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Economic Risks in the Context of Logic

ANTON FILIPENKO[1]

Abstract: The article examines the economic nature of risks due to the interaction of local (internal and external) and global factors that influence the course of economic events. Logical dimensions of economic risks are considered mainly in the context of probabilistic approaches formulated by K. Popper and J.M. Keynes. Applied aspects are analysed on the basis of the Bayes conditional probability theorem and decision theory which considers the maximisation of the expected value, the maximisation of the expected monetary value and the maximisation of the expected utility.

Keywords: risk, uncertainty, probability, logical probability, logical proximity, global risk

Introduction

Studies of the problem of risk were initiated in economic works (F. Knight) and in scientific works on probability and statistics (T. Bayes, D. Bernoulli, P.S. Laplace, K. Pearson, etc.). They consider a set of factors of any system, including economic, analyse the relationship between them, study trends and patterns of their behaviour in the context of the probability of economic, social, technological, and environmental risks, and so on. *A priori*, logical-mathematical probabilistic approaches or statistical groupings are used at that. In his economic works, J.M. Keynes explored the question of probability, paying more attention to the problem of uncertainty, being one of the main principles of his scientific doctrine. In modern risk management, Bayesian approaches and tools of fuzzy logic predominate. Among recent experts in this area are Beck (1992, 1999), Power (2004), and Schelhase (2019). The issues of Davos World Economic Forum concerning global risks were created in 2019, 2020 and 2021.

To clarify probabilistic approaches in the riskology system it is essential to consider the basic principles and economic nature of economic risks. The essence of economic risk and its forms of manifestation are determined by the content and nature of the system of economic relations of the appropriate hierarchical level – from a household to global super-systems. Thus, the neoclassical scientific school prefers the micro level; considering individual behaviour and risks in conditions of limited resources, Keynesian and post-Keynesian schools of thought use a holistic methodology, analysing holistic economic systems and macro-level risks. The behavioural concept gravitates to normative economics and uses an interdisciplinary approach based on a combination of economics and psychology (Dhami, 2016, p.7). The elements of decision theory, where economic risk is considered through the prism of the cognitive and psychological capabilities of the subjects to make decisions, may be noticeable in it.

The article aims to clarify the nature, economic content of risks, and justify the need to use logical concepts, methods, techniques for identifying risks and their consequences.

Research Results

The existing dialectical relationship between risk and uncertainty is unquestionable, but they have different quantitative characteristics. Uncertainty had not had any quantitative measurements for a long time while manifesting qualitative differences, in particular S. Hawking and L. Mlodinow used the term ‘fundamental uncertainty’ (Hawking & Mlodinow, 2018, p.78-79). At the same time, last century meteorologists proposed four methods for measuring uncertainty. One of them includes the standard deviation, expressed in the probability density functions based on experience or other information. Quantitative risk parameters have mostly probabilistic and statistical dimensions. In addition, the

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literature uses the relationship between the concepts of risk-ignorance-uncertainty (Peterson, 2009, p.5-6; Treich, 2018, p.133-134). Under risk, the probability of certain consequences is assumed; for ignorance – the probability is either unknown or does not exist; uncertainty is articulated as a synonym for ignorance or in a broad sense includes both risk and ignorance with an unknown probability.

Therefore, the economic nature of risks is conditional upon the uncertainty, stochasticity of internal and external economic processes, on the one hand, and the impact of a number of global factors on the economy, on the other hand, the most striking example of which is the current COVID-19 pandemic. Taxonomy and classification of internal risks is based on the qualitative and quantitative composition of the economic system of the country, when the main components of its structure – labour, capital, property, resources, institutions, technologies and more – are considered. In the labour subsystem, the risks are associated with the problem of unemployment, the quality of the workforce, various social movements, and migration processes. In the area of capital, there are risks of profitability, adequate dividend policy, repatriation of profits, deficits or imbalances in the sectoral and territorial distribution of investments. Property risks may be caused by nationalisation and expropriation of means of production, outdated fixed assets and infrastructure, low efficiency of state property, and insufficient level of public-private partnership. The resource subsystem creates risks of depletion of certain types of resources, financial component deficit, reliability of food security of the population, and risks of outflow or reduction of the intellectual resources level. The institutional area generates risks of inconsistency between the positive and normative vision of the economy, inadequacy of economic policy to the challenges and tasks of sustainable development, lack of proper trust in society, flourishing of a shadow economy, or legislative and legal systems imperfection. The technological aspect includes the risk of technological backwardness in the context of the 4thindustrial revolution requirements, pushing to peripheral positions in the world technological development, or formation of a technological gap in comparison with the leading industrialised countries. The economic nature of internal risks is also determined by the content and nature of the sectoral and territorial structure of the economy, and development of production and market infrastructure.

External risks are related to the level of openness of the national economy, its participation in the system of international division of labour (trade, investment, technology, finance, and labour migration), membership in international integration associations and international economic and financial organisations. The experience of recent decades shows that the country's presence in international institutions, groups or close cooperation with the latter makes it possible to mitigate the crisis by obtaining loans, credits, and free aid.

The following types of economic risks are distinguished in aggregate form: financial, physical (sectoral), environmental, and technological (Hay-Gibson, 2008, p.153-154).

A generalized, widespread, somewhat simplified definition of economic risk, which is determined by the abovementioned economic processes and factors, is considered to be 'the possibility (probability) of deviating from the objective for which the decision was made'. Such deviations may be observed at all levels of the economic system – from the household to the global economic dimensions. In the context of the current article, the interpretation of risk as 'a combination of a chance event with negative consequences and the probability for that event' is close in meaning (Landell, 2016, p.4). The one-sidedness of this definition is to emphasize the negative results while positive economic risks (additional income, increase in investment income, financial transactions, etc.) exist.

Economic risk is defined by such functions as analytical, innovative, regulatory and protective. The analytical function arises from the behavioural concept, where the subject of the economic process analyses the situation and builds alternative preferences based on the neoclassical theory of rational expectations, which considers the whole array of available information. The innovative function is substantiated in the works of J. Schumpeter. It envisages the renewal of production as a result of so-called 'creative destruction growth', when crises affect entire sectors of the economy (British coal industry in the 1980s, heavy industry in Germany in the last quarter of the twentieth century, etc.). Instead, new industries are evolving: electronics, computer technology, instrument engineering, robotics, artificial intelligence, and more. The regulatory function is manifested mostly at the level of a firm or an enterprise when regulation is based on the risk management concept, which involves analysing the ratio of possible positive and negative consequences of risky economic and financial transactions. The protective function

has an institutional dimension. It entitles the business entity to open a window of opportunity for risky transactions, on the one hand, and creates the preconditions for risk insurance, on the other.

While studying the problem of risks, such general principles as argumentation, reliability, universality and objectivity are used. The International Organization for Standardization (ISO) offers 31 methods of risk analysis, mostly of an applied, practical nature in the context of their sources (causes), probability, ranking, determination of consequences, prevention mechanisms, risk negative impact mitigation, etc. The basic principles of risk management are proposed, such as avoiding unwanted risk, risk analysis at appropriate levels, risk perception in case of revenues exceeding costs, use of risk management at all levels of planning.

The basic logic of identifying, assessing and controlling a risk situation involves performing five successive stages (steps). In the *first* stage, the real and potential possibilities of the consequences of the risks are clarified. The main purpose of this step is to identify the maximum possible range of risks.

The *second* step is to assess the risks in the context of the probability of possible losses. Quantitative and qualitative parameters that determine the level of risk given the specific hazard are defined. This step determines the probability and severity of an adverse event that could occur in light of the above results.

In the *third* stage, risk control measures are analysed. Specific strategies and mechanisms that reduce, mitigate or eliminate risk are explored. With effective control, it is possible to reduce or neutralize the assessed risk under three components: probability, severity and impact.

The *fourth* step results from the previous one and involves monitoring on the basis of preliminary data and mechanisms to determine the level of final risk in the examined areas.

Finally, the *fifth* stage focuses on monitoring and verifying the life cycle of a system or an activity. Executors of all levels shall perform their respective functions in ensuring constant and reliable control, under which economic processes are periodically examined, and the level of effectiveness of risk control is measured.

At one time, F. Knight identified three main ways to determine risks based on a priori probability, statistical probability and largely intuitive estimation (Knight, 1994, p. 21-22). In further studies of economic risks, issues of economic behaviour associated with risks, the theory of decision-making began to apply the concept of logical probability, which had a deep economic meaning primarily through the inclusion of provisions for determining value, utility and other preferences. The pioneers in this field were J. M. Keynes (1921), K. Popper (1935), R. Carnap (1950), and others. The approaches of these authors were based on the classical concepts of Laplace-Bernoulli probability, the numerical value of which in a simplified version looked like a fraction of the division of the number of favourable cases by the number of equally possible cases. In this case, Popper distinguished three interpretations of probability: subjective, logical-subjective and objective (Popper, 2010, p.178-179). Subjective interpretation has a psychological nature, in which the degree of probability is defined as a measure of feelings of authenticity or unreliability, confidence or doubt caused by certain statements or considerations. In the logical-subjective interpretation used by Keynes, the logical component, the so-called ‘logical proximity’, the logical relationship is dominant. For example, the statement q assigns another statement p the probability I if p results from q. If p and q contradict each other, the probability assigned by the statement q to the statement p equals 0. Between these extremes there are other probability relationships which may have a numeric expression. Thus, the numeric probability p for a given q is the greater, the less its content goes beyond what is already contained in the statement q, on which the probability p depends, and which gives the statement p a certain (some) probability. In this approach, Keynes defined probability as ‘the degree of rational confidence’ (Popper, 2010, p.179).

The logical proximity may be illustrated by the example of the ratio of global and local financial markets and the corresponding probability of risks. If we take for granted the global financial market with its inherent risks q and dependent upon it national (local) financial market with potential risk p, the probability of the latter will be greater the less the local financial market goes beyond the global one. A perfect example of logical proximity is the global financial crisis of 2008-2009, when financial risks prevailed in countries more integrated into the global financial environment. The example of Ukraine is also illustrative. During the Asian financial crisis of 1995-1996 being actually global in nature (scale) domestic financial risks were relatively small because at that time the financial system of Ukraine was only establishing ties with international financial markets. However, the global crisis processes of 2008-

2009 significantly affected this economy, including the financial sector and the risks thereof due to closer interaction with global financial networks.

Third, an objective interpretation of probability considers each numerical probabilistic statement as a statement on the relative frequency with which a certain event occurs within a sequence of phenomena. It is also called the frequency theory, the founder of which is considered to be Richard von Mises (works of 1919-1931). This theory considers probability as some recurring events and phenomena that are random and disordered, an example of those is the throwing of dice. That said, two axiomatic conditions are used: the axiom of convergence (or the axiom of limitations) and the axiom of randomization. The axiom of convergence (or axiom of limitations) indicates that as the sequence of events becomes longer, the sequence of frequencies gravitates to a certain limit. The axiom of randomisation shapes the random nature of the sequence into a mathematical form. Thus, according to Mises, the probability applies only to sequences of events, which involves the determination of unknown probabilities on the basis of the known ones (probability data).

Based on Keynes' critique of that theory and his own perception of it, Popper proposed two hypotheses of his own: equal opportunities (the hypothesis of equal probability) and extrapolation of statistical results, and replaced the axiom of randomization with the axiom of unity. In addition, using the work of B. Bolzano, J. von Kries and F. Weissman, Popper came close to the concept of logical probability based on the concept of 'logical space of possibilities' (Popper, 2010, p.145-146; 263-264). Popper's logical probability serves as a criterion for falsifying the theory. K. Popper wrote: 'Comparing the degree of falsification of two statements, we can say that a less falsified statement is at the same time more probable on the basis of its logical form. I call this probability a 'logical probability – denoted by P(*x*) and P(*x,y*)' (Popper, 2010, p.138, 484). Keynes called a similar approach as 'a priori probability' (Keynes, 1921, p. 225). The conditional probability is also close in meaning, which is mainly associated with Bayes' theorem (the terms such as modal, comparative, empirical logical probability, etc. are also used in the literature). The role and significance of logical probability lies,

firstly, in the formalisation of inductive rezoning,

secondly, in rational estimates of empirical probability,

thirdly, in the explication (interpretation) of classical probability,

fourthly, in the rational justification of decisions. In the context of determining the logical probability of risks, it is important to consider their economic content, other essential properties in order to obtain sufficient explanatory power in the form of so-called 'weight of evidence' or 'weight of argument'.

Among the probabilistic methods of determining risks and possible consequences, Bayesian approaches based on the concept of conditional probability hold a prominent place. The mathematical expression of conditional probability is as follows:

$$p\left(h/e\right) = \frac{p\left(e/h\right)p\left(h\right)}{p\left(e\right)}, \qquad (1)$$

where:

p(h) is the prior probability of the hypothesis **h**;

p(h/e) is the probability of hypothesis **h** provided that the event **e** occurred;

p(e/h) is the probability of the event **e** occurrence provided that the hypothesis **h** is true;

p(e) is the total probability of the event **e** occurrence.

Bayesian formula allows to re-arrange the cause and consequences: based on the known fact of the event to calculate the probability that it was generated by this cause. This principle is used in risk analysis, especially to determine the causes in order to remove or eliminate them in the future. Events that reflect the actions of the causes, in this case are called hypotheses.

There are a priori and *a posteriori* hypotheses, which, in particular, Keynes used.

Bayes' theorem performs a threefold function in risk analysis. It allows, firstly: to analyse and assess the risk in general; secondly, to differentiate risks according to different qualitative and

quantitative characteristics; thirdly, to determine the consequences of risks based on the use of different models (Cantore et. al., 2013, p. 458). Integrated Bayesian Risk Analysis option is illustrated in Fig. 1.

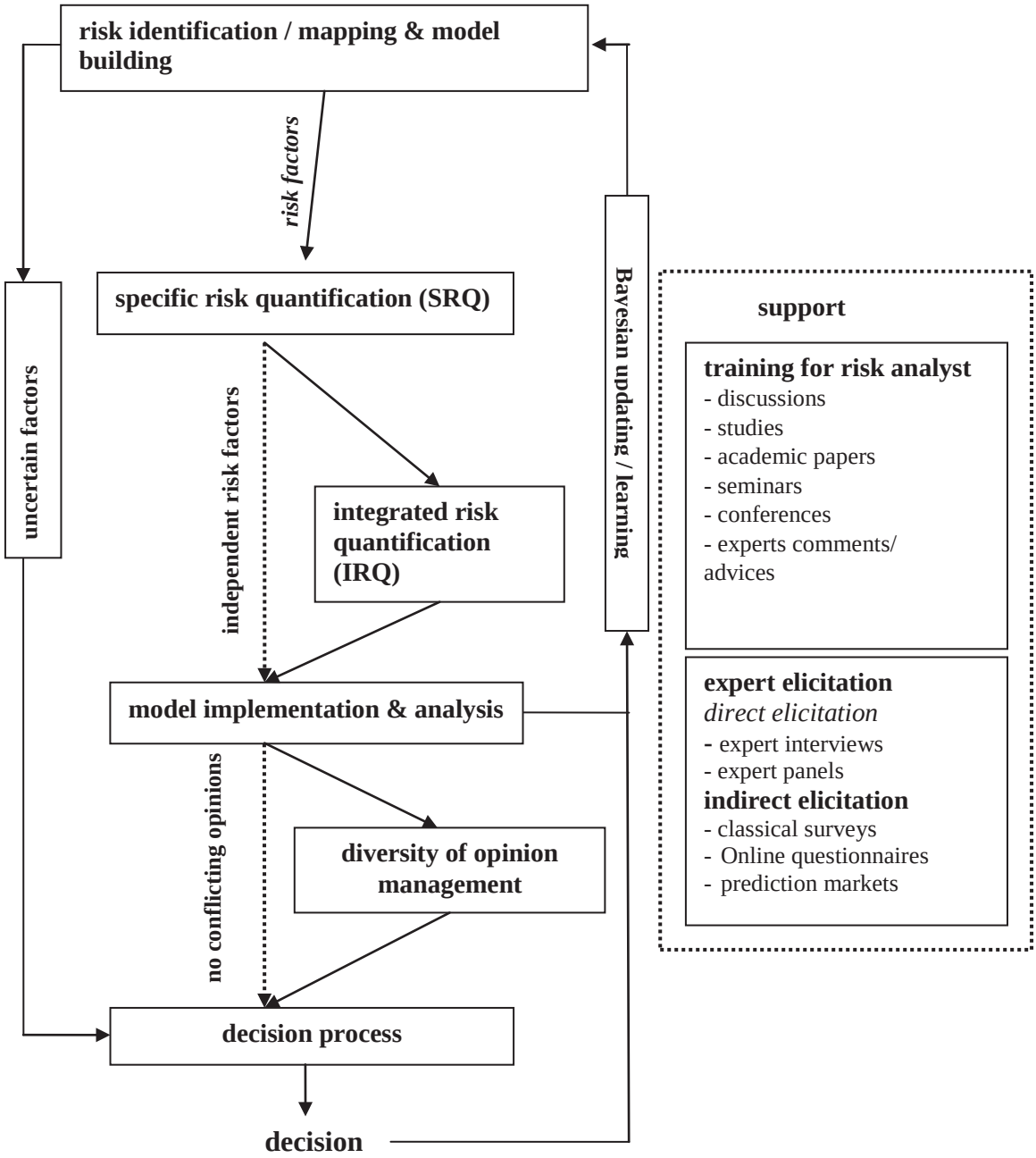

Figure 1. Integrated Bayesian Risk Analysis.
Source: Fucik, 2010, p.140)

This risk analysis includes updated Bayesian doctrine, risk factors including independent, uncertain factors, quantitative measurements of specific (special) and integrated risks, implementation of models and analysis, choice of management concept, decision making. Let us dwell in more detail on the latter in the context (theory) of the principles of decision-making in conditions of risk. The key position is to determine the probability of the consequences of risks. The maximisation of the expected value, the maximisation of the expected monetary value and the maximisation of the expected utility are considered there. (Peterson, 2009, p.65-66).

