

Modelling the Risk Management of Financial Investments by the Fisher Criterion in Public Administration

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Abstract: Industry 4.0 will fundamentally change the way of life, work and attitude towards each other; the role of public administration is increasing many times. The government should develop measures for implementation in enterprises as the well-being of the nation as a whole depends on the success of business structures. The activity of an enterprise in a market economy is characterized by a system of risks and uncertainties that arise due to the inability to evaluate the prospects of a market situation through functional dependence. The solution of this problem is based on statistical, mathematical methods of analysis, the use of which is simplified with the widespread use of computer technology ARM systems, etc.

Authors in the article describe Top 5 global risks in 2019, according to the World Economic Forum, consider the investment risks and propose to calculate the effectiveness of financial investments using Fisher's criterion.

Index Terms: risk, risk management, financial investments, Fisher criterion, public administration.

I. INTRODUCTION

The world is on the verge of technological revolution, which will fundamentally change the way of life, work and attitude towards each other. According to the concept of Industry 4.0 [1-5], the scale and complexity of the transformation will not be similar to the fact that humanity has survived earlier. It is not yet possible to predict precisely how it will unfold, but one thing is clear: the answer to it must be integrated and comprehensive, with the participation of all actors from the global public authorities, from the public and private sectors to academia and civil society. Accordingly, the role of public administration is increasing many times.

II. TOP 5 GLOBAL RISKS IN 2019 ACCORDING TO THE WORLD ECONOMIC FORUM

The government should, first of all, monitor current trends and risks and develop measures for implementation in enterprises. After all, the well-being of the nation as a whole

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depends on the success of business structures.

The World Economic Forum, which is the leading global forum where the main trends and prospects of the global economy and business are discussed, published the latest edition of its report on global risks.

The annual presentation focuses on the most pressing global issues, giving an idea of which tasks are of high priority for officials making critical decisions and developing strategic plans in the global economy and geopolitics.

Below (Fig. 1) are the five significant risks noted in this year's report[1].

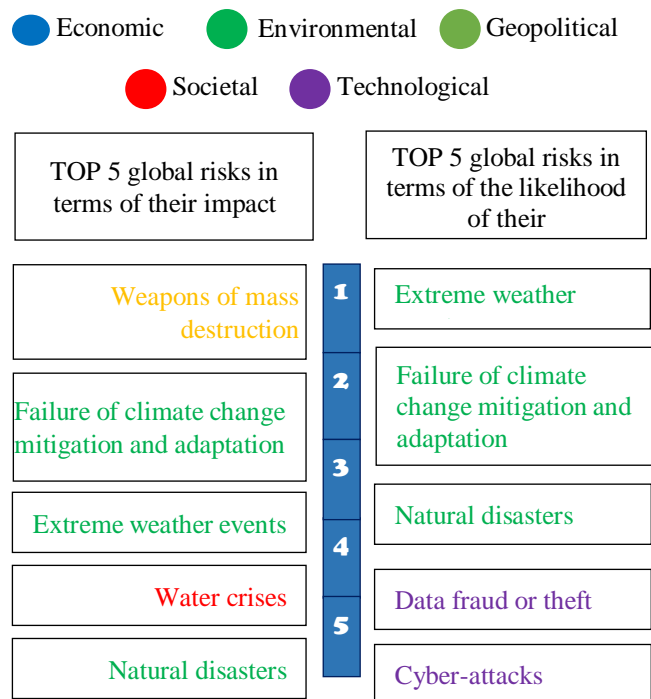


Fig. 1 Global risks in 2019 [6]

Now the most likely unfavourable scenarios for the development of events in the near future are associated with extreme weather events and natural disasters. There is also an increasing trend related to cyber threats and concerns about the security of personal data.

Experts expect a buildup of most risks in 2019.

It is primarily about economic (91% of the polled experts expect increased risks in this area) and political (85%) confrontation between the leading powers, dilution of trade agreements (88%) and cyber attacks (82%).



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The risk interconnection is shown in Fig. 2.

