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Expected Return on Capital in Mining Industry

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Abstract

Capital is a necessary element of each economic activity. In the enterprises functioning in capital-consuming industries, such as mining industry, the problem of capital becomes more complex and is followed by a number of problems. Investors (both owners and creditors) expect the return on invested capital, taking into consideration the risk level connected with the activity that is to be financed by them. The problem raised in this work is related to the determination of the ways of calculation of the expected return on capital from the point of view of capital provider, with the inclusion of the specificity of mining industry. The universal calculation methods in use are difficult to be applied in the enterprises from mining industry because of the specific character of risk emerging in these enterprises, unique character, and high capital consumption. The author suggests modification of one of the most popular methods and presents her own, new solutions in this area, adjusted to the specificity of mining enterprises. The solutions presented allow a more realistic look on the issue of financing mining activity.

Keywords: cost of capital, mining industry, mining enterprises, risk factors, return on capital

1. Introduction

Capital is a necessary element of each economic activity. Its significance is increasing along with the increase of capital consumption in the activity. In the enterprises functioning in capital-consuming industries, such as mining industry, the problem of capital becomes more complex, which is followed by a number of problems that do not emerge in the enterprises functioning in other industries. Taking the size of capital used in mining industry into account and the problems linked to its management, the measurement of the return on capital expected by investors became the objective of this research. The problem of how to calculate

the expected return rate is known, both in scientific circles and business practice. However, the universal calculation methods in use are difficult to be applied in the enterprises from mining industry due to a specific character of risk occurring in such enterprises, unique type of activity, and high capital consumption. In order to meet such a goal, diagnostic and conceptual research was conducted. As a part of diagnostic research, the method, often used, of estimating the return rate on capital called capital asset pricing model (CAPM) was analyzed and verified, but that does not fully resolve the problem. Therefore, it was used as the grounds for conceptual research, as a part of which an attempt was made to design a new method including the conditions of mining industry. The suggested solutions, to a great extent, facilitate the process of calculation of the expected return on capital used to finance mining activity; even in cases when such calculation was not possible or did not provide rational results, they make this process possible and give measurable results. The solutions presented allow a more realistic look on the issue of financing mining activity. They may find use in the efficiency calculus of mining enterprises, value pricing of mining enterprises, in the area of development of optimal structure of financing sources, when obtaining capital through shares or bonds issuance, etc.

2. Essential definition set

In order to define the expected return rate on capital, firstly, one should refer to the definition of capital. Capital is one of the most often used notions in economic sciences and many others. At the same time, it is interpreted in various ways, both in theory and economic practice. For this reason, some kind of theoretical pluralism appeared, where the proper essence is sought for the particular area of knowledge. For example, one may talk about real capital, tangible, operating, money, human, intellectual, social capital, etc.

The definition of capital started to be used in the Middle Ages, although there is a proof that the foundation for the conception of capital has already appeared in prehistoric times, several thousands of years BC. The conceptions linking capital with a corresponding return rate have been developed as the definition of capital was shaping. Capital was initially defined as the monetary value being able to earn interest [1]. The notion of capital also referred to all the goods possessed [2], and as the time went by, it encompassed a wider range of possessions, going beyond a traditional understanding of assets and including other, even intangible values. At present "capital" is a wide and equivocal category. Various ways of approach to defining and interpreting this definition appear in both theory and economic practice. Capital is perceived as strength, which is the basis for progress; it increases work efficiency and creates the wealth of nations [3]. Capital is at the same time noticed as a category responding to goods (resources) possessed, used to run and develop economic activity (tangible or resource conceptions) or responding to savings gathered (monetary conceptions). Its basic feature is the ability to grow (see more in [4]). Such growth may take a form of income, financial revenue (percentage), value added, and others. However, a fact is emphasized that the growth occurring as a result of capital use takes place after a particular amount of time (compare with [5]). These are only some of the conceptions of capital appearing in the history.

In the process of enterprise management, capital may also be analyzed in the forms of existence as **real** capital and **financial** capital. From this perspective, real capital refers to the particular material goods participating in the production process. It is identified with a factor of production, which subjectively materializes on each stage of the particular action process, emerging at the same time from the combination of other elements of the production process, material resources, work, and time, which are combined in an entrepreneurial performance of people [6]. Accordingly, financial capital does not possess a form of resources used to produce goods and services; however, it constitutes the source of financing for real capital [7]. This way of capital perception appears in **corporate finance** too. In that area the streaming character of capital is marked, which comes from the fact that capital equals to the stream introduced to the enterprise and circulates in its operations, generating value increase [6]. The dual character of real and financial capital may be found in **accounting**. The definition of capital is treated dually as capital materialized in a form of assets, serving an active role, and as an abstract capital, having its reflection in enterprise's liabilities, playing a passive role [8]. Following this pattern, capital is defined as funds entrusted to the enterprise by its owners and creditors [9]. Such perception of capital is used in this work.

Despite a great variety of approaches to defining capital, it should be noticed that in most conceptions of capital there is one inherent feature, namely, the ability to generate profit. Some people identify this profit with income (most often in asset, production approach to capital) [10]. However, the most common understanding of capital profits is interest, which mainly relates to capital in value depiction, that is, money. In this work it is assumed that the return on invested capital consists of the **return rate on capital**, expected by investors (both owners and creditors) at a given risk level [9]. It is connected with opportunity cost, that is, expected return rate by the investors, which they may resign from when choosing a particular variant of action and therefore resigning from other possibilities available at that moment [11].

The significance of risk should be emphasized when defining the expected return rate. Investments of the same risk level have the same return rate. Consequently, the return rate expected by investors, in case of investing capital in a particular undertaking, should be at least equal to the highest total return that the investors could expect if they invested in an alternative portfolio of securities with a comparable risk [12]. According to this approach, the more risky the enterprise's activity is, the higher return rate should be generated (compare with [13]). The expected return rate defined in this way has its interpretation in the price that the enterprise pays for the possibility of using capital. This price is expressed in a form of interest rate, reflecting the relation of expenses borne by the capital provider in a yearly scale due to putting capital at someone's disposal and the value of this capital. In this depiction the expected return rate is strictly connected with the source of capital's origin and accompanies capital coming from any source. It may be described as interest, dividends, other benefits, or even opportunity cost for capital providers. In subject literature the division emerged into the expected return rate on equity and debt capital. Individual financing sources, being the components of these groups, are characterized by a different return rate for capital providers. Usually, the return rate even on the same type of capital is different. For example, a different interest rate is assigned to the investment loan in different banks. It results from the contents of particular agreements.

The expected return rate may be understood in a different way from the point of view of capital provider and recipient. For capital recipient the desired return rate at a given risk level is the cost of capital. However, some circumstances should be taken into account, when the return rate may be higher or lower than the cost of capital. For capital recipient the cost of capital is lower than the return rate expected by capital provider, when tax benefits emerge thanks to decreasing the taxable amount by the interest on capital. It consists in the fact that the interest paid by the enterprise decreases gross financial result, lowering at the same time taxable amount. This phenomenon is called **tax shield** and causes that the total cost of debt is lower than the return rate expected by creditors. Also, an adverse situation may take place when the cost of capital for capital recipient is higher than the return rate for capital provider. It is connected with bearing additional costs by capital recipient. For example, when the enterprise gains capital through securities issuance, the cost of capital is higher than the return rate expected by investors, due to the costs related to securities issuance (compare with [14]).