Consider an example of maximising of expected utility as a universal concept of neoclassical economic theory. Mathematical formalization shall be as:

$EU = p_1 \cdot u_1 + p_2 \cdot u_2 + \ldots + p_n \cdot u_n$, where

EU - is the maximum expected utility;

p is the probability of expected utility;

u is the expected utility of the corresponding consequence.

Bayesian logical network, like logical probability in general, is based on knowledge, so it is called epistemological probability. As a rule, it is acceptable for small-scale economic problems that posess sufficient knowledge of the relationship between the elements of the system. If knowledge about the system and its elements is insufficiant, the elements of fuzzy logic are added to the Bayesian model, which improves the testing of the conclusions of the system of the general Bayesian network. Under such conditions, it is called a Bayesian network of fuzzy logic.

Conclusions

The Global Risks Report 2019 of World Economic Forum focuced on the main risks in the economic area. In particular, there have been accented of asset bubbles in a major economy, unsustainably overpriced assets such as commodities, housing, shares, etc. in a major economy or region; failure of a major financial system that impacts the global economy, failure/shortfall of critical infrastructure, failure to adequately invest in upgrade and/or secure infrastructure networks (e.g. energy, transportation and communications), leading to pressure or a breakdown with system-wide implications; fiscal crises in key economies, excessive debt burdens that generates sovereign debt crises and/or liquidity crises; high structural unemployment or underemployment, as sustained high level of unemployment or underutilization of the productive capacity of the employed population; illicit trade, large-scale activities outside the legal framework such as illicit financial flows, tax evasion, human trafficking, counterfeiting and/or organized crime that undermine social interactions, regional or international collaboration, and global growth, severe energy price shock, significant energy price increases or decreases that place further economic pressures on highly energy-dependent industries and consumers, unmanageable inflation, unmanageable increases in the general price levels of goods and services in key economies (WEF 2019, p. 96).

The Global Risks Report 2020 (WEF, 2020) continued researching these tendencies in terms of, first of all, risks to economic stability and social cohesion under condition of macroeconomic fragilities and financial inequality.

Second, low trade barriers, fiscal prudence and strong global investment fraying as leaders advance nationalist policies. The margins for monetary and fiscal stimuli are also narrower than before the 2008/2009 financial crisis, creating uncertainty about how well countercyclical policies will work (WEF, 2020, p. 6).

Finally, the Global Risks Report 2021 (WEF, 2021) has certainly stressed on COVID-19 namely by looking at four key areas of the response to it:

1.institutional authority,
2.risk financing,
3.information collection and sharing,
4. equipment and vaccines.

It then looks to national level responses – acknowledging the varied starting point for individual countries and draws lessons from five domains: government decision-making, public communication, health system capabilities, lockdown management and financial assistance to the vulnerable (WEF, 2021, p. 9).

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Basis Trading Effectiveness: Evidence from International Vegetable Oil Market

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Abstract: This paper analyzes the correlation between Crude Soybean Oil basis, calculated as a difference between price of Argentinian cash market of Crude Soybean Oil and price of futures contracts that are listed on The Chicago Board of Trade (CBOT), and Ukrainian cash market of Crude Sunflower Oil to evaluate basis trading effectiveness. Up-to-date statistical data base with daily price quotations of three markets is employed to get accurate and comprehensive results. Substantial dependence between two most liquid markets of respective agricultural commodities in the world is discovered which enables to arrive at important practical conclusions that should be considered by economic agents when conducting their international trading activities with taking positions on both cash markets.

Keywords: basis • futures • international Vegetable Oil market • correlation • cash market • Crude Soybean Oil • Crude Sunflower Oil • hedging • multinational enterprise (MNE).

Introduction

International trade in agricultural commodities implies that economic agents always face uncertainty with regard to the occurrence of future events which can influence market prices significantly. Price fluctuations in international markets of agricultural commodities, in their turn, create high level of volatility that can have an adverse impact on sustainable development of market participants that conduct their international activity within such markets. In fact, prices of agricultural commodities are changing every second and only an effective approach towards quantifying the market risk, which is also called the price risk, allows economic agents to secure solid financial results. Hedging as one of the most effective risk management practices helps to exchange the market risk for the basis risk which a lot of economic agents, including big multinational enterprises (MNEs), do prefer as the basis fluctuations are less volatile compared to flat price fluctuations. In this regard, the basis risk, which is a risk of a change of a difference between an asset price and a hedging tool price, is entirely controlled. At the same time, economic agents who are still encountering the price risk in one market have a possibility to take advantage of monitoring the basis fluctuations happening in another market to identify the respective dependences between them to make sure correct measures are taken if unfavourable tendences start to appear. Since an overall risk exposure is limited in case of the basis trading compared to the speculative trading based on having an opinion with regard to a flat price direction, economic agents who are actively employing hedging technics in their risk management practices when participating in international trade of agricultural commodities, find studying of the relationship between the basis fluctuations in one market and flat price fluctuations in another market to be extremely useful for their decision-making process.

Literature Review

Problems of hedging the market risk and basis trading effectiveness have been studied by different foreign and Ukrainian scientists while there are less attempts to describe it through an international market of agricultural commodities. Fundamental concepts of hedging the market risk were presented in

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‘A Treatise on Money. Vol. II: The Applied Theory of Money’ (Keynes, 1930) as well as in ‘Value and Capital: An Inquiry into Some Fundamental Principles of Economic Theory’ (Hicks, 1946) and developed by American economists H. Working in ‘Futures Trading and Hedging’ (Working, 1953) and L. Telser in ‘Futures and Actual Markets: How they are Related’ (Telser, 1986).

More recent studies were focusing on using hedging when discovering its potential to foster the basis risk management (Adam-Müller & Nolte, 2011; Arnade & Hoffman, 2015). Factors that can impact the local basis and its trading were described in ‘Forecasting a Moving Target: The Roles of Quality and Timing for Determining Northern U.S. Wheat Basis’ (Bekkerman et al., 2016).

We will study the relationship between the basis fluctuations in one agricultural commodity market (Crude Soybean Oil, FOB Argentina) and flat price fluctuations in another agricultural commodity market (Crude Sunflower Oil, FOB Ukraine) in order to find out whether it could be a useful information for a decision-making process of economic agents operating in both international markets and aiming to minimize potential adverse effects caused by an occurrence of unforeseen events.

Methodology

To analyze the relationship between the basis fluctuations taking place in one international market of agricultural commodity and the spot price fluctuations in another international market of agricultural commodity we have prepared the statistical databank that consists of 977 observations each coming from three different while interdependent markets: Argentinian cash market of Crude Soybean Oil, U.S. futures market of Crude Soybean Oil and Ukrainian cash market of Crude Sunflower Oil. Both vegetable oils can substitute each other to a certain extent as they compete for a share in the global edible oils market as well as in the global biodiesel feedstock market. Cash market of Crude Soybean Oil represented by FOB (free on board) quotes in Argentinian ports on the Parana river and cash market of Crude Sunflower Oil represented by FOB quotes in Ukrainian ports in the Black Sea are two the most liquid cash markets of the respective agricultural commodities. Thus, understanding of the relationship between them is critical for economic agents who operate there.

The main goal of this research is to define statistical patterns that potentially exist between the Argentinian Crude Soybean Oil basis fluctuations and Ukrainian Crude Sunflower Oil spot prices. In this regard, methodologically, we propose to carry out the establishment of the existence of a particular dependence between the variables under studying as follows:

1. First, to create a statistical databank of the up-to-date market information obtained from Thomson Reuters Eikon (Refinitiv Eikon) platform covering period from January 1, 2017 till December 24, 2020. Generally, it is the aggregate of 977 daily observations each:
    - 1.1. Futures market price quotes of Crude Soybean Oil traded on CBOT (Chicago Board of Trade), in U.S. cents per pound;
    - 1.2. Cash market price quotes of the Argentinian Crude Soybean Oil, FOB Argentina, in U.S. dollars per metric ton;
    - 1.3. Cash market price quotes of the Ukrainian Crude Sunflower Oil, FOB Black Sea, in U.S. dollars per metric ton.
2. Second, to convert the respective daily price quotes of the Argentinian Crude Soybean Oil cash market from U.S. dollars per metric ton into U.S. cents per pound;
3. Third, to calculate the Argentinian Crude Soybean Oil basis, i.e. the difference between price quotes of the Argentinian Crude Soybean Oil cash market and the respective price quotes of the U.S. Crude Soybean Oil futures market;
4. Forth, to present the basis values in points which is a common way for trading operations;
5. Fifth, to calculate the Pearson correlation coefficient for the Argentinian Crude Soybean Oil basis and the Ukrainian Crude Sunflower Oil spot price;
6. Sixth, to interpret the obtained results.

Thus, in accordance with the above-mentioned algorithm, we created a statistical databank. Further, we converted each value of the Argentinian Crude Soybean Oil cash market spot price from U.S. dollars per metric ton into U.S. cents per pound employing the following conversion given 1 metric ton equals to 2204.623 pounds and 1 U.S. dollar equals to 100 U.S. cents:

$$1\ U.S.\ dollar\ per\ metric\ ton = 22.04623\ U.S.\ cents\ per\ pound \qquad (1)$$

The Equation (1) presented daily spot price quotes of the Argentinian Crude Soybean Oil cash market in U.S. cents per pound. As a next step we calculated the basis by subtracting price quotes of the U.S. Crude Soybean Oil futures market from the respective price quotes of the Argentinian Crude Soybean Oil cash market. As the received values had four and five digits after the decimal point, we recalculated them into points. Finally, we calculated the Pearson correlation coefficient for two variables using the below equation:

$$r = \frac{\sum_{i=1}^{n}(x_n - x_{avr}) * (y_n - y_{avr})}{\sqrt{\sum_{i=1}^{n}(x_n - x_{avr})^2 * \sum_{i=1}^{n}(y_n - y_{avr})^2}} \qquad (2)$$

Where, $x_{avr} = \frac{1}{n}\sum_{i=1}^{n} x_i$ is an arithmetic mean of the daily price quotes of the Ukrainian Crude Sunflower Oil cash market;

$y_{avr} = \frac{1}{n}\sum_{i=1}^{n} y_i$ is an arithmetic mean of the daily values of the Argentinian Crude Soybean Oil basis;

n is a number of observations.

The equation (2) is the bivariate correlation which acts as a dimensionless quantity and, as a result, does not depend on the dimensions of both variables (in our model U.S. dollars per metric ton and points are compared). The Pearson correlation coefficient always gets a value between -1 and 1, where -1 means strongly negative (inverse) linear dependence while +1 means perfect positive (direct) linear dependence. A value of 0 implies that there is no linear correlation between the variables. If r є [0…0.25], there is a weak positive linear correlation; if r є (0.25…0.75], there is an average positive linear correlation; and if r є (0.75…1], there is a strong positive linear correlation.

Results

To visualize a strength of the correlation between the two variables we draw the respective scatter plot as shown in Figure 1.

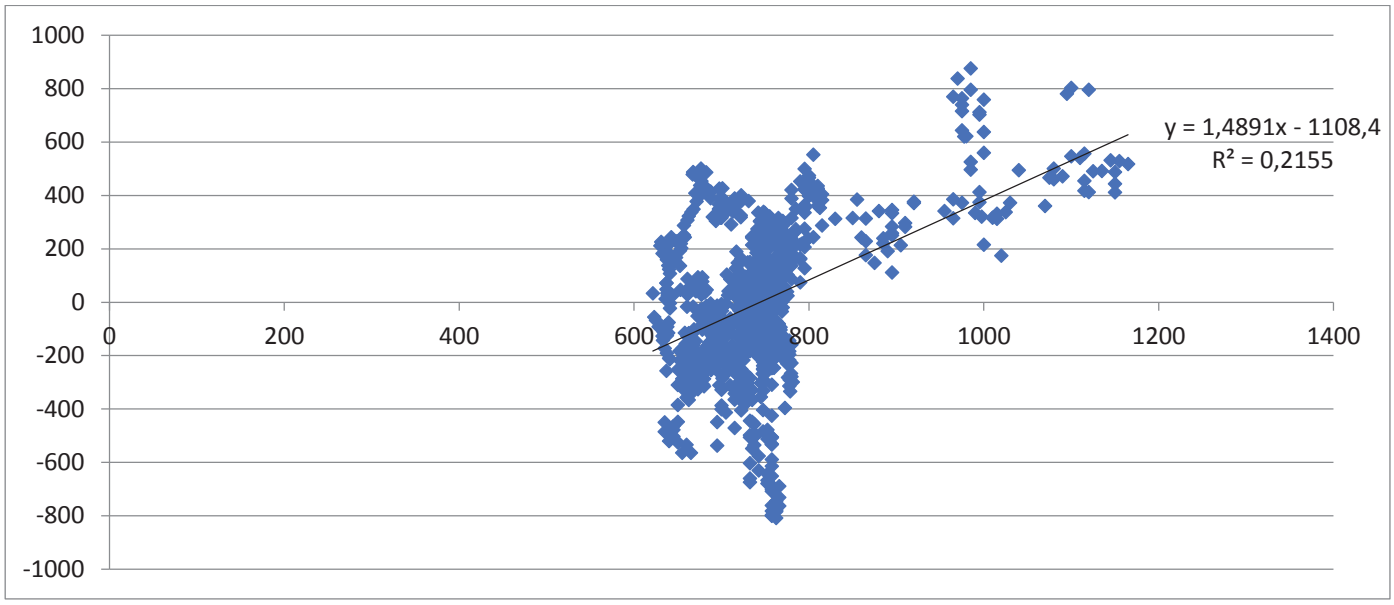

Figure 1. A Scatter Plot of the Daily Price Quotes of the Ukrainian Crude Sunflower Oil Cash Market and the Daily Values of the Argentinian Crude Soybean Oil Basis.

The above diagram also includes a trendline as well as an estimation of the coefficient of determination R^2 which is the highest one among all potential variations, and therefore it can be stated

that the tendency under study is indeed described by a positive linear (the slope is 1,4891>0) correlation and not by a polynomial, logarithmic or power dependence.

By employing the equation (2) the Pearson correlation coefficient at a level of 0.703681283 was received which proves the existence of a sufficient positive linear dependence as shown in Figure 2.

