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## Determinants of mining companies' capital structure

### Introduction

Contemporary theories of capital structure identify numerous macroeconomic and microeconomic factors that determine the choice of financing sources. Undoubtedly, the most important macroeconomic factors include general economic conditions, inflation, interest rates, tax rates and other factors that are beyond managers' control, but which they must nonetheless be considered when financing methods are being chosen. The economic situation is related to the uncertainty surrounding demand for products and their prices, the situation on the market for raw materials and fuels, changes in exchange rates, the tax system, etc. Interest rates likewise exert a strong influence on the choice of financing sources, as they determine the cost of external capital, and tax rates, in turn, affect the effects of the tax shield.

The most frequently mentioned microeconomic factors affecting the capital structure include the size of the business entity and its development potential, the level of its investments, asset structure, cost of capital, non-interest tax shields, company's life cycle, financial risk, industry-related specificity of the company's activities, profitability and liquidity.

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Both theoretical and empirical works recognize an extremely broad range of microeconomic determinants whose impact on the structure of companies' financing sources is studied. However, there are no studies into the determinants of the capital structure in mining companies. No comparative analysis of the financing structure of Polish and global mining companies has not been carried out so far. The results of research in this area may prove to be helpful in the process of decarbonizing the Polish energy sector.

This paper considers the structure of financing sources in mining companies and selected determinants that influence the structure. Three hypotheses were formulated for the study:

- ◆ H1 – the structure of financing sources in Polish coal mining companies is similar to the same in global mining corporations,
- ◆ H2 – the structure of assets determines the choice of financing sources in mining companies,
- ◆ H3 – the rate of return on assets and companies' ability to service debt, both of which affect the structure of capital, are determined by the cyclical volatility of financial results.

## 1. Determinants of capital structure – analysis of relevant literature

The search for a rational capital structure comes down to establishing the correct relationship between equity and external capital. This relationship plays an essential role in shaping the long-term development of the company. Moulding a company's target capital structure requires that a number of conditions and factors influencing this structure be taken into account. Thus far, no universal formula has been developed in the theory of finance which would enable the determination of the optimal capital structure. The structure depends on numerous complex macro- and microeconomic factors that are in constant flux. Nevertheless, given the conditions underlying the activities of a specific company, certain principles can be defined that should be considered when a decision is being made on how to shape its capital structure.

While optimizing the capital structure, it is essential, first and foremost, to consider the long-term goal of the company, but one should also take the interdependence of current activities and those which are aimed at development into consideration, adequately assess the relationship between leverage and the cost of capital, as well as be aware of the need to periodically reassess the long-term financial strategy, so as to ensure that it reflects the current economic, social or political realities. Given the optimum capital structure, the market value of the company reaches its peak and obviously the market price of its shares also peaks out (Ostaszewski 2003).

When pertinent literature analyses the microeconomic determinants of the structure of financing sources, it does so in connection with various theories of financing sources. The following are broadly presented: trade-off theory, pecking order theory, signaling theory, market timing theory, bankruptcy theory.

The pecking order theory assumes that large entities are less indebted than smaller companies due to their preference to use internal sources of financing before other sources. The theory assumes that larger entities have higher equity than smaller entities, therefore the share of debt in the structure of financing sources should decrease as the size of the company increases. On the other hand, according to the assumptions of the compromise theory, larger economic entities use debt more widely than smaller ones. They have assets of a certain value which they can pledge as security and their economic activity is more diversified, which reduces the risk of bankruptcy and facilitates access to the debt market. Their stable financing situation favoring access to external financing is an additional advantage. The results of global studies on the impact of the size of an economic entity on its financing structure usually reveal a positive correlation between debt and the size of the entity. However, there is no absolute clarity as to the results obtained. Research by A. Kythreotis, B.A. Nouri and M. Soltani (Kythreotis et al. 2018) proves that the size of the company has a mixed influence on the structure of financing sources and further that it depends on the country and the debt ratio selected for the study. According to D. Forte, L.A. Barros, W.T. Nakamura (Forte et al. 2013), company size strongly stimulates indebtedness, which the authors construe to evidence that larger companies have broader access to external financing, and particularly to the debt market. On the other hand, S. Kurronen (Kurronen 2018), who studied companies from the raw materials industry in 70 countries, presents evidence that this industry is less indebted than other non-financial companies. The results also show that the level of indebtedness in the surveyed companies does not rise with the increase in the size of the company, as is the case of economic entities from other sectors, and further that high profitability does not reduce debt ratios.

Studies of pertinent literature demonstrate that the structure of financing largely depends on **the stage of the company's life cycle**, i.e., its age. According to the theory of capital, which considers the phases of the company life cycle, debt levels increase as the entity grows and exits the early phases of its life cycle. On the other hand, they decrease as the company enters the decline phase. At the initial stage and during the phase of rapid expansion, companies make little use of debt. Entities commencing their activity or being in the initial stage of development usually finance operations through equity. As time passes and their operations grow, companies wishing to expand must also use external sources of financing (Zarzecki et al. 2010). As growth slows down and the cash flow from existing investments grows and becomes more predictable, companies increasingly use debt to finance their operations. Entities in the development phase and those with only a concept of the business they want to finance face the greatest demand for capital. The situation of a small, newly established entity, its capital needs and the possibilities of satisfying them are completely different from those of a large, mature company with a stable position on the market (Duliniec 2011).

Studies of pertinent literature indicate that entities enjoying a stable market position may incur additional risks inherent in debt financing, hence during the maturity stage, shareholders' equity is replaced by debt, and in the initial and final period of a company's life, the opposite tendency holds (Frielinghaus et al. 2005). In some industries, large compa-

nies boasting high liquidity and profits have a conservative capital structure and avoid debt. Higher profitability affords them the opportunity of financing their activities through equity. According to a theory considering the stages of the company's life cycle, companies pay out dividends when the share of net income in equity is high. The dividend pay-out rate decreases when most of the equity comes from the issue of shares (Sierpińska-Sawicz 2015). In industries with high volatility of financial results caused by the impact of market parameters, the share of equity in the structure of financing sources is also relatively large. The results of coal mining companies largely depend on the prices of raw materials on commodity exchanges and these are characterized by a high cyclicality.

According to A.B. Sibindi (Sibindi 2016), one of the key determinants of companies' capital structure is their age. He believes that the age of economic entities is closely related to other determinants of the capital structure. More mature entities should have more internally generated funds at their disposal and should therefore, in line with the pecking order theory, first use these funds to finance their activities. On the other hand, entities which have been on the debt market for a longer period of time enjoy a certain credibility, which makes it much easier for them to obtain debt financing and reduces its cost. Therefore, regardless of the level of positive cash flows, it can be expected that age will be positively correlated with the debt of economic entities. Proponents of the good reputation theory argue that the longer the debt repayment history, the better the reputation of the entity and the lower the cost of borrowing. Companies with an established position in the market find it best to choose safe projects, and reluctantly run increased risk as they wish to maintain their good reputation. In turn, new entities characterized by limited recognition may choose more risky projects. If they manage to survive in the market and improve their visibility, they will also use less risky forms of financing over time. As a result, companies with a long history will have lower default rates and lower costs of debt than those with a short history (Harris and Raviv 1991). On the other hand, A. Ramjee and T. Gwatidzo (Ramjee and Gwatidzo 2012) emphasize that pertinent literature indicates limited consensus as to the impact of age on the structure of financing sources used by economic entities. By reference to the good reputation theory, one can expect a stimulating effect of age on the level of debt. According to the pecking order theory, older, more profitable companies tend to use internally generated funds instead of debt, so in this case a negative relationship between age and the level of financial leverage can be expected. Therefore, it can be assumed that age does not have a clear-cut impact on the structure of corporate financing sources, a fact that is reflected in global research. Results obtained by S.A. Johnson (Johnson 1997) are consistent with the expectations for a positive relationship between strong financial leverage and the age variable. In turn, authors such as M. Ahmed et al. (Ahmed et al. 2010), K.P. Huynh and R.J. Petrunia (Huynh and Petrunia 2010) and A. Ramjee and T. Gwatidzo (Ramjee and Gwatidzo 2012) present a negative relationship between these variables.

One of the most important determinants behind the choice of financing sources involves **the cost of raising funds**. In broad terms, the cost of raising capital is understood as the expected rate of return at which market players make their funds available for specific

investment purposes. According to K. Jajuga (Jajuga 2007), the cost of capital is a discount rate (the rate of return) at which the sum of the expected future net income generated by capital equals the current value of capital. The price and, at the same time, the cost of the capital that flows from the provider of capital to the entity obtaining financing is the interest rate. It is a kind of reward for the investor for lending capital and at the same time it is the expected rate of return on the investment. The cost of capital can also be defined as the expected rate of return investors require in return for lending capital to finance a given risk investment. The higher the risk of a given investment, the higher the expected rate of return, which directly translates into a higher cost of obtaining capital for the buyer of that capital (Duliniec 2012).

Each type of capital is associated with a different level of cost. Hence, the differences in the cost of raising specific types of capital afford companies the opportunity to shape the optimum capital structure at which the cost of capital will be the lowest. On the one hand, the cost of raising capital affects the capital structure, and on the other, the structure itself affects the cost of capital. It is a two-way street (Michalak and Nawrocki 2015). Due to the tax shield, external capital is cheaper than equity capital. The tax shield is construed as the benefits that the taxpayer derives because of a reduction in the company's tax burden. In determining the factors that shape capital structure, pertinent literature pays much attention to non-interest tax shields involving depreciation and investment reliefs. It is emphasized that companies benefitting from large depreciation-driven tax shields in relation to the expected financial flows use less external capital to finance their operations.

The cost of equity capital is generally higher than the cost of external capital due to the higher rate of return expected by providers of such capital (Michalak 2012). The risk borne by the economic entity's creditors investing in equity instruments is higher than the risk borne by creditors investing in debt instruments. This interdependence is reflected in the difference between the cost of equity and the cost of external capital. Creditors incur a lower risk than owners as they are better secured, both in terms of return on capital (interest payments) and the repayment of invested capital (priority over owners) (Duliniec 2012). An additional factor lowering the cost of capital is constituted by the impact of the tax shield. Interest expenses reduce the tax base, whereas the cost of equity in the form of dividends does not.

A company's use of external financing and the issue of preference shares generates financial risk. As indebtedness increases, there is an increased risk on the company's part of not having enough funds to cover costs in the form of interest, commissions and margins on long-term loans and borrowings as well as dividends on preferred shares. This is the result of leverage whose increase means increased financial risk. The risk premium is the difference between the return on equity and the return on total capital (Sierpińska and Jachna 2007).

In conclusion, the cost of capital is an important factor influencing management's decisions on sources of financing. The more cheaply capital can be raised, the more attractive an offer it will be for the management board, but each form of borrowing carries a certain risk, e.g., an increase in debt financing heightens the risk of bankruptcy, and equity financing increases the possibility of losing control over the company.

Another factor that affects the chances of raising capital from a specific source is its availability. This availability is bounded by capital providers' requirements regarding collateral, sureties, guarantees and even the degree of detail of the business plans submitted. The availability of capital is influenced by the entity's size and the level of its development (Borkowska 2007). This is emphasized in pertinent literature that the terms on which loans are granted and the procedures related to their repayment are strongly connected with the bank's interference in the company's operations, especially when the company has a problem with payment of instalments. However, one cannot overlook the fact that loans are safer for the borrower from the point of view of the disclosure requirement. Information about the company is disclosed to the bank alone rather than a wide group of stakeholders including bondholders or shareholders, which holds true when the entity raises capital on the capital market. The disclosure requirement for listed companies goes a long way and can make life easier for competitors thereby reducing the competitiveness of the company raising capital. On the other hand, above-average profits are possible when the company outruns competitors by introducing innovations. If certain information about planned investments must be disclosed in advance, the company loses its competitive edge, creating space for existing or unknown competitors to launch imitation products (Różański 2008). For small businesses, the availability of capital on the financial market is completely different from that for companies with an established market position. For small businesses, the costs of issuing debt securities or bonds would be too high, therefore they do not reach out for capital on the debt market. During an economic slowdown when the money is tight, the cost of capital increases significantly and capital becomes difficult to access. This makes it hard for economic entities to select the optimal sources of financing their assets.

Companies with a large share of non-current assets may tap into external capital to a greater extent, i.e., they can use more leverage. The level of leverage strongly depends on the type of assets a company owns. This is so because specific types of assets protect creditors, who are exposed to losses in the event of the debtor's bankruptcy, to a specific extent. Therefore, the possibilities of incurring debt depend, to a large extent, on the values of assets that can be pledged as security to reduce lenders' uncertainty. According to the bankruptcy costs theory and the agency costs theory, entities with a greater possibility of securing debt will report a relatively higher share of debt in their capital structure. On the other hand, companies with a large share of intangible assets in the structure of their non-current assets should report a much lower debt ratio. According to the signaling theory, the impact of the asset structure on the capital structure is quite the opposite to that in the bankruptcy costs theory: a high share of tangible assets in the structure of assets, including tangible fixed assets, should be accompanied by a relatively lower level of debt (Gajdka 2002).

The company's profitability, mostly measured in terms of the profitability of assets or sales, is an important factor shaping the capital structure. The influence of profitability on the structure of assets is corroborated by the pecking order theory. According to the theory, enterprises prefer to finance their activities through their net income and retained earnings, then through debt, and finally through the issue of new shares. Therefore, it is fair to con-

clude that high profitability should be consistent with lower debt ratios, as the enterprise can more easily use the generated profit to finance new investment projects. On the other hand, unprofitable companies are forced to take loans (Grzywacz 2012). A different conclusion, however, can be drawn on the basis of the signaling theory which holds that a high level of indebtedness is indicative of high profitability and good financial health. This way of reasoning leads to the conclusion that highly profitable companies are characterized by a high share of debt in their capital structure (Gajdka 2002). When analyzing profitability as a determinant of the capital structure, attention should be paid not only to the level of profits, but also to their volatility, as volatility is one of the most important factors adversely affecting leverage. Companies characterized by a high volatility of profits will curtail their debt financing because of the financial risk related to debt servicing. Substantial volatility of profits also makes it difficult to predict the financial situation of the company, especially its cash flow. Therefore, the company should exercise more caution when reaching out for external capital to reduce the risk of losing its liquidity (Barburski 2019).

The effect of dividend pay-out on leverage can be explained in two ways. The first explanation comes from the assumptions of the signaling theory, which states that the payment of dividend is one of the mechanisms informing the environment about the good shape of the company. Increased levels of dividend pay-out signal an increase in future profits, which, in terms of the hierarchy of financing sources, will lower the cost of equity, favoring financing with internally generated cash flows over debt. Lowering the level of dividend pay-outs, in turn, will have the opposite effect, i.e., it may signal a financial crisis and stimulate negative sentiment on the stock market. Therefore, from the point of view of the signaling theory, leverage levels are expected to be in inverse proportion to the dividend pay-out ratio.

Secondly, according to the opportunity cost theory, one way to alleviate the problem of free cash flow in the event of overinvestment is to increase the dividend pay-out ratio. Similarly, to alleviate the problem of non-optimal investments, the company may pursue a restrictive dividend policy and thus reduce its dividend pay-out ratio. In the first scenario, companies are forced to use more debt, while in the second, they are more independent, as retained earnings can be used to finance day-to-day operations. Relying on their research, A.B. Sibindi (Sibindi 2016). A. Antoniou, Y. Guney and K. Paudyal (Antoniou et al. 2008) claim that US practice reveals an inverse relationship between financial leverage and dividends. According to these authors, dividend pay-out is correlated with the structure of financing sources, in line with the assumptions of the signaling theory. This supports the notion that dividend pay-outs signal a company's future financial performance, and therefore companies paying significant dividends benefit from a lower cost of equity capital. T. Lemma and L. Negash (Lemma and Negash 2014) conducted a study of companies from nine emerging African economies: Botswana, Egypt, Ghana, Kenya, Mauritius, Morocco, Nigeria, South Africa and Tunisia and found an inverse relationship between the level of leverage and the dividend pay-out ratio.

Forecasts of future income or cash flow are another determinant exerting a significant impact on the capital structure and thus on the level of liquidity (Gajdka 2002). On the one

hand, economic entities that maintain a higher level of liquidity may use debt more widely because they can meet their current liabilities, which directly translates into their better credit rating. Therefore, liquidity can be expected to positively correlate with debt ratios. On the other hand, companies with a lot of free cash can use it directly to finance their activities, including development activities. In this case, liquidity has a negative effect on the level of leverage.

Theories from the field of corporate financing structures assume a diverse influence of liquidity on the structure of financing sources of economic entities. The compromise theory assumes that companies with higher liquidity will be more willing to use debt because of their better access to and better conditions of obtaining external financing. Moreover, it is assumed that the agency conflict between owners and managers is conducive to increased indebtedness. Hence, in this approach, a positive correlation between liquidity and debt ratios can be expected. On the other hand, the pecking order theory assumes that companies will first use internally generated funds to finance their activities. Consequently, an increase in the level of liquidity should be assumed to reduce the share of debt in the financing structure (Aydin and Kiraci 2018). As in the case of other determinants, the results of empirical studies are not clear-cut. The positive impact of the liquidity ratio on the debt level is presented in the research by e.g., U.M. Umer (Umer 2014), L.M. Pacheco and F.O. Tavares (Pacheco and Tavares 2015), S.N. Bhaduri (Bhaduri 2002), Sibindi A.B. (Sibindi 2016), who prove that the level of liquidity has a de-stimulating effect on the level of leverage.

Credit rating is another microeconomic determinant of capital structure mentioned in pertinent literature. Research by K.J. Kemper and R.P. Rao (Kemper and Rao 2013) suggests that credit ratings as determinants of the capital structure policy are probably a secondary rather than a primary factor. . Contrary to their expectations, they noticed that in companies on the S&P watch list, the enlisting on which may result in a downgraded rating, the share of debt increases. On the other hand, potential rating upgrade reduces debt financing, possibly due to a desire to ensure that the credit rating agency maintains this rating.

The structure of the company's capital is also influenced by the ownership structure and management attitude. A conflict of interest between management and shareholders leads to problematic situations between them, which are explained by the agency costs theory and the competition theory, which first analyze the extent of management's and shareholders' ownership of equity. This analysis reveals that a relatively low management's equity ownership is conducive to debt rather than equity financing to avoid the danger of a hostile takeover and loss of control over the company. On the other hand, if the management is not interested in exerting control in its capacity as owner, it may decide to raise new funds by issuing shares since debt incurred reduces the level of cash flow at its disposal.

Shareholders' main goal of is to see shareholder value maximized, while managers usually seek to grow the company through large investment projects that do not always translate into increased shareholders value. Managers who are not the company's owners often follow the prudence principle in their decision-making processes because of a sense of responsibility towards the company's creditors and a fear of tarnishing their own image and credibility.

Consequently, from shareholders' point of view they tend to keep debt below the optimum (Grzywacz 2012). However, an increase in benefits and improvement in financial performance tends to make managers more prone to increasing the value of the company by expanding the share of external capital.

Just as in the case of other determinants, also the results of global studies indicate that the impact of the ownership structure on the structure of financing sources is quite varied. In their research, R.J. Zeckhauser and J. Pound (Zeckhauser and Pound 1990) did not find any relationship between the discussed variable and debt. On the other hand, a study by M. Fith (Fith 1995) showed that the structure of capital in American companies is significantly influenced by the ownership structure. T.J. Brailsford et al. (Brailsford 2002) presented a statistically significant, non-linear, positive relationship between the ownership structure and financing decisions, whereby the share of debt financing measured in terms of the management ownership ratio increases up to a certain level, and then debt is replaced by equity financing. Regardless of the above conflicts of interest between managers and shareholders, the quality of company management also plays an important role in shaping the structure of financing sources. The role depends on the quality of the management' competence.

## 2. Research methods

The author studied 12 global mining concerns listed on several stock exchanges. These concerns can be divided into two groups. The first consists of entities with diversified mining activities. In addition to coal, they also extract other raw materials in the area for which the concern has obtained a mining concession. Such a diversified activity smoothenes their financial results, as crises do not occur simultaneously across all sectors. Losses in one area are compensated for by profits from other activities. This group includes the British concern Anglo American, Australian concern Rio Tinto, Brazilian company Vale SA, Russian corporation Mechel.

Britain's Anglo American extracts raw materials on all continents. Apart from coking and steam coal, it mines copper, nickel, iron ore and diamonds. The Anglo-Australian company Rio Tinto is the second largest mining corporation in the world right after BHP. Its diversified business structure is the result of a series of mergers and acquisitions. BHP prospects for various types of minerals. This Brazilian mining company is the world's largest producer of iron ore and nickel. It also produces manganese, ferroalloys, copper, bauxite, potassium and cobalt. It owns nine power plants and has a large network of railways, ships and ports that facilitate the transport of manufactured products. Russia's globally active Mechel coal and metallurgical corporation produces coal, iron ore, steel, rolled products, ferroalloys, heat and electricity. All the Group's companies operate within a single production chain – from raw materials to high added-value products.

The second group consists of entities focused on the coal mining segment, and diversification is the result of either coal processing processes or coal's use in heating or auxiliary

processes connected with mining processes. The largest entities in this group are the American companies Arch Resources and Peabody. Arch Resources extracts, processes and sells low-sulphur coal in the United States, but also exports it to China, Australia and the United Kingdom. The second US coal company, Peabody, is the world's largest private coal mining company. Its customers include power plants, steel producers and industrial plants. Coal India is the world's largest state-controlled company, supplying 82% of the coal used by the Indian economy. Australia's Whitehaven Coal Ltd. mines steam and coking coal and exports it to buyers around the world. Similarly, the Russian company Rospadskaya is in the market for coal mining and transport alone. The Polish companies LWB SA and JSW SA also belong to the group of entities whose activity is focused purely on coal mining, processing and transport. LWB SA is in a logistical link with a power plant. On the other hand, JSW SA focuses mainly on the extraction of coking coal, some of which is processed into coke and some delivered to coking plants in the metallurgical industry.

The structure of the financing sources of mining companies was assessed based on:

- ◆ ratio of equity to the assets of the researched business entities,
- ◆ ratio of equity to non-current assets (balance sheet golden rule),
- ◆ ratio of capital and long-term debt to non-current assets (silver balance sheet rule). Fixed capital and long-term debt (with a return period above the balance sheet year) is the sum of equity and long-term liabilities.

The following factors were used as determinants of the structure of financing sources:

- ◆ asset structure showing the ratio of non-current assets to total assets,
- ◆ return on assets, which is the ratio of gross profit (pre-tax profit) to total assets,
- ◆ ratio of net debt to EBITDA showing companies' ability to repay their debt. Net debt is the debt that generates debt financing costs less cash and cash equivalents. EBITDA is the sum of operating profit and depreciation and amortization of tangible and intangible assets, respectively.

### 3. Structure of financing sources in mining companies

The structure of financing sources presented in Table 1 indicates a high degree of asset financing through equity. Its scale varies greatly.

Companies focused on coal mining have a more diverse share of equity in the structure of financing sources than companies with diversified mining activities. In the latter, in 2018–2019 equity accounted for 45–50% of financing assets whereas in the former it ranged between 34% and 75%. Only two of these companies were outliers in terms of the ratio of equity to assets. In Coal India it stood at 21.4%. In the Russian company Mechel PAO, negative equity in relation to assets averaged 78% during the entire study period. On the other hand, in the other Russian company Rospadskaya PAO, the share of equity in financing assets was exceptionally high at 74% in 2019, and was similar to the Polish company LWB SA at 75.7% and the Australian company Whitehaven Coal Ltd.

Table 1. Equity to total assets in mining companies in 2015–2019 (%)

Tabela 1. Udział kapitałów ogółem w spółkach górniczych w latach 2015–2019 [%]

Company	2015	2016	2017	2018	2019
Anglo American PLC	31.9	37.9	42.1	45.2	44.2
Arch Resources Inc.	(24.7)	34.9	33.6	37.4	34.3
BHP Group PLC	45.6	48.9	49.6	46.8	45.8
Coal India Ltd.	30.9	20.8	16.1	19.9	21.4
JSW SA	33.3	34.7	52.8	58.7	56.7
LWB SA	57.9	60.1	69.1	74.7	75.7
Mechel PAO	(78.3)	(80.0)	(79.3)	(76.5)	(78.5)
Peabody Energy Corp.	8.4	1.5	44.1	45.7	40.0
Raspadskaya PAO	11.3	23.2	49.0	60.8	74.0
Rio Tinto PLC	40.8	44.0	46.7	48.0	46.2
Vale SA Brazilian	38.0	39.4	43.8	50.0	43.7
Whitehaven Coal Ltd.	68.4	70.9	83.0	75.3	72.7

Source: own calculations based on balance sheets of mining companies retrieved from a Reuters database.

All the companies surveyed in 2015–2019 reported a marked increase in equity financed assets. The increase in coal prices boosted equity through additional profits. A similar tendency occurred in Polish coal companies. In JSW SA, the share of assets financed through equity increased from 33% in 2015 to almost 57% in 2019, and in LWB SA it rose from 58% to almost 76%. Authors assume that in industries, the average share of equity in the aggregate financing stands at about 33%. However, the specificity of the mining industry necessitates a higher level of asset financing through equity. It relates to large loss-generating fluctuations in coal prices in some years, and these are covered through equity. A shortage of equity with which to cover losses leads to business entities' bankruptcy or their takeover by companies with a better financial standing. The case of Mechel PAO, which did not improve its structure of asset financing for 5 years, does not lend itself to the provisions of any financial rules.

To assess the sources of economic entities' financing of assets, two ratios are adopted: the golden and silver balance sheet rules. The golden balance sheet rule is satisfied when all non-current assets are financed through equity and the silver rule stipulates that non-current assets should be fully financed through capital and long-term debt. Table 2 shows the degree of coal companies' compliance with the golden balance sheet rule. The degree of financing of non-current assets through equity in the companies surveyed is highly diverse.

Table 2. Equity to non-current assets (golden balance sheet rule) in mining companies in 2015–2019 (%)

Tabela 2. Kapitały własne w majątku trwałym (złota reguła bilansowa) w spółkach górniczych w latach 2015–2019 [%]

Company	2015	2016	2017	2018	2019
Anglo American PLC	31.9	37.9	42.1	45.2	44.2
Arch Resources Inc.	(31.9)	59.3	58.0	70.0	55.2
BHP Group PLC	53.6	59.7	72.3	60.9	57.5
Coal India Ltd.	131.1	75.8	53.4	62.7	71.4
JSW SA	44.5	53.5	93.5	110.6	91.1
LWB SA	73.1	82.7	89.2	89.9	97.5
Mechel PAO	(124.1)	(127.4)	(126.9)	(128.0)	(124.5)
Peabody Energy Corp.	9.9	2.0	70.5	65.2	54.9
Raspadskaya PAO	20.0	50.6	95.1	166.5	232.6
Rio Tinto PLC	61.2	66.8	72.0	77.5	70.4
Vale SA Brazilian	62.1	70.4	79.2	90.9	86.2
Whitehaven Coal Ltd.	76.6	78.0	92.5	81.8	80.3

Source: own calculations based on balance sheets of mining companies retrieved from a Reuters database.

In 2015, the golden balance sheet rule of was adhered to solely by Coal India Ltd., and in 2018 by JSA and Raspadskaya PAO. Prior to 2018, the degree of financing of non-current assets through equity was on the rise across all companies. 2019 witnessed a significant decline in the ratio on the heels of their poor performance. Only LWB, Raspadskaya PAO and Coal India reported an increase in the share of equity financed non-current assets on the previous year. Raspadskaya PAO's equity was over 2.3 times higher than its non-current assets, an unmistakable sign of equity being used to finance its operating activities.

The silver balance sheet rule (Table 3) shows the extent to which non-current assets are financed through capital and long-term debt. In 2015, only three companies (Raspadskaya PAO, Vale SA and Whitehaven Coal) fully financed their non-current assets through capital and long-term debt. In 2017–2018, the silver balance sheet rule was adhered to by JSA SA, and Raspadskaya PAO observed it in 2015, 2018 and 2019. In the Brazilian company Vale SA's capital and long-term debt was on average 17% higher than its non-current assets throughout the study period. The remaining companies did not satisfy the silver balance sheet rule. This means that coal companies financed their operations with short-term capital and some of them used some of this capital to finance long-term assets. The assessment of the degree of application of long-term external capital to finance coal companies' assets

Table 3. Capital and long-term debt to non-current assets ratio (silver balance sheet rule) in mining companies in 2015–2019 (%)

Tabela 3. Relacja kapitału i zadłużenia długoterminowego do aktywów trwałych (srebrna reguła bilansowa) w spółkach górniczych w latach 2015–2019 [%]

Company	2015	2016	2017	2018	2019
Anglo American PLC	31.9	37.9	42.1	45.2	44.2
Arch Resources Inc.	(31.9)	59.3	58.0	70.0	55.2
BHP Group PLC	53.6	59.7	72.3	60.9	57.5
Coal India Ltd.	131.1	75.8	53.4	62.7	71.4
JSW SA	44.5	53.5	93.5	110.6	91.1
LWB SA	73.1	82.7	89.2	89.9	97.5
Mechel PAO	(124.1)	(127.4)	(126.9)	(128.0)	(124.5)
Peabody Energy Corp.	9.9	2.0	70.5	65.2	54.9
Raspadskaya PAO	20.0	50.6	95.1	166.5	232.6
Rio Tinto PLC	61.2	66.8	72.0	77.5	70.4
Vale SA Brazilian	62.1	70.4	79.2	90.9	86.2
Whitehaven Coal Ltd.	76.6	78.0	92.5	81.8	80.3

Source: own calculations based on balance sheets of mining companies retrieved from a Reuters database.

based on the data obtained from the financial statements of the companies surveyed shows a low degree of asset financing through this capital. Companies use flexible, short-term sources of financing.

#### 4. Selected factors determining the capital structure of coal companies surveyed

The asset financing structure of coal companies is undoubtedly affected by the structure of their very assets, the rate of return on assets and their debt servicing capacity.

Coal companies belong to the highly capital-intensive sectors of the economy and this fact has a bearing on the structure of their assets. In 2019 The highest ratio of non-current assets to total assets at over 90% was reported by Australia's Whitehaven Coal, Poland's LWB (82.5%) and the Brazil's Vale SA (81.4%). Only Coal India and Raspadskaya PAO reported the ratio at below 50%. In the remaining companies, the ratio ranged between 60 and 80%. A downward trend in the ratio of non-current assets to total assets can be seen in Arch Resources, JSW SA, Mechel PAO, Peabody and Raspadskaya PAO, while Coal India

Table 4. Ratio of non-current assets to total assets in coal companies in 2015–2019

Tabela 4. Relacja aktywów trwałych do sumy aktywów spółek węglowych w latach 2015–2019

Company	2015	2016	2017	2018	2019
Anglo American PLC	73.5	75.2	73.2	74.5	75.2
Arch Resources Inc.	77.4	58.9	58.0	53.4	62.2
BHP Group PLC	85.1	82.0	68.6	76.8	79.5
Coal India Ltd.	35.9	43.2	47.3	47.6	44.3
JSW SA	87.4	79.0	67.1	74.8	77.5
LWB SA	82.4	77.1	82.4	88.1	82.5
Mechel PAO	81.5	80.4	78.9	77.3	77.9
Peabody Energy Corp.	87.9	82.2	73.2	73.7	75.3
Raspadskaya PAO	68.5	52.8	56.0	44.0	48.0
Rio Tinto PLC	83.3	83.1	80.5	77.8	80.3
Vale SA Brazilian	82.5	77.2	80.9	82.7	81.4
Whitehaven Coal Ltd.	93.1	94.3	92.4	92.7	91.2

Source: own calculations based on balance sheets of mining companies retrieved from a Reuters database.

was the only surveyed company to report an increase in the ratio. In companies with a very high share of non-current assets in total assets, the ratio remains at a relatively stable level, averaging 92% in Whitehaven Coal, 82% in LWB, 80% in Vale SA and Rio Tinto PLC each. The strong predominance of non-current assets in the structure of coal companies' assets necessitates the use of long-term capital (mainly equity) to finance them.

The cyclical changes in coal prices, climate policy and the policy of moving away from coal to other energy carriers all cause considerable fluctuations in companies' bottom line, which affects the rate of return on ROE and entities' ability to service debt. These rates are also influenced by the level of assets held. The ROA presented in Table 5 was calculated on pretax profit. This ensures rates comparability across the companies analyzed. The tax rates vary from country to country, and the companies surveyed operate in various countries, within different tax rates and tax regimes. In addition, some concerns extract not only coal but also other raw materials whose prices are highly volatile on the metal exchanges, not necessarily in the same time periods. A rise in coal prices does not coincide with a rise in copper or zinc prices. Diversification of activities smoothens the financial result and increases the companies' ability to service debt.

All the companies analyzed exhibit a high degree of ROA volatility. In 2015, only BHP Group and Coal India reported a positive net profit and Coal India's ROA reached 19%. Arch Resources generated a loss amounting to half of the assets held, and in JSW negative profit

Table 5. Pretax ROA in coal companies in 2015–2019

Tabela 5. ROA przed opodatkowaniem w spółkach węglowych w latach 2015–2019

Company	2015	2016	2017	2018	2019
Anglo American PLC	(9.2)	5.1	10.5	11.6	11.3
Arch Resources Inc.	(48.8)	35.4	9.9	13.5	12.5
BHP Group PLC	1.5	9.4	12.9	14.1	13.1
Coal India Ltd.	19.0	12.5	8.9	21.0	17.0
JSW SA	(29.8)	0.2	26.5	17.0	5.8
LWB SA	(8.6)	6.0	20.8	1.6	9.2
Mechel PAO	(31.3)	4.3	4.9	5.1	3.9
Peabody Energy Corp.	(16.5)	(6.7)	0.9	8.5	(2.0)
Raspadskaya PAO	(16.9)	20.5	29.4	39.0	16.6
Rio Tinto PLC	(0.7)	7.0	13.9	19.5	12.4
Vale SA Brazilian	(19.7)	8.1	7.6	7.5	(3.2)
Whitehaven Coal Ltd.	(11.4)	0.7	11.8	17.7	15.5

Source: own calculations based on balance sheets of mining companies retrieved from a Reuters database.

equaled 30% of assets held. In 2017, JSW's profits exceeded the value of a quarter of its assets. In 2019, ROA declined across the board. The high levels of ROA volatility resulted from cyclical changes in coal prices. Such volatility negatively affects debt levels.

Whether companies will be able to repay liabilities in a timely manner or not depends on the debt repayment period. The period determines what financing sources can be matched to the structure of the company's assets.

The net debt/EBITDA ratio in Table 6 shows that a decline in profits cost some companies an exceptionally long debt repayment period in 2015. Arch Resources continued to suffer for almost 17 years. After restructuring and disposal of some of its assets and thanks to debt restructuring, the company did not use cost-generating debt. The Polish JSW had the lowest net debt/EBITDA ratio. In the last three years of the period analyzed, several companies did not report cost generating debts. They financed their activities through equity and short-term liabilities. In other companies (except Mechel PAO) the period of debt repayment measured against EBITDA was less than a year, and in BPH it was just over two years. The above-mentioned volatility of profits makes it difficult to predict companies' financial situation, especially their cash flows. Therefore, coal companies are more cautious in using external capital as they try to reduce the risk of losing liquidity. After a difficult period of large losses, Polish coal companies limited the use of external capital. Therefore, it can be concluded that the hypothesis about a significantly lower debt in Polish coal companies

Table 6. Net debt/EBITDA ratio in coal companies in 2015–2019

Tabela 6. Wskaźnik długu netto/EBITDA w spółkach węglowych w latach 2015–2019

Company	2015	2016	2017	2018	2019
Anglo American PLC	4.73	1.70	0.73	0.41	0.36
Arch Resources Inc.	16.71	14.90	–	–	–
BHP Group PLC	2.29	2.04	2.01	2.14	2.19
Coal India Ltd.	–	–	–	–	–
JSW SA	1.55	0.67	–	–	–
LWB SA	8.62	0.45	–	–	–
Mechel PAO	9.49	6.08	5.03	5.54	5.31
Peabody Energy Corp.	9.40	6.22	–	0.32	0.55
Raspadskaya PAO	2.36	2.06	0.43	–	–
Rio Tinto PLC	1.09	0.83	0.35	0.08	0.07
Vale SA Brazilian	3.73	1.72	1.40	0.78	0.46
Whitehaven Coal Ltd.	1.90	1.59	0.52	0.27	0.26

Source: own calculations based on balance sheets of mining companies retrieved from a Reuters database.

compared to global companies, partially confirmed by the structure of financing sources, is also confirmed by the net debt/EBITDA ratio.

## Conclusions

Research into pertinent literature showed that the selection of financing sources in companies is influenced by many parallel factors. The most important ones are: asset structure, cost of capital, non-interest tax shields, business life cycle, financial risk, industry specificity of the company's activity, profitability and liquidity. In raw material companies, capital structure strongly depends on financial results and cash flow. Industries in which financial results are highly volatile due to the effects of market parameters reveal a relatively large share of equity in the structure of financing sources. This dependence is apparent in coal companies. Fixed assets are usually financed through equity. The structure of financing sources in Polish coal companies is similar to that in global mining corporations. It is noticeable that they finance their assets largely through equity. Many coal companies do not use capital generating financial costs. Instead, they finance their operations through equity and short-term liabilities, even though the cost of equity is higher than the cost of debt.

The level of indebtedness and companies' ability to service debt are adversely affected by the cyclical changes in coal prices and financial results.

However, by reducing its indebtedness, in the long run, the company inhibit its long-term development prospects. Mining companies should therefore look for a rational capital structure that will allow them, first of all, to maintain liquidity and service debt, and secondly, to maximize the rate of return on invested capital. They should strive to strike a balance between risk and the profit.

The right choice of financing sources and their effective use make it easier for mining companies to survive in the marketplace in the long term and to restructure their activities. It is critically important at a time when coal use for electricity generation is being reduced.

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**DETERMINANTS OF MINING COMPANIES' CAPITAL STRUCTURE****Keywords**

capital structure, asset structure, rate of return on assets, ability to service debt

**Abstract**

The choice of financing sources made by coal mining companies reflects a number of macro- and microeconomic factors. The paper attempts to present only those that play the most important role in mining companies' market activities. The structure of sources of financing mining companies' operations is presented by computing the share of equity in liabilities and shareholders' equity, the golden balance sheet rule showing the degree of financing of non-current assets through shareholders' equity and the silver balance sheet rule which shows the ratio of long-term capital to non-current assets. Only a few mining companies can satisfy those two rules as they finance their economic activity through equity and short-term liabilities. Mining companies are not indebted. Their caution in incurring long-term debt results from the implementation of high volatility of financial results, which are prone to the effects of the economic situation. The basic determinants of the choice of financing sources include the structure of assets, the rate of return on assets and companies' ability to service debt. The high capital intensity of the mining sector is reflected in the large share of non-current assets in total assets, which in some mining companies exceeds 80% of total assets. The rates of return on assets vary widely and are influenced by fluctuations in coal prices at different phases of the market situation. They also have a significant impact on companies' ability to service debt. Empirical research conducted by the author revealed that the structure of financing sources in Polish coal mining companies is like that of global mining corporations, as are the economic relations shaping this structure.

**DETERMINANTY STRUKTURY KAPITAŁU SPÓŁEK GÓRNICZYCH****Słowa kluczowe**

struktura kapitału, struktura aktywów, stopa zwrotu z aktywów, zdolność do obsługi długu

**Streszczenie**

Na dobór źródeł finansowania działalności spółek górniczych wpływa szereg czynników makro- i mikroekonomicznych. W artykule zaprezentowane zostały tylko niektóre czynniki mikroekonomiczne, najistotniejsze z punktu widzenia funkcjonowania przedsiębiorstwa na rynku. Struktura źródeł finansowania działalności spółek górniczych zaprezentowana została w oparciu o udział kapitału własnego w pasywach, złotą regułę finansową obrazującą stopień sfinansowania aktywów trwałych kapitałami własnymi oraz srebrną regułę bilansową stanowiącą relację kapitału długoterminowego do aktywów trwałych. Reguły te spełnione są w niewielu spółkach górniczych. Finansują one swoją działalność gospodarczą kapitałami własnymi i zobowiązaniami krótkoterminowymi.

Spółki górnicze nie są zadłużone. Ostrożność w zaciąganiu przez nie długów długoterminowych wynika z dużej zmienności wyników finansowych pozostających pod wpływem koniunktury gospodarczej. Do podstawowych determinant doboru źródeł finansowania zaliczono strukturę aktywów, stopę zwrotu z aktywów oraz zdolność spółek do obsługi długu. Wysoka kapitałochłonność sektora górniczego znajduje wyraz w dużym udziale aktywów trwałych w aktywach ogółem, wynoszącym w niektórych spółkach górniczych powyżej 80% łącznych aktywów. Stopy zwrotu z aktywów są mocno zróżnicowane i pozostają pod wpływem wahań cen węgla w różnych okresach koniunktury gospodarczej. Mają one również zasadniczy wpływ na zdolność spółek do obsługi długu. Przeprowadzone badania empiryczne pozwoliły ustalić, że struktura źródeł finansowania w polskich spółkach górniczych jest zbliżona do struktury w światowych korporacjach górniczych, podobnie jak relacje ekonomiczne kształtujące tę strukturę.