уверенностью утверждать, что роль потребителей в формировании прибыли и конкурентоспособности предприятия носит, если не определяющий, но уж точно индикативный характер.

Таким образом, резюмируя выше сказанное, можно сказать, что прибыль, с точки зрения комплексного анализа, – это показатель, характеризующий конечные результаты деятельности не только конкретного субъекта, но и всей национальной (а все чаще глобальной) экономической формации в целом. Формирование прибыли – это сложный многогранный процесс, находящийся под влиянием качества и плодотворности функционирования всех действующих в экономике контрагентов. Бизнес невозможен без взаимодействия с внешней средой – инфраструктурой, государством, потребителями. Если инфраструктура, государственная политика, социальная обстановка нерациональны и неэффективны, то это в конечном итоге выльется в неразрешимые проблемы формирования прибыли компаний. Также, и наоборот, если государство (инфраструктура, общество, потребители) заинтересовано в увеличении своих доходов и прочих показателей экономического роста, оно должно придерживаться стимулирующего курса для развития бизнеса в стране.

1. Грачик М.Е. Влияние инвестиций в человеческий капитал на экономический роста предприятия и проблемы управления человеческими ресурсами // ТДР. - 2011. - №2.
2. Ефимова О.В. Финансовый анализ. – М.:Бухгалтерский учет, 1998.
3. Колодня В.Г. Роль потребителя в процессе повышения уровня конкурентоспособности современного бизнеса // Финансы и кредит. - 2013. - №47(575).
4. Ульянина А.С., Молчанова А.Г. О некоторых проблемах формирования финансовых результатов деятельности предприятий // Молодой ученый. – 2016. - №9.
5. [Электронный ресурс]. - <https://hr.superjob.ru>
6. [Электронный ресурс]. - <https://www.transparency.org>
7. [Электронный ресурс]. - <https://cybernetics.wikia.org>

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Mathematical modeling of the impact of sanctions on the prices of gold mining companies

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Abstract

The paper examines the impact of sanctions imposed on Russian companies in April 2018 on the change in the price of gold mining companies' shares. The change in the structure of demand for gold indicates the instability of the global economy, which leads to the withdrawal of the accumulation of gold and foreign exchange reserves to the "quiet" harbor, including in the form of jewelry. A statistical analysis of the dynamics of the price for shares for the years 2017 and 2018 of the two largest gold mining companies PJSC "Polyus Gold" and Barrick Gold did. The conducted correlation analysis revealed the dependence of the change in the prices of shares of resource-producing companies on the cost of the resource itself, confirming the Dow theory, as well as political influences in the form of sanctions.

Key words: sanctions, gold, gold mining companies, correlation analysis, statistical analysis of indicators dynamics.

The company's entry into the stock market is always associated with attracting investments that could be used to expand production and to replace outdated equipment. In addition, it enables the company to assess the real value of its production at the global level.

The analysis is based on the well-known assumption that the value of shares of companies depends on the prices of goods they produce. Logically, the correlation is obvious: according to a fundamental analysis, the change in the price of goods produced by a company should lead to a change in profit, whereas according to a technical analysis and the Dow Theory, the value of shares should take it into account [1].

Gold was chosen as the most convenient commodity to analyse this statement.

Gold is the most popular precious metal in the world. It is used for jewellery purposes as well as for investment and production purposes. In Figure 1 is shown the distribution of demand for gold by category over the past two years. The cost of gold per ounce in dollars is shown in Figure 2

Figure 1 – Gold demand structure by category in 2016 and 2017, %.

Source: according to the Polymetal mining company and [2] and World Gold Council [3].

According to Figure 1, there is a change in the structure of demand for gold in the following categories: a decline in the share of investment in gold by 7% compared with 2016 and an increase in the use of gold in the jewellery industry by 6%.

Among the largest producers that are listed on the stock exchanges, we can distinguish PJSC Polyus Gold and Canadian mining company Barrick Gold. The value of gold is determined at the exchange trading during the trading session. For calculations, the price of gold was taken on the liquid and well-known COMEX exchange (part of the CME group - the Chicago Commodity Exchange).

13.04.2018	13,15	0,46	103,62%	3,50%	-3,72	77,67%	-22,33%
20.04.2018	13,17	0,02	100,15%	0,15%	-3,70	77,79%	-22,21%
AVERAGE	15,90	-0,05	99,70%	-0,44%	-0,97	93,92%	-6,08%

As the data in Table 1 shows, the price of a company's shares fluctuated throughout the year. By the end of 2017, the price of the company's shares fell by \$1.98, and amounted to 88% of the price at the beginning of 2017. The highest growth was observed on 13/02/2017 up to 119.4%, on 10/04/2017 up to 117.13% of the cost in January 2017. By the end of 2017, the share price of the company declined by an average of 1%. The average share price for 2017 was \$16.7. In 2018 (by 20.04.2018), the share price fell by 11.93% compared to the end of 2017. The average share price fell to \$15.9.

Table 2

*Relative and absolute values of the dynamics of changes in the shares price of the company
PJSC Polyus Gold*

Date	PJSC Polyus Gold's share price	Absolute chain increment, rub.	Chained growth rate	Chained rate of increment	Base absolute increment	Base growth rate	Base increment rate
1	2	3	4	5	6	7	8
02.01.2017	4527	0	100,00%	0,00%	0	100,00%	0,00%
09.01.2017	4527	0	100,00%	0,00%	0	100,00%	0,00%
16.01.2017	4613	86	101,90%	1,90%	86	101,90%	1,90%
23.01.2017	4609	-4	99,91%	-0,09%	82	101,81%	1,81%
...	...	...	...	...	...	...	...
06.04.2018	4359	-161	96,44%	-3,69%	-168	96,29%	-3,71%
13.04.2018	3550	-809	81,44%	-22,79%	-977	78,42%	-21,58%
20.04.2018	3790	240	106,76%	6,33%	-737	83,72%	-16,28%
AVERAGE	4455,4	-10,8	99,81%	-0,33%	-71,6	98,42%	-1,58%

For 2017, the shares of PJSC Polyus Gold mainly lost in price. The greatest growth can be noted on 13/11/2017 to 111.99%, the most significant drop was recorded on 13/04/2018 to 78.42% relative to 02/01/2017, i.e. the fall at this time was 21.58%. Thus, by April 20, 2018, the average value of the share amounted to 4455.4, while the value of the share price relative to January 2, 2017 decreased by 1.58%.

In 2017, both companies recorded a decrease in the value of shares by approximately 2%, despite the price increase of the product being produced. In 2018, the value of gold continued to grow, while the value of Barrick Gold shares from 02/01/2017 to 20/04/2018 decreased by 22.21%, and the value of shares of PJSC Polyus Gold - by 16.28%.

Figure 3 shows the dynamics of changes in the value of shares of companies during 2017.

a) Timeline of PJSC Polyus Gold's share value

б) Timeline of Barrick Gold's share value

Figure 3 - the Dynamics of changes in share prices of selected companies

Next, we will conduct a correlation analysis. In order to determine the impact of sanctions on stocks and gold, a correlation analysis will be carried out: 1) for the entire period (from 02/01/2017 to 04/04/2018); 2) before the sanctions (from 02/01/2017 to 03/30/2018); 3) after the sanctions (from 04/06/2018 through 04/20/2018). We find the pair correlation coefficients, where X is the price of gold, Y is the price of shares of mining companies. Calculations will be carried out using the software MS Office Excel.

The results are given in tables 3, 4, 5.

Table 3

Correlation table for the data for the entire period

variable	Gold, \$ per ounce	Barrick Gold's share value, \$	the Polyus Gold's share value, rub	USD/RUB	the Polyus Gold's share value, \$
Gold, \$ per ounce	1				
Barrick Gold's share value, \$	-0,48	1			
the Polyus Gold's share value, rub	0,06	-0,12	1		
USD/RUB	-0,40	-0,03	-0,39	1	
the Polyus Gold's share value, \$	0,18	-0,11	0,96	-0,63	1

As can be noted, for the entire period, the correlation between the value of gold and the value of Barrick Gold shares is moderate inversive, i.e. with the increase in the price of gold, the value of shares decreases; There is practically no dependence between the value of gold and the price of Polyus Gold PJSC shares in rubles, but in dollars it is direct but weak, i.e. with the increase in the price of gold, the value of shares in dollars grows, but only slightly, and in rubles almost does not change. This trend can be explained by a moderate dependence between gold and the dollar (as gold grows, the ruble strengthens against the dollar), although this does not diminish the unusualness of this phenomenon.

Table 4

Correlation table for the data for the pre-sanction period

variable	Gold, \$ per ounce	Barrick Gold's share value, \$	the Polyus Gold's share value, rub	USD/RUB	the Polyus Gold's share value, \$
Gold, \$ per ounce	1				
Barrick Gold's share value, \$	-0,44	1			
the Polyus Gold's share value, rub	0,21	-0,29	1		
USD/RUB	-0,62	0,10	-0,19	1	
the Polyus Gold's share value, \$	0,39	-0,29	0,95	-0,49	1

Now let us analyze the situation before the introduction of sanctions against Polyus Gold PJSC: the relationship between the price of Barrick Gold shares and gold is slightly lower, while it is also inverse; The dependence of the share price of PJSC Polyus Gold on gold is noticeably higher than for the entire period, while in rubles it is significantly less than in dollars. The relationship between the dollar / ruble pair is just the opposite, but already noticeable.

Let us turn to the most interesting - let us analyze the situation after the imposition of sanctions: the relationship between the price of gold and the price of Barrick Gold shares has changed and now has become direct and noticeable; The relationship between the price of gold and the price of PJSC Polyus Gold shares in both dollars and rubles has become reverse and noticeable. The relationship between the dollar / ruble pair and gold has changed similarly - it has become direct and noticeable, i.e. the ruble declined both against the dollar and against gold (Table 5).

Table 5

Correlation table for post-sanction data

variable	Gold, \$ per ounce	Barrick Gold's share value, \$	the Polyus Gold's share value, rub	USD/RUB	the Polyus Gold's share value, \$
Gold, \$ per ounce	1				
Barrick Gold's share value, \$	0,55	1			
the Polyus Gold's share value, rub	-0,51	-0,25	1		
USD/RUB	0,50	0,24	-0,81	1	
the Polyus Gold's share value, \$	-0,53	-0,27	0,99	-0,88	1

The situation that occurred after the imposition of sanctions can be explained as follows. Since the introduction of sanctions the tension growth has increased, which triggered the growth in demand for gold, as it traditionally considered the most reliable asset during the crisis. It is likely that potential problems for PJSC Polyus Gold, caused by the sanctions, could affect the balance of supply and demand, because this company is a major producer of gold. Therefore, with an increase in the value of gold in dollars, the value of shares of PJSC Polyus Gold significantly decreased due to potential problems. At the same time, the relationship between the value of gold and the price of Barrick Gold shares changed and became direct. This can be explained by the fact that the cost of shares of this company was influenced by the possibility of eliminating a competitor in the market, but over the entire period the correlation between the price of gold and Barrick Gold's shares value remained inverse and even increased.

This trend was noted by analysts in 2015. According to analysts, “In the past decade, investors have preferred to buy gold itself, rather than stocks of its mining companies,” writes Goldman Sachs. This led to a paradoxical situation: since 2002, the metal price has increased by 335% in nominal terms, and the NYSE Arca Gold Miners Index, which includes 40 global publicly traded gold and silver companies, has decreased by 45%.[6]

Despite forecasts of an increase in the shares of these companies in 2015, the downward trend remained in 2017. This is due to the fact that gold mining companies are still conducting geological exploration. They spend the profit on the sale of their goods and stocks on investment in production. Investors who buy shares of gold mining companies are hoping for dividend profit. If the price of gold falls, companies will reduce costs, dismissing employees, reducing metal production, development and the search for new deposits. Therefore, in many respects investments in gold mining companies depend on the profitability of this business.

Based on the above data, we can conclude that a logical relationship between the value of gold and the price of gold mining companies' shares is not observed, so when choosing an asset for investment while maintaining the observed dependencies, you should choose the underlying asset, gold.

1. Burilich I.N., Zhuravleva E.V., Skripkina E.V. “The task of checking the homogeneity of two independent samples” [Text] / Tidings of South-West State University. Series: Management, Computer Engineering, Computer Science. Medical Instrument. - Kursk: SWSU - 2016. № 1 (18). pp. 62-65.
2. Murphy J. Technical Analysis of the Futures Markets: A Comprehensive Guide to Trading Methods and Applications. Moscow, Sokol Publ., 1996. 592p.
3. Official site of “Barrick” company. Available at: <https://barrick.com/> (last accessed: 24 Dec. 2018)
4. Official site of “Polymetal” company. Available at: <https://www.polymetalinternational.com/ru/> (last accessed: 24 Dec. 2018)
5. Official site of PJSC Polyus Gold. Available at: <http://polyus.com/ru/> (last accessed: 24 Dec. 2018)
6. Poznyakov A. “The United States imposed sanctions against Russian oligarchs”. Article. Available at: <http://ru.euronews.com/2018/04/06/us-ru-oligarchs-sanctioned> (last accessed: 24 Dec. 2018)
7. Verenikin A. “Is it worth buying the shares of gold mining companies”. Article. Available at: <https://www.rbc.ru/money/02/03/2015/561546909a7947095c7dc4ac> (last accessed 24 Dec. 2018)
8. World Gold Council. “Gold Demand Trends Full Year 2017”. Report. Available at: <https://www.gold.org/research/gold-demand-trends/gold-demand-trends-full-year-2017> (last accessed: 24 Dec. 2018)

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Digital transformation of the public sector of the Russian economy

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Abstract

The article substantiates the relevance of digital transformation of the public sector of the economy. The organizational structure of the public sector is considered. The problems and