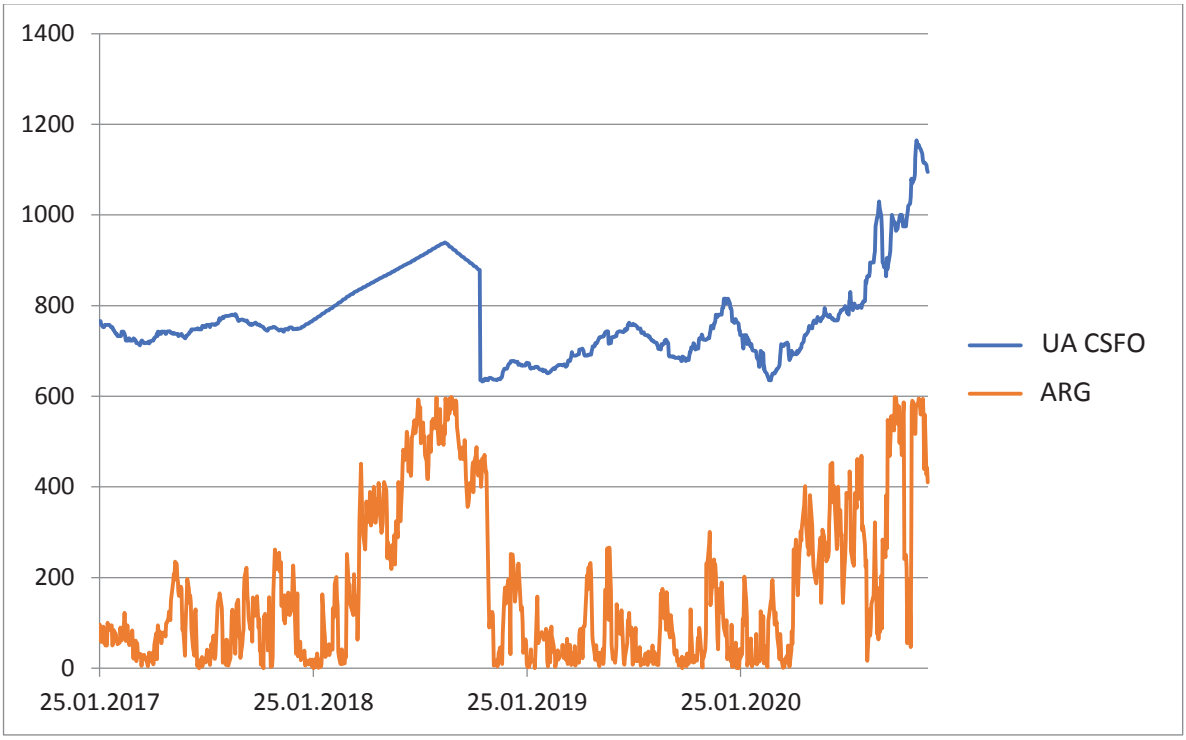

Figure 2. A Trend of the Price Fluctuations of the Ukrainian Crude Sunflower Oil Cash Market (UA CSFO) and the Fluctuations of the Argentinian Crude Soybean Oil Basis (ARG BSS).

For obtained value of the bivariate correlation we tested its statistical significance by determining whether the null hypothesis should be rejected or retained, i.e. there is a primary H_0 hypothesis stating that a real value of the bivariate correlation equals to 0, r = 0, and an alternative H_1 hypothesis stating the opposite, $r \neq 0$.

It is possible to retain or reject the null hypothesis comparing the t-statistic that is calculated using the below equation:

$$t = r\frac{\sqrt{n-2}}{\sqrt{1-r^2}} \tag{3}$$

with critical values from Student's t-distribution tables. For a two tailed critical region of the given significance level α critical value t_{cr} can be found in a table according to the below equation:

$$t_{cr} = t_{\alpha/2,m} \tag{4}$$

where m = n-2 is the number of degrees of freedom;

α = 0,05 – the significance level, i.e. the probability to make a type 1 error that is set in advance.

The significance level α shows a probability of the study rejecting the null hypothesis, given that it assumed to hold true. In this case it is a probability of the situation when we would consider the correlation not to equal 0 while it actually equals to 0.

A value obtained by employing the equation (4) shall be interpreted as follows:

- if $|t| \leq t_{cr}$, the null hypothesis is retained;
- if $|t| \geq t_{cr}$, the null hypothesis is rejected.

In our model $t \geq t_{cr}$ (Student's t-test 7.57 > 2.20) which means that the correlation coefficient is statistically significant.

Conclusions

The investigation of the relationship between two the most liquid international cash markets of the respective agricultural commodities is pivotal for the decision-making process of the economic agents trading those products on a global scale. Understanding particular patterns that take place in those vegetable oil markets and analyzing price dynamics enables to come up with effective risk management tools that foster financial performance of the market participants. A decent positive linear dependence discovered in this study based on the reliable up-to-date statistical data provides an additional evidence of the existing connection between the Argentinian Crude Soybean Oil cash market and the Ukrainian Crude Sunflower Oil cash market. By following changes in the basis of Crude Soybean Oil in Argentina closely economic agents who are actively trading Crude Sunflower Oil in the Black Sea region are able to make assumptions with regard to a potential flat price moves that have a high chance to materialize as well as develop efficient trading strategies around this decent dependence level which can significantly improve their overall commercial performance. With those two markets having plenty of international participants which adds to a price volatility magnitude, we think that this research contributes to the efforts of developing an efficient risk management approach that will help them to achieve sustainable financial results. Throughout the process of conducting this study we also realized that the next step could be to investigate a correlation of the deferred positions as well to be able to receive an even more complete picture in terms of price patterns that are common for both markets during the whole marketing season.

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World Agglomeration Clusters: An Example of the Ile-de-France Region

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Abstract: The article summarizes the current state of development of agglomerations in the world. The research investigates the leading agglomerations by the economic indices such as placement of MNC, inflow of foreign direct investment, the gross domestic product of the city, etc. In addition, it helps to highlight the advantages that regions receive from the economy of agglomeration as well as further prospects for its development. The benefits for a particular region were considered on the example of the agglomeration of Ile-de-France. This territory is attractive not only in the context of Europe, but also around the world, as it has demonstrated sustainable economic growth over a long period of time. Such indicators have been achieved thanks to a comprehensive policy for the implementation of the economy of agglomerations and, accordingly, this instance can serve as a basis for other regions. The further up-to-date research also shows that this form of economic activity among MNEs will be the most attractive and profitable for them.

Keywords: Spatial Agglomeration • Cluster • Multinational Enterprise • Economy • Foreign Direct Investment

1. Introduction

One of the recent years' trends is that the foreign direct investment (FDI) is placed very unevenly. Some regions have significant investments in various areas, while others have no investments at all (WIR UNCTAD, 2019). Thus, there is a steady trend regarding the FDI concentration in certain regions due to the economic attractiveness of multinational enterprise (MNE). This leads to the creation of spatial agglomerations, with the so-called agglomeration economy, which will further contribute to the growth of clusters. A number of individual scholars are already speculating that in the future it is not countries that will compete for foreign direct investment, but their regions, individual agglomerations and cities (Venables & Krugman, 1995). Another trend that has emerged alongside the increase in the number of agglomerations is also the cluster approach to doing business among the world's MNEs. Therefore, individual cities in the world or even several cities within one country are trying to build a cluster that specializes in a particular industry and reflects the economic potential and capacity of such cities (Rogach, 2019). Such organizations also contribute to the growth of scientific and technological development, the creation of patents, the development of innovation and the opportunity to become a leader in their niche. This, in turn, creates a number of economic benefits for MNEs, which can either work with other similar companies, sharing experiences or necessary components, and receive new technologies directly from the centre engaged in such research (Rogach, 2020). All these determine the extreme relevance of this topic.

2. Literature Review

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Significant differentiation of the localization of international production has prompted many scholars to give a theoretical analysis of the development of economic concentration of production in general and the activities of MNEs. One of the most well-known approaches to the study of these issues was the theory of 'new economic geography' (NEG). Its foundations were developed by Paul Krugman, Masahisa Fujita and Anthony Venables in the 1990s (Fujita & Krugman, 2004; Venables & Krugman 1995). Later, other researchers (E. Bergman, K. Boja, P. Combes, D. Puga, G. Hansen) deepened the directions of this theory, its mathematical tools and empirically tested its hypotheses. A number of other scientists, including L. Alfaro, G. Garretsen, I. Gauche, M. Dirzu, M. Enricht, E. Fang, M. Franco and others, also made a research in this field. In their works they studied the spatial economy from various aspects, and contributed to the further development of the topic, substantiating the economic aspects of functioning (Rogach, 2018).

Moreover, the study of the formation and development of spatial agglomerations and clusters, which formed the basis of our research, are reports of leading international analytical, scientific and research institutions, including UNCTAD, the International Finance Organization, the World Intellectual Property Organization, the World Bank Group, OECD , Oxford University, the European Commission, and the European Cluster Collaboration Platform. Each of these institutions has its own research methodology, which allows us to assess the role of spatial agglomerations and clusters from different angles, developing certain patterns of formation and development.

Such leading analytical, consulting and research institutions as Deloitte, KPMG, McKinsey Global Institute and others, also became the basis of the study, as they study further trends in the development of spatial agglomerations and clusters, allowing to form further prospects, benefits and opportunities for development.

3. Methodology Framework for the Study of Spatial Agglomeration

Measuring and evaluating the effectiveness of spatial agglomerations and clusters requires the coverage of a wide range of indicators given the breadth of issues that would reflect the socio-economic, environmental, cultural and other aspects of the agglomeration/site.

In particular, the World Bank Group (2019) on the decision of the MNC to locate its production activities in a particular agglomeration is determined by such factors as: specialization of economics; the level of development of society; quality of life; and technological advantages. Thus, PWC in its study "Global Ranking of Metropolitan Area" (PWC, 2017) identifies 6 main indicators by which the company forms 10 most successful and powerful agglomerations in the world. These indicators include:

- specialization of agglomeration economics;
- reduction of transaction costs and their impact;
- concentration of patents and intellectual property within the agglomeration;
- high quality of life of the population of the agglomeration;
- balanced transport system;
- effective approaches to agglomeration development management.

Other studies of urban economics use FDI's based matrix of clusters such as the number of projects in which FDI was invested, the number of MNEs that committed FDI, the number of new jobs created, and the number of FDI involved.

All of the above indicators have formed the methodology for studying the spatial agglomerations.

4. Research Results

One of the trends of recent decades, along with population growth, is the growing level of urbanisation. This process covered all continents without exception. In 2019, the global level of urbanisation was 54%, but it varies from region to region. The highest level of urbanisation is observed in North America, and the lowest – in Africa (Figure 1) (Statista, 2020).

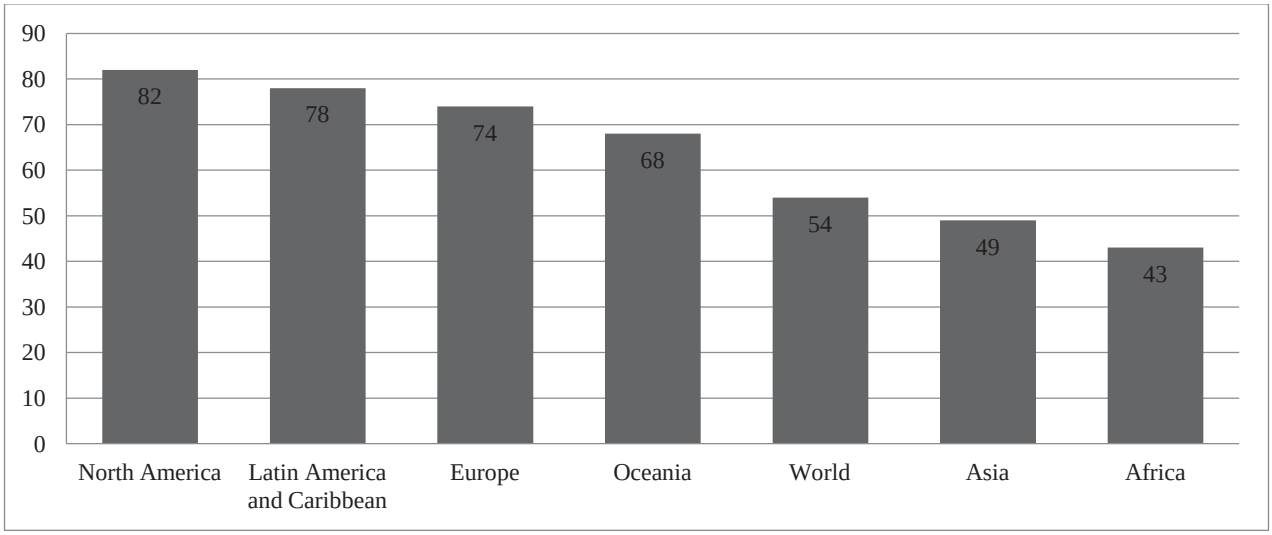

Figure 1. The Degree of Urbanisation by Continents, 2019, %.
Source: Statista 2020

Accordingly, this degree of urbanization has led to creation of a large number of agglomerations. In particular, a significant number of agglomerations are located in Asia - 52 largest agglomerations in the world, North America – 16, Africa – 13, Europe – 10, South America – 7, Australia and Oceania – 2 (figure 2) (City Population, 2020).

Figure 2. The Largest Agglomerations in the World 01.2020
Source: City Population 2020

Spatial agglomerations such as Ile-de-France (France), Bangalore (India) and Silicon Valley (USA) are among the most impressive in terms of economic development in the world. These spatial agglomerations themselves attract a number of MNEs to operate in these regions.

However, Ile-de-France is one of the best examples in the world where MNE's activities clearly demonstrate the benefits of introducing agglomeration economics. Ile-de-France or the Paris region is one of the most developed regions in France that includes several other regions (Center Val de Loire,

Normandy, Hauts-de-France, Burgundy-Franche-Comté and Grand Est). According to Eurostat, the Paris region had a population of 12.1 million in 2019, making it the most densely populated region. The region is also the richest in France and one of the best regions in Europe in terms of GDP per capita (5th place). It is one of the leading European regions in research, development and innovation (European Commission, 2020).

The Paris region is an economic power, with the largest GDP in the EU, the largest Fortune 500 headquarters in Europe, a vibrant startup scene and a thriving scientific community. The diverse economic landscape of the region covers all sectors. Companies choose the Paris region to develop their business.

The Ile-de-France region leads in many ways in the world. Thus, in 2019, the agglomeration was among the top three regions in terms of economic indicators, and among the five cities with the best return on investment. Moreover, it is the leading region in most positions in France, and contributes the lion's share to the country's growth (Table 1) (Paris Region Statistics, 2018).

Table 1. Ile-de-France Region by Economic Indicators, 2019.

Indicator	Sum
GDP of the region	709 billion euros
GDP per capita	58,300 euros
Number of companies	1,166,000
Number of newly created companies	244,000
Number of foreign companies	409
Number of headquarters	29
Number of jobs created	6.4 million
Number of employees in the field of R&D	165,500
R&D investment	20.2 billion euros
Import of the region	148.5 billion euros
Export of the region	97.5 billion euros

Source: Paris Region Statistics 2018.

The main supplier countries are the nearby countries as well as the major world's economies (China, USA and Japan). The United States, Germany, and China have been the region's major export and import partners for many years. Among the main goods exported by the Paris region are the aerospace and defense industry, automotive and pharmaceuticals, the goods with high added value, which once again confirms the development of the region (Figure 3) (Paris Ile-de-France Regional Chamber of Commerce and Industry, 2020).

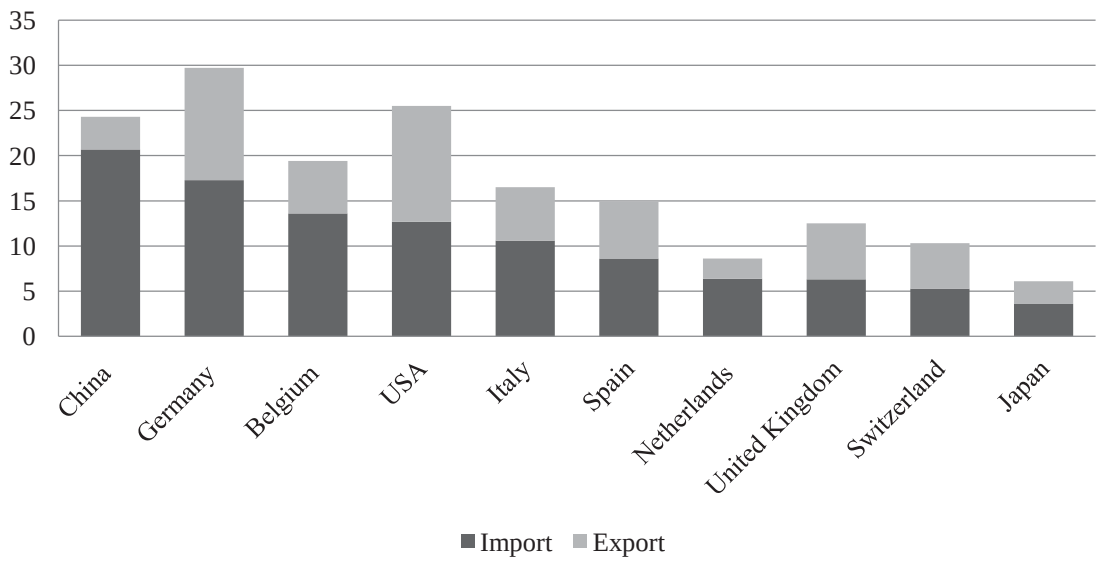

Figure 3. Ile-de-France Business Partners, 2018, billion euros.
Source: Paris Region Facts & Figures 2020.

The Ile-de-France agglomeration is attractive to the MNE, and these companies, which have chosen the region to operate, invest heavily in the industry, creating significant added value and creating new jobs and thus raising living standards (Figure 4) (Paris Region Statistics, 2018).

