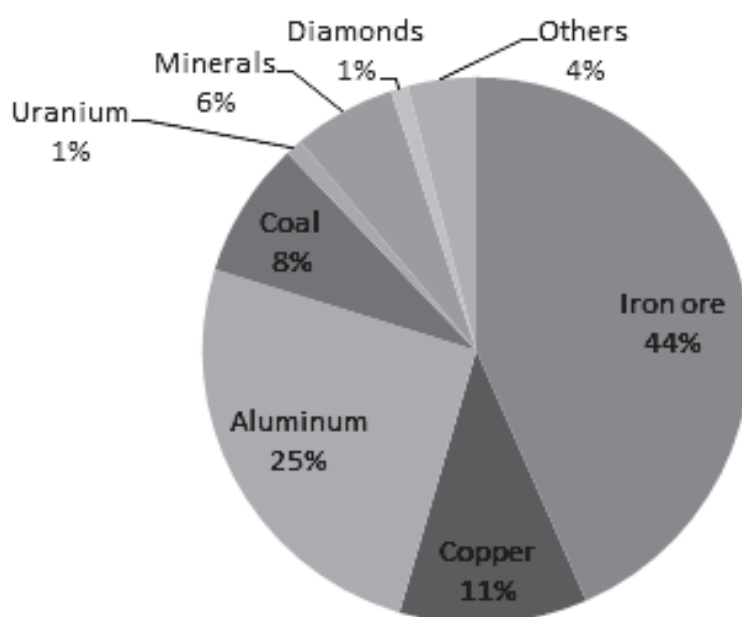
Tab. 6. Summary of the multiple regression for share prices KGHM S.A. (source: personal elaboration)

Tab. 6. Podsumowanie regresji wielorakiej dla cen akcji KGHM S.A. (źródło: własne)

	b^*	Standard error with b^*	b	Standard error with b	$t(40)$	p
Free term			-62.92	22.76	-2.76	0.008
Incomes	0.52	0.16	0.00	0.00	3,11	0.003
Gold prices	0.28	0.16	0.03	0.02	2.35	0.024
Course USD	0.12	0.07	12.94	7.59	1.70	0.096

Tab. 7. Summary of step regression for share prices KGHM S.A. (source: personal elaboration)

Tab. 7. Podsumowanie regresji krokowej dla cen akcji KGHM S.A. (źródło: własne)

	Step	Multiple Spearman coefficient	Multiple R^2	R^2 change	F	p	Covered variables
Incomes	1	0.89	0.80	0.80	169.21	0.000	1
Gold prices	2	0.90	0.82	0.02	4.29	0.045	2
Course USD	3	0.91	0.83	0.01	2.91	0.096	3

Tab. 8. Summary of the multiple regression for the receipts from the sale of KGHM POLSKA MIEDŹ S.A. (source: personal elaboration)

Tab. 8. Podsumowanie regresji wielorakiej dla przychodów ze sprzedaży KGHM S.A. (źródło: własne)

	b^*	Standard error with b^*	b	Standard error with b	$t(40)$	p
Free term			-4694737.00	1090569.00	-4.31	0.000
Incomes	0.57	0.08	2082.00	310.00	6.71	0.000
Copper prices	0.44	0.09	383.00	80.00	4.79	0.000
Course USD	0.33	0.07	1391460.00	294521.00	4.72	0.000

As it was proved, similarly as in case of KGHM S.A., here also the values of incomes, copper prices and coal prices are the main features deciding about changeability of share prices. Also, iron prices are significant. Because the main factor deciding about price of shares of Rio Tinto are values of incomes it was decided to investigate what are the factors the most correlated with them.

Similarly as in case of KGHM S.A., the main source of incomes of Rio Tinto is not the decisive one about changeability of incomes, however this is not insignificant. The main factor deciding about changeability of incomes are coal prices, while the less important are aluminum prices (only 15.95%, although their share in incomes is equal to 25%).

Multiple regression and step regression analysis

The previous chapter of elaboration presented relations between share prices changeability and variations of: incomes, materials' prices (copper, silver, gold) and course of USD. The obtained results do not show which of the factors and how much influence on changeability of share prices of the company KGHM S.A. To this purpose the analysis of multiple regression was conducted (progressive step method) on which basis the calculation was made (Stanisz, 2006). The red color shows the statistically important coefficients.

As it was shown in Table 6, the main variables having influence on changeability of share prices of KGHM S.A. are variation of incomes and variation of gold prices (coefficients of regressive equation are equal to 0.51 and 0.38, respectively.

Tab. 9. Summary of step regression for the incomes of KGHM POLSKA MIEDŹ S.A. (source: personal elaboration)

Tab. 9. Podsumowanie regresji krokowej dla przychodów ze sprzedaży KGHM S.A. (źródło: własne)

	Step	Multiple Spearman coefficient	Multiple R^2	R^2 change	F	p	Covered variables
Gold prices	1	0.91	0.84	0.84	218.42	0.000	1
Copper prices	2	0.92	0.85	0.01	2.87	0.098	2
Course USD	3	0.95	0.95	0.05	22.32	0.000	3

Tab. 10. A summary of the multiple regression for the share price of Rio Tinto (source: personal elaboration)

Tab. 10. Podsumowanie regresji wielorakiej dla cen akcji Rio Tinto (źródło: własne)

	b^*	Standard error with b^*	b	Standard error with b	$t(40)$	p
Free term			-756.28	367.41	-2.06	0.069
Incomes	0.90	0.06	44.81	3.26	13.74	0.000
Aluminum prices	0.26	0.07	0.91	0.23	3.97	0.003

Tab. 11. Summary of step regression for the share price of Rio Tinto (source: personal elaboration)

Tab. 11. Podsumowanie regresji krokowej dla cen akcji Rio Tinto (źródło: własne)

	Step	Multiple Spearman coefficient	Multiple R^2	R^2 change	F	p	Covered variables
Incomes	1	0.95	0.89	0.89	85.71	0.000	1
Aluminum	2	0.98	0.96	0.07	15.73	0.003	2

The course USD occured to be not significant statistically (level of significance p for the conducted t-Student test is bigger than 0.05). As it occurred from the conducted investigation of variation of share prices, the changeability of the prices of the main material produced in KGHM S.A, which is copper does not have a significant influence on it. On the basis of step regression is possibile to determine the level of results description by individual variables (Table 7).

As it occurs from the conducted analysis (what is not surprising) the main factor is the value of the generated incomes (their changeability). Their joined influence on share prices is higher than 89%. The main meaning of incomes in context of share prices is caused by the fact that investors (shareholders) expect benefits in form of dividend (growth of incomes causes potentially higher ben-

efits for shareholders). Because incomes occurred to be the main factor deciding about share prices, so it was decided to determine what factors influence on their value. To this purpose, similarly to the previous case, multiple regression analysis was conducted (Table 8).

As it occurred from Table 8, the value of incomes depends on prices of gold, copper and course of USD. In the following step the level of influence of individual factors on the value of incomes was determined by means of step regression (Table 9).

The biggest influence on the value of incomes have gold prices (hig value of Spearman's multiple correlation coefficient). It describes more than 83% of the value of incomes. Adding other variables as copper prices and course of USD increases the level of description till 90%. However,

Tab. 12. A summary of the multiple regression for the receipts from the sale of Rio Tinto (source: personal elaboration)

Tab. 12. Podsumowanie regresji wielorakiej dla przychodów ze sprzedaży Rio Tinto (źródło: własne)

	b^*	Standard error with b^*	b	Standard error with b	$t(40)$	p
Free term			42.11	14.55	2.89	0.028
Coal prices	0.60	0.10	0.34	0.06	5.91	0.001
Iron prices	0.18	0.21	0.06	0.06	0.88	0.421
Copper prices	1.14	0.32	0.01	0.003	3.53	0.012
Aluminum prices	-0.62	0.19	-0.04	0.01	-3.23	0.018
Gold prices	-0.68	0.28	-0.04	0.02	-2.42	0.052

Tab. 13. Summary of step regression for the receipts from the sale of Rio Tinto (source: personal elaboration)

Tab. 13. Podsumowanie regresji krokowej dla przychodów ze sprzedaży Rio Tinto (źródło: własne)

	Step	Multiple Spearman coefficient	Multiple R^2	R^2 change	F	p	Covered variables
Coal prices	1	0.92	0.85	0.85	55.17	0.00	1
Iron prices	2	0.96	0.93	0.08	9.84	0.01	2
Copper prices	3	0.97	0.93	0.01	1.13	0.32	3
Aluminum prices	4	0.98	0.95	0.02	2.72	0.14	4
Gold prices	5	0.99	0.98	0.02	5.87	0.05	5

it is needed to pay attention to the fact that the influence of copper prices was not considered as statistically significant (p>0.05), low value of F coefficient from F-Snedecor statistical test). According to conducted analysis, silver prices on international markets has not a significant influence on the value of incomes in KGHM S.A.

It occurs that the influence of the main factor which seems to be copper prices on share prices or the value of incomes is not significant. Probably, the investors are more responsive to the changes of precious metals, which in this case is gold. The level of copper production maintains on very high level and then changes of copper ores do not cause big changes in the incomes' structure. The changeability of copper ores characteristics, because of additional elements contents like gold, causes significant changes of the values of produced concentrates. That is why their influence is more visible than the influence of the main product, which is copper.

The similar analysis was conducted for Rio Tinto. Here, the main factor which has a significant influence on share prices of the researched company are incomes and aluminum prices. Table 10 presents the multiple regression coefficients for dependent variable "share prices". The appropriate values of coefficients for incomes and aluminum prices are equal to 0.90 and 0.26, respectively. Both are statistically significant.

Similarly as in case of KGHM S.A., the step regression analysis was conducted also for share prices of Rio Tinto (Table 11). It occurred that both concerned independent variables, which are incomes and aluminum prices, generate together the influence on share prices on the level of even 96%. That means that the rest of the metals, which are iron, copper and gold do not have to be taken into consideration.

In the next step the multiple regression analysis was conducted for incomes of Rio Tinto. This time the prices of all significant metals in this case were taken into consideration. It occurred that the significant influence can be determined not only for aluminum prices but also for copper and coal prices. The gold prices slightly exceeded the acceptable significance level p = 0.05. The surprising thing is lack of significant influence of iron prices.

However, if the step regression analysis is conducted, the results can be different. It occurs that changes of coal and iron prices explain even 93% of incomes changeability. The other variables

were considered as statistically not significant, not adding important information to the considered model. In comparison with multiple regression analysis the conclusions considering coal prices were repeated. The significant were iron prices, which in case of traditional regressive model were not treated in this way. Probably, in multiple regression model too many variables occurred what caused that the existing correlations influenced on the results.

Conclusions

The conducted analyzes indicated that performing economical analyzes with purpose of determining influences of individual random variables on forming of share prices of investigated companies and their incomes do not give homogenous results. The prices of the main product of KGHM S.A. (copper) were not the main factor influencing on changes of considered values. At the same time it was stated that the investors feel when changes may occur and they react with anticipation to what happens on securities market. The applied multiple regression and step regression models did not give same results (what is visible especially in the case of Rio Tinto). The most important is then selection of the appropriate variables to the model in purpose of avoiding autocorrelations between independent variables. However, it can be stated, that markets of individual metals are correlated and changes of, for example, gold prices have strong influence on the changes of other metals' prices too.

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Przychody i ceny akcji przedsiębiorstw górniczych w kontekście cen surowców

Artykuł poświęcony jest badaniu zależności pomiędzy cenami akcji a przychodem ze sprzedaży w przedsiębiorstwach górniczych na przykładzie KGHM Polska Miedź S.A., oraz firmy zagranicznej Rio Tinto. Składa się on z czterech części. Rozdział pierwszy jest wstępem do przedstawionej problematyki, w którym wyjaśniono cel badań. Część druga ukazuje wybrane przedsiębiorstwa górnicze oraz korelacje pomiędzy cenami akcji, przychodami ze sprzedaży oraz cenami surowców na rynkach międzynarodowych (w przypadku KGHM Polska Miedź S.A. wzięto również pod uwagę kurs dolara amerykańskiego). W części trzeciej zdecydowano się przeprowadzić analizę regresji wielorakiej (analiza regresji krokowej, postępującej) w celu określenia wpływu każdej zmiennej, po pierwsze na ceny akcji a po drugie na przychody wybranych przedsiębiorstw górniczych. Część ostatnia jest podsumowaniem analizy. Całość artykułu zakończono wnioskami i spisem zastosowanej literatury.

Słowa kluczowe: ceny surowców mineralnych, ceny akcji, przedsiębiorstwa górnicze, regresja wieloraka