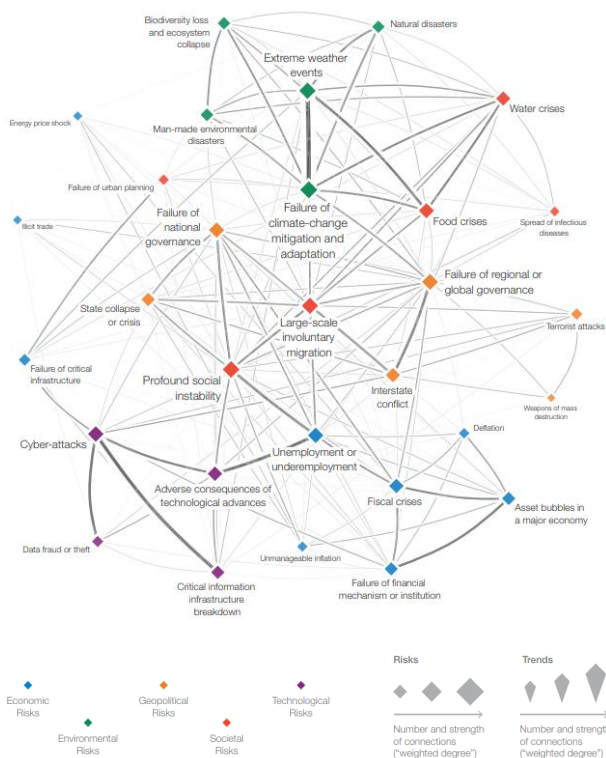


Fig.2 The Risks-Trends Interconnections Map 2019 [7]

Edition of The Economist named ten risks, which will undergo the world economy this year. According to analysts' forecasts, in 2019 its growth rates will slow to 2.8% (in 2018, the increase was 2.9%), and in 2020 – to 2.6%.

According to experts [2; 14], the world economy will face such threats:

№1. China and US Trade War

The edition's experts estimate the risk of such a war as moderate. They note that such scenes will have negative consequences for the global economy.

The current negotiations between the US and Chinese authorities give hope for the conclusion of such a transaction that will avoid conflict, but even in this case, the risk persists, as no decision will force China to reform its trade balance the way the US wants.

№2. World Trade Wars

According to experts, trade conflicts in the coming years may be exacerbated on other fronts, and this will lead to a reduction in global trade.

Experts of The Economist noted that the introduction of large-scale import duties by some countries and subsidizing of local producers to fight global protectionism might be a reason for launching a risk scenario.

Number 3. Recession in the USA

As the newspaper writes, in the next two years, the US economy will be able to avoid a devastating recession, although the country's GDP growth will slow down to 2.3% in 2019, and to 1.5% in 2020. Such a recession, according to experts, will harm the country's economy.

A slowdown in the US economy can lead to an increase in the number of companies that reduce investment and the number of staff while at the same time experiencing difficulties in repaying debts, as well as to re-evaluate their

ratings, which will force investors to reduce investments.

The implementation of such a scenario (its risk edition also notes as moderate) will have a negative impact on the global economy, as many countries will suffer from a decline in demand for their goods in the United States and a weakening of American investment.

№4. Large-Scale Emerging Market Crisis

The crisis in emerging markets can be triggered by new difficulties in those countries whose economies have already suffered from domestic problems and the aggravation of the trade war between China and the US, as well as currency crises in Argentina and Turkey and a weakening investment flow.

№5. The beginning of the crisis in China

The probability of a collapse of the Chinese economy (in 2018, its GDP, according to preliminary estimates, increased by 6.6%, which was the worst result in 28 years), The Economist experts believe is unlikely (risk intensity – 10 points).

Analysts believe that the Chinese authorities, by taking measures to support the republic's economy in a trade conflict with the United States, may make a mistake. The Economist considers the volume of private loans over 230% of GDP to be the most vulnerable spot in the PRC's economy.

Publication experts warn that if the Chinese authorities fail to prevent the “unwinding of the downward economic spiral,” this will lead to a sharp decline in global prices for raw materials, especially for metals, which will hit Latin America, the Middle East and Africa.

In the top 10 threats to the global economy in 2019, The Economist experts also attributed [7]:

6. a sharp jump in oil prices as a result of a shortage of supplies;
7. the outbreak of hostilities over disputes over the ownership of islands in the South China Sea – the Spratly Archipelago (claimed by China, Vietnam, Taiwan, Malaysia, the Philippines and Brunei), the Paracel Islands (claimed by the PRC, Taiwan and Vietnam) and Scarborough reefs (pretend China, Taiwan and the Philippines);
8. causing severe harm to large segments of the Internet as a result of cyber-attacks;
9. the outbreak of hostilities on the Korean Peninsula;
10. UK withdrawal from the EU without a deal (no-deal Brexit);
11. the beginning of the banking crisis in Italy due to political and financial instability in the country.

Meanwhile, investors have reason to be optimistic in 2019: the economy remains relatively stable, the fundamentals of all global companies also seem to be stable, and stocks are relatively inexpensive compared to their expected profitability.

Nevertheless, political instability, growing protectionism, declining revenues and slowing economic growth have recently caused considerable concern among investors, respectively, the management of this type of risk requires special attention. Accordingly, public administration should focus on investment risks.



III. INVESTMENT RISKS: CLASSIFICATION

Investments – long-term capital investments to generate income. Finances are an integral part of the modern economy. Investments differ from loans by the degree of risk to the investor (lender) – the loan and interest must be repaid within a specified period, regardless of the project's profitability, investments are returned and generate income only in profitable projects. If the project is unprofitable, the investment may be lost. At present, the problems of risks, including financing, are considered by many Ukrainian scientists [3-8].

Investment activity – investment and implementation of practical actions to profit and (or) to achieve a different beneficial effect. Investment classification:

According to the object of investment, there are:

– *real investments* (direct purchase of real capital in various forms):

1. in the way of tangible assets (fixed assets, land), payment for construction or reconstruction.
2. Capital repairs of fixed assets.
3. Investments in intangible assets: patents, licenses, rights to use, copyrights, trademarks, know-how, human capital (education, education, science), etc.

– *financial investments* (indirect purchase of money through financial assets):

1. securities, including through mutual funds
2. loans granted
3. leasing (for the lessor)

– *speculative investments* (purchase of assets solely for the sake of possible price change):

1. currency
2. precious metals (in the form of impersonal metal accounts)
3. securities (stocks, bonds, certificates of joint investment institutions, etc.)

For the principal investment objectives:

- Direct investments
- Portfolio investment

In terms of investment:

- Short-term (up to one year)
- Medium term (1-3 years)
- Long-term (over 3-5 years)

Investments are characterized, among other things, by two interrelated parameters: risk and profitability (profitability). As a rule, the higher the risk of investment, the higher should be their expected return. The CAPM model is often used to describe the relationship between risk and profit.

The magnitude of investment risk indicates the probability of losing investments and income from them. The scope of the total, integral risk consists of seven types of risk: legislative, political, social, economic, financial, criminal, environmental. In this case, the average Russian risk is taken as a unit, and the real indicators of the regions may deviate.

According to the form of ownership of investment resources: private, state, foreign, mixed. We will visually present the above described in Fig. 3.

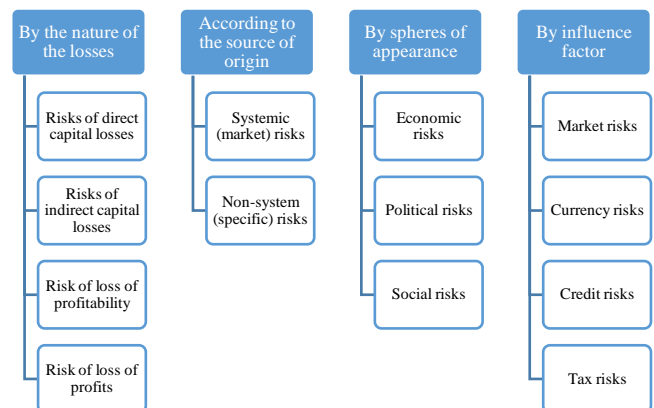


Fig.3 The standard classification of investment risks

Understanding the nature of investment risks will allow to choose a mathematical model better to calculate the effectiveness of financial investments.

IV. THE EFFECTIVENESS OF FINANCIAL INVESTMENTS

To identify the relationship between the effectiveness of financial investments (Y) and qualitative changes in the investment activity of the enterprise (X), we will conduct a consistent study of the individual components of the work of the personnel of the enterprise.

Based on statistical data of the indicator Y and factor X , it is possible to find estimates of the parameters of the econometric model, which assume that the stochastic relationship between the factor and the indicator. Using Fisher's criterion, it is possible to assess with reliability $p=0.95$ the adequacy of the adopted model with statistical data and the significance of the model parameters by t -Student's criterion.

If the given mathematical model with the given reliability is adequate to the experimental data, it is possible to find:

- 1) with the reliability $p=0.95$ of the trust zone of primary data;
- 2) spot estimation of the forecast;
- 3) with reliability $p=0.95$ interval estimation of the prognosis.

$$\text{Relation: } y = a_0 \cdot x^{a_1} \quad (1)$$

We construct a correlation field, an empirical regression line (in the form of a broken one) and define the kind of connection between the signs X and Y .

We calculate the parameters of the econometric model a_0 and a_1 evaluate the parameters of the model.

Unknown parameters of the econometric model a_0 and a_1 and we find from the system of ordinary equations:

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$$\begin{cases} n \cdot a_0 + a_1 \cdot \sum_{i=1}^n x_i = \sum_{i=1}^n y_i; \\ a_0 \cdot \sum_{i=1}^n x_i + a_1 \cdot \sum_{i=1}^n x_i^2 = \sum_{i=1}^n (x_i \cdot y_i). \end{cases} \quad (2)$$

In cases where a function is nonlinear (but not polynomial), it is reduced to a linear logarithm and a subsequent substitution of nonlinear variables on a linear (metric and power function) or only one change depending on the type of service. This method of reducing the nonlinear function to a direct form is called linearization of the regression equation.

Find the logarithm the given function $y = a_0 \cdot x^{a_1}$
Logarithm this equation, we obtain:

$$\ln y = \ln(a_0 \cdot x^{a_1}); \quad (3)$$

$$\ln y = \ln a_0 + \ln(x^{a_1}); \quad (4)$$

$$\ln y = \ln a_0 + a_1 \ln x \quad (5)$$

Replacing the variables $y' = \ln y$, $x' = \ln x$,
 $a'_0 = \ln a_0$, we obtain the equation $y' = a'_0 + a_1 x'$

The system of ordinary equations for these transformations will have the form:

$$\begin{cases} n \cdot \ln a_0 + a_1 \cdot \sum_{i=1}^n \ln x_i = \sum_{i=1}^n \ln y_i; \\ \ln a_0 \cdot \sum_{i=1}^n \ln x_i + a_1 \cdot \sum_{i=1}^n (\ln x_i)^2 = \sum_{i=1}^n \ln x_i \cdot \ln y_i. \end{cases} \quad (5)$$

The average value of the forecast of the indicator is determined by the method of mathematical extrapolation by substituting it into an econometric model instead of its relative predictive value.

V. CONCLUSION

When managing economic risks in 2019, it is necessary to remember that the World Bank has worsened the forecast for world economic growth in 2019 from 3% to 2.9% against the background of increasing risks and adverse factors. From the state of the global economy, the deployment of protectionist sentiments in the world, the dynamics of commodity prices and investors' appetites for developing countries, the ability to reduce inflation and move to free capital flow depends.

The purpose of investment activity is to obtain maximum income with the lowest possible risk of losing investments. Investment risk management includes the search for the best combination of profitability and business risk, taking into account a large number of factors that predetermine the complexity of the task. Based on statistical data, it is possible to find estimates of the parameters of the econometric model, which assume that the stochastic relationship between the factor and the indicator. Using Fisher's criterion, it is possible

to assess with reliability the adequacy of the adopted model with statistical data and the significance of the model parameters by *t*-Student's criterion.

REFERENCES

- Schlund, S., & Baaij, F. "Describing the technological scope of Industry 4.0– A review of survey publications". *LogForum*, 14(3), 341–353, 2018 <http://dx.doi.org/10.17270/J.LOG.2018.289>
- Hofmann E., Rüschi, M. "Industry 4.0 and the current status as well as future prospects on logistics", *Computers in Industry*, 89, 23–34, 2017 <http://dx.doi.org/10.1016/j.compind.2017.04.002>.
- Iryna Bashynska, Maryna Baldzhy, Larysa Ivanchenko, Larysa Skliar, Olena Nikoliuk, Galina Tkachuk, Decision making under risk: training "investment portfolio", *International Journal of Recent Technology and Engineering*, Volume-8 Issue-8 July, 2019, to be published
- Strange R., Zucchella, A. Industry 4.0, global value chains and international business. *Multinational Business Review*, 25(3), 174–184, 2017 <https://doi.org/10.1108/MBR05-2017-0028>
- Karabegovi Ē. I. "The role of industrial and service robots in the industrial revolution– "Industry 4.0". *Acta Technica Corvinensis – Bulletin of Engineering*, 11(2), 11–16, 2018
- World Economic Forum Global Risks Perception Survey 2018–2019
- Cause for concern? The top 10 risks to the global economy 2019. A report by The Economist Intelligence Unit. https://pages.eiu.com/rs/753-RIQ-438/images/Global_risks_2019.pdf?mkt_tok=eyJpJoiTIRZeE5qUTFPRGcxTIRkaSIsInQiOiJDbD2lQU2h0RmJJOOVZVTzNObmVhMlpwdDhhTHpkRGFMZE1TaGhTSIJEXC9ZSjZHeVhIS3JVeVwvTjBqWmN0Y0IER1BCZTlMUUNBVTBZSWdSbUNwQ1RtQXJRN2N4cGFRMHN5UDZ3VGJmWUFQRVF2RGNwTmd6UElVMXdaVXZ6Y1hlVTFhIn0%3D
- Irtysheva, I.O., Minakova, S.M. Types, purposes and formation process of the program of changes in logistics system, *Actual Problems of Economics*, 3 (165), 2015, 155-160
- Iryna Bashynska, Marina Malanchuk, Olena Zhuravel, Kateryna Olinichenko, Smart Solutions: Risk Management of Crypto-Assets and Blockchain Technology, *International Journal of Civil Engineering and Technology (IJCIET)* 10(2), 2019, pp. 1121–1131.
- Iryna Bashynska, Volodymyr Filipov, Nadiia Novak, Smart Solutions: Protection NFC Cards with Shielding Plates, *International Journal of Civil Engineering and Technology (IJCIET)* 9(11), 2018, pp. 1063–1071
- Bondarenko Svitlana, Bodenchuk Liliya, Krynytska Oksana and Gayvoronska Inna, Modelling Instruments in Risk Management, *International Journal of Civil Engineering and Technology*, 10(01), 1561–1568, 2019
- Svitlana Bondarenko, Volodymyr Lagodienko, Iryna Sedikova and Olga Kalaman, Application of Project Analysis Software in Project Management in the Pre-Investment Phase, *Journal of Mechanical Engineering and Technology*, 9(13), 676-684, 2018
- Svitlana Anatoliivna Bondarenko, Igor Ivanovych Savenko, Iryna Oleksandrivna Sedikova and Kateryna Volodymyrivna Kucherenko. The ranking of the level of remuneration as a motivational mechanism. *International Journal of Civil Engineering and Technology*, 9(11), 1384-1394, 2018
- Prokopenko O., Omelyanenko V., Klisinski J. Innovation policy development conceptual framework for national resource security providing, *Journal of Environmental Management and Tourism*, Volume IX, Fall, № 5(29), 2018