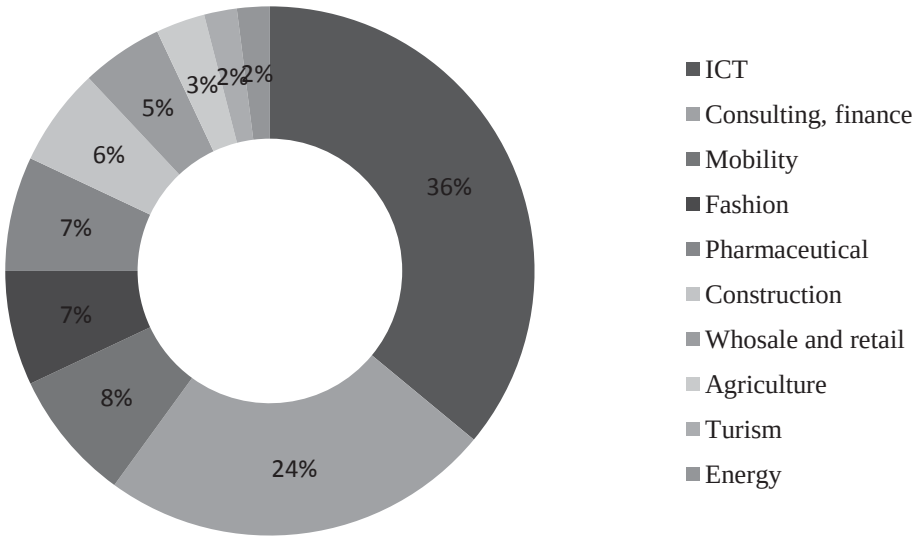

Figure 4. Distribution of Investments by Industry in the Ile-de-France Region, 2018, %
Source: Paris Region Statistics 2018.

Services form the foundation for the economy of Paris. It attracts more than 83% of employees in the region. Industry accounts for only 15.9%, but due to the large number of workers in the region, Ile-de-France is still the first region in France in terms of industry, attracting about 847,000 workers (Agence D'attractivité et de Promotion Internationale de la Region Ile-de-France, 2018). Ile-de-France is also one of the most popular national and global tourist destination.

The unemployment rate in Paris is 6.6%. This region also offers the best social support for people in need, including the elderly, people with disabilities and the unemployed, which underscores once again the potential of this spatial agglomeration (French Property, 2018).

The attractiveness of the Ile de France agglomeration is also evidenced by the fact that in 2018, Apple invested $285 billion in the opening of headquarters in continental Europe on the Champs Elysees in Paris. Two floors of this building are dedicated to retail, and the upper is used as an office space (FDI Intelligence, 2019). Apple has announced that about 300 people will work in the new location. Apple benefits from a high concentration of Parisian highly skilled technological talent; according to research by Stack Overflow, Paris is home to software developers more than any other European city (Global Database, 2019).

The Paris Region is the top French region in terms of hosting foreign companies and it accounts for a third of all new business creations in France. MNEs from 90 countries operate within the agglomeration. The leading countries are the Great Britain, Netherlands, USA, Sweden, Qatar etc. The main areas are wholesale, industry, scientific and technical activities and information and communication activities (Paris Ile-de-France Regional Chamber of Commerce and Industry, 2020).

Yet, the French MNE itself does not graze the rear. Thus, in 2019, of the 20 largest French companies in terms of profit, 16 had their headquarters in the Ile-de-France region, generating a total profit of $1,150.84 billion (Figure 5) (Global Database, 2019).

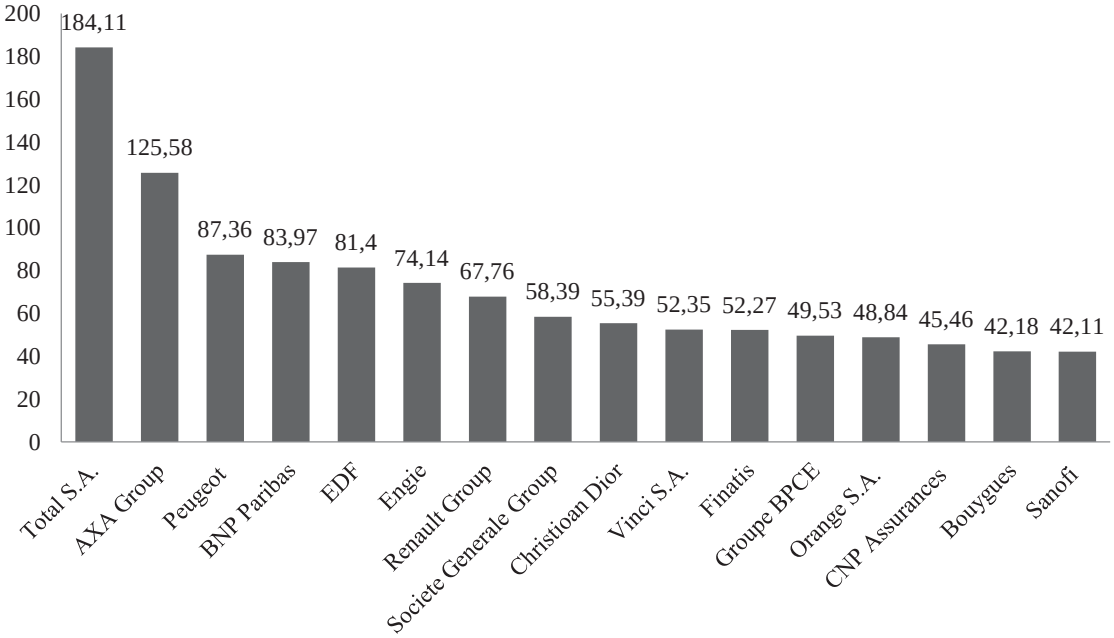

Figure 5. MNE`s Profit of the largest MNE of France with headquarters in the Ile-de-France region, 2019, billion dollars.
Source*:* Global Database 2019

Thus, the Ile-de-France region is a leader in many economic indicators not only in Europe, but also around the world, attracting a number of MNEs to operate within this agglomeration.

5. Conclusions

Foreign direct investment is uneven: some regions have more than a surplus, while others have a minimal inflow or no inflow at all. This pattern has prompted many scientists to give a theoretical justification for these processes. Paul Krugman, Masahisa Fujita, and Anthony Venables were the first to form the basis of the theory in the 1990s that later became known as the New Economic Geography, where there were first attempts to explain such trends. Later, other researchers deepened the research data, checked its empirical and theoretical substantiation, investigated with the help of mathematical tools, etc. (Rogach,. 2019). As a result, in 2008 Paul Krugman received the Nobel Prize in Economics in this field.

The growing level of urbanization is a characteristic feature of almost all countries. Accordingly, more and more countries are trying to address the issues that may arise as a result of this trend, one of the possible solutions is to create spatial agglomerations within which MNEs can function effectively, creating new jobs, implementing projects and investing in FDI.

However, these benefits also arise for companies operating within such agglomerations. As they receive benefits from the location, get a skilled workforce and have the opportunity to cooperate with each other. The largest number of such groups is developing within the Asian region, where the largest share of the world's leading agglomerations is concentrated. Accordingly, the region is also a leader in attracting FDI, creating new jobs, developing R&D and the gross domestic product of individual cities.

Yet, the Ile-de-France agglomeration is a leading region in terms of research, development and innovation. In turn, this affects the economic performance of the city, which is one of the best not only in the country or region, but also in the world.

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World Lamb Market: Prospective Export Outlets

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Abstract: The purpose of this article is to study the world lamb market and to outline and assess the most promising export outlets. In the course of the research, we studied the features of the world sheepmeat production, its volumes, as well as factors that affect its price. As part of the assessment of trade and export development prospects, the specifics of lamb consumption and world market dynamics were studied; an overview of major importers was carried out, as well as an analysis of prices and dynamics of the most promising export outlets. Special attention is paid to the quality requirements and price overview in the high price segment, including halal and organic certification and production. As a result, a conclusion was made about the most promising directions for the development of lamb exports.

Key words: world lamb market • export • consumption • price • halal • organic

Introduction

Attention to the type of meat products traditional for mankind, such as lamb, has been increasing in recent years. The latest research by dieticians and nutritionists, as well as the gradual rise in the middle class incomes in the developing world with a concomitant change in consumer preferences due to the expansion of the range of products consumed are among fundamental long-term factors driving the growth of consumption. Consumption is also driven by the global growth in the number of people professing Islam, for whom lamb is between chicken and beef in the price context.

The short-term factors that support the growing demand for lamb include a reduced pork production (primarily due to a sharp reduction in the number of livestock in the PRC due to African swine fever and a 2-fold increase in pork prices), which will probably last until the end of 2021. It should be noted that the increase in the lamb consumption in China over the past two years associated with its price advantage and the aforementioned growth of the middle class can form a stable consumer preference for this product and a further increase in its popularity. According to forecasts by the Food and Agriculture Organization of the United Nations (FAO), trade in this type of meat will expand supported by the expected sharp increase in imports to China (FAO, 2019 a, b).

The purpose of this study is to study general trends and features of development of the world lamb market, namely, production, trade and the most promising sales markets.

1. Production and Prices

Global lamb production in 2018 was estimated at 15.2 million tonnes (0.6% more than in 2017) with the main centres in China, Australia, New Zealand and the EU (FAO, 2019 a, b).

It should be noted that the limited supply of lamb from Oceania (Australia and New Zealand) due to the incomplete livestock recovery after the period of 2017-2019 (e.g. in Australia, due to prolonged drought, the total sheep population fell from 72 million to 66 million from 2017 to 2019 (OECD/FAO, 2020), as well as unfavourable climatic conditions, significantly influenced the reduction in supply and high prices in 2019-2020. With a high degree of probability, it can be argued that the COVID-19

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pandemic has also affected functioning of supply chains and disruptions in their operation, which also limited supply and kept prices high.

The rise in the prices of lamb, as well as for all food commodities, is also supported by inflationary trends in all markets, which is associated with colossal liquidity injections from governments in the form of measures to support the economy in a pandemic.

In the near future, the above factors in producing countries (climatic conditions, consequences of the pandemic, lack of growth in livestock, competition for pastures between breeders of sheep and meat and dairy cows), as well as continually growing imports to Asia, will maintain a consistently high price level. But, in turn, it will curb consumption growth, especially in developing countries among lower-middle-income consumers.

High prices for lamb, uncertainty about the prospects for the development of economies of different countries and, accordingly, the welfare of consumers will affect the consumption of lamb as a niche (for many premium) product. A decrease in household income may lead to the abandoning this type of meat and transition to consumption of chicken both in developing and in developed countries.

The growth of lamb production will mainly occur in Asia, primarily in China, as well as in African countries. It should be noted that from 2013 to 2017, the sheep population in China increased by an average of 3.1%, although in 2018 the growth was only 0.8%, which indicates a slight decrease in the sheep population. Despite the need to rebuild the herd, higher meat prices could prompt Chinese farmers to increase slaughter and livestock production by about 2% (Statista, 2019).

Importantly, China's lamb production has grown thanks to large-scale farms that use large-scale feeding systems. This is due to the fact that all of the largest growers in the world still use grazing as a traditional cultivation method (extensive pastures and low population densities explain the competitive advantages of Australia and New Zealand). According to the existing data, so far only in Russia there are attempts to raise sheep in an industrial way (Belaya, 2018), but the effectiveness of this method requires study, since the pilot project was launched only in 2019.

In the EU, production is expected to be stable, given the common agricultural policies of the EU countries. It is highly likely that Australia could return to pre-crisis levels of production, but this will depend on climatic factors in 2021 and beyond. New Zealand's exports are projected to grow modestly as farmers have shifted their focus to dairy farming, given the rise in consumption of dairy products and beef in China and in Asia as a whole (OECD / FAO, 2020).

2. Trade and Export Development Prospects

High demand for imported lamb can be traced in *China, Iran, USA, Japan and Qatar, as well as in Canada and Saudi Arabia.* China (238 thousand tonnes), the USA (117 thousand tonnes), France (88 thousand tonnes) and the UK (82 thousand tonnes) are the largest importers of lamb in the world – together, these countries account for about 45% of the total the volume of imports (FAO, 2019).

Considering the above volumes of imports and the situation with world production, we believe that Ukraine can potentially enter the top 5 producers of lamb in the world in the future.

2.1. Consumption

The data in *Table 1* show that the consumption of lamb in developing countries has actually doubled over the past 60 years, taking into account their explosive economic growth and the increase of animal protein in the diet of consumers.

Table 1. Lamb Consumption *(kg per capita, based on carcass weight).*

	1964/66	1974/76	1984/86	1994/96	1997/99	2015
World	1.8	1.6	1.7	1.8	1.8	2.1
Developing countries	1.2	1.1	1.3	1.6	1.7	2.0

Source: OECD-FAO, 2018.

Lamb consumption is projected to decline slightly in Africa, Americas, and Oceania, but will continue to grow in China and some other Asian countries, where lamb associated with healthy lifestyle and quality (OECD/FAO, 2019).

2.2. Market Dynamics

In the period from 2007 to 2017 the average annual growth rate of the mutton market volume increased by an average of 0.9%, which indicates the relative stability of the market in physical terms and changes in world prices for lamb. The most notable growth rates were recorded in 2013, when consumption grew by 3.4% compared to the previous year.

In monetary terms, the average volume of the world lamb market from 2007 to 2017 amounted to 54 billion dollars. This figure reflects the total revenues of manufacturers and importers (excluding logistics costs, marketing costs and retail margins – the components included in the final consumer price.

The **growth of the population and its income in the largest consumer countries** are considered to be **the main driver of the growth of the lamb market**. Since mutton is a product with an established culture of consumption, there are no prerequisites for a sharp growth in the world market.

Consumption growth in developing countries in Asia and Africa is a key driver of the global market. China remains the biggest consumer of lamb in the world, with consumption growing at an average rate of 2.2% per year over the past decade. China's leadership is determined by its large population and the presence of regions with a predominantly Muslim population (in the west of the country). There are prerequisites for further growth in consumption of both meat in general and lamb in particular.

Lamb is consumed in many countries of the world, especially among the Muslim population, where it replaces pork and partially beef. The world market is primarily growing due to the increase of consumption in developing countries in Asia and Africa, many of which are predominantly Muslim.

Sudan, Iran, Uzbekistan, Algeria and Turkey, in addition to *China*, are major consumer countries with growing market volumes. Besides, significant market growth is noted in *Malaysia, Oman, Tajikistan, Yemen and Azerbaijan*.

China is characterized not only by the largest volume of lamb imports in the world, but also by its high rates of growth in comparison with other countries: imports of mutton to China are growing with an average annual growth rate of about 17.7% from 2007 to 2017, import growth is expected to continue.

As of 2018, Australia (427 thousand tonnes) and New Zealand (394 thousand tonnes) dominated the structure of world exports. They are followed by the United Kingdom (90 thousand tonnes), which is about 7.7% of total exports, as well as Ireland (55.6 thousand tonnes), Spain (31.4 thousand tonnes), the Netherlands (24.9 thousand tonnes) and India (22.7 thousand tonnes) (FAO, 2019).

2.3. World average/regional prices

In 2017, the world average export price for mutton was $5,731 per tonne. In general, over the past 10 years, average export prices have been growing with an average annual growth rate of about 3.4% per year (price growth is higher than the inflation rate in the main sales markets).

Export prices vary considerably by supplier country: the Netherlands was the country with the highest export price ($8507/t), while export prices in Spain ($4819/t) were among the lowest.

From 2007 to 2017, the highest growth rates in export prices were recorded in Australia (+ 5.6% p.a.), while other major supplying countries showed more modest growth rates. This was caused by the reduction in livestock due to deterioration of growing conditions (climate and food supply).

In the medium term, in the absence of significant shocks in the global economy, the trend towards moderate growth in prices is expected to continue.

In the regions where pork consumption is subject to religious restrictions, and cattle breeding is hampered by the lack of sufficient pasture in a desert or mountainous climate, – lamb will remain a key red meat in the population's diet. Therefore, the demand for meat will continue to rise as the world's population grows, which will ensure the growth of the world market against the backdrop of rising incomes.

3. Overview of Major Importers

Developed countries stimulate the growth of lamb consumption globally. Rising incomes as well as growing number of consumers stimulate further consumption growth. Lamb availability is likely to be the key limiting factor for consumption.

Cultural and religious practices support the trend of consumption of more lamb in developing countries such as China and the Middle East. It should be pointed out that the situation is gradually changing due to the interpenetration of cultures, including culinary recipes and traditions.

In many developed countries such as the United States, lamb is a niche product that is not available or usually not consumed except in certain demographic groups and ethnic minorities. However, due to its population size, the United States has been identified as a market with great potential for consumption and import of lamb (American Lamb Board, 2015; MLA, 2019).

In all developed countries, the consumption of lamb is influenced not so much by the purchasing power as by the perception and awareness of consumers. In these countries, the preference is given to a high quality product, and in some cases *halal* or *organic* products.

Globally, lamb has only a small share of total meat consumption. Although total consumption of lamb worldwide has increased over the past 20 years and is projected to continue to grow until at least 2030s, its share of total meat consumption has declined since the 1990s. This was driven by a combination of factors such as supply, price, competition from cheaper proteins, consumer preferences and habits, and modern cooking convenience (MLA, 2019).

Europe and Asia are the main importers of lamb (~80%). In recent years, two groups of sheepmeat importers have been formed – a group of large importers (Europe, Asia, US), which account for 93% of world imports, and a group of minor importers (Africa, Oceania) (IndexBox, 2019) *(Table 2).*

Table 2. Top 10 Countries Importing Lamb in 2018

Place	Country	Import value, million dollars	Share in world imports, %	Growth in the cost of imports over 3 years,%	Price per import unit, $/kg	Herfindahl-Hirschman index*
1	USA	348.97	25.8	+25.5	13	62.7
2	UK	174.79	12.9	-26.8	8	64.8
3	France	130.98	9.7	+4.9	9	19.5
4	Belgium	85.58	6.3	+13.7	11	19.4
5	Germany	85.28	6.3	+49.6	9	30.3
6	Netherlands	53.50	4.0	+37.6	10	58.4
7	Canada	46.13	3.4	+11.3	11	53.0
8	UAE	39.10	2.9	+11.6	9	76.6
9	PRC	37.90	2.8	+32.1	9	86.4
10	South Korea	37.45	2.8	+333.0	10	98.6

* Indicator of trade dispersion among importing partners. A country with a concentration of trade based on several countries will have an index closer to 1, and a country with the most diversified trading portfolio will have an index closer to 0.

Source: compiled by the authors based on (Tridge, 2019).

3.1. Analysis of Prices and Dynamics of the Most Promising Sales Markets

Average indicators of the wholesale price for the period 2013-2018 years in the main sales markets were in the range of 5.37-11.1 $/kg. The minimum price 1.1 $/kg was in the PRC, and the maximum was 13.94 $/kg in the Netherlands. Average price for halal products was 15.5; for organic products it was 14.6 $/kg (Table 3).

At the same time, prices in the markets of the USA, France, China, UAE, Republic of Korea – demonstrated growth; Belgium, Germany, the Netherlands, Canada – showed moderate growth; and prices in the UK were stable. The growth in physical volumes of imports was observed in Germany and the Netherlands.

Table 3. Fluctuations in the Wholesale Price for 1 kg of Lamb in the Main Sales Markets

	Country	Price Range (last 5 years), $/kg
1	USA	6.74 ~ 13.85
2	UK	5.37 ~ 8.54
3	France	5.38 ~ 8.59
4	Belgium	6.96 ~ 12.72
5	Germany	8.23 ~ 13.20
6	Netherlands	7.96 ~ 13.94
7	Canada	6.04 ~ 11.75
8	UAE	2.64 ~ 9.48
9	PRC	1.11 ~ 9.34
10	South Korea	3.27 ~ 9.71

Source: compiled by the authors based on (Tridge, 2019) (the same source for the below statistic data)

3.2. Quality Requirements and Price Overview in the High Price Segment

3.2.1. Halal Certification

The countries of the Middle East are among the largest importers of halal lamb in the world, meeting their demand by importing it mainly from non-Muslim countries. However, the recent surge in demand for halal meat has also been seen in non-Muslim countries, including Germany, Britain and France, where Muslims are considered a minority.

Halal certification plays an important role in meeting the demand of indigenous Muslim consumers, as well as complying with strict rules for the import of goods from Muslim countries. At the same time, halal certified products have a higher price compared to products without certification (Table 4).

Table 4. Average Price for 1 kg of Halal Lamb in the Main Sales Markets

	Country	Price, $/kg
1	USA	20.1
2	UK	19.1
3	South Korea	17.0
4	UAE	16.9
5	Germany	16.8
6	Belgium	16.0
7	PRC	15.1
8	Canada	14.1
9	Netherlands	11.4
10	France	8.3

Source: material collected by the authors from various sources.

It is estimated that 122 certification bodies are currently active in the global halal market, including local governments that regulate halal certification in the countries such as the Philippines, Thailand, Malaysia, Singapore and Indonesia. Certification is provided for slaughterhouses and food, including processed and raw (Farouk et al., 2014; SGS, 2015).

There are different types of certification depending on the purpose and duration:

1. Certificate for the Place of registration; manufacturing facility, slaughterhouse, abattoir, factory, food business, or any other enterprise where food is processed. The place is checked and authorized to process, distribute and sell halal food. However, it does not register the product as Halal and implies that only the object itself is halal;

2. Certificate of registration of the halal product for a certain period of time;

3. Annual certification; if the food is certified and the certification is renewed automatically after the annual inspection, and duties are paid (White & Samuel, 2016).

The certificates that are known as halal food from various countries include JAKIM (Malaysia), MUI (Indonesia), SMIIC (Islamic Cooperation Organization), GSO (Gulf Countries), ESMA (UAE), IFANCA (USA), HFA (UK) and SGS (Pakistan) (White & Samuel, 2016).

The global market for halal lamb is constantly growing. Its growth is primarily driven by the health benefits provided by halal products, which continually influence people's eating habits. This has led to an increase in consumption and acceptance of halal food among non-Islamic communities. The consumption of such foods is also increasing due to the growth of the Muslim population around the world.

By regions, the market is divided into Asia-Pacific, Middle East and Africa, Europe, North America and Latin America. Among them, the Asia-Pacific region is the leading market, which accounts for most of the sales (Grand View Research, 2018).

3.2.2. Organic Production

Currently, the following types of organic standards are distinguished:

1) international private or intergovernmental frameworks such as IFOAM International Basic Standards or Codex Alimentarius Commission regulations;

2) the main applicable Standards or Directives, such as Directives of the European Union No 2092/91 (Amendments to Organic Regulations No 834/2007 and 889/2008 came into force throughout the EU from January 1, 2009) or the American National Organic Program;

3) private organic production standards such as Demeter, Naturland, Bioland, Ekowin, etc. (DAERA, 2019).

Methods used in the production of organic food, in particular lamb:

1. Eliminate the use of GMOs, GMO derivatives and products made with GMOs;
2. Eliminate the use of chemically synthesized substances, preservatives, synthesized (artificial) dyes, hormones, antibiotics, flavourings, stabilisers, flavour enhancers, or growth stimulants;
3. Eliminate the use of ionizing radiation for processing of organic raw materials or feed;
4. Eliminate hydroponic production (for plants);
5. Feed plants mainly through the ecosystem of the soil (including forage) (Alberta Agriculture and Forestry, 2017).

Due to the fact that there are few examples of industrial stall cultivation in the world practice, the certification process for organic cultivation will require more effort in the preparation.

North America currently holds approximately 40% of the global organic lamb market share and dominates the organic food market with the highest growth rates. The high growth in the use of organic products in the region is associated with the increased awareness of health and the growing number of health problems such as obesity, diabetes, hypertension, etc. (AgMRC, 2018).

Europe is the second largest consumer of organic lamb and accounts for over 33% of the world's total income. The development of this market in Europe can be explained by the changing views of the population about the propensity to a healthy lifestyle and the growing awareness of the health benefits of organic food. Increased availability of organic products in retail outlets makes organic products even more popular (AgMRC, 2018).

The Asia-Pacific region is seeing rapid growth in the organic lamb market driven by lifestyle changes and increased consumer cash flow. It is envisaged that increasing awareness of the health benefits of organic food, coupled with advances in organic cultivation procedures will stimulate interest in natural nutrition in the region over a period of time (AgMRC, 2018).

The Asian market consumes significant volumes of processed organic products made by advanced nations. There is also growing demand for food in developing countries such as India and China, thanks to the awareness of the benefits of organic food.

The Middle East, Africa and Latin America are also seeing significant growth in the organic lamb market (Transparency Market Research, 2019).

Organic lamb is gaining popularity for quite simple reasons, namely: non-GMO content, nutrient richness, lack of growth hormones, antibiotics, fewer pesticides, increased levels of freshness and improved environmental sustainability. For producers, organic lamb is also an interesting business development, despite the complexity of the process, given the higher prices for this product (Table 5). At

the same time, the combination of organic certification and *Halal* certification seems to be very promising.

Table 5. Average Price for 1 kg of Organic Lamb in the Main Sales Markets.

	Country	Price, $/kg
1	Netherlands	22.1
2	Belgium	15.5
3	PRC	15.4
4	Canada	15.1
5	Germany	13.5
6	UK	13.4
7	France	12.4
8	USA	9.5
9	UAE	-
10	South Korea	-

Source: material collected by the authors from various sources.

4. Conclusions

Our analysis of the indicators of the dynamics of the main importers (the study examined the value of imports (in million US dollars), the volume of imports (million tonnes) and the price of imports (US dollars/kg) for the period of 2014-2018) makes it possible to draw certain generalizations and conclusions:

USA: import cost is rising; the price and volume of imports are showing positive growth dynamics. *The market is promising for export.*

UK: physical volumes and cost of imports are decreasing; the price shows insignificant fluctuations. *At the moment, the market is quite unattractive.*

France: physical volumes of imports show a downward trend; however, the price and value of imports are volatile. It can be assumed that in the medium term, the indicators will grow, given the influx of Muslim migrants into the country with a traditionally high level of lamb consumption. *The market requires a more detailed study.*

Belgium: the volume and value of imports are relatively stable; and the price is showing moderate growth. As in the situation with France, it can be assumed that in the medium term, the indicators will grow, given the influx of Muslim migrants into the country, while we consider the Belgian market to be more promising. *The market is more promising for export.*

Germany: all indicators show positive dynamics as the country is the largest attractor of Muslim migrants in Europe. The consumption of niche lamb of the premium segment among local residents is also growing. The market is promising for export.

Netherlands: all indicators show positive dynamics as the country is the biggest attractor of Muslim migrants in Europe. Also, the consumption of niche lamb of the premium segment among local residents is growing. *The market is promising for export.*

Canada: The physical volume of imports, their value and prices are relatively stable. It can be assumed that in the medium term, the indicators will not practically change. *At the moment, the market is hardly attractive.*

UAE: the physical volumes of imports and their value are relatively stable; prices are showing positive dynamics. It can be assumed that in the medium term, the indicators will grow, but the target segment will be niche products. *The market is promising, but requires more detailed study.*

Republic of Korea: all indicators show positive dynamics. *The market is very promising for export in all segments.*

PRC: The market is complex and extremely volatile, requires constant monitoring, while the price demonstrates positive dynamics. In the medium term, it is promising, given the expansion of African swine fever, the trade confrontation with the United States (part of the lamb was imported from there) and growing consumption of meat products in general. It is interesting in the niche segment and the segment of cheap products.

Table 6. Assessment Results of Promising Sales Markets *(max. 10 points, ranking descending)*

	Country	Assessment
1	South Korea	10
2	Germany	10
3	USA	9
4	Netherlands	9
5	PRC	9
6	UAE	8
7	Belgium	8
8	France	6
9	Canada	4
10	UK	3

Source: authors' estimations.

The analysis suggests that the Republic of Korea is a leader in import growth and is an emerging market for lamb, so there is an opportunity to gain a foothold in it in a wide range of segments. The USA is the largest importer and a promising sales market in the niche segment. Germany, the Netherlands and Belgium are the most promising markets in Europe in the low and high price segments. It is also advisable to consider the Middle East as a sales market: a high-profile niche segment in oil-producing countries; and low in the rest of the region (Table 6).

China is an extremely attractive growing market in all segments, and the main difficulties will be associated with pressure regarding pricing policy and the requirement for high quality. It is advisable to consider the high price segment.

In our opinion, the markets of Singapore and Hong Kong are also promising in the premium segment.

It should be noted that the markets of African countries (in particular North Africa) and Asia with a large number of Muslim populations (e.g. Indonesia, Malaysia) require additional study. We classify them as promising, but for products in a low price segment.

As noted above, large consumer countries with growing market volumes are Sudan, Iran, Uzbekistan, Algeria and Turkey, Malaysia, Oman, Tajikistan, Yemen and Azerbaijan. We believe that in the medium term they will consume cheap products, but with the requirement of an average quality level.

In general, the search for a niche and competitive position in the market will depend on the following factors:

- Cost of production;
- Consumer qualities of sheep meat of the raised breed;
- Certification of the rearing and slaughtering system;
- Processing of animal carcasses (cutting, cooling, freezing, etc.);
- Logistic capabilities;
- Work with local partners in the field of marketing and distribution.

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Special Economic Zones in China

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Abstract: This paper analyzes China's successful experience in transforming the economy to attract foreign direct investment by creating a system of special economic zones. The Chinese government has pursued a policy of attracting foreign investment, creating strictly regulated areas open to foreign direct investment. The author examines the effectiveness of the policy of attracting foreign investment through the prism of different types of special economic zones and their evolution. Despite many common features, special economic zones differ in regulation, special measures applied to foreign investors, and the purpose of creation. Thus, the authors of the article chronologically analyze the stages of creation and evolution of different types of special economic zones, their purpose and specialisation, features of regulation in each case, and deregulation practices. The authors examine the incentives, special policies, restrictions and prohibitions applied to foreign investors operating in various special economic zones. The key elements of the policy of special economic zones on the efficiency of attracting foreign capital, increasing exports and reorienting the economy to the production of high-tech products are highlighted. Analyzed the impact of the introduction of a system of special economic zones on the transformation of China from an underdeveloped agricultural economy to a strong industrialized export-oriented economy with a growing share of innovation and high technology. The article demonstrates the impact of the introduction of the SEZ system on China's economic performance and economic growth.

Keywords: China • special economic zones (SEZ) • foreign direct investment • benefits to foreign investors • exports

Introduction

Today, China is the second largest economy in the world characterized by the largest industrial potential and a growing share of finished high-tech products with high added value in GDP. However, today's economic greatness of China was preceded by fifty years of growth under qualitative reforms and transformations. At the beginning of the path of growth, the Communist Party of China, led by Deng Xiaoping, acknowledged the need for deep structural economic reforms which included a Programme of "four modernizations". The large-scale transformation of industry, agriculture, education, and armed forces, and introduction of "openness policy" were aimed at increasing the level of involvement of the Chinese economy in the world economy. The Four Modernizations Programme was planned to be implemented through the attraction of foreign capital, which was to give impetus to industrialisation using surplus cheap labour of China.

Literature Review

The following are among the main thematic areas of research and authors:

1. The role of FDI in the formation of gross national product, the impact of FDI on economic growth in the country of FDI investment (O. Rogach, E. Mansfield, A. Romeo, M. Haddad, A. Harrison, R. Lipsey, M. Blomstrom, M. Zeyan, L. Alfaro, K. Arindam, S. Selin, V. Kasuro, etc.);

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2. The impact of FDI on the level of technological and innovative development, the impact on human capital development in the country of FDI investment (O. Rogach, R. Findley, S. Radowitz, E. Borenstein, J. De Grigorio, J. Lee, J. Rappaport etc.);

3. The impact of FDI on the competitiveness of the economy, exports, and imports of countries receiving FDI (O. Rogach, F. Barry, J. Bradley, H. San, Z. Zeng, S. Song, L. Goldberg, M. Kline, M. Kutan, G. Vuksic, Z. Haylu, etc.).

Research Results

Fifty years ago, an open-door policy was adopted, which provided for the transformation of several coastal areas in eastern China into special economic zones which were to receive foreign capital on special terms. Four coastal areas in Guangdong and Fujian provinces: Shenzhen, Zhuhai, Shantou, and Xiamen – were selected to implement the experimental regime, where "special policies and flexible measures" would be in place, thus creating pilot SEZs. This location was chosen because of backwardness of these territories, their remoteness from Beijing (the centre of political power), long history of contact with the outside world, and proximity to the so-called bridges between the celestial and outer worlds: Hong Kong, Macao and Taiwan.

With the opening of China to foreign trade and investment, pilot SEZs yielded instant results, so in 1981, four SEZs received 59.8% of total FDI in China ($265 million), of which 50.6% went to Shenzhen. In 1985, the accumulated FDI in four SEZs amounted to $1.17 billion, which accounted for 20% of total FDI in China. The combination of SEZs with cheap labour from rural areas, the necessary resources for production, and a favourable regime for foreign investors created the conditions for increasing industrial production. Foreign capital was present in the form of joint ventures with Chinese partners, so the rapid growth of zones was accompanied by an increase in Chinese production capacity. Thus, through the involvement of FDI in SEZs, China has mobilized its potential for surplus free labour and natural resources to launch the processes of primary labour-intensive industrialization. Thus, by 1986, primary markets for capital, labour, land, and other factors had formed in Shenzhen and other SEZs. In 1988, the Chinese government decided to grant SEZ status to Hainan Island, which became the fifth and largest zone (Zeng D. Z. 2012; Yeung Y., Lee J., Kee G. 2009). Hainan Island was originally part of Guangdong Province, but after 1988 it was granted provincial status and benefits similar to those in the SEZ, but in an expanded version, given the specifics of the Chinese government's policy on high technology and exports.

The term "special economic zone" is a specific name given to the first four special zones in China. Therefore, terminologically, SEZs are economic development zones (EDZ) – zones created to attract FDI, capacity building, and industrial cooperation, and are one of the types of general term special economic zones (WIR UNCTAD 2019).

At the next stage of evolution, China needed capital-intensive industrialization, i.e. creating enterprises with more complex production processes, and strengthening in international export markets. To achieve these goals, based on the success of the SEZ experience, the Chinese Government decided to expand the practice of zones, so economic and technological development zones (ETDZs) were launched in the coastal cities of the Pearl, Yangtze, and Fujian deltas in 1984. They differed from the first four SEZs in smaller size and focus on creation of industrial parks, industrial units, and enterprises engaged in finishing. Such nodes of concentration of production and industrial cooperation between related industries were to facilitate the transformation of Chinese production into more capital-intensive and technological forms. Thus, another 35 zones of economic and technological development were created in 1992, and their number was already 69 in 2010 (Zeng D. Z. 2012; Yeung Y., Lee J., Kee G. 2009).

The Chinese Government presented the High Technology Research and Development Plan in 1986, and the High Technology Industrial Development Plan in 1988. These two plans should be a continuation of the Government's industrial policy to carry out capital-intensive industrialisation by stimulating the presence of high technology in the activities of enterprises in the SEZ. In 1988, the Chinese Government launched the first high-tech industrial development zone (HIPD) which focused on using the technological potential and resources of research institutes, universities, large and medium-sized enterprises to develop new and high-tech products and accelerate the commercialisation of research and development. High-tech industrial development zones proved to be a very effective tool, as the

enterprises located there were more efficient, had higher sales, and were more capital-intensive than those based on ETDZs, although smaller in size. Therefore, there were 54 HTDZs in the territory of China in 2010 (Howell A. 2019).

In addition to the creation of ETDZs and HTDZs, the PRC actively developed the system of EDZ having smaller territories than SEZ, ETDZs, HTDZs (specific types of EDZ), and a higher level of specialization. They differed in their strategic goals, incentives and level of autonomy. Until the mid-2000s, new EDZs were created in more developed areas of China, mainly in the eastern part, then, the practice of EDZ spread to less developed areas in central and western parts of China. As of 2006, 1,568 EDZs were operating at the national and provincial levels in more than 270 cities in China. Even though EDZ occupied only 0.1% of China's total area, about 10% of China's GDP was generated within these zones. The creation of new EDZs involves 2 main components: 1) local authorities make large capital investments in improving the infrastructure of transport, utilities, warehouses, and other facilities; 2) introduction of a package of preferences, including tax deductions, discounts on utilities, land use fees, utilities, and lower loan rates. As a rule, benefits cannot be used by existing firms, only new ones (Zeng D. Z. 2012; Yeung Y., Lee J., Kee G. 2009; Howell A. 2019).

Having carried out the industrialization of the country, and constantly increasing the capacity of industries with capital and high technology, the Chinese Government has begun to actively develop the logistics infrastructure of warehouses, and to strengthen exports and international trade. Therefore, the next step in the evolution of SEZ forms within the Chinese model was the creation of a free trade zone (FTZ) in 1990. Fifteen more FTZs were launched after 1990. Free trade zones have three target functions: export processing, foreign trade, logistics, and warehousing. Although they are physically located within the Chinese border, they operate outside China's customs regulations. Companies in the FTZ are entitled to a refund of export tax, exemption from import duties, and preferential value-added tax.

Since 1992, fourteen Border and Economic Cooperation Zones (BECZs) have also been established for the development of cross-border trade in north and west China and thus for the development of underdeveloped economic regions (Xie L., Swerts E., Pumain D. 2018).

The policy of increasing exports was continued by the launch of the Export Processing Zone (EPZ) in 2000 developed mainly for enterprises engaged in the manufacture, processing, and assembly of export-oriented goods to increase their expansion and foreign exchange earnings. In the period from 2000 to 2010, the Chinese Government was actively encouraging the involvement of enterprises in global production chains to increase the share of production for export under the EPZ, the number of which was 61 at the end of the period.

Therefore, following Table 1, it can be stated that the gradual evolution of the SEZ system in China was accompanied by the success of previous forms of SEZs and the goals set by the Government along with the gradual economic growth of China. At the time of the launch of the Open Door Policy, the Chinese Government aimed to industrialise the economy by attracting foreign capital and mobilizing its cheap labour and natural resources. The next step was to direct FDI to EDZ (ETDZs, HTDZs, EPZs, etc.), which were to stimulate the transition to more complex production within the industrial parks and industrial units formed in ETDZs, with an emphasis on finishing, so the industry became more complex and capital-intensive, although still with a large share of human labour. Shortly after the launch of the first 14 ETDZs, the Government adopted several documents declaring the need to stimulate high technology and innovation, increase the country's scientific capacity through research centres, universities, and private technology companies. Therefore, the Chinese Government began implementing a number of HTDZs value-added, based on high technology and the latest developments through the provision of a wide range of benefits and preferences. The next stage of evolution was the active development of logistics centres and transport hubs and the creation of FTZs near these facilities for FEP, the first served to process exports, stimulate foreign trade, provide logistics and warehousing services, the following is to produce and process export products, natural resources, and re-export. Thus, through the system of FTZ and EPZ, a platform was formed to increase export expansion, increase international trade and deeper integration into global value chains.

The introduction of special economic zones proved to be an effective tool for attracting FDI, industrialising the economy, creating new jobs, increasing exports, and the scientific capacity of the economy – by creating effective regulation of SEZs which provided numerous incentives, benefits and requirements for foreign investors.

Table 1. Stages of creation and evolution of special economic zones in China.

Type of special economic zone	Periods of foundation and development	Orientation of zones and their specifics
Special economic zones (SEZ)	1979 – Shenzhen, Zhuhai, Shantou and Xiamen 1988 – Hainan Island 1989 – New district of Shanghai Pudong 2006 – The new district of Tianjin Binhai	Attracting foreign capital, creating jobs in backward regions, development of labour-intensive export industries. In case of Hainan, the emphasis was already on the export of complex and technological products.
Economic and technological development zones (ETDZs)	1984-1988 – 14 ETDZs in coastal cities 1992 – 35 ETDZs, some of them are created in inland regions In 2010, there were 69 ETDZs (18 in the Yangtze River Delta, 10 in the Pearl Delta, 15 in the central region, 11 in the Bohai Bay area, 2 in the northeastern region and 13 in the western region)	Formation of industrial concentration nodes, transformation from labour-intensive to capital-intensive production with a higher content of technologies, production and assembly of finished products, creation of hubs of related industries.
High-tech zones of industrial development (HTDZs)	1988 – Zhongguancun (Beijing) 2010 – 54 HTDZs	Emphasis on high technologies and innovation, creation of concentration of scientific potential for further commercialization of scientific developments and researches, development and production of new technological products.
Other types of economic development zones (EDZs)	1990s - 2000s 2006 –1568 EDZs	Different levels of autonomy, small size, sometimes created for a specific large investment project, contribute to the industrialisation of individual territories.
Free Trade Zones (FTZs)	1992 – Shanghai Waigaoqiao FTZ 2010 – 15 FTZs operate in 13 coastal cities	Export processing, foreign trade, logistics and warehousing, duty-free territory, logistics infrastructure.
Export processing zones (EPZs)	2000 – Kunshan 2010 – 61 EPZs (44 of them are located in the coastal region, while the other 17 – in the inland of China)	Manufacture, processing and assembly of export-oriented products, developed export infrastructure, re-export.

Source: complied by the author.

The tangible positive results of the SEZ system were due to many special policies and measures. The enterprises operating within the SEZs were required to sell their products on the international market within the framework of the policy of increasing exports. If all the requirements were met, a company with foreign capital was taxed at a reduced corporate tax rate of 15% while for domestic companies it ranged from 30 to 50%. A special preferential regime within the SEZ was provided to enterprises with investments of $5 million or more, as well as companies that use the latest technology or have a longer period of capital turnover. An investor who reinvests his profits in the SEZ for five or more years may apply for reduction or exemption from income tax on the reinvested portion. Also important were: cheap land, soft loans for land, fast customs clearance, the possibility of the repatriation of profits and capital investments, duty-free import of raw materials and intermediate goods intended for export, and exemption from the export tax.

After the success of the investment reform, the Chinese Government decided to expand the presence of FDI. The Chinese Government made Hainan Island the fifth-largest SEZ. For the Hainan SEZ, the Chinese Government formulated a more flexible policy than for the first four SEZs. As a result, new FDI companies are exempt from the industrial and commercial consolidated tax for the first two profits and receive an 85% discount for the next five years. Also, companies in developing, high-tech, and new products are exempt from income tax for the first five years and receive a reduction of 85% over the next five years.

Also, the New District of Shanghai Pudong was included in the SEZ, where benefits for foreign investors were also expanded. Corporate tax is 15%, manufacturing companies in Pudong, which operate for more than ten years, can be exempt from corporate income tax in the first and second years after the

companies become profitable, and are entitled to a 50% discount from the third to fifth year. In addition, FDI enterprises in Pudong were completely exempt from local income tax by the end of 2000. Also, FDI companies in Pudong involved in the construction of airports, ports, railways, highways, power plants, and other projects to develop energy resources or transport enjoy a 15% tax rate. And those companies that have been operating for more than 15 years are entitled to income tax exemption from the first year of income for five years and will have a 50% discount from the sixth to the tenth income year. Also, a foreign investor in a joint venture can transfer its share of profits from the company's operations outside China without paying withholding tax.

It is necessary to single out the principal characteristics of SEZs, namely the political and economic autonomy of the zones. Their activities are regulated by separate legislative instruments, and local authorities can independently set the structure and rates of local taxes, as well as manage and administer SEZs. Also, the Chinese local authorities have contributed to the creation of a favourable business climate. As a result, the SEZ not only created an effective regulatory and administrative system but also provided the necessary infrastructure, including roads, sewers, communications, and ports, as well as access to water, electricity, and gas. In addition to the basic infrastructure, local authorities also provided various business services within many SEZs. Given the independence of local governments from central ones, foreign investors also gained freedom of decision-making and management, which was a significant advantage of SEZs.

After the formation of the labour-intensive industry within the SEZs, the Chinese Government began to lay the foundations for the development of capital-intensive high-tech production. To achieve these goals, the authorities begun to pursue a differentiated policy towards foreign investment by providing benefits and preferences for FDI in the field of science-intensive and innovative technologies. Such a policy formed the basis for the creation of ETDZs and HTDZs. Special measures for foreign investors in ETDZs and HTDZs, for the most part, repeat those in SEZ, but within ETDZs there was a division into manufacturing and non-manufacturing enterprises, if the tax rate for the former is 15%, then for the latter it is 30%. The activity of an enterprise with foreign capital within the HTDZs is approved by the State Council, i.e. only export-oriented and/or knowledge-intensive enterprises were located in the HTDZs. ETDZs have special tax rates for science-intensive and technological projects and Technology Development Centres – 15%, enterprises with a share of exports of 70% or more, which have left the period of tax exemption – 10%, infrastructure projects – 15%, and financial institutions with foreign operating capital of more than $10 million – 15%. Extension of the grace period (50% tax rebate) for high-tech companies is 3 years, if they remain focused on high technology after the end of the initial benefit regime. Also, the refund of the tax on reinvested capital in the case when the investor reinvests profits in the company for 5 years is 40%. When the reinvestment is carried out in high-tech or export-oriented companies they get 100% refund. Thus, the Chinese Government has specialized ETDZs and HTDZs to attract FDI in export-oriented capital-intensive industries (in the case of ETDZs) and export high-tech enterprises (in HTDZs), while SEZs stimulated FDI in general.

Although China opened only part of the country to foreign capital, not all industries were available to foreign investors. At the legislative level, the Chinese Government introduced terminology that provided for the existence of three groups of industries: FDI is encouraged, FDI is limited and FDI is prohibited. As a result, foreign investment is ‘encouraged’ in areas where China needs to attract new technologies, improve product quality, help build infrastructure and make better use of domestic resources and raw materials. Foreign investment is ‘limited’ in the areas where China has developed some degree of domestic capacity (usually through previously imported technology), as well as in areas where the Government is testing the optimal level of investment liberalisation or trying to control its share. The ban on FDI applies in areas where Chinese production is developed or there is a state monopoly, or FDI could potentially harm domestic production or threaten national security.

Thus, at the beginning of the Open Door Policy, the annual flow of FDI was $58 million in 1980, in forty years this figure was $141.22 billion in 2019. As a result, the growth of FDI flows from year to year was enormous and for the period from 1980 to 2019 the average annual growth was 30%. In turn, China's GDP in 1980 was $191.15 billion and reached a value of $14.3 trillion in 2019. Thus, China's GDP has grown 75 times in 39 years, and the average annual growth was 12.08%. The correlation coefficient between accumulated FDI and GDP in the period from 1980 to 2019 is equal to 0.99 – which is a positive correlation. This correlation indicator shows a high degree of connection between the two

indicators, the growth of the first indicator provides a proportional growth of the second, which confirms the importance of FDI in China's economic growth.

The creation of the SEZ system in China has led to the formation of powerful centres of concentration of economic potential, located mainly in eastern China. Within the framework of these most powerful SEZs, tertiary industries focused on the latest technologies and high added value were formed and strengthened. In 2018, Shenzhen's exports accounted for 10% of China's total exports. High-tech sectors account for 51% of SEZ exports. The presence of a large number of export-oriented enterprises in the SEZ has led to the formation of a strong financial sector to serve the needs of both foreign and Chinese capital. As a result, the Lujiatsui Sub-Zone was established within the New Pudong Area, which housed the headquarters and operation centres of international financial institutions and provided financial leasing and asset management services, as well as maritime finance. To stimulate the country's scientific potential, HTDZs were created, which became a concentration of higher education institutions, institutes, research centres, and high-tech enterprises focused on generation of knowledge-intensive added value. For example, Zhongguancun's HTDZ has become the centre of venture capital and the location of most startups in the country. Also, the connection of the elements of the SEZ system should be noted. Thus, ETDZs industrial facilities were serviced by the logistics and warehousing infrastructure of EPZ and FTZ, which ensured China's export expansion.

Conclusions

At the beginning of its creation the SEZ system was aimed at mobilizing national labour and natural resources by providing a package of preferences and benefits to foreign investors for labour-intensive industrialisation. With the beginning of the Open Door Policy, a regulatory framework for the existence of foreign capital in China was created, in the form of joint ventures with Chinese and foreign capital. Within the SEZ, there was a corporate tax rate of 15% (with the tax ranging from 30-50% outside the zone), and a number of benefits and discounts in the case of large investments, their export orientation, and the availability of new technologies. The efficiency of joint ventures with Chinese and foreign capital has led to an expansion of the list of forms of the presence of foreign capital, resulting in companies with 100% foreign capital and contractual joint ventures. These forms of organization later prevailed in the SEZ. As the list of SEZs (Hainan Island, New Pudong District) expanded, the package of benefits and incentives was expanded to encourage FDI in high-tech industries. In order to create industrial clusters and parks, where capital-intensive and more technological products will be concentrated, ETDZs were created, where production and non-production activities were distinguished, and significant tax benefits were provided within the framework of the former. The presence of foreign capital in the form of high-tech export enterprises and research centres was actively stimulated within the framework of HTDZs. Privileges under the ETDZs and HTDZs were provided to newly established enterprises or large-scale long-term projects where foreign capital was present. SEZs were given broad autonomy, and local authorities could independently set the structure and rates of local taxes, as well as manage and administer SEZs. By introducing all the above benefits, the Chinese Government has managed to maximize the positive impact of SEZs and minimize or eliminate possible negative effects of FDI. Therefore, due to the creation of SEZs, and stimulated the accumulation of fixed capital and increase the investment potential of the economy, which in turn led to GDP growth. Due to a number of incentives, tax preferences, and discounts, China has managed not only to concentrate factors of production in more profitable and efficient sectors of the economy but also to avoid redistribution of factors in favour of raw materials through the introduction of bans. The condition of mandatory partnership with the Chinese side in enterprises with foreign capital made it impossible to displace the domestic producer (due to the loss of their competitiveness compared to powerful international companies) after China has formed a competitive national production potential (public or private). Enterprises with full foreign ownership were allowed. Due to many benefits provided to investors who reinvest profits for a long time, there was no repatriation of profits from China, but rather the accumulation of FDI. By introducing a mandatory export share of more than 70% to receive tax benefits, the Chinese Government has ensured the effect of export expansion, which has provided additional foreign exchange earnings and left the domestic market to national enterprises. Thanks to a number of benefits for enterprises that use the latest technologies or produce the latest products, SEZs have led to the

transfer of new technologies to China, stimulated the country's technological development, and contributed to the development of human capital and, consequently, productivity growth.