3. Risk as the basic indicator of expected return rate

Risk is considered to be one of the most important indicators of the expected return rate, especially in mining industry, due to the capital-consuming character of this industry and long period of return for the outlays put. **Risk premium**, which should compensate risk borne by capital providers, constitutes an additional remuneration for capital providers over the return rate on bonds. Risk connected with a particular enterprise may be divided into specific risk (also called individual risk) and systematic risk (also called market risk). Both categories of risk mean a probability of occurrence of future incidents affecting the results of enterprise's activities; however, **specific risk** refers to the incidents that may be partially controlled by the enterprise and generally come from its internal decisions. The source of specific risk may be the way of enterprise management, financial liquidity, level of financial and operating leverage, availability of resources, and other factors. The measurement of this risk is disseminated neither in literature nor in practice. In general, ready-made rankings are used, or it is treated as an average risk of enterprises from the same industry. In an international scale, the rankings of industry risk are examined by, among others, A. Damodaran. Nevertheless, it does not fully correspond to specific risk as the rankings do not include the individual risk generated inside the enterprise. The need to include this risk is noticed in the subject literature, but there are no model solutions showing how to accomplish that. Usually, the component related to specific risk is indicated in an arbitral way, or based on experts' opinions. However, **systematic risk** refers to the general conditions of management; it is a result of the impact of external forces, out of the subject's control when exposed to that risk. It is connected with macroeconomic factors, such as economic situation, monetary and tax policy, social situation, legal system, etc. In connection with the occurrence of specific and systematic risk, the expected return rate on capital should include specific risk premium and systematic risk premium. Below, the solution to that problem is suggested, using appropriate indicators.

Risk generated inside the enterprise may be generally divided into operational and financial risk. **Operational risk** is most often perceived as a probability of operating loss or of

not achieving the expected level of operating profit coming from inadequate or faulty internal processes, people, and systems or also from external incidents [15]. In a similar context, risk is connected with uncertainty toward the level of future cash flows of the enterprise [9]. Operational risk is strictly connected with the enterprise, industry, and close environment's specificity that the enterprise functions in. It is dependent from the complexity of enterprise as an organization, systems used, production process, products, or services (compare with [16]). In particular, operational risk depends on relationship between operating costs and sales revenues and on cost structure, including fixed and variable costs. The share of fixed cost in total operating cost determines the reaction of operating income (EBIT—earnings before interest and taxes) to change in sales revenues. This relation is the basis of the mechanism of **operating leverage**, which is considered to be the basic measure of enterprise's operational risk [17]. When the level of fixed cost in the structure of operating cost is high, also the level of operating leverage is high, and at the same time, risk of changes in sales revenues increases (if fixed cost is too high, even small change of price or sales amount may significantly influence the level of operating income). Operational risk is high in such situation. The degree of operating leverage (DOL) may be calculated as a function of EBIT change, and sales revenues change using information about the value of fixed cost in the following way [18]:

$$DOL = \frac{\frac{\Delta EBIT}{EBIT_0}}{\frac{\Delta S}{S_0}} = \frac{S_0 - Cv}{EBIT_0} \tag{1}$$

where $EBIT_0$ is the earnings before deducting interest and taxes, $\Delta EBIT$ is the change in EBIT, S_0 is the sales revenues, ΔS is the change in sales revenues, and Cv is the variable operating cost.

Financial risk is connected with the way of financing enterprise's activity, and the basic factor determining its level is capital structure [19]. Financial risk increases along with the growth of debt. It is suggested to parameterize financial risk using a substantially selected set of diagnostic indicators. When choosing them, firstly the attention was paid to the fact that financial risk is connected with the level of financial leverage in the enterprise. **Financial leverage** is the basic indicator reflecting capital structure in the enterprise. Its level expresses the relation of debt capital to equity, which may be written as

$$financial\ leverage\ ratio = D/E \tag{2}$$

where D is the debt burdened with interest and E is the equity.

If the financial leverage ratio in the enterprise is higher than 0 (only when the enterprise is financed by debt capital), the effect of financial leverage appears. It consists in a situation when, due to financial costs resulting from interest on debt, possible fluctuations of earnings per share are more than proportional to fluctuation of operating income. The higher the financial cost, the stronger the effect of financial leverage. It may be positive when it translates into increase of earnings per share or negative when such earnings decrease. The degree of this effect depends on the share of fixed financial cost in total cost of the enterprise [20].

The effect of financial leverage is measured using the **degree of financial leverage** (DFL). It is a measure of the assessment of enterprise's financial risk that informs by how many percent

earnings per share change (rise or fall) due to 1% change (rise or fall) in operating income. It is expressed through a relation of relative change of earnings per share to a relative change of operating income, which may be shown as [21]

$$DFL = \frac{\Delta EPS/EPS}{\Delta EBIT/EBIT} = \frac{EBIT}{EBIT-I} \tag{3}$$

where EBIT is the earnings before deducting interest and taxes, EPS is the earnings per share, $EPS = \frac{(EBIT-I) \times (1-I)}{n}$, I is the interest as fixed cost of debt capital (financial cost), and n is the number of issued shares.

The indicator of the degree of financial leverage is calculated for the particular value of EBIT. If EBIT is close to the cost of servicing debt, which means net income is close to zero, then the level of DFL is high. Along with EBIT rise, the level of DFL decreases (the share of fixed cost of servicing debt falls in relation with operating income), which proves that financial risk decreases. The higher the share of debt in the enterprise's capital structure and the higher the cost of servicing debt representing the return rate expected by capital providers, the higher the effect of financial leverage and the higher the value of DFL. When the enterprise is financed by equity only (I = 0), the effect of financial leverage does not occur and DFL = 1. The effects of financial leverage are different for various variants of corporate capital structure, however, the effects (positive or negative) are stronger when the share of debt capital increases in financing structure and the expected return rate on capital is higher.

In practice, based on DFL indicator expressing the relation of operating income and cost of debt servicing, ratings are assigned for enterprise's debt. Then, a corresponding financial risk premium resulting from debt is determined. The indicator showing the ability of servicing debt is used here—times interest earned (TIE) (used by renowned rating agencies, such as Standard & Poor's and Moody's Investors Service)—which measures the relation of operating income and cost of servicing debt capital [22]:

$$TIE = EBIT/I \tag{4}$$

TIE indicator is helpful in determining the border for debt capital employed. Low (close to 1) level of this indicator is a sign that the cost of servicing debt in the enterprise constitutes too much burden for operating income (the probability of insolvency increases). The fall under 1 of this indicator's value means that the enterprise loses the ability to pay interest on debt capital (operating income is not sufficient for covering financial costs) (compare with [23]).

Financial risk in the enterprise may be additionally pictured in practice using other indicators characterizing the financial structure of the enterprise. These include the share of equity in total capital (**equity to capital ratio**) and the share of debt in total capital (**debt to capital ratio**) (it is assumed that total capital is a sum of equity and debt capital with interest):

$$equity-to-capital\ ratio = E/C* 100 \tag{5}$$

$$debt-to-capital\ ratio = D/C* 100 \tag{6}$$

The first ratio informs about the level at which the enterprise is able to finance itself in the activity conducted. A high value of this ratio means solid financial grounds of the enterprise and ensures the creditors that in case of failure, the enterprise will be able to settle the debt incurred using equity. Debt to capital ratio informs about the level of enterprise's debt, that is, what part of corporate capital is debt [24].

Furthermore, when examining the corporate capital structure, also the level of assets coverage by equity (**equity to assets ratio**) is used. It allows determining if the enterprise fulfills the balance sheet's golden rule. This ratio is calculated in the following way:

$$equity-to-assets-ratio = E/A^* 100 \qquad (7)$$

When the value of this ratio is equal to or more than 100%, it means that the balance sheet's golden rule has been fulfilled. It says that fixed assets, which are engaged in conducting economic activity for a longer time, should be fully financed by equity as they are at enterprise's disposal in a long term.

The next variable considered to be an important indicator of financial risk is the level of net **operating capital (OC)**, also called working capital. It may be calculated as the subtraction of fixed liabilities (equity and long-term liabilities) and fixed assets. Net operating capital may have a positive, zero, or negative value. The first and the second situation may be considered as appropriate, but the fact of financing fixed assets by liabilities of shorter deadline than a year may be connected with the risk of losing financial liquidity. This happens in a situation of inability to settle due liabilities using current assets [25]. It is a particularly risky situation in case of capital-consuming industries such as mining industry, where we deal with great immobilization of assets of high value, which are very difficult to cash in most cases (underground buildings and objects, longwalls, professional mining devices, etc.).

An important problem during analysis of this area of the enterprise is determination of the limit of debt capital engagement. It may be identified using dependency analysis between the return on equity (ROE) indicator and return on net operating assets (RNOA) indicator. ROE informs about the value of net profit ascribed to one unit of employed equity. This indicator alone may serve as an estimator of specific risk premium. Nevertheless, it is not a perfect measurement method as it only bases on book value. The current financial reports do not include intellectual capital of the enterprise, which may lead to extremely high values of this ratio caused by decreasing the actual value of denominator in the formula [26]. **Return on equity** is indicated according to the formula

$$Return\ on\ equity\ (ROE) = net\ income/shareholder\ equity \qquad (8)$$

Theoretically, the higher the value of this indicator, the more favorable the corporate financial situation. However, in each case, ROE indicator should be confronted with other measures of financial risk, for example, **RNOA**. In the further part of the analysis, ROE is related to RNOA. The latter one is indicated in the following way:

$$Return\ on\ operating\ assets\ (RNOA) = (NOPAT)/(NOA) \qquad (9)$$

where T is the income tax, NOA is the *net operating assets*: NOA = fixed assets + current assets – short-term liabilities – operating notes (short term, without interest), and NOPAT is the *net operating profit after taxes*: NOPAT = EBIT*(1 – T).

Positive assessment is noted for the relation

$$ROE > RNOA \tag{10}$$

Systematic risk is interpreted as part of the risk connected with the enterprise's activity, which depends on a general situation on the market. It is the risk determined by external forces (general economy, force majeure), out of corporate control. A classic measure of systematic risk is **β coefficient** (also called a measure of a security or risk index), included in many calculation methods regarding the expected rate of return. β coefficient measures the volatility of a given security on the whole market, determining the level of market risk connected with investing in assets of a certain enterprise [27]. β coefficient may be defined as a relation of covariance of a security with market portfolio and variance of market portfolio. Covariance indicates the correlation between the volatility of return on investment in a given security and the volatility of return on investment in market portfolio. Furthermore, variance of market portfolio is a measure of systematic risk of this portfolio. β coefficient may be directly indicated from regression of past data regarding the particular instrument and market portfolio (stock exchange index). At that time β coefficient is a gradient of regression function (compare with [28]). β coefficient of value more than one is specific for a security with greater volatility of the return rate than the market index (aggressive securities); when it is lower than 1, it characterizes securities of lower volatility of the return rate compared to the return rate on market portfolio (defensive securities) (compare and see [29, 30]). In some cases β coefficient may be negative, which means that the return rate on a security reacts differently to changes than the return rate on market portfolio. Another untypical case is β equal to zero. In such situation the return rate on a security does not react to market changes (risk-free security, bonds in particular). In general, it is assumed that the enterprises with a higher level of β are more risky than the ones with lower β [31].

In practice, the value of β coefficient may be calculated according to the formula [11]

$$\beta = \frac{\text{cov}(r_{it}, r_{mt})}{\text{var}(r_{mt})} = \frac{\sum_{t=1}^{n}(r_{mt} - \overline{r}_m) \times (r_{it} - \overline{r}_i)}{\sum_{t=1}^{n}(r_{mt} - \overline{r}_m)^2} \tag{11}$$

where β is the beta coefficient, $\text{cov}(r_{it}, r_{mt})$ is the covariance of market return with stock return, $\text{var}(r_{mt})$ is the variance of market return, r_{it} is the return on stock in t period, r_{mt} is the return on market portfolio in t period, $\overline{r}_m$ is the average return on market portfolio in t period, $\overline{r}_i$ is the average return on stock in t period, and t is the period used as the basis for model parameters.

The calculation of β coefficient is connected with numerous problems that need to be resolved. One of the most important issues is to indicate the duration of estimation period, so-called estimation window. It is assumed at that time that based on daily return rates a shorter estimation window may be chosen (e.g., 2 years) and based on monthly return rates this period should be accordingly extended to several years [32]. In this area it is important to comply with the requirement of normal distribution of return rates on stock and benchmark index [33].

4. Analysis of limitations and possibilities of CAPM as the most popular method of estimating the expected return rate

In practice the estimation of the expected return rate is most often based on CAPM method. CAPM is a part of greater theory called *capital market theory* (CMT) [34, 35]. The basic assumption of CAPM is that a part of risk premium on the expected return on investment in securities is a function of market risk of these securities [36]. The expected return rate, in this approach, is a function of individual risk index, describing the volatility of return on stock of a given enterprise in relation with the return on the whole economy (usually represented by a particular market index) [37]. In terms of the analysis of market relationships, which lead to a certain investor behavior, CAPM refers to portfolio theory [38]. It assumes that the return rates on stock depend on the influence of market factor (stock exchange). It is connected with the regularity observed that on most developed stock exchanges, the fall or rise, measured by the change in the main market index, is accompanied by fall or rise of most stock prices. This basic assumption cannot be directly transferred to the expected return rate estimation in mining industry. The observation of capital market proves that stock of enterprises from this industry often reacts in an adverse way than stock of other enterprises. The conditions of mining activity are different to a great extent from the conditions of other economic activities. Nevertheless, for various reasons, CAPM is one of the most popular ways to calculate the expected return rate, also in mining industry. The usefulness of CAPM is noticed by renown authors of many American academic books—E.F. Brigham and L.C. Gapenski. These authors assume that CAPM bases on several, but not very realistic assumptions, and the model cannot be empirically verified. However, its logics provide the grounds for its application in the estimation process of expected return rate [39]. Similarly, A. Buckley, summarizing the dispute concerning CAPM, claims that even if empirical research does not fully confirm the usefulness of this method, it still is a convenient conception explaining the dependency of income and risk [40]. Despite the passing of time and many researches conducted on the problem of CAPM, it remains at a beginning stage of research, and, as the authorities in this field claim, explicit solutions are far to reach (compare with [41]). The difficulties in determining the expected return rate occur on the majority of developed markets of the world and are especially intensified on so-called emerging economies [42] that include the countries of Central and Eastern Europe, South America, and many countries of Southeast Asia. The difficulties particularly appear in specific industries, such as mining industry.

In general, there is no agreement in literature concerning the type of explanatory variables or the ways of determining the basic parameters, etc. Nevertheless, CAPM constitutes the basis for further attempts of searching for an optimal method of estimating the expected return rate. In most methods the attention is paid to risk pricing; however, only systematic risk is usually included, omitting specific risk of the enterprise. Within the frames of the actions taken in this area, it is necessary to add the specific features of the analyzed sector.

Capital asset pricing model assumes that a part of risk premium for the expected return on investment in securities is a function of market risk of these securities (more in [36]). The expected return rate in this approach is a function of individual risk index, describing the volatility of return on stock of the particular enterprise in relation with return on the whole economy (usually

represented by a certain market index) [34, 35]. Return on capital invested in stock of the particular enterprise is connected with the market, which may be presented in the following formula:

$$Re = r_F + \beta \times (r_M - r_F) \tag{12}$$

where Re is the expected return on equity, r_F is the theoretical risk-free return rate, r_M is the average return rate on the market, and β is the beta coefficient determining the level of systematic risk (measure of dependence between the return rate on equity in the particular enterprise and the return rate on the market).

Risk-free return rate (r_F) is mainly indicated based on return on government securities [43]. In literature the return rate on long-term bonds or treasury bills is usually used [44]. **β coefficient** defines the level of systematic risk connected with investing in assets of the particular enterprise [27]. In turn, **average return on the market (r_M)** is most often adopted as the return rate on the basic stock exchange index. The analysis of risk premium bases on real returns from the past.

In some situation the assessment of market risk premium is especially difficult, for example, on emerging markets, where capital market does not provide sufficient data (not enough data or they are characterized by too high volatility, and they cannot be a source of reliable estimation of risk premium). Thus, in order to avoid complications in terms of r_M determination, total difference is calculated between the return rate on the market portfolio and risk-free return rate ($r_M - r_F$), which is called as **market risk premium (MRP)**. Next, it is assumed that this return rate is adequate for all market undertakings, as it is determined by objective macroeconomic conditions [45]. A disadvantage of the conceptions basing on the average return rate on the market is the unified expected return rate that does not include differences concerning risk between the enterprises performing on the same market. Estimation of the return rate is burdened with a mistake of averaging.

5. Alternative conceptions of expected return rate calculation: literature review

A response to CAPM limitations mentioned in the previous part can be alternative estimation methods of expected return rate. These include dividend growth model (DGM), Fama–French model, and arbitrage pricing model (APM).

DGM was created by J.B. Williams [46] and improved by M.J. Gordon and E. Shapiro [47]. The basic DGM bases on a formula describing the value of equity:

$$V_E = \sum_{t=1}^{n} \frac{DIV_t}{(1 + r_w)^t} \tag{13}$$

where V_E is the equity market value (stock market price x number of stock), DIV_t is the dividend paid in t period, where t = 1,2,…n, and r_w is the expected return rate on equity.

Such construction in a simplified way brings the estimation of equity down to examining two factors: expected dividend growth in the future and return rate that reflects systematic risk

of the growth. However, it does not contradict the portfolio theory, which assumes that the return rate consists of dividend and capital profit or loss per share.

Dividend growth model has not found many supporters in literature or practice. The use of this model in its basic form, that is, with the assumption that the dividend growth is unlimited in time, requires developing the forecast of dividend growth from present up to unlimited yearly periods, which is very time-consuming. The difficulty of this model may also come from the necessity of determining the dividend level and its growth rate, which limits its application only to the enterprises characterized by stable growth and dividend policy aimed at regular payoffs, proportionally to the corporate profits. Mining enterprises do not comply with such requirement. Most of them do not have a policy of regular dividend payoff due to huge capital needs, connected with investment.

The model that constitutes a critical response to the standard version of CAPM is Fama and French three-factor model (Fama-French model), also called F-F model. Some researchers place this model among the nonstandard variations of CAPM. The authors of this model (E. Fama and K. French) proved in 1992 that the standard CAPM does not sufficiently explain the level of return rates on securities. Based on research conducted, they positively verified that the relationship between β and average return rate, analyzed in the years 1941–1990, is very weak and has a tendency to diminish. At the same time, they questioned the existence of positive relationship between the return rates on stock and estimated risk index for them (β). Nonetheless, they did not exclude the existence of covariance with the market. The factor, which reflects the volatility of securities to changes on the market, was supplemented with two other factors describing the return rates better. These were market value (market capitalization) and book-to-market ratio, describing financial risk. The supporters of this model claim that the factors included reflect the additional, undiversified (macroeconomic) risk, not taken into account in β coefficient in the standard CAPM version [48]. It is particularly important in case of subjects with low capitalization. Other voices, emerging in the discussion about the usefulness of Fama–French model, undermine the conclusions drawn by its authors. These are, among other, publications by S.P. Kothari, J. Shanken, and R.G. Sloan [49]. They claim that the yearly return rates include remuneration for risk, measured using β in the standard model. Furthermore, the model by E. Fama and K. French is criticized by F. Black, L.K. Chan, and J. Lakonishok, who state that those authors did not manage to prove to a sufficient degree that β from CAPM does not explain the expected return rates [50, 51].

APM is often called APT model (*arbitrage pricing theory*) [52] as it bases on arbitrage pricing theory. APM may be treated as multifactor version of CAPM (the nature of CAPM is single regression, APM is a multi-regression model) [53]. APM uses a set of macroeconomic factors determining the risk of a given business. This set is varied and may be developed if needed. Among the most often included factors, the following ones are mentioned: difference between long-term and short-term treasury bills or market rates, inflation rate, sales growth rate in production sector, exchange rates, or changes in forecast of macroeconomic variables such as GDP [37]. Also, substitute factors can be used if data about the primary factor are not available in the research period [54], which shows great flexibility of APM. One of the risk factors in APM may be the traditional β used in CAPM. In practice, other factors may be used, specifically for the particular activity, e.g., resources price index, energy price index, income level of certain

groups of people, etc. [55]. APM does not have a standard character. Taking this into account, APM may be considered as an attractive estimation method of expected return rate; however, it raises serious problems when used in practice. Numerous attempts of return rate estimation using this model so far have not led to its dissemination among practitioners [56]. The reason for low popularity may be the fact that it is difficult to identify the group of factors which could be universal for all corporate assets. Additionally, as the time goes by, the groups of factors determining risk may change in case of the same assets. Therefore, the selection of factors and analysis of their impact on risk specific for a given enterprise has an arbitral character [57].

After the analysis of the basic assumptions of the models above, it may be concluded that most of them cannot be directly used, without modification, in mining enterprises; furthermore, some of them should even be rejected. These models possess a number of limitations. The primary problem connected with their utilization is the fact that in many countries mining industry does not have many representatives; often the market is ruled by a few enterprises with very high production potential, which causes that this industry has a few representatives on capital market that provide statistical data for the most pricing models based on capital assets. Another problem related to the use of traditional calculation models of return rate is that they usually include systematic risk only and assume that the pricing of return rate is performed from the investor's point of view, who possesses a well-diversified portfolio. Such investor, when calculating the expected return rate, pays attention to market (systematic) risk only. On the other hand, capital provider, who does not possess a diversified investment portfolio, invests a great share of assets in one enterprise; she or he is exposed to both market risk and specific risk of the enterprise. Stock of mining enterprises often, in majority shareholding, belongs to one strategic investor, who is strongly connected with mining industry and does not have a diversified portfolio. The necessity of modification of some models also comes from the issue that they include the elements of specific risk not compliant with the characteristics of mining enterprises or not occurring in the industry. Thus, many categories linked to the return rate calculation in mining enterprises require a new definition or better precision.

6. Modification conception of CAPM for the purpose of expected return rate calculation in mining industry

In this point a modification is suggested regarding the existing method of the expected return rate calculation. An example of the selected mining enterprise—X—is used for that purpose. The expected return rate was calculated for that enterprise and compared with 19 mining enterprises listed on global stock exchanges. The basic subject of research is the mining enterprise from hard coal mining industry, conducting mining activity in Poland, listed on Warsaw Stock Exchange.

For the purpose of research conducted, to enable comparison, the research sample encompassed the largest global mining enterprises in terms of hard coal excavation, comprising the so-called cluster. The parameters characterizing their financial situation are going to form, after an appropriate verification and modifications leading to comparability, benchmarks—reference points for the calculation of expected return rate in Polish mining industry. The

selection of enterprises for the research sample was made on the basis of business homogeneity, that is, all the selected enterprises gain a great part of their revenues (over 50%) from hard coal mining activity. Among the benchmark of mining enterprises, the following ones can be mentioned: American corporations (Alpha Natural Resources, Arch Coal, Consol Energy, Peabody Energy Corp., Walter Energy, Inc., Westmoreland Coal Company), Chinese corporations (Inner Mongolia Yitai Coal Company, Ltd., Yanzhou Coal Mining Company, China Coal, Shenhua Group), Australian corporations (BHP Billiton Ltd., Coal of Africa, Coalspur Mines, New Hope Coal, Whitehaven Coal Ltd.), British corporations (Anglo American Coal, Glencore plc), and one Indian corporation (Coal India). They are listed on global stock exchanges such as the New York Stock Exchange (NYSE) in the USA, National Association of Securities Dealers Automated Quotations (NASDAQ)—over the counter, regulated stock market in the USA, Shanghai Stock Exchange (SSE) in China, Hong Kong Stock Exchange (HKSE) in Hong Kong, Australian Securities Exchange (ASX) in Australia, London Stock Exchange (LSE) in Great Britain, and National Stock Exchange of India (NSE) in India.

As it was stated above, the expected return rate depends to a great extent on **specific risk** generated in the particular enterprise. A decisive significance in this area is ascribed to the financial conditions of management process, translating into operational and financial risk of the enterprise. The measures of **operational and financial risk** suggested above were calculated for the selected research sample and placed in **Table 1**. The period of analysis encompassed 5 years. The indicators calculated are listed in a form of average values of the examined parameters in the whole research period, that is, 5 subsequent years.

Some indicators may serve themselves as the measures of specific risk premium of the enterprise. In this work it is assumed that this risk is determined by the whole set of indicators. The first one—degree of operating leverage—identifying the level of operational risk, shows very high fluctuations in the enterprises. DOL fluctuates in the range of over 134 to about 150. Such great volatility with positive or negative numbers appears only in single cases. In general, operating leverage is positive (almost 30% of the examined enterprises are characterized by negative average operating leverage in the examined period, which may mean sales below operational break-even point). In most cases yearly average operational leverage is lower than one, which means that the majority of mining enterprises possesses high vulnerability of operational income to changes in sales revenues. It is specific for hard coal mining industry, where fixed costs dominate. Their great share has an impact on high vulnerability of operating results and on changes in sales amount. The results obtained indicate a high level of operational risk in hard coal mining industry.

The next indicator included in the listing presented in **Table 1** is financial leverage and degree (effect) of financial leverage. Financial leverage is used in most enterprises (apart from one enterprise, all of them use debt capital in financing their activity), and in most cases, we deal with a positive effect of financial leverage. The strongest effects appear in the enterprises with the highest level of debt. In order to determine whether the effect of financial leverage is positive or negative, it was examined whether debt of the enterprises increases or decreases the return on equity. It was observed that the financial leverage is not effectively used, though. It is supported by the fact that, in average, in about half of the enterprises the return on equity is lower than the return on net operating assets. In the majority of the examined enterprises, the

No.	Name	DOL	D/E	DFL	TIE	E/tot capital	D/tot capital	E/fix assets	OC	ROE [%]	RNOA [%]	ROE > RNOA
1	Enterprise X	1.73	0.19	1.03	40.71	0.68	0.13	0.84	+	12.4	10.78	Yes
2	Alpha Natural Resources	−47.72	0.95	1.54	−3.99	0.44	0.40	0.55	+	−18.7	−7.07	No
3	Arch Coal	29.02	1.77	2.62	−0.34	0.36	0.58	0.42	+	−8.5	−0.91	No
4	Consol Energy	0.72	2.11	2.21	5.24	0.30	0.59	0.35	+	14.7	5.32	Yes
5	Peabody Energy Corp.	−0.15	1.66	0.83	1.45	0.34	0.55	0.42	+	3.7	8.13	No
6	Rio Tinto	−153.66	0.94	1.05	5.31	0.45	0.41	0.55	+	8.68	7.61	Yes
7	Walter Energy, Inc.	12.40	3.66	0.92	4.42	0.22	0.71	0.28	+	−7.3	6.80	No
8	Westmorel and Coal Company	13.07	−4.89	−2.42	−0.29	−0.24	1.13	−0.29	—	1.35	2.41	No
9	Inner Mongolia Yitai Coal Company Ltd.	0.98	2.14	1.06	20.83	0.31	0.57	0.41	—	53.1	25.58	Yes
10	Yanzhou Coal Mining Company	134.52	0.97	0.87	24.38	0.42	0.38	0.60	+	16.2	9.93	Yes
11	China Coal	3.81	1.27	1.11	10.91	0.46	0.46	0.69	+	12.0	10.83	Yes
12	Shenhua Group	0.25	0.71	1.04	12.22	0.61	0.43	0.84	—	15.9	20.61	No
13	BHP Billiton Ltd.	−4.54	0.63	1.06	15.68	0.53	0.33	0.68	+	28.6	22.83	Yes
14	Coal of Africa	1.38	0.22	0.99	−116.5	0.79	0.17	0.98	+	−33.0	−11.10	No
15	Coalspur Mines	0.48	0.15	0.96	−19.99	0.83	0.12	1.18	+	−23.0	−27.40	Yes
16	New Hope Coal	−1.83	0.08	1.02	64.27	0.86	0.07	2.96	+	9.83	29.85	No
17	Whitehaven Coal Ltd.	−73.57	0.29	1.13	5.59	0.75	0.22	1.03	+	3.65	2.95	Yes
18	Anglo American Coal	2.54	1.24	1.12	4.77	0.44	0.50	0.57	+	9.45	11.29	No
19	Glencore plc	1.31	5.06	0.50	0.47	0.15	0.62	0.30	—	8.90	3.41	Yes
20	Coal India	−0.17	1.05	1.00	291.99	0.38	0.39	1.94	+	40.3	63.10	No

Source: own work.

Table 1. Basic operational and financial risk measures in the examined enterprises: average values for 5 subsequent years.

cost of servicing debt (TIE) constitutes too big burden for operating income. These problems can be noticed, in particular, in the last 2 years of the analyzed period. Financial risk of the analyzed mining enterprises is growing as the time goes by. An additional risk factor is a low degree of financing fixed assets by equity. It can be seen that in six out of nineteen investigated enterprises equity dominates in their financing structure. These are all Australian enterprises and one Chinese enterprise. Fixed assets in these corporations are to a great extent (60% and more) or even fully covered by equity. In the other cases, it relates to about 2/3 of enterprises, and in their liabilities, structure debt capital dominates; furthermore, a great share of debt capital with interest is clearly outlined, and mostly this capital constitutes over 50% of all liabilities. In this group of enterprises, only about 50% of fixed assets is covered by equity. It means that mining industry, despite a high degree of assets immobilization, finances assets from external sources. Taking the character of fixed assets in mining industry into account, this state of things should be assessed as increasing the risk of financing, which may lead to losing liquidity.

The next examined element is **net operating capital**, also called working capital. Its positive level shows that the part of so-called fixed capital (equity and long-term liabilities), after covering fixed assets, finances current assets. It is a feature of enterprises that use conservative financing strategy, reducing their financing risk. The negative level of working capital means that some part of fixed assets is financed by short-term liabilities. It is a very risky situation from the point of view of losing financial liquidity, and it characterizes the enterprises being in a crisis financial situation or using aggressive strategy, aimed at minimization of the cost of capital. The character of working capital is shown in **Table 1**, marking the sign "+" as positive and the sign "−" as negative net operating capital. The domination of positive or negative working capital is understood as the appearance of the capital with "+" or "−" sign in at least 3 years of the researched period. Negative working capital dominates in the examined period in five mining enterprises. When confronting it with the results obtained in the previous stage, which showed that the share of equity in financing total assets is relatively low in mining industry, it turns out that this industry to a great extent uses financing from long-term debt capital. However, positive working capital indicates that most enterprises in the industry finance fixed assets and some part of current assets by fixed capital, that is, equity and long-term liabilities. Nevertheless, the fact is disturbing that the activity of mining enterprises becomes more risky year by year from the point of view of financial risk. It can be noticed that in the last years of the examined period the number of enterprises with negative working capital is increasing. In the first year of the researched period, only six enterprises note negative working capital, and in the last year, one as many as 11 out of 23. In the last year of analysis, negative working capital in almost half of the examined enterprises shows a very risky configuration, in which highly immobilized fixed assets of mining enterprises, difficult to cash, are financed by short-term liabilities.

Another element taken into account in effectiveness assessment of capital management is **return on equity** and **return on net operating assets**, measured using ROE and RNOA indicators. The analysis of these indicators shows a deteriorating financial situation of mining industry. The return on net operating assets falls down from an average level of about 12% in the first 2 years of analysis to barely 6% in the last researched years. At the beginning of the examined period, only one enterprise from the whole research sample indicates a lack of

return on operating assets (Coalspur Mines), and in the last analyzed year, seven enterprises have a negative value of RNOA.

In further analysis ROE is compared with RNOA. A positive evaluation occurs in case of the relation in which the return on equity is higher than the return on net operating assets. The verification of whether ROE > RNOA is made in **Table 1**. The relation of ROE to RNOA, according to the tendency in hard coal mining industry observed before, deteriorates year by year. At the beginning of the examined period only in 1/3 of corporations, the level of ROE is lower than RNOA. In the subsequent years, the number of enterprises characterized by unfavorable relation of these two indicators is increasing, and in the last analyzed year, such situation is noted in almost 80% of the examined enterprises. It means that at the beginning of the examined period in about 65% of the examined enterprises, capital management is effective, that is, the enterprises use a positive effect of financial leverage. However, this situation deteriorated, and, recently, positive assessment of the effects of capital management may obtain only 20% of the investigated corporations.

For the purpose of calculation of the expected return rate in mining enterprises, a model is used in this work. Firstly, a decomposition and qualitative description were made for the most important variables affecting the expected return rate. These are variables representing specific and systematic risk of the enterprise. The next stage of model building is an attempt to parameterize the aforementioned variables.

On the stage of variable selection in the process of model building, cluster analysis is used [58]. Its basis is a selection of research sample among the mining enterprises listed on stock exchanges. On the grounds of the features characterizing the researched areas of enterprise's activity belonging to a particular cluster, the averaged levels of these features were calculated for the whole industry; next, the comparison of averaged values with their values was conducted for the enterprise that the expected return rate was calculated for (in case of this work for the enterprise X). Where necessary, the individual features were brought to comparability with the inclusion of external factors, specific for the enterprises representing different world markets.

Next to specific risk, an important indicator of expected return rate is systematic risk. A classic measure of systematic risk is β coefficient. In case when it cannot be calculated properly, only industry or sector average of β coefficient can be determined and used in CAPM. However, a problem appears that consists in the fact that all the assessed enterprises from the same industry have a common β coefficient, which may be connected with a possible, huge assessment mistake (averaging error).

In some approach it is advised to include, beside systematic risk, the factors of specific risk in addition when calculating β coefficient. Such postulate is proposed by, for example, A. Damodaran, who uses the notion of total risk, marked as "total β," explaining that [28]

$$total\ \beta\ =\ industry\ average\ \beta/correlation\ between\ the\ industry\ and\ the\ market \qquad (14)$$

Considering the fact that the correlation cannot be higher than 1, total β cannot be lower than a regular one. It allows stating that the inclusion of specific risk always gives a result in a form of increasing the expected return rate [59, 60]. Nevertheless, a problem still remains unsolved

concerning the differentiation of the expected return rate for different mining enterprises on the same market. In further analysis an attempt is made to solve this problem through specific risk modeling. It consists in appropriate transformation of β coefficient calculated for similar enterprises listed on stock exchange and adjusting it to the specificity of the investigated corporation. A starting point is a solution suggested in a model by **R. Hamada** [61]. He assumes that risk index is increasing along with the share growth of debt capital in capital structure (providing that other factors remain unchanged). It means that the use of financial leverage in the enterprise increases the risk connected with investing in stock of this enterprise and has a direct translation in the level of β coefficient. According to Hamada's model, β, in the enterprise using financial leverage, may be written as a function of the same indicator in the conditions when debt capital is not used [33]:

$$\beta_L = \beta_U[1 + (1 - T)(D/E)] \tag{15}$$

where β_L is the β coefficient with financial leverage (levered β), β_U is the β coefficient without financial leverage (unlevered β), and T is the income tax rate.

After transformation this formula takes the following form:

$$B_U = \beta_L/[1 + (1 - T)(D/E)] \tag{16}$$

The usefulness of both formulas consists in the possibility of making simulation how β is shaping, depending on changes in the level of financial leverage.

In order to analyze systematic risk in the mining enterprise X, as its quotation history on Warsaw Stock Exchange is too short to use statistical methods, cluster analysis was applied. In the enterprises representing global mining industry, β coefficient was calculated. The condition for β determination is compliance of empirical distribution of return rates on stock and market index with normal distribution. In order to examine the empirical distribution of return rates on stock and market indexes, Shapiro–Wilk test and Kolmogorov–Smirnov test with Lilliefors significance correction were used. All the tests univocally indicate that this condition is fulfilled by monthly return rates on stock and market indexes calculated on the basis of 5-year estimation period. Thanks to the selection of enterprises subjected to business homogeneity, grounding on β coefficients calculated for the aforementioned enterprises, industry average β indexes were indicated for the researched market and for the whole research sample in the period of the past 5 years. Industry average β coefficients for the individual markets are included in **Table 2**.

Industry average β for the cluster of hard coal mining in the examined period fluctuates in the range of 1.36–1.54. At the beginning of the analyzed period, the highest value of β is ascribed to the corporations listed in Great Britain (at the beginning this coefficient amounts to 1.92, and after 5 years, it goes down to 1.79). The lowest β coefficient is specific for Chinese enterprises in the whole examined period (average β of enterprises listed on this market equals 0.84). It means that the stock of Chinese mining enterprises is characterized by lower systematic risk than the whole market represented by SSE Composite Index. Beside China, on all the investigated markets, β is higher than 1, which means that the stock of mining enterprises is more risky than the average market portfolio. The stock of British enterprises is the most risky

(average β = 1.84) and American ones (average β = 1.66). A bit lower risk is specific for the enterprises listed in Hong Kong (average β = 1.6640) and Australia (average β = 1.43).

In order to include a wider dimension of risk in β coefficient, the correlation between the industry and the market was estimated using Pearson coefficient (the results are placed in **Table 3**). After dividing the industry average β by the correlation coefficient between the industry and the market, total β was obtained, which is shown in **Table 4**.

No.	Name	Average
1	NYSE/NASDAQ (USA)	1.66
2	SSE (China)	0.84
3	HKSE (Hong Kong)	1.40
4	ASX (Australia)	1.43
5	LSE (Great Britain)	1.84
	Total mining industry	1.43

Source: own work.

Table 2. Industry average β coefficient for individual markets with the assumption of 5-year estimation period.

No.	Name	Pearson correlation coefficient
1	NYSE/NASDAQ (USA)	0.632
2	SSE (China)	0.492
3	HKSE (Hong Kong)	0.827
4	ASX (Australia)	0.447
5	LSE (Great Britain)	0.712

Source: own work.

Table 3. Correlation between monthly return rates in the industry and the market.

No.	Name	Total average β
1	NYSE/NASDAQ (USA)	2.62
2	SSE (China)	1.71
3	HKSE (Hong Kong)	1.77
4	ASX (Australia)	2.97
5	LSE (Great Britain)	4.12
6	Total hard coal mining industry	2.70

Source: own work.

Table 4. Total industry average β for individual markets.

The highest correlation between the return rates on stock and the market is noticed in case of the enterprises listed in Hong Kong and Great Britain. The lowest one belongs to stock of Chinese and Australian corporations.

The calculation of total β confirms that the highest risk is specific for stock of British mining enterprises. The lowest risk in the assessed group is characteristic for stock of enterprises listed in Hong Kong and China.

In the area of systematic risk, the subject of analysis was another form of β coefficient. To be exact, β is transformed according to Hamada model, presenting it in an unlevered version for the particular markets (**Table 5**).

Unlevered β coefficient is considered to be a universal systematic risk measure of mining enterprises, and in this form, it is going to be used for modeling of the expected return rate for the enterprises not listed on a capital market or for the enterprises with too short quotation history, based on Polish mining enterprise X.

Specific risk is parameterized based on scoring assessment that includes the operational and financial risk measures presented above. The parameterization of diagnostic features in the enterprise X consists in their comparison with the values of a given feature in the industry, represented by a certain cluster of enterprises and assigning a scoring value to them, corresponding to specific risk class. In **Table 6** there are diagnostic features from scoring model listed, showing at the same time a median of their value for hard coal mining industry (with tolerance level ± 10%), represented by the investigated cluster of enterprises. Median was used in the research as the distribution of the examined diagnostic features is usually asymmetric, which rules out using arithmetic mean.

In the next step, it is suggested to list three specific risk classes, depending on the level of particular diagnostic indicators:

Class 0—low specific risk

Class 1—average specific risk

Class 2—high specific risk

No.	Name	Average unlevered β
1	NYSE/NASDAQ (USA)	0.71
2	SSE (China)	0.48
3	HKSE (Hong Kong)	0.74
4	ASX (Australia)	1.20
5	LSE (Great Britain)	0.99
	Total hard coal mining industry	0.84

Source: own work.

Table 5. Average industry unlevered β for individual markets.

No.	Assessment criterion/diagnostic feature	−10%	Median in global hard coal mining	+10%
1	DOL	1.40	1.55	1.71
2	D/E	0.63	0.70	0.77
3	DFL	0.95	1.05	1.16
4	TIE	4.51	5.01	5.51
5	E/C total	0.40	0.44	0.48
6	D/E total	0.35	0.39	0.43
7	E/fixed assets	0.53	0.59	0.65
8	OC		+	
9	ROE > RNOA		Yes	

Source: own work.

Table 6. Criteria of specific risk assessment with the reference point in a form of median of individual indicators in global hard coal mining.

Each of the accepted diagnostic features is assessed by having assigned the value of 0, 1, or 2, compliant with the specific risk class. The scale was constructed in a descending order, that is, class 0, and assessment 0 is ascribed to the indicators, the values of which is more favorable than the industry average level of a given diagnostic feature, class 1 and assessment 1 (level equal to industry average ± 10%) and class 2 and assessment 2 (unsatisfactory level), meaning a worse level than industry average. The average sum of scores for all diagnostic features is transformed into specific risk premium (SRP). The lower the scoring value, the lower the specific risk and in consequence lower risk premium, which is followed by lower expected return rate.

The first diagnostic feature in a form of the degree of operating leverage informs about the operating risk level. The higher leverage the higher risk. The average industry level of operating leverage in the examined period amounts to 1.55. The enterprises in which the operating leverage is lower than 1.4 (average minus 10%) but higher than 0 are placed in risk class 0. The enterprises with DOL higher than 1.71 (average plus 10%) and a negative one are burdened with high operating risk (risk class 2). If the degree of operating leverage takes the value in the range [1.4; 1.71], the enterprise obtains risk class 1. The next diagnostic features are financial leverage and the degree of financial leverage, informing about the level of financial risk. In average, in the examined cluster of hard coal mining, financial leverage amounts to 0.7 and the degree of financial leverage to 1.05. The increase of these indicators triggers risk growth. When D/E ratio is lower than 0.63 and DFL lower than 0.95, risk class 0 is assigned. If these indicators have the values, D/E from 0.63 to 0.77 and DFL from 0.95 to 1.16, it is risk class 1. Furthermore, above these levels, we deal with risk class 2. Another diagnostic feature is the possibility of debt servicing (TIE). Its higher level is positively evaluated; therefore, the enterprises with the TIE level above 5.51 are in risk class 0, level from 4.51 to 5.51 is risk class 1, and below 4.51 means qualification to risk class 2. Equity to total capital (understood as equity and debt capital with interest) ratio is another criterion of ascribing the enterprise to the particular risk class. The lower the level of this ratio, the higher the risk. The share of equity in

total capital below 0.4 is assessed as unsatisfactory and qualifies the particular enterprise to risk class 2. The level from 0.4 to 0.48 is risk class 1 and above 0.48 is class 0. In turn, the next feature—share of debt in total capital—is estimated as unsatisfactory in case of the level below 0.35 (risk class 0). The increase of debt capital in capital structure triggers risk increase. The level of the share of debt capital from 0.35 to 0.43 means risk class 1 and above 0.43 is class 2. The next diagnostic feature relates to the share of equity in financing fixed assets. The lower the scale of financing fixed assets by equity, the higher the risk; thus, the enterprises financing less than 53% of fixed assets by equity are ascribed to risk class 2. Risk class 0 appears in case of financing over 65% of fixed assets by equity. Between these ranges, we deal with, as in previous cases, risk class 1. Another criterion of specific risk assessment is the level of working (operating) capital. For this indicator, a positive level is considered to be satisfactory (risk class 0); indicator equal to zero is risk class 1, and negative working capital means qualifying the enterprise to risk class 2. The last examined criterion is the relation of ROE and RNOA indicators. If ROE > RNOA the corporation is in risk class 0. In adverse situation the relation is unfavorable, which indicates risk class 2. If ROE = RNOA it is risk class 1.

According to the guidelines above, an attempt of parameterization of the assessment criteria of specific risk was made for Polish mining enterprise X (**Table 7**).

Specific risk of enterprise X amounts in the examined period to 0.49 in average. Operational risk increases the level of specific risk (in this area risk class 2 occurs in 3 years of the researched period). In terms of financial risk, the situation of the enterprise is generally more favorable than in the industry, which is confirmed by the domination of financial risk class 0 in the assessment made. However, attention should be paid to the fact that in the last year a rapid deterioration occurred concerning the level of many diagnostic features, which were previously at the more favorable level compared to the industry average. Above all, the ability of the enterprise to service debt is deteriorating, DFL level is increasing, and effectiveness of equity management is decreasing.

No.	Indicator	Year I	Year II	Year III	Year IV	Year V
1	DOL	—	2	0	2	2
2	D/E	0	0	0	0	0
3	DFL	0	1	1	1	2
4	TIE	2	0	0	0	2
5	E/C total	0	0	0	0	0
6	D/E total	0	0	0	0	0
7	E/fixed assets	0	0	0	0	0
8	OC	2	0	0	0	0
9	ROE > RNOA	—	0	0	2	2
	Average score	0.57	0.33	0.11	0.56	0.89

Source: own work.

Table 7. Scoring assessment of diagnostic indicators in mining enterprise X.

No.	Indicator	Year I	Year II	Year III	Year IV	Year V
1.	IRP for hard coal mining [%]	6.00	6.00	6.00	6.00	6.00
2.	Score$_{SR}$	0.57	0.33	0.11	0.56	0.89
3.	SRP [%]	3.43	2.00	0.67	3.33	5.33

Source: own work.

Table 8. Calculation of specific risk premium (SRP) in mining enterprise X.

Having qualified the individual diagnostic features to specific risk classes and performed their scoring assessment, one may start the calculation of specific risk premium. It is assumed that in each enterprise this premium consists of average score of specific risk multiplied by base premium, for which industry premium was adopted, known in practice as *IRP (industry risk premium)*. The level of IRP was accepted in an arbitral way for the whole examined period based on available research [62–64]. A. Damodaran adopts IRP for hard coal mining industry in the examined period at the level of 5%. In research by B. Francis, I. Hasan, and D. Hunter of American market, the yearly average premium is suggested for mining industry at the level of 7.045%. For the purpose of research conducted in this work, its level was adopted in an arbitral way amounting to 6%.

Specific risk premium in scoring model may be written in the following way:

$$SRP = Score_{SR} \times IRP \tag{17}$$

where SRP is the specific risk premium, Score$_{SR}$ is the arithmetic mean of scores resulting from scoring assessment of specific risk, and IRP is the industry risk premium.

Such construction of specific risk premium means that, when all diagnostic features in the enterprise are in specific risk class 1, specific risk premium is equal to IRP. The enterprises, where the level of diagnostic features is more favorable than the industry average, are characterized by specific risk premium lower than IRP. In turn, the corporations, which have diagnostic features at a more risky level than the industry average, obtain specific risk premium higher than IRP. The listing of specific risk premium (SRP) is included in **Table 8**.

After calculating specific risk premium, one can estimate the expected return rate according to the assumptions of modified CAPM. It may be written as the following formula:

$$C_e = r_{RF} + \beta_U \times (MRP + SRP). \tag{18}$$

7. Conclusions

The calculation of the expected return rate in the Polish mining enterprise X requires the adoption of the following parameters: β coefficient, market risk premium and specific risk premium, and risk-free return rate. The basic parameters necessary for this calculation along with its results are presented in **Table 9**. Risk-free return rate was accepted as the return rate

No.	Indicator	Year I	Year II	Year III	Year IV	Year V
1.	Risk-free rate (10-year treasury bills) [%]	6.17	5.80	5.98	4.94	4.10
2.	Unlevered industry average β	0.82	0.91	0.87	0.85	0.74
3.	MRP [%]	6.08	6.5	7.5	7.3	6.28
4.	SRP [%]	3.43	2.00	0.67	3.33	5.33
5.	Expected return rate [%]	13.97	13.54	13.09	13.98	12.69

Source: own work.

Table 9. Calculation of the cost of equity in Polish mining enterprise X according to the assumptions of modified CAPM.

on 10-year Polish treasury bills. Market risk premium was adopted at the level recommended by A. Damodaran for the whole Polish economy [65]. Furthermore, specific risk premium was accepted at the level according to the calculation made on the basis of scoring model for specific risk parameterization.

The activity of the examined enterprise is burdened with high risk. It is a corporation being in a difficult financial situation. The results obtained may be considered as adequate to risk that is connected with the engagement of capital in this enterprise. The enterprise is in debt and significantly burdened with the cost of debt capital and performs on the edge of financial liquidity. Another big problem is the influence of trade unions on corporate activity and low level of activity diversification. Taking the high risk into account, capital providers expect the return rate at the level of about 13%.

The presented calculation model of the expected return rate does not lack limitations. In comparison with the traditional CAPM, it is better adjusted to the specificity of the activity of mining enterprises. Its limitation may be some kind of subjectivism, especially in relation with the specific risk factors that are difficult to measure. However, the solution proposed eliminates the basic defects of the existing calculation models of the expected return rate, which made it impossible to obtain a realistic pricing in mining enterprises. The models suggested constitute a significant help for the managers of mining enterprises.

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