

DOI: 10.26794/2587-5671-2022-26-4-29-43
UDC 330.354(045)
JEL F3, G0, G3, Q40, M2

Multi-Capital Approach for Sustainable Growth: Experience from the Oil & Gas Companies

A.N. Steblyanskaya^a, Mingye Ai^b, O.V. Efimova^c, G.B. Kleiner^d, M.A. Rybachuk^e

^{a,b} Harbin Engineering University, Harbin, China;

^c Russian University of Transport (RUT), Moscow, Russia;

^{d,e} Finance University, Moscow, Russia

ABSTRACT

Nowadays, companies traditionally use economic capital and follow the interests of profit-making by shareholders or financial structures. However, recently there has been a tendency to analyze non-financial factors affecting equity. Multi-capitalism is a doctrine that studies the impact of social, environmental, and economic indicators on equity. **The subject** of the study is the Chinese oil and gas companies' sustainable growth. **The paper's purpose** is to consider the interdependence of non-financial indicators with the Higgins Sustainable Growth Rate (SGR) and the Ivashkovskaya Sustainable Growth Index (SGI). The primary task is to solve the problems faced by China oil and gas companies regarding the introduction of non-financial reporting. **The methodological basis** of the study is a regression analysis of the influence of non-financial factors on sustainable growth indices. The authors analyze the impact of non-financial factors EROI, PRP, ES, ROE_{env} , ROL, ROE_{sr} on the China oil and gas companies' SGR and SGI. It is shown that non-financial indicators show a stronger correlation with SGR than SGI. The study's main conclusion is that there is a significant positive correlation between individual non-financial indicators and sustainable growth indices. The practical application of the obtained research results is seen in the development of non-financial reporting of oil and gas companies in China by including indicators EROI, PRP, ES, ROE_{env} , ROL, ROE_{sr} to assess the work of sustainable growth of the enterprise.

Keywords: multi-capital approach; sustainable growth; China oil and gas companies; Higgins sustainable growth rate; Ivashkovskaya sustainable growth index

For citation: Steblyanskaya A.N., Ai Mingye, Efimova O.V., Kleiner G.B., Rybachuk M.A. Multi-capital approach for sustainable growth: Experience from the oil & gas companies. *Finance: Theory and Practice*. 2022;26(4):29-43. DOI: 10.26794/2587-5671-2022-26-4-29-43

Мультикапитальный подход для устойчивого роста: опыт нефтегазовых компаний

А.Н. Стеблянская^a, Мингье Ай^b, О.В. Ефимова^c, Г.Б. Клейнер^d, М.А. Рыбачук^e

^{a,b} Харбинский инженерный университет, Харбин, Китай;

^c Российский университет транспорта (ПУТ), Москва, Россия;

^{d,e} Финансовый университет, Москва, Россия

АННОТАЦИЯ

В настоящее время общество традиционно использует экономический капитал в интересах получения прибыли акционерами или финансовыми структурами. Однако в последнее время появилась тенденция анализировать нефинансовые факторы, влияющие на собственный капитал. Мультикапитализм — это доктрина, которая изучает влияние социальных, экологических и экономических показателей на капитал. **Предметом** исследования является устойчивый рост китайских нефтегазовых компаний. **Цель** статьи — рассмотреть взаимосвязь нефинансовых показателей с индексом устойчивого роста Хиггинса (далее — SGR) и индексом устойчивого роста Ивашковской (далее — SGI). Важной задачей видится решение проблем, с которыми сталкиваются нефтегазовые компании Китая в отношении внедрения нефинансовой отчетности. **Методологическая основа** исследования — регрессионный анализ влияния нефинансовых факторов на индексы устойчивого роста. Проанализировано влияние нефинансовых факторов EROI, PRP, ES, ROE_{env} , ROL, ROE_{sr} на SGR и SGI нефтегазовых компаний КНР. Показано, что нефинансовые показатели демонстрируют более сильную корреляцию с SGR, чем SGI. Главный **вывод** исследования заключается в том, что существует значительная положительная корреляция между отдельными нефинансовыми показателями и индексами устойчивого роста. Практическое применение полученных результатов исследования видится в развитии нефинансо-

вой отчетности нефтегазовых компаний КНР путем включения показателей $EROI$, PRP , ES , ROE_{env} , ROL , ROE_{sr} для оценки работы устойчивого роста предприятия.

Ключевые слова: мультикапитальный подход; устойчивый рост; китайские нефтегазовые компании; индекс устойчивого роста Хиггинса; индекс устойчивого роста Ивашковской

Для цитирования: Steblyanskaya A.N., Ai Mingye, Efimova O.V., Kleiner G.B., Rybachuk M.A. Multi-capital approach for sustainable growth: Experience from the oil & gas companies. *Финансы: теория и практика*. 2022;26(4):29-43. DOI: 10.26794/2587-5671-2022-26-4-29-43

INTRODUCTION

Economic issues have become global concerns regarding ecological imbalances, resource exhaustion, and pollution because they have a strong connection with social progress and the survival of humans [1]. An economy with low energy consumption, low pollution, and low emission levels, has become the necessary choice and direction for economic development. During the 1980s, researchers began a fundamental reappraisal of thinking on economic growth. However, nowadays contradictions of the sustainable financial growth traditional organization model as “alone” functional focused on the finance aspects only [2, 3]. Nowadays, economic development and sustainable growth are inseparable from green finance support. Green finance sees social responsibility and environmental protection as the core of action based on traditional finances and has become a new point of development, a new driving force for developing the economy [4].

China companies are quite an interesting example of how non-financial indicators are implemented in the companies’ reporting. Thus, in August 2016, China’s seven ministers and committees announced Guidelines for the Green Financial System, specifically recommending supporting a multi-capital approach to support green finance change. China chose a more progressive way for the country’s sustainable development and Ecological civilization formation. For the first time, the 17th National Congress raised the construction of ecological civilization as a strategic task. At this meeting, comrade Hu Jintao described the main objective of ecological civilization, namely, “the formation of a larger circular economy, a significant increase in the proportion of renewable energy” [5]. Hu Jintao pointed out that one of China’s current environmental work priorities is “to improve the legal and policy system to promote ecological construction, to develop national ecological protection plan, vigorously carry out ecological civilization education in the whole society.” At the end of the year issued the “State Council on the implementation of the scientific concept of development to strengthen environmental protection decision” also clearly requires environmental protection work should be in the scientific concept

of development under the leadership of “relying on scientific and technological progress, the development of circular economy, promote ecological civilization, strengthen the environmental rule of Law, improve. So, environmental “vision” will be in all points of view [6]. Analyzing energy, environmental and social indicators for the reporting on China’s companies has attracted much attention, especially after 2000 [7, 8].

This paper addresses the theory of sustainable growth. Unlike traditional financial treatments, in this research, sustainable growth is treated as a result of the interaction and interconnection among energy, environmental, economic, and social indicators. The primary purpose of the study is to evaluate non-financial indicators influencing Higgins sustainable growth rate (SGR) [2] and sustainable growth index SGI [3]. The authors give recommendations on which indices need to involve in non-financial reporting. The paper analyzes various factors in the non-financial reporting, analyzing the correlation between energy and environmental indicators with China’s oil and gas companies’ sustainable growth.

1. LITERATURE REVIEW

1.1. Multi-Capital Approach in Non-Financial Reporting Initiatives

Multi-capitalism is a doctrine that measures and manages the impacts organizations are having on multiple capitals and therefore their own triple bottom lines: their social, environmental, and economic performance. There are few researchers investigated Systems Thinking Using a Multi-Capital Model [9].

The financial system has been extraordinarily successful at moving the capital to where it can create more financial value. But it has not been successful at moving capital to create social or environmental value. The result is large swaths of society and the environment that continue to need capital even as our global economy grows year over year. The resulting tension between those that have and those that need capital is leading to new frameworks for how capital can be conceived, measured, and balanced [10]. These multi-capital approaches bear the potential to create more responsible and sustainable companies. However,

too frequently, multi-capital approaches are presumed to lead to inclusive or equitable distribution [11].

David Alexander and Veronique Blum emphasized attention that German sociologist Niklas Luhmann (1927–1998) said that multi-capital approach development is the only way for sustainable reporting development. Niklas Luhmann with the highly topical issue of sustainability reporting. Luhmann sought a detailed description of the world asset of complex systems which applied to ecology. Consistent with Luhmann's approach was found a coherent way of understanding and analyzing the complex set of systems and sub-systems involved in the multi-capital, multi-measurement-unit, multi-stakeholder, and multi-motivated current content of the sustainability issue [12].

Brestovanska Eva and M. Medved derive a system of differential equations on time scales of the Solow type corresponding to a production function depending on several capitals. A sufficient condition for the exponential stability of the steady-state solution with positive coordinates is proved. The obtained results are applied to the case of the Cobb-Douglas type production function [13]. In the Mariia Evdokimova and Sergei A. Kuzubov working paper, it was revealed that companies publishing non-financial reports have a lower COC. COD, COE, and WACC reduce after NFR. Six industries, where the cost of equity and debt capital is lower for companies publishing NFR, were determined: consumer discretionary, energy, industrials, information technology, healthcare, and materials. According to the analysis, companies that issued non-financial reports have a lower COE capital growth rate. [14]. In response to pressure from civil society and investors, the corporate sector has developed multi-capital accounting to report on a company's impact on natural, social, and human capital [15, 16].

1.2. How Non-financial Factors Influence Sustainable Growth

Concerning social responsibility questions, Chami et al. [17] and Scholtens and Dam [18] showed that green finance and Equator Principles might obtain social recognition and reputation by providing financial institutions successfully and improving financial results. However, the research on green finance evaluation lacks precise quantitative norms and statistical data. The scientific literature includes numerous articles in which the interrelation between Energy, Economy, and Environment is identified with the nomenclature "3E" [19, 20].

Nowadays society traditionally educates the generation of economic capital, mainly for the benefit

of shareholders or other providers of financial capital. In the same way, oil and gas companies are concerned about financial capital globally [21]. However, we also recognize the enormity of the environmental footprint our economic growth has left over the last 250 years and the ever-growing disparity between that footprint's annual demands and the biosphere's capacity to support them. Many researchers therefore believe the world needs to attend to the quality and sufficiency of all its vital capitals, not just its economic capitals.

China's oil and gas companies' have implemented energy factors in the annual reporting, like Energy Return on Investment (EROI) [22, 23]. In the same way, some companies used energy efficiency indicators [8, 24]. While the current growth rate could not easily be met by renewable energy technologies (capacity expansion is slower on an absolute scale than conventional technologies), it is also apparent that renewable energy holds solutions to two of the three E's: environment and energy [25], [26–28]. It is reasonable to use the 3E methodology for building energy efficiency too [29].

Steblyanskaya with co-authors fulfilled research concerning influencing nonfinancial factors on the China oil and gas companies' sustainable growth. The result showed that EROI, ROEnv, and RER influence sustainable growth in a serious way [30–32].

2. METHODOLOGY

2.1. Data

This paper took into consideration the biggest Chinese oil and gas companies' financial data. The study focused on CNPC, Sinopec, and CNOOC data between the years 1996 and 2020. Internal companies' indicators were divided into energy, environment, and social data. A list of indicators used in the study is included in Appendix A. Full dataset is available under reasonable request. The python package SciPy and scikit-learn were used in the implementation of linear and polynomial regression models respectively. SciPy's statistics module was employed to perform linear regression models to obtain the Pearson correlation coefficient (coefficient of determination).

2.2. Sustainable Growth Indicators

In this study we used calculations of the Higgins sustainable growth rate (SGR) [2] and Ivashkovskaya sustainable growth index (SGI) [3, 33] for the evaluation of how non-financial indicators influence companies' sustainable growth.

Higgins R. proposed a model of sustainable growth — a tool for effective interaction between the operating policies, financing policies, and strategies for growth [2]. According

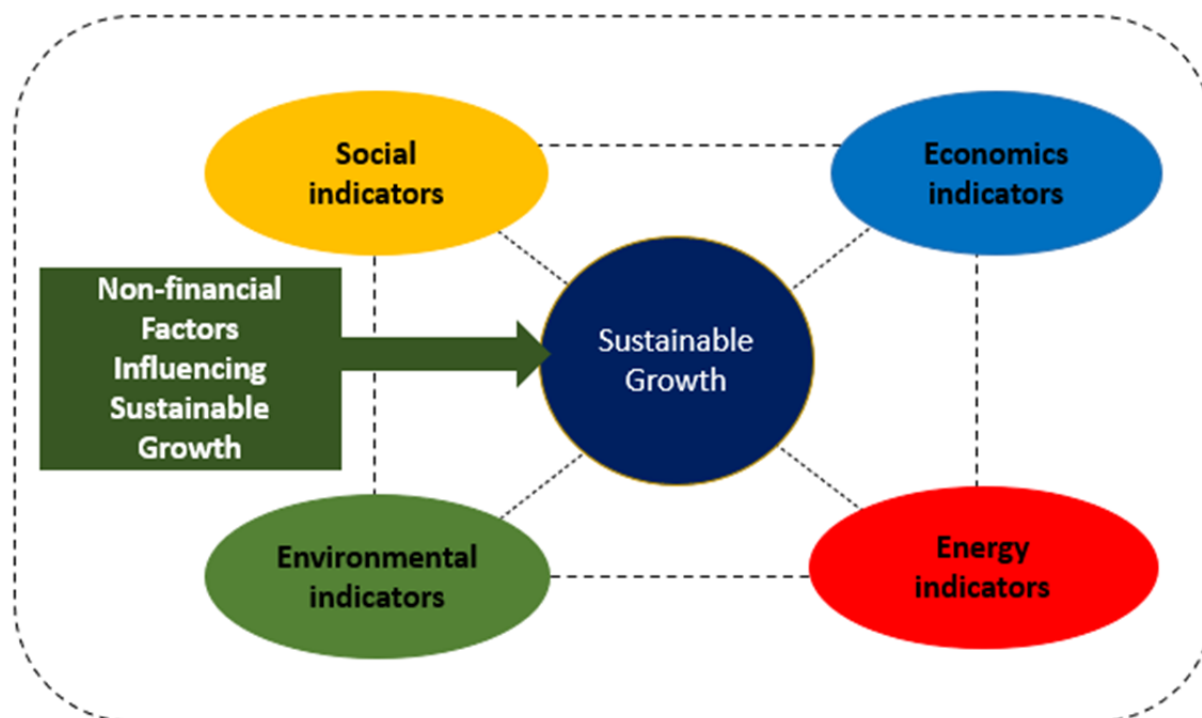


Fig. 1. Non-financial indicators influence sustainable growth

Source: authors' vision.

to Higgins, “the enterprise’s financial sustainable growth rate (SGR) refers to the biggest increasing sales by enterprises under conditions of financial resources are not exhausted”. Factors such as industry structure, trends, and position relative to competitors can be analyzed to detect and use special features. A sustainable growth rate is usually expressed as follows:

$$SGR = f(P, R, A, T), \quad (1)$$

where SGR — is the index of sustainable growth, expressed in percent;

P — Profit after taxes;

R — The Rate of reinvestment;

A — Turnover of assets;

T — The Ratio of assets to Equity or Financial leverage.

Irina Ivashkovskaya and Elene Zivotova presented the rationale for a new tool for financial analysis of the company’s growth — the growth sustainability index. The proposed tool develops the concept of substantiating the company’s market strategies based on the economic profit created in it. The method and results of empirical testing of the analysis of growth sustainability on a sample of 26 large Russian companies are shown.

Thus, to analyze and assess the sustainability of the company’s growth, a comprehensive indicator is

needed, in which key factors of economic profit are integrated. Ivashkovskaya and co-authors suggested using the following index [34]:

$$SGI = (1 + g_s) \times \frac{1}{k} \times \sum_{i=1}^k \max[0, (ROCE_i - WACC_i)], \quad (2)$$

where $1 + g_s$ — average sales growth rate;

k — number of years of observations;

l — number of years during which the return-on-investment capital spread is positive;

$ROCE_i$ — return on capital employed per year;

$WACC_i$ — weighted average cost of capital per year.

The direct introduction of spread values into the sustainable growth index focuses on two different directions of creating a positive spread: increasing the return on capital and reducing the cost of capital.

2.3. Methodological Base

A multi-capital approach looks at all capitals (financial and natural, social, human, built, etc.) not with an eye toward maximizing them, but rather dynamically balancing them amongst each other, and importantly, maintaining the health of their cycles (through regeneration of flows from originating stocks) within the carrying capacities of these resources.

Figure 1 shows the research scheme, where the authors analyze the interrelations between sustainable growth indicators and energy, economy, and environmental indicators. For evaluating the correlation between indicators, we use regression analysis. There are many regression methods available such as linear, polynomial, and multivariate regression. These regression methods are employed to investigate relationships between a phenomenon of interest and its features or variables. In this work, we investigate the relationship between sustainable growth rates data (as provided by Higgins and Ivashkovskaya) and non-financial features such as environmental capital, human and social. To answer whether some features influence the growth rates and to what extent.

We seek to find a function that maps these features or variables to the sustainable growth rates sufficiently well to get an estimator for future sustainable growth rates. Our dependent variable, in this case, is sustainable growth rates denoted by SGR and SGI for Higgins and Ivashkovskaya respectively.

The independent variables are environmental capital features denoted by EROI, PRP, ES, ROEnv. Human capital features are denoted by RoL, RER. Human capital features are denoted by ROEsr. Both dependent and independent variables are continuous and normally distributed.

We investigate these relationships by first performing linear regression and 2nd to 8th order polynomial regression analysis on each instance of the independent and dependent variables. In implementing linear regression of the dependent variable $y = (SGI \text{ or } SGR)$ on the set of independent variables

$$x = (EROI, PRP, ES, ROEnv, RoL, RER, ROEsr),$$

we assume the linear relationship between y and x : $y = \beta^0 + \beta^1 x^1 + \dots + \beta_r x_r + \varepsilon$.

Where $\beta_0, \beta_1, \dots, \beta_r$ are the regression coefficients, and ε is the random error.

Linear regression calculates the predicted weights, denoted with b_0, b_1, \dots, b_r , which defines the estimated regression function $f(x) = b_0 + b_1 x_1 + \dots + b_r x_r$. For polynomial, the regression function takes the form $f(x) = b_0 + b_1 x + b_2 x^2 + \dots + b_r x_r^r$. It is expected that this function captures the dependencies between the independent and dependent variables significantly well. Thus, the method of least squares is employed to minimize the sum of squared residuals (SSR) for all events

$$i = EROI, PRP, ES, ROEnv, RoL, RER, ROEsr : SSR = \sum_i (y_{SGR} - f(x_i))^2.$$

The Pearson correlation coefficient of determination, denoted by R^2 , measures the linear relationship between two datasets. It indicates the amount of variation in y that can be explained by the dependence on x using the regression model. A Larger R^2 indicates a better fit and means that the model can better explain the variation of the independent with different and dependent variables. Hence, $-1 < RI < 1$, with 0 implying no correlation. Correlations of -1 or $+1$ imply an exact linear relationship. Positive correlations imply that as x increases, so does y . Negative correlations imply that as x increases, y decreases and vice-versa.

3. RESULTS AND DISCUSSION

In the paper, we analyzed the SGI and SGR with the purpose of understanding which non-financial indicator will influence the sustainable growth rate more.

Figure 2 shows the coefficient of determination of SGI with the features expressed from the linear to 8th order regression explored. It is seen that, except for RER which has a negative correlation, all the features namely EROI, PRP, ES, ROEnv, RoL, and ROEsr have a positive correlation coefficient of determination and thus suggest some level of influence on the SGI. The magnitude of such influence is determined by the value of R^2 . Therefore, the exact values of R^2 is seen in table 1 below. Therefore, there is enough evidence to support the claim that the non-financial features EROI, PRP, ES, ROEnv, RoL, and ROEsr have a significant positive relationship with SGI.

Again, it can be observed that the order of polynomial regression has a significant determination on the magnitude of such a relationship. Increasing the order of polynomial regression increases the fit between the features and SGI. The effect of the polynomial increase is however maxed out on the 4th order polynomial regression for EROI, PRP, ES, and ROEsr. Whilst ROEnv and RoL have the highest correlation on the 8th order polynomial regression.

It can also be deduced that the 4th order polynomial regression:

SGI verse EROI:

$$y = 0.1633594 + 1.0576463x - 24.0784120x^2 + 137.0858166x^3 - 248.0717506x^4, R^2 = 0.0676965$$

SGI verse PRP:

$$y = 0.1918784 - 6.1934256x + 139.0819089x^2 - 1068.048928x^3 + 2638.9344516x^4, R^2 = 0.1136183$$

SGI verse ES:

$$y = 0.9178820 - 0.0011764x + 0.0000006x^2 - 1.29E - 10x^3 + 9.64E - 15x^4, R^2 = 0.1461317$$

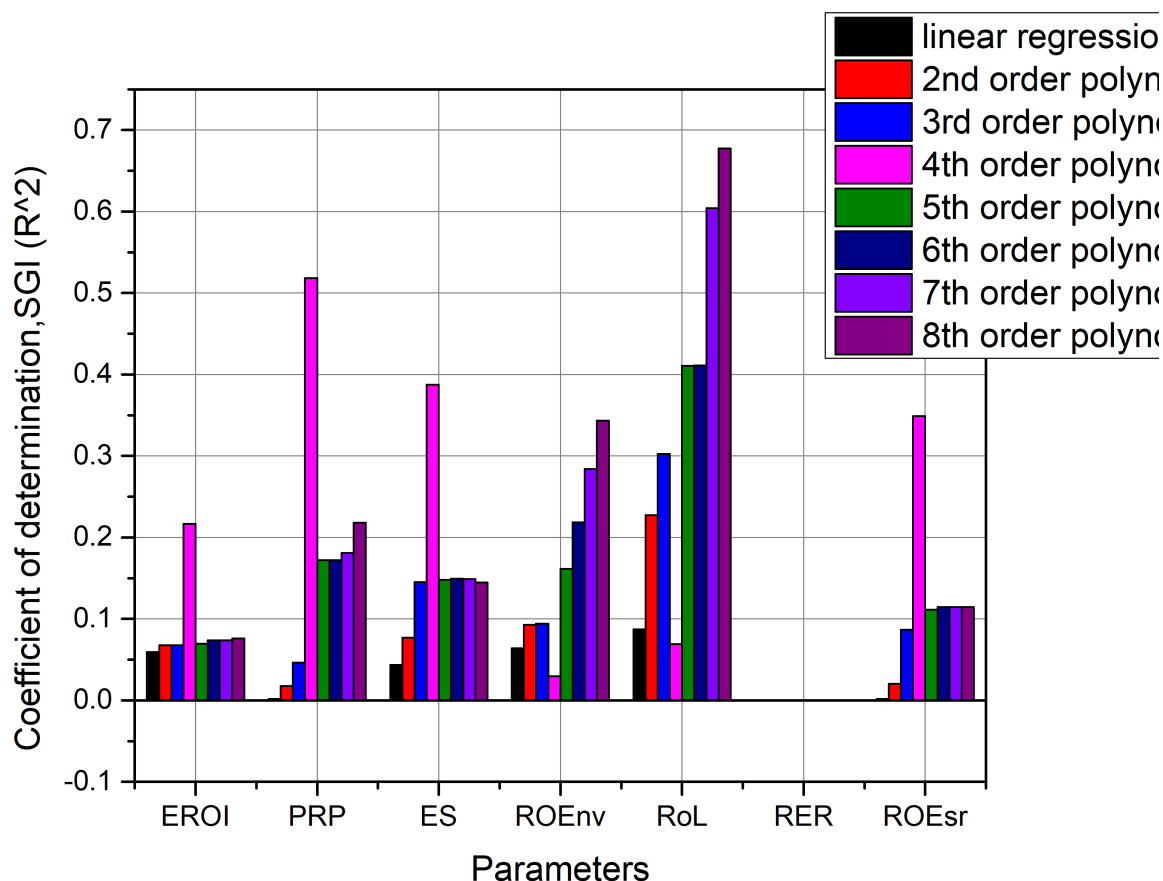


Fig. 2. Coefficient of determination of features with SGI for linear to 8th order polynomial regression

Source: authors' calculations.

SGI verse ROEsr:

$$y = 1.0839354 - 67.8717151x + 1673.8930564x^2 - 17139.45041x^3 + 62006.47505x^4, R^2 = 0.1011466$$

SGI verse ROEnv:

$$y = 1.9050217 - 344.7190396x + 24277.7789104x^2 - 824660.5207x^3 + 15246982.85x^4 - 160407538.8x^5 + 948660837.4x^6 - 2902121369x^7 + 3547344946x^8, R^2 = 0.3432300$$

SGI verse RoL:

$$y = -13.9212974 + 726.7650830x - 15059.8085693x^2 + 161692.2653x^3 - 977313.7548x^4 + 3405013.097x^5 - 6752103.714x^6 + 7067345.133x^7 - 3029118.311x^8, R^2 = 0.6775944$$

Figure 3 shows detailed correlation SGI with EROI, ES, PRP and ROE_{sr} .

Figure 4 shows a detailed correlation of SGI with ROE_{env} and Ro L.

Please, see the detailed calculations in Tables 1–3.

Single EROI, PRP, ES, and ROEsr show a significant positive correlation to SGI at the 4th polynomial regression, they are all combined to form a linear multivariate polynomial regression to obtain a final function that maps the relationship significantly.

In the case of SGR, as shown in Figure 5, there is also a positive correlation of SGR with all features except for PRP which has a slightly negative to zero correlation. With PRP showing the strongest correlation, followed by ES, ROEsr, EROI, RoL, and then ROEnv in order of decreasing correlation. The correlations in SGR show a continuous increase with increasing order of polynomial regression as opposed to SGI which showed no widespread increase in correlation after the 4th order polynomial, except in the case of ROEnv and Ro L.

The feature RER has zero correction because the data points are constant. Consequently, there are no variations in the data points. Hence do not influence both SGI and SGR.

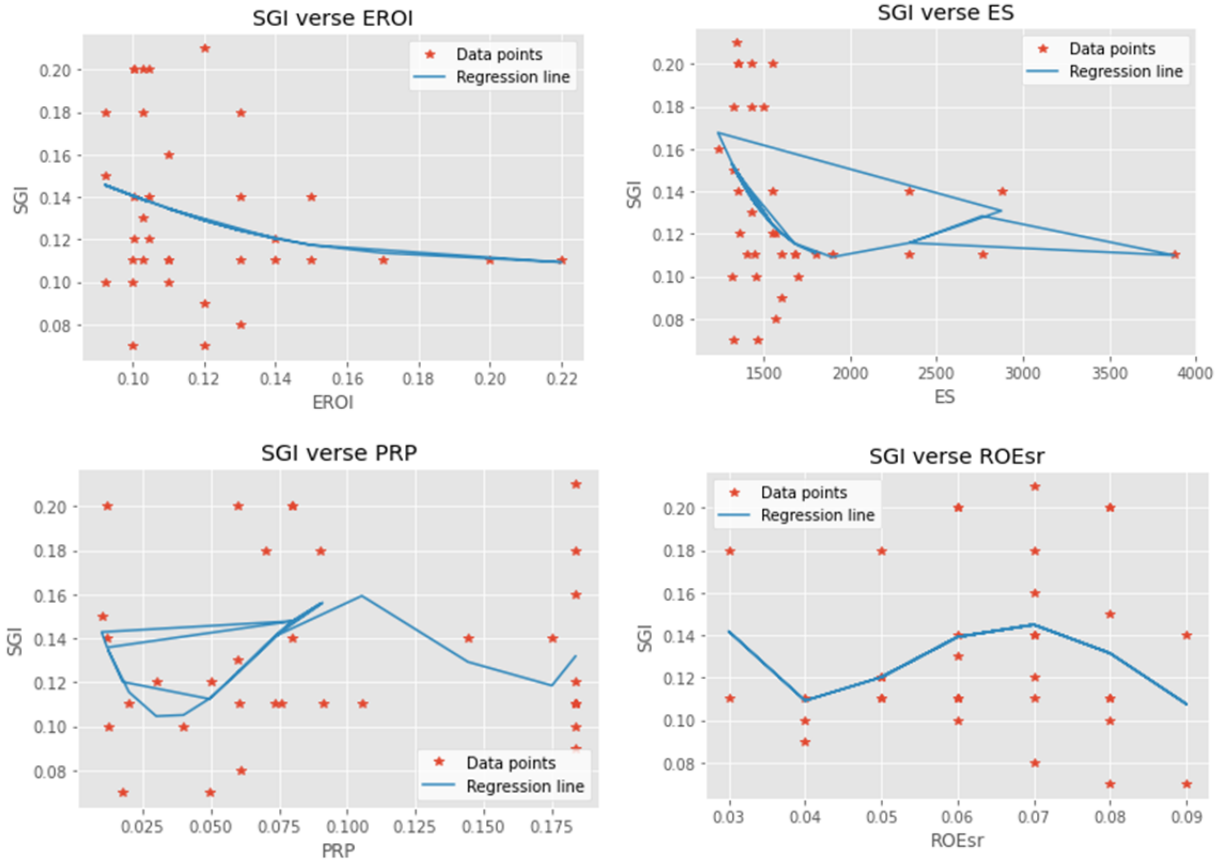


Fig. 3. Plot of 4th order polynomial regression of SGR_{iv} with individual features: EROI, ES, PRP, roesr

Source: authors' calculations.

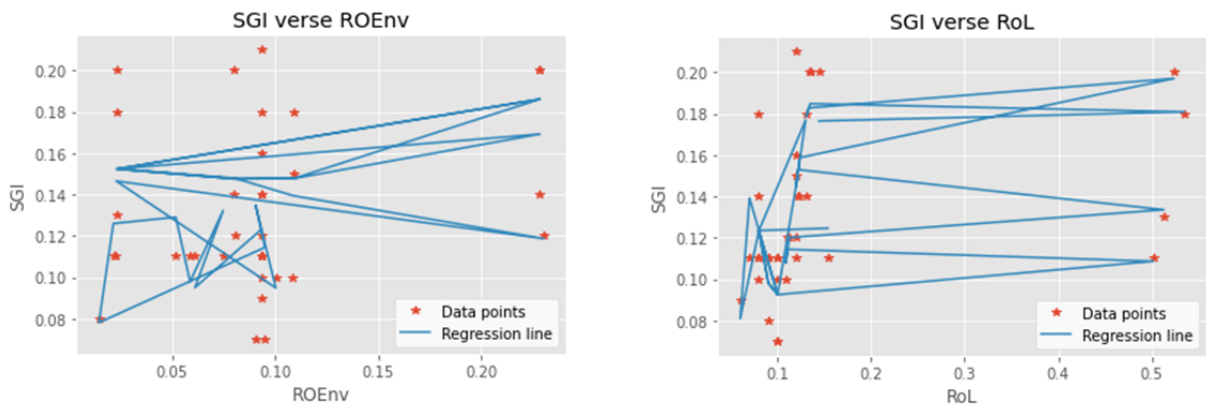


Fig. 4. Plot of 8th order polynomial regression of SGI with social and environmental coefficients

Source: authors' calculations.

SGR verse EROI:

$$y = -377.6863593 + 22662.48585x - 588267.0465x^2 + 8626723.633x^3 - 78152213.19x^4 + 447762514.8x^5 - 1583956781x^6 + 3162220431x^7 - 2727168475x^8, \\ R^2 = 0.2608748452$$

SGR verse ES:

$$y = 0.0252724484 - 5.25E - 30x + 6.14E - 21x^2 - 1.95E - 23x^3 - 2.28E - 20x^4 - 1.58E - 17x^5 + 1.63E - 20x^6 - 5.47E - 241x^7 + 5.98E - 28x^8, \\ R^2 = 0.3468527717$$

Table 1

4th order polynomial regression coefficients and R²

	4th order	intercept	Coefficients			
	R ²	b ₀	b ₁	b ₂	b ₃	b ₄
EROI	0.0676965	0.1633594	1.0576463	-24.0784120	137.0858166	-248.0717506
PRP	0.1136183	0.1918784	-6.1934256	139.0819089	-1068.048928	2638.934451
ES	0.1461317	0.9178820	-0.0011764	0.0000006	-1.29E-10	9.64E-15
ROEnv	0.1581626	0.0129479	9.1785511	-201.3707226	1597.916548	-3846.148708
RoL	0.3722127	0.2444385	-4.4463105	43.6525574	-130.6186373	120.1394892
ROEsr	0.1011466	1.0839354	-67.8717151	1673.8930564	-17139.45041	62006.47505

Source: authors' calculations.

Table 2

8th order polynomial regression coefficients and R²

	8th order	intercept	Coefficients							
	R ²	b ₀	b ₁	b ₂	b ₃	b ₄	b ₅	b ₆	b ₇	b ₈
ROEnv	0.343229991	1.905021	-344.719039	24277.7789	-824660.52	15246982.8	-160407538.	948660837.	-290212136	3547344946
RoL	0.67759444	-13.921297	726.765083	-15059.8085	161692.26	-977313.754	3405013.09	-6752103.71	7067345.13	-3029118.311

Source: authors' calculations.

Table 3

Table of the correlation coefficients of SGI with all parameters from the linear regression to the 8th order regression

Parameters	R ² (SGI)							
	linear	2 nd order	3 rd order	4 th order	5 th order	6 th order	7 th order	8 th order
EROI	0.0594	0.0675	0.0676	0.0677	0.0695	0.0737	0.0737	0.0758
PRP	0.0019	0.0177	0.0462	0.1136	0.1719	0.1719	0.1807	0.2181
ES	0.0435	0.0769	0.1453	0.1461	0.1480	0.1493	0.1487	0.1447
ROEnv	0.0639	0.0929	0.0940	0.1582	0.1616	0.2186	0.2837	0.3432
RoL	0.0869	0.2271	0.3023	0.3722	0.4106	0.4111	0.6044	0.6776
RER	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROEsr	0.0017	0.0201	0.0866	0.1011	0.1114	0.1145	0.1145	0.1145

Source: authors' calculations.

SGR verse PRP:

$$y = 0.06385453633 - 9.952344456x + 675.6822926x^2 - 22262.70369x^3 + 405507.9399x^4 - 4276838.995x^5 + 25896465.68x^6 - 83207537.77x^7 + 109583896.1x^8,$$

$$R^2 = 0.5950886545$$

SGR verse ROEsr:

$$y = 1.41616219 - 161.0682442x + 7446.784405x^2 - 179117.6437x^3 + 2366291.403x^4 - 16126684.43x^5 + 42141609.86x^6 + 18913043.85x^7 + 4700468.791x^8,$$

$$R^2 = 0.3607652186$$

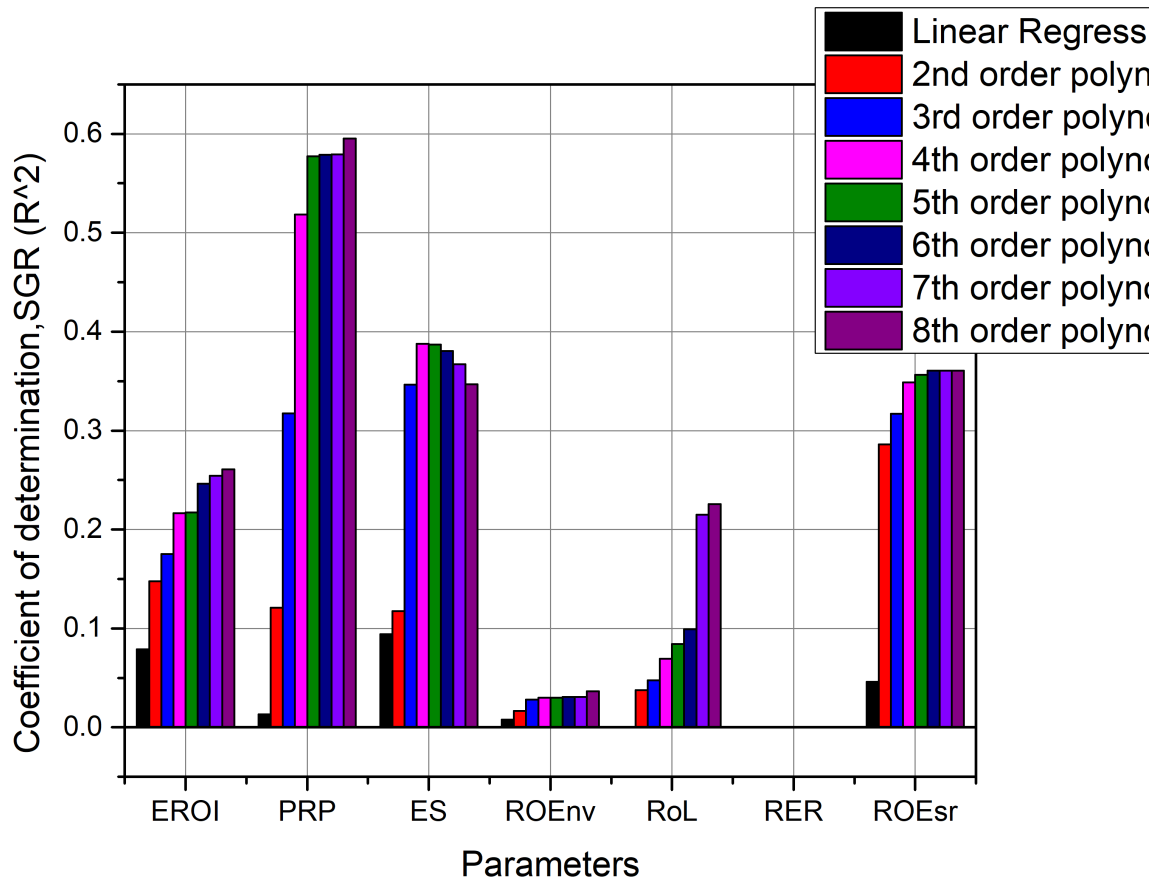


Fig. 5. Coefficient of determination of features with SGR from linear to 8th order polynomial regression

Source: authors' calculations.

SGR verse ROEnv:

$$y = 0.1789796526 - 28.65621749x + 1856.517925x^2 - 59036.57124x^3 + 1036874.695x^4 - 10485694.29x^5 + 60180501.33x^6 - 180066081.5x^7 + 216563186x^8, \\ R^2 = 0.03641632218$$

SGR verse RoL:

$$y = -1.658893372 + 84.42928597x - 1703.836978x^2 + 17705.35134x^3 - 102294.378x^4 + 334990.4207x^5 + -616652.984x^6 + 594718.7362x^7 - 233943.3675x^8, \\ R^2 = 0.2258364275$$

Figure 6 shows a detailed correlation SGR with ROE_{env} , PRP, EROI, ES, ROE_{sr} , Ro L.

Please, see the detailed calculations in Table 4.

Figure 7 shows SGI is more correlated with environmental, energy, and social coefficients used in our study.

Multivariate linear regression with all the positively correlated features gives the function:

$$SGI(EROI, PRP, ES, ROE_{env}, RoL, ROE_{sr}) = 0.06595061016801151 + 0.12670756390143945 * EROI + 0.12628401541077403 * PRP + -4.416662630818413e - 06 * ES + 0.3143022053244236 * ROEnv + 0.15729076179055257 * RoL + 4.416663587664127e - 06 * ROEsr$$

$$SGR(EROI, PRP, ES, ROE_{env}, RoL, ROE_{sr}) = -0.006416830576369234 + 0.07445738465165233 * EROI + 0.01425364038750357 * PRP + 1.244561168310676e - 06 * ES + 0.04280166790648274 * ROEnv + 0.01673734154952822 * RoL + 1.2445606376587648e - 06 * ROEsr$$

Thus, we could observe that both sustainable growth rates correlated with non-financial indicators. However, SGI is more correlated with the energy and environmental issues.

Table 4

Table of the correlation coefficients of SGR with all parameters from the linear regression to the 8th order regression

Parameters	R^2 (SGR)							
	linear	2 nd order	3 rd order	4 th order	5 th order	6 th order	7 th order	8 th order
EROI	0.0790	0.14761	0.17509	0.21667	0.21733	0.24626	0.25432	0.26087
PRP	0.0131	0.12089	0.31743	0.51851	0.57732	0.57877	0.57912	0.59509
ES	0.0940	0.11734	0.34637	0.38753	0.38691	0.38040	0.36708	0.34685
ROEnv	0.0078	0.01658	0.02801	0.02979	0.02986	0.03085	0.03087	0.03642
RoL	0.0004	0.03773	0.04746	0.06916	0.08413	0.09905	0.21492	0.22584
RER	0.0000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
ROEsr	0.0461	0.28623	0.31682	0.34880	0.35637	0.36077	0.36077	0.36077

Source: authors' calculations.

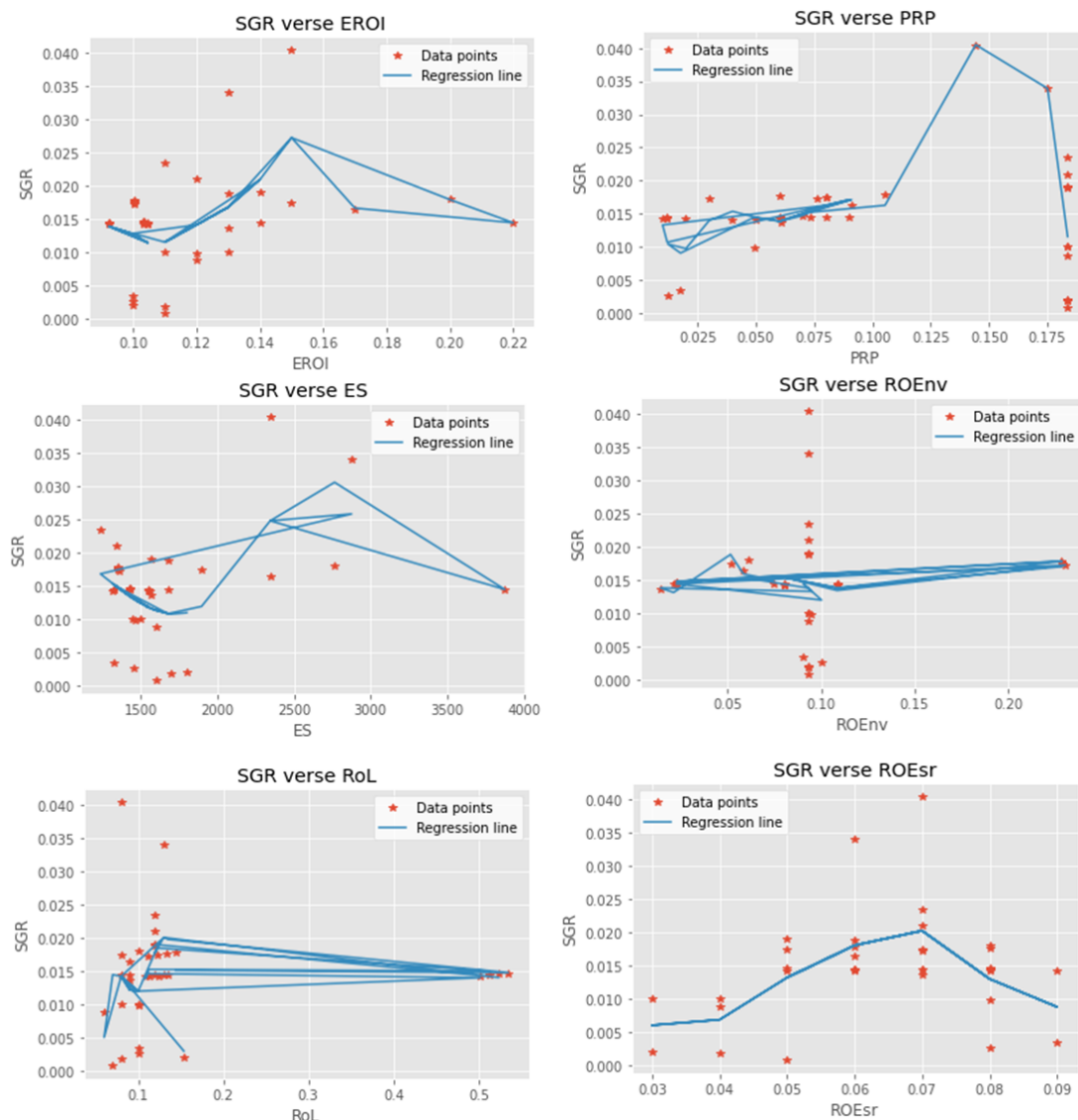


Fig. 6. Plot of 8th order polynomial regression of SGR with features EROI, ES, PRP, ROEsr, ROEnv, and RoL

Source: authors' calculations.

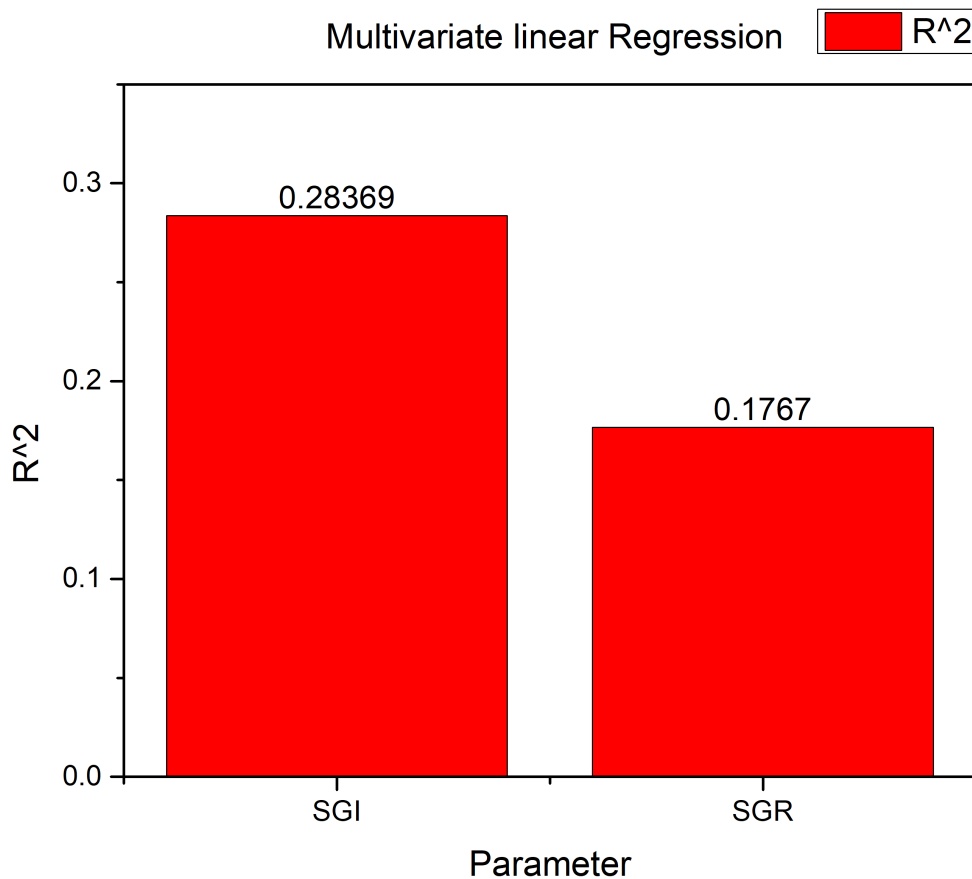


Fig. 7. Correlation coefficient of multivariate linear regression of both indices' types and features, with exception of RER

Source: authors' calculations.

CONCLUSION

Companies' economic growth leads to energy resource utilization and environmental degradation when pursuing rapid development [35]. Nowadays, the primary task for companies is to find such indicators for operating that could support environmentally-oriented sustainable growth. Thus, the inevitable way to protect Nature is to implement nonfinancial reporting at all company levels.

The research results are fruitful and lightful. There exists a significant relationship between the non-financial features and sustainable growth rates. Specifically, there is a significant positive correlation between individual non-financial features and sustainable growth rates. The non-financial elements show a stronger correlation

with SGI than that of SGR. The authors especially emphasize that SGI has strong correlations with energy indicators, like EROI and ES, social indicators, like RoL, and environmental indicators, like ROEnv. Thus, the research proved the China University of Petroleum (Beijing) Feng Lian Yong research group's results, where were found that EROI is the base for healthy and green economic growth (see, for example, [9]).

The research uniqueness is that the authors emphasized attention on the multi-capital approach with an accent on energy indicators. Thus, here is an exciting example of how non-financial indicators could move economics forward sustainability. It is recommended to companies' management to consider EROI, ES, ROEnv, ROEs, and RoL for non-financial reporting.

ACKNOWLEDGEMENTS

The authors thank reviewers for their great help and support. This research was supported by the Fundamental Research Fund for the Central Universities (Harbin Engineering University) (Projects Numbers: GK2090260229, XK2090021006010, GK2090260236), Heilongjiang Provincial Natural Science Foundation (Project number: LHG2021009), Ministry of Science and Technology of China high level foreign expert project (Project number: DL2021180001L). Harbin Engineering University, Harbin, China.

БЛАГОДАРНОСТИ

Авторы благодарят рецензентов за большую помощь и поддержку. Данное исследование было поддержано Фондом фундаментальных исследований для центральных университетов (Харбинский инженерный университет) (номера проектов: GK2090260229, XK2090021006010, GK2090260236), Фондом естественных наук провинции Хэйлуцзян (номер проекта: LHG2021009), проектом Министерства науки и технологий Китая для иностранных экспертов высокого уровня (номер проекта: DL2021180001L). Харбинский инженерный университет, Харбин, Китай.

APPENDIX

Table

Full list of indicators used in this study

Factors	Indices	Proxy	Source (date of access: 14.10.2021)
	Sustainable Growth Rate	SGR, SGI	CNPC https://www.cnpc.com.cn/en/ar2019/AnnualReport_list.shtml , Sinopec www.sinopec.com/.../reports/annual_report , CNOOC https://www.annualreports.com/Company/cnooc-limited
Energy indicators	Energy Return on Investments	EROI	CNPC https://www.cnpc.com.cn/en/ar2019/AnnualReport_list.shtml , Sinopec www.sinopec.com/.../reports/annual_report , CNOOC https://www.annualreports.com/Company/cnooc-limited
	Energy Savings	ES	
Environmental indicators	Return on environmental costs (costs concerning environmental protection)	ROEnv	CNPC https://www.cnpc.com.cn/en/ar2019/AnnualReport_list.shtml , Sinopec www.sinopec.com/.../reports/annual_report , CNOOC https://www.annualreports.com/Company/cnooc-limited
	Production/Reserves ratio	PRP	
Social indicators	Revenue per employee ratio (total revenue/total number of Employees)	RER	CNPC https://www.cnpc.com.cn/en/ar2019/AnnualReport_list.shtml , Sinopec www.sinopec.com/.../reports/annual_report , CNOOC https://www.annualreports.com/Company/cnooc-limited
	Return on social expenses (costs concerning employee benefits/net profit)	ROEsr	
	Return on Labour (number of employees/Net profit)	ROL	

Source: authors' calculations.

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ABOUT THE AUTHORS / ИНФОРМАЦИЯ ОБ АВТОРАХ



Alina N. Steblyanskaya — PhD, Assoc. Prof., School of Economics and Management, Harbin Engineering University, Harbin, China

Алина Николаевна Стеблянская — PhD, доцент Школы экономики и менеджмента, Харбинский инженерный университет, Харбин, Китай

<https://orcid.org/0000-0002-1995-4651>

Correspondence author / Автор для корреспонденции

alina_steblyanskaya@hrbeu.edu.cn



Mingye Ai — PhD, Assoc. Prof., School of Economics and Management, Harbin Engineering University, Harbin, China

Мингье Ай — PhD, доцент Школы экономики и менеджмента, Харбинский инженерный университет, Харбин, Китай

<https://orcid.org/0000-0002-4508-1284>

aimingye@hrbeu.edu.cn



Olga V. Efimova — Dr. Sci. (Econ.), Prof., Chairman of the Economics, Organization of Production and Management Department, Russian University of Transport (RUT), Moscow, Russia

Ольга Владимировна Ефимова — доктор экономических наук, профессор, декан кафедры «Экономика, организация производства и менеджмент», Российский университет транспорта (РУТ МИИТ), Москва, Россия

ovefimova@mail.ru

<https://orcid.org/0000-0002-1106-6131>



Georgiy B. Kleiner — Dr. Sci. (Econ.), Corresponding Member of RAS, Prof., Deputy Director, Central Economics and Mathematical Institute of RAS, Moscow, Russia; Chairman of the Department of System Analysis in Economics, Financial University, Moscow, Russia

Георгий Борисович Клейнер — доктор экономических наук, член-корреспондент РАН, профессор, заместитель научного руководителя, Центральный экономико-математический институт РАН, Москва, Россия; заведующий кафедрой системного анализа в экономике, Финансовый университет, Москва, Россия

george.kleiner@inbox.ru; GKleiner@fa.ru

<https://orcid.org/0000-0003-2747-6159>



Maksim A. Rybachuk — Cand. Sci. (Econ.), Senior Research Associate, Central Economics and Mathematics Institute of the Russian Academy of Sciences; Assoc. Prof., Financial University, Moscow, Russia

Максим Александрович Рыбачук — кандидат экономических наук, старший научный сотрудник лаборатории микроэкономического анализа и моделирования, Центральный экономико-математический институт РАН доцент, Финансовый университет, Москва, Россия

<https://orcid.org/0000-0003-0788-5350>

m.ribachuk@gmail.com

Authors' declared contribution:

A.N. Steblyanskaya — methodological base.

Mingye Ai — general conclusions and recommendations.

O.V. Efimova — data analysis.

G.B. Kleiner — theoretical part.

M.A. Rybachuk — modelling processes in the Python program.

Заявленный вклад авторов:

А.Н. Стеблянская — методологическая база.

Мингье Ай — общие заключения и рекомендации.

О.В. Ефимова — анализ данных.

Г.Б. Клейнер — теоретическая часть.

М.А. Рыбачук — процесс моделирования в программе Питон.

Conflicts of Interest Statement: The authors have no conflicts of interest to declare.

Конфликт интересов: авторы заявляют об отсутствии конфликта интересов.

The article was submitted on 15.04.2022; revised on 29.04.2022 and accepted for publication on 17.05.2022.

The authors read and approved the final version of the manuscript.

Статья поступила в редакцию 15.04.2022; после рецензирования 29.04.2022; принята к публикации 17.05.2021.

Авторы прочитали и одобрили окончательный вариант рукописи.