Therefore, the Chinese approach to the creation of special economic zones, providing a wide range of preferences and opportunities for foreign investors, along with setting clear requirements, rules, and restrictions to maximize the effective attraction of foreign capital, maximizing the positive effects of FDI and protecting the country from possible negative consequences.

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The Effect of Regulatory Policy on the UAE Financial Market Flexibility

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Abstract: The article discusses the regulatory measures of the UAE government to liberalize the domestic economic climate and attract investment flows. Attention is paid to the conditionality of the specificity of the UAE regulatory and legal system, the credibility of which is becoming one of the reasons for the UAE popularity among foreign investors. A number of recent legislative changes that have made significant changes in the investment regime are considered, a comparative analysis of past and current opportunities is carried out, while comparing the legal status of resident and non-resident investors. The preferences for special legal regimes are shown. The role of global digitalization and sustainability trends for the UAE's economic diversification strategy is revealed. The author depicted the specifics and role of the financial sector, revealing the regulatory distribution of powers in the field of finance. It has been confirmed that certain remained restrictions are determined due to the transformational transition and adopting the practices of advanced nations. The author of the article propose a positive scenario for further development through flexible regulatory mechanisms, provided that the level of sufficient and necessary government intervention continues.

Keywords: regulatory policy • economic • diversification • political economy • liberalization • government intervention • regime preferences • special economic zones • banking • currency restrictions • development strategy

The double shock of low hydrocarbon prices and the aftermath of the COVID-19 pandemic (a sharp contraction in the tourism sector, air transport, reconfiguration of global value chains, increased health sector funding, lockdown payments, increased fiscal deficits, etc.) has provoked new challenges before the UAE financial system, which must not only prove its resilience in a crisis, but also be able to continue to play its role in providing necessary resources for advanced economic development. The issue of increasing the financial market flexibility through improing regulatory policy has become increasingly urgent for the country in the context of economic liberalization of the basic framework of business operations, main registration procedures, and the specifics of the regulatory policy of free zones (FZ) and free financial zones (FFZ).

As a federation, the UAE is governed by a constitution that regulates, among other things, the distribution of legislative powers between the federation (federal capital – Abu Dhabi) and the individual emirates. According to the UAE Constitution, federal laws take precedence over the laws of individual emirates. However, some emirates are allowed to adopt their own legislation in areas other than those that belong exclusively to the federation, or in which the federation has not yet exercised its legislative powers (Auchoybur, Isabel & Miller, 2018). Federal laws usually regulate civil and commercial agreements, with the exception of property rights. Thus, the UAE's legal system is based on the principles of civil law, most of which are strongly influenced by Egyptian law (which, in turn, is influenced by French law), and Islamic Sharia. The legislation is divided into a number of basic laws that provide general principles of law, including civil, criminal, commercial, civil, company, intellectual property, immigration, maritime, industrial, banking, and employment. There is no precedent system in the UAE, but the decisions of higher courts have a convincing effect and are often upheld by lower courts (US Department of State, 2020).

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The federal and emirate courts coexist with parallel local jurisdictions, depending on which system the emirate has chosen. Each emirate has the right to create its own judicial system or unite with the federal judicial system. In addition to federal and local courts, Dubai International Financial Centre (DIFC) has its own courts. DIFC courts have jurisdiction over civil and commercial cases concerning contracts entered into or performed under DIFC, insolvency of DIFC legal entities, and civil or commercial disputes between parties who have chosen to submit to those courts. Moreover, Abu Dhabi Global Market (ADGM) has its own courts, modelled on the English judicial system. That is, investors have more confidence in securing property rights through offshore or national courts. Decisions of foreign civil courts can be recognized and enforced in local courts in case of signing an international agreement providing for procedures for mutual enforcement of financial decisions (KPMG, 2020).

As part of the strategic diversification, the UAE has reasonably shown its openness to FDI, viewing the UAE Vision 2021 strategic plan, aimed to achieve FDI inflows of 5% of GNP, as a key element of long-term economic growth. The practical expression of relevant freedoms for entrepreneurship can be found. Thus, the ownership of the majority of votes in public joint stock companies is not limited; foreign companies are allowed to work onshore (in the UAE outside the FZ) and in free zones, if certain requirements are observed; foreign ownership of land and shares is restricted only under certain circumstances; and the absence of a national regime is ensured for foreign investors. On the other hand, it is fair to mention that non-tariff barriers to investment persist through the use of restrictive agency, sponsorship and distribution requirements. In order to prevent the outflow and encourage the arrival of highly skilled foreign labour (expats), several emirates have recently introduced new long-term residence and land ownership visas (International Market Advisor, 2018). Therefore, a certain degree of positive discrimination against local investors instead of the foreign ones should be recognized. At the same time, steps are being taken to harmonize the application by companies of international financial reporting standards and accounting practices, despite the fact that there are no generally accepted local accounting principles in the UAE.

The UAE Government seeks to strengthen the share of domestic investors through a special federal incentive initiative called emiratisation: the private sector of the Emirates should grow up to 8% in 2021 (Ministry of Economy, 2020). Despite the fact that the authorities do not formally demand the foreign investors to provide with some of the latest technologies imported or to use some degree of local resource involvement, as some other developing countries do, there are other ways to encourage the UAE's inclusion in value chains (e.g. Abu Dhabi Local Content Programme (ADLC) as a extension of the Ghadan 21 Programme to intensify the development of the domestic market and the participation of entrepreneurs in Emirati tenders (Mishrif, 2019). In the defense field, the Tawazun economic programme is practiced. It requires that contractors with contracts worth more than $10 million work with local business partners, providing projected profits of 60% of the contract value for over seven years (Government Accelerators Programme, 2018).

A the new internal value (The In-CountryValue strategy, ICV, presented by the National Oil Company of Abu Dhabi (Abu Dhabi National Oil Company, ADNOC) in 2018 was a separate milestone of smart government intervention. According to the plan, contracts that provide for employment of the Emiratis or the use of local content have priviledges in the queue for conclusion. Interested companies have the opportunity to submit a single application for a unified ICV certificate, which will be the selection criterion for further procurement (SWFI, 2020a). The authorities see great prospects in this approach, as evidenced by the coordination between the Department of Economic Development of Abu Dhabi and ADNOC, the signing of an agreement on standardization of the ICV certification programme in February 2020, and plans to expand to other sectors and emirates in the coming years. Investment promotion agencies in each emirate support attraction of investment.

One of the key aspects of restrictions on foreign investment in the UAE is illustrated in the Federal Law on Commercial Companies of 2015, which requires at least 51% of legal entities to be owned by a UAE citizen or a legal entity wholly owned by UAE citizens. In addition, exclusively UAE nationals or organizations wholly owned by UAE nationals may carry out some activities, such as activities of commercial agencies and provision of labour (PwC, 2020). However, restrictions on foreign ownership of companies in the UAE have been significantly relaxed or lifted for certain sectors through application of the recent Foreign Direct Investment Act. Citizens of the Gulf Cooperation Council and organizations wholly owned by its citizens are not subject to foreign investment restrictions applicable in

the UAE and are allowed to carry out most of their activities, except for a very short list of prohibited businesses reserved exclusively for UAE citizens. The UAE is currently implementing a legal framework for free zones, which helps to create an attractive business environment by offering companies incentives such as a zero rate of income tax and exemption from currency controls. Such free zones include free economic zones, such as JAFZA, and financial free zones, such as DIFC and ADGM (International Trade Administration, 2019).

While free zone companies are technically allowed to operate only in the immediate vicinity of the relevant free zone, a number of free zones have introduced a dual licensing regime which allows free zone companies to establish presence and operate on the mainland under a license from the Department of Economic Affairs. In all cases, investors should carefully consider these geographical constraints when assessing the compliance of the company's registration in the free zone with their objectives.

As part of the ongoing federal course on digitalization, the Dubai Department of Economic Development presented a one-year 'instant trade license' (i.e. in minutes without a registered lease agreement) in 2017. In 2018, Abu Dhabi announced the issuance of dual licenses, expanding the scope of FZ activities outside the free zone, including participation in government tenders. In early 2019, Dubai Free Zones gave companies permission to work in several FZs in Dubai under a single license ('*One Free Zone Passport*'). In 2019, Dubai introduced a 'virtual business license' for non-resident entrepreneurs and freelancers. The emirate of Sharjah allowed foreigners to buy real estate without a residence visa on the basis of a 100-year renewable land lease (KPMG, 2019; Hogan Lovells, 2020). Second, registration procedures were liberalised, which became important in terms of building new forms of contractual relations based on the cyber-physical principle of interaction. Third, the government encourages creation of intangible assets and expansion of operations with them in the UAE, which, in turn, has a positive impact on the country's inclusion in global virtual networks for creation of such assets. Analyzing the current trends, it should be noted that the cryptocurrency market in the UAE, which is still in its infancy, is among the promising areas. According to Coin Schedule, the UAE ranked seventh (along with Germany) in the world in cryptocurrency sales in 2019 (Unlock Blockchain, 2019).

Increased use of electricity for mining shows that the cryptocurrency market as a whole and in the UAE will continue to grow, which is undoubtedly facilitated by the flexibility of the government approach at both federal and local levels, as well as the development of digital infrastructure. All the above proves the role, which is played by FZs in the process of stimulating the inflow of FDI to the country and government measures to liberalize regulatory policy, which administers their activities and deserves a more detailed analysis.

Currently, all UAE FZs create a number of incentives to encourage FDI: (1) throughout the emirates, foreign companies enjoy investment rights almost equal to those of the emiratis; (2) permission for up to 100% of foreign capital for a registered enterprise; (3) FZs are provided with full exemption from: payment of taxes and duties on imports and exports; commercial fees; full repatriation of capital and profits; long-term lease; easy access to ports and airports; buildings for rent, and subsidized energy resources; (4) the FZ administration provides significant support services (financial incentives, staff housing, labour supply, canteens and physical security) (Baker McKenzie Habib Al Mulla, 2019). Thus, free zones create an attractive environment for business for foreign investors offering them a number of useful preferences.

Given the above, it can be concluded that two types of free zones: FZ and EFZ have emerged in the process of developing optimal policies to promote investment in the UAE. Although, the UAE EFZs have some specific features characterizing their activities, their main features can be generalized as follows: 1) EFZ companies are not allowed to do business outside a particular EFZ; 2) provided that a company wishes to operate outside a specific EFZ or maintain a separate onshore presence in the UAE, it must either open a branch (which cannot carry out any trading activity) or create a new onshore company subject to restrictions on foreign ownership), and this requires a license from the Department of Economic Development of Dubai (DED) for the onshore branch/subsidiary; 3) FZs have the right to adopt their own rules applicable to companies, as well as special rules on employment and labour issues, which are often applied in connection with the Labour Law (Backer McKenzie, 2020). In other words, regulatory policy shows a high level of flexible decentralization: FZs have their own independent bodies responsible for licensing and assisting companies in starting a business, supervising, providing ancillary

services, etc .; investors can register new companies in the EFZ, license branches or representative offices with minimal expenditure of time and money.

In analyzing the regulatory policy of the EFZ DIFC, it should be noted that although the DIFC is exempt from UAE civil and commercial law and acts mainly as a self-regulatory general law jurisdiction, the DIFC applies UAE criminal law and special federal regulations, including anti-money laundering regulations. Any organization operating in DIFC must obtain a license from the Dubai Financial Services Authority (DFSA), which is the only independent financial services regulator at DIFC (Mayew, 2010). If a DIFC company wishes to operate outside DIFC or maintain a separate onshore presence in the UAE, it must open a branch or a new onshore company and obtain the necessary licenses from the relevant federal or emirate agencies. Since 2018, DIFC has had the DIFC Company Act which has changed the way resident companies operate; made it easier to do business; provided more flexibility for SMEs and strengthened corporate governance requirements for all DIFC companies.

There are two systems of regulation of the securities market – namely the federal regulatory scheme and DIFC – that developed at the UAE financial market, which is represented by three stock exchanges – the Abu Dhabi Securities Exchange, the Dubai Financial Market and NASDAQ Dubai (Mayew & Pretorius, 2020). In recent years, the prerogative of management over stock exchange, securities circulation and listing companies has shifted from the traditional UAE Central Bank (CB) to the UAE Securities and Commodities Authority (SCA) (Farn & Khan, 2018). The scope of the SCA has expanded significantly, and it is now the main regulator of capital markets within the UAE federal operation scheme. Such regulatory optimization has paid off: since 2014, Morgan Stanley Capital International (MSCI) has raised the UAE's capital markets from frontier financial markets (Frontier Markets) to emerging markets (Emerging Markets) and added nine UAE companies to its MSCI Emerging Markets Index (Torchia, 2014).

In 2018, the UAE Council of Ministers adopted a resolution allowing 100% ownership by foreign investors, and shortly thereafter the Federal FDI Act was adopted (allowing 100% foreign ownership but not applicable to all sectors and all applicants) (STA Law Firm, 2020; Sandater, 2020). The new full ‘Positive List’ for FDI in the UAE, which entered into force on March 31, 2020, demonstrates the UAE government's desire to create better conditions for economic activity. It lists 122 activities and sectors where 100% foreign ownership will be allowed (UAE has long maintained certain restrictions on the level of foreign ownership by UAE-based companies – a maximum of 49% of shares for a foreign investor and 51% for a UAE national shareholder), as well as detailed criteria for establishing and licensing of companies under the UAE FDI Law.

In practical terms, the changes have enabled economic development departments to decide to what extent a foreign investor may have an increased stake in a registered company and which shareholders or companies may qualify. Thus, according to the ‘Positive List’, companies must comply with the requirements of the new Law, in particular: a) companies that have received a license to carry out one of the activities from the ‘Positive List’ should maintain a certain minimum share capital; b) companies should adhere to certain targets set for the employment of UAE citizens (Momany et al., 2020). Overall, the implementation of the Positive List and the expanded FDI Law will stimulate FDI in the UAE as global economic challenges grow and help the UAE overcome both regional and global economic challenges.

The Rules of Investment Funds (2012), known as the ‘Twin Peak’ regulatory framework, are designed to manage the marketing of investment funds established outside the UAE for domestic investors and creation of local funds based in the UAE. This gave SCA the authority to license, regulate and supervise the marketing of investment funds. Thus, the marketing of foreign funds, including offshore funds in the UAE, such as funds registered with the DIFC, requires the appointment of a placement agent with a local license (STA Law Firm, 2020). This way, the UAE government, first, encouraged implementation of certain strategic projects through a public joint stock company to ensure public offering of shares; second, it required that any company providing banking, insurance or investment services to a third party be a public joint stock company.

In modern conditions, SCA, in addition to foreign funds, carries out regulatory supervision over the marketing of most types of foreign securities in the UAE, in particular, simple (not listed foreign securities), while the Central Bank still retains oversight powers over complex products (for example, bonds with a built-in default swap) (Central Bank UAE, 2020). In the period 2016-2019, the regulatory

body introduced a series of regulations aimed at addressing the following issues: a) short sales and liquidity, b) centralized clearing, c) cross-border securities trading, d) control of efficiency and compliance with the criteria.

Changes are also gradually taking place in the field of taxation: the UAE introduced VAT at a standard rate of 5% on January 1, 2018. VAT in the UAE is a broad-based tax with few exemptions. Exceptions are life insurance supplies, financial services that are not provided for an explicit fee, residential buildings, land and local passenger transport. Taxpayers who provide exempt services are not entitled to a refund of the VAT charged on them (Export Entreprises SA, 2020). The zero VAT rate applies to certain supplies, such as exports of services and goods, preventive and basic medical services, and educational services. Deliveries of goods within a number of FZs are not subject to VAT in certain conditions. The new provisions also define mandatory tax registration, optional tax registration, registration subject to exceptions, and cancellation of registration.

Although there is no fixed income tax at the federal level, some emirates have adopted their own corporate income tax decrees, but in practice corporate income tax is currently levied only on oil companies and branches of foreign banks. The sale of shares is not subject to capital gains tax. Real estate transfer tax, or 'registration fee', is levied on the transfer of ownership of real estate in the UAE (including in the case of indirect transfer to a company that owns real estate in the UAE). In 2020, the Ministry of Finance announced the study of reform corporate tax regime, analyzing possible levels of tax rates and emphasizing the provision of at least one year to prepare for any changes for businesses (however, there are no exact deadlines for implementation of corporate tax legislation, as the laws still go through many stages before they enter into force) (Baker McKenzie Habib Al Mulla, 2020).

At the same time, the government is imposing additional restrictions on the ownership of some public companies. As a result of these restrictions, the demand from foreign investors for shares of individual public companies can sometimes exceed the number of shares allowed for sale to foreign nationals.

The developed banking sector of the country, which has 49 banks, 27 of which are foreign institutions, deserves special attention within the regulatory policy: according to the UAE Central Bank, as of January 2020, assets amounting to $839 billion were registered (Central Bank UAE, 2020; John, 2015). There is an increased trend towards concentration and centralization of capital, and the physical presence of bank branches has decreased significantly due to development of online banking. Custodial agreements have become widespread. Although there are some restrictions on opening bank accounts for non-residents and residents have access to more favourable loans, loans are provided on market terms, the peg of the national currency to the US dollar simplifies targeting for investors. After all, interest rates are usually quite close to rates in the United States.

According to the IMF, there are no restrictions on international payments and transfers in the UAE (the UAE dirham has been pegged to the dollar since 2002, the average point between the official AED buying and selling rate is AED 3.6725 per US dollar, and the currency is freely traded at market rate), except for security-related restrictions (CMS Law-Now, 2019). The Foreign Exchange and Remittance Group (FERG, 2020) has been organized, because, in contrast to similar international companies that mainly exchange money, exchange companies in the UAE are the main official channels for transferring large amounts of money by border: according to migration and remittance data from the World Bank, the outflow of remittances from migrant workers from the UAE was $44.9 billion in 2019 (Gibbon, 2020).

Sovereign wealth funds occupy a special place in the practice of improving regulatory policy in the context of their role in diversification processes (SWFI, 2020b; Investment Corporation of Dubai, 2020). In general, UAE funds show differences in their approaches to investment management: Abu Dhabi Investment Authority (ADIA) usually does not seek to actively manage public companies, while Mubadala seeks to play a more active role in certain sectors (oil and gas, space, venture capital, infrastructure). Thanks to its autonomy from the government of Abu Dhabi in terms of implementing investment programs, ADIA is able to protect its interests or oppose economically unviable proposals through its voting rights (SWFI, 2020c; DFSA, 2020).

In view of all the above, it can be stated that today there is a gradual but systematic liberalization of the UAE financial sector through legislative and regulatory changes. The results confirm this conclusion: the volume of FDI in the UAE for the period from 2018 to 2019 increased by 32%, reaching 13.8 billion US dollars according to the UNCTAD report on global investment for 2020. Over the same

period, accumulated FDI reached $154 billion (UNCTAD, 2020a; UNCTAD, 2020b). The UAE was the largest recipient of FDI in the West Asian subregion in 2019 due to a significant number of investment transactions in the oil and gas sector. The bulk of FDI is concentrated in the sectors of trade, real estate, finance and insurance, manufacturing, mining and construction; and the United Kingdom, India, the United States, France and Saudi Arabia are the main investors.

Consequently, the indisputable assets of the country are absence of direct business taxation (excluding banks and oil companies) and direct income taxation, currency control and any restrictions on capital repatriation, as well as the presence of a developed and profitable banking sector, and a significant amount of expat labour resources. Furthermore, the government is likely to liberalize laws concerning foreign ownership of enterprises in certain sectors that have yet to be determined. In a more general sense, taxation is an area where significant changes may occur in the future (introduction of corporate tax and income tax), taking into account new economic and environmental challenges.

In this context, it is also logical to continue the process of in-depth digitization of regulatory and business procedures and processes to optimize the time spent by companies and government agencies. Measures to liberalize business conditions, where simplification of regulatory procedures is one of the elements, are aimed at stimulating attracting FDI. It, in turn, can provide funding for development of a wide range of projects in various sectors of the economy, which has a positive impact on flexibility and adaptability and the financial market in particular. Liberalization of regulatory policy in EFZ and FZ, simplification of licensing procedures, expansion of onshore operations, in particular, is aimed at attracting new residents and stimulating FDI. This demonstrates the fact that regulatory policy shows a high level of flexible decentralization, as evidenced by a consistent set of legislative regulation of financial markets.

In our opinion, the process of improving the UAE regulatory policy needs to focus on harmonization of regulatory rules and procedures governing the financial markets, which are currently relatively uncoordinated, and to continue liberalization of procedures in the banking sector. In the medium term, the UAE's regulatory policy will aim to ensure a balance between: foreign participation and emiratisation; minimum taxation and tax revenues; economic and scientific and technological development within the liberal model and traditional religious values and cultural traditions, – which can only be achieved by non-standard approach to regulatory policy, which should be based on adaptability, moderation and compliance with national strategic interests.

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Theories of the SME Internationalization

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Abstract: The article is aimed at systematization of modern business internationalization research and its application to the analysis of small and medium-sized enterprises (SMEs). It discusses theories of multinational enterprises' (MNE) internationalization and considers their relevance within the discourse of the SME internationalization. The paper showcases the advancements of the theories developed before the start of informatization, as well as an overview of the latest concepts. The article is based upon the theoretical framework that proposes two approaches for business internationalization analysis – gradual and immediate. The author discusses the reasons of inclination towards the second approach, following the ideas described in the international new ventures studies.

Keywords: business internationalization theory • small and medium-sized enterprises • international new ventures • born global • information enterprise

Introduction

Value added created by small and medium-sized enterprises has amounted to 55.9 percent of the total value added created in the business economy in the European Union (27 countries) (Eurostat). The growth of the SMEs has not gone unnoticed by researchers and scholars, particularly in the field of international business. The growth in the volume of operations, the increase in the share of production and income of small and medium-sized enterprises, which characterize their growing competitiveness, requires explanation. The growing share of SMEs in exports (accounting for 38 percent of EU exports (excluding Estonia) (Eurostat) requires attention in terms of developing a theory of business internationalization that can explain the international success of companies that do not have significant financial and human resources. Exports of services account for about 48 percent of SME exports according to a survey of individual EU countries.

The need to study the issue is determined by the importance of SMEs in creating value added and exports. The aim of the article is to analyse the current state of theoretical developments in the field and to define the paradigm in order to develop the appropriate framework for analysis of the SME internationalization.

Literature Review

The basics of the business internationalization analysis were set in the works of S. Haimer, C. Kindlberger, R. Vernon, P. J. Buckley, M. Casson, A. M. Rugman, J. Stopford, and L. Wells. Different approaches – from the stages of enterpise's development to lifecycle of the product – were used in order to explain the reasons for internationalization and to find the factors influencing its success. Empirical reflection of the gradual internationalization beliefs may be found in the Uppsala model presented by J. Johanson and J.-E. Vahlne, including the revised model presented in 2009.

The resource-based view, which is considered to be one of the main forming bases of the modern SME internationalization models, was presented by J. Barney. Future development of the theory have led to the development of the VRIO model and have changed the accent from the knowledge as internationalization factor to knowledge as the resource.

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The non-gradual internationalization concepts including the theory of the international new ventures and 'born global' are discussed in the works of B. Oviatt, P. McDougall, T. Cavusgil, and G. Knight. Systematization of the developments in the field of international business theories till the end of 2000s is conducted by O. Rogach (Rogach, 2020a).

The marketing concepts and modern view on the internationalization is based on research of J. Paul.

Research Results

Since the start of the extensive research and analysis of business internationalization, the leading theories of international business have been based on the gradual internationalization of the enterprise. They argue that a company should first take a strong position in its own market, and then enter the international market. Acquisition of monopolistic advantages, need to extend the product life cycle, gain knowledge about foreign markets or internalize transactions are believed to be the reasons for that. Those models are relevant for large multinational companies, but they cannot explain the phenomenon of the rapid small business internationalization.

The turning point in the analysis of the small enterprise internationalization is development of international new venture theory and 'born global' concept. It rejects the idea of gradual internationalization and states that new ventures are able to start international operations since inception.

Each theory discusses different aspects of enterprise internationalization. The emphasis here is made on the differences between large MNEs and SMEs, and possibilities of model's application to its analysis.

The revised Uppsala model (Johanson & Vahlne, 2009) is a view that focuses more on the external environment of the company. In the initial model external factors that influence decision making in the process of internationalization and its success were mostly ignored. The level of market competitiveness, availability of market information, effectiveness, and growth potential were not discussed before the revision of the model in the late 2000's. In both models, internationalization is viewed as a gradual process. Vital role of step-by-step approach was defined by the needs of risk management. In the initial model, the lack of knowledge about the foreign market was seen as the main obstacle for the rapid internationalization of firms. The revised one shifted accent from the internal acquisition of knowledge to the possibilities of external cooperation for the transition of information. Despite significant improvements, the improved Uppsala model still did not meet the actual market conditions, as it could not explain existence and success of the companies that start international activities right after establishment. Organizational training is not conducted by such enterprises to achieve a high degree of internationalization, which questions the approach of gradual analysis.

The revised Uppsala model discusses certain provisions of the network theory. The network theory is aimed at showing the potential of network-based knowledge acquisition, which provides a closer look at the potential of the beginning of international operation since inception.

Activities of the small and medium-sized enterprises are mainly based on intangible assets in its possession or disposal. Resource-based view (Barney, 1991) discusses the influence of resources on internationalization. It states that unique resources are the key for competitive advantage, which is considered as the main factor for successful internationalization. According to the VRIO model (Barney, 1995), for the resource to be considered as 'unique' it should be:

- valuable;
- rare;
- unique;
- organizationally embedded.

The value of the resource includes a possibility to effectively use it in the enterprise to achieve strategic goals, allows an enterprise to use opportunities and neutralize threats (Barney, 1995).Valuable resources are the ones that have potential for profit creation and loss prevention (Miller & Shamsie, 1996).

The rarity of the resource means its scarcity and access barriers. The same resource within different enterprises may gain or lose the characteristic of rarity (Barney, 1995).

The uniqueness of a resource is determined by the conditions of its creation and use, as well as the uncertainty of the results, which means the actual impossibility of reproduction of the resource by repetition of strategic steps taken by the company in order to obtain the resource of another company (Rogach, 2018).

Organizational embeddedness means the inseparability of the company's operating activities and resources and the inability to remove it from the value chain within the company without partial or complete loss of its usefulness.

The gradual development of the concepts based on the essential characteristics of a unique resource has led to their integration into a theory that took into account the factor of the unique resources, but also described organizational structure, transactions and market conditions of the enterprise.

The theory of international new enterprises (Oviatt & McDougall, 1994) considers the internationalization of a new international enterprise as an intellectual process rather than empirical, which means that previous practical acknowledgement about the market and history of interaction with it does not play the key role in the internationalization decision-making, neither does it affect the results of it.

The formation of an international new enterprise starts with the beginning of cross-border activities and internalization of transactions related to such activities. As a result of relations with economic counterparties from abroad, activity gets an organizational structure, resulting in that activity becomes an enterprise. Due to the small size of the enterprise, it is managed through alternative structures in which the greatest role is played by the authority of management and personal relationships. An integral element that is responsible for the strength of the structure and sustainability of the enterprise is the availability of unique resources. This element is in the focus of researchers, because it is the source of a stable competitive advantage. Protection of such a resource is often the most important function of enterprise management, which significantly complicates its management due to existence of contractual relations and significant adaptability of the organization. The combination of all the above mentioned elements underlies the concept of sustainable new international ventures.

The theory points out the difference between a large MNE and SME. Alternative management structures are irrelevant for large companies due to their size. In contrary, maintenance of hierarchy in the organizational structure of the small enterprise may require additional sources that appear to be scarce for the venture.

As knowledge is identified to be a part of the firm’s unique resource base, an enterprise should limit the dissemination of its knowledge in order to preserve commercial value (Oviatt & McDougall, 1994). Thus, the following ways to apply restrictions on the dissemination of unique resource in the form of knowledge have been identified:

1) due to patents and copyrights the use of unique knowledge may be impossible, knowledge is protected from imitation or at least the production of substitutes is slowed down;

2) the complexity and imperfection of the imitation of knowledge due to their organizational integration and social complexity, as well as the unpredictability of causal relationships that preceded the formation of knowledge as a competitive advantage;

3) the use of flexible licensing conditions by establishment of relatively small license fees for long-term use of technology, which significantly reduces the motives for imitation of knowledge without the permission of their owner, and short-term use of knowledge (caused by rapid destruction of its value).

The concept of ‘born global’ (Knight & Cavusgil, 1996) complemented the international new ventures theory, and sometimes is referred to as a spinoff (Rogach, 2018).

‘Born globals’ are characterized as the firms:

1. conducting only international operations;
2. having early internationalization;
3. having high organizational capability.

The analysis of the enterprise in the ‘born global’ concept is conducted through the lens of management effectiveness and variability of organizational structures, and innovation culture, which brings in product, operational and organizational innovations.

The abovementioned concepts are concentrated on the key differences between the large enterprises and the small ones. From the point of view provided by the theory of the international new ventures and the concept of ‘born global’, the key for the international success is the availability and

possibility to defend unique resources, complemented by the ability to act agile and effective with the use of innovative structures.

The research on the internationalization of the last 20 years brought in a few old-new concepts. Interdisciplinary research allowed scholars to merge the international business theory with business management and marketing. It is worth mentioning two of them – the 7-P approach to the analysis of the purposes of internationalization (Paul & Mas, 2020) and the CPP model (Paul & Sánchez-Morcilio, 2019).

The 7-P approach offers a framework for the analysis of the factors infuencing the extent of possible success in the field of internationalization through the prism of seven parameters. The performance depends on the potential, path, processes, pace, pattern, and problems. This approach is widely used in marketing and business management in the enterprises of all levels. The reason for the use of this framework for the analysis of the possible outcomes of internationalization is concerned with the possibility of unification of all the process analysis under the same framework. However, this concept is a tool, but does not provide an exact outcome when using defined combination of factor values.

Another view, the CPP model, provides an insight to the internal view on internationalization. The model classifies companies into categories according to the level of perception of internationalization risk (Paul & Sánchez-Morcilio, 2019):

- conservative – choose not to conduct internationalization to any extent;
- predictable – those internationalizing to the markets with predictable conditions (for example, the EU market for EU member states);
- pacemakers – internationalizing to the third-country markets.

Finally, yet another theory of the SME internationalization is being discussed. This digital enterprise theory is aimed at explaining the purposes of rapid internationalization of the firms that do not hold unique resources (Herve et al, 2020), questioning the traditional models regarding the applicability of resource-based view and gradual internationalization to the current market conditions (Coviello et al, 2017).

Conclusions

As a result of the analysis, the conclusion can be made that there are four main theories discussing the internationalization of small enterprises:

- revised Uppsala model;
- resource-based view and VRIO model;
- theory of international new enterprises and ‘born globals’;
- network theory.

There are also several external views on the internationalization of SMEs brought from the different fields, namely marketing 7-P approach and the CPP model.

Systematization of the research in the field of the non-gradual SME internationalization allows us to draw the following conclusions:

- small and medium-sized enterprises are characterized by flexibility, high efficiency and dynamism of processes. This allows them to resist the capabilities of large companies, which include the ability to use the effect of scale, market knowledge, financial and technological capabilities;
- in order to effectively compete in the international environment, SME should obtain and maintain the resource which can be characterized as valuable, rare, unique, organizationally embedded;
- the obstacles of the small and medium-sized companies’ internationalization are concerned with the lack of experience in export activities, a high degree of influence of trade barriers on export opportunities, low coordination opportunities, and lack of knowledge about the market;
- internationalization of the SMEs is based on market knowledge that can be obtained from external sources (e.g. foreign partners) without the need for internal learning and knowledge formation.

The international new ventures theory lies within the current paradigm of the SME internationalization research. Based on the research, it may be called the base theory for the current developments in the field. Future development in the theories of business internationalization are expected to be concerned with the global processes of reshoring and global value chain reorganization (Rogach, 2020b), which means the shift of emphasis from international production to exports.

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Contemporary Conceptual Approaches to Global Value Chains Analysis

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Abstract: A global value chain is the full cycle of activities undertaken to bring a product or service from its conception to its end use and how these activities are distributed over geographic space and across international borders.

Keywords: multinational eneterprises **(**MNEs) • internationalization • fragmentation of production • global value chains (GVCs).

Survey of literature: Information base of research is the research of books and article of Rugman, A.M., Verbeke, A., Rogach O., Gereffi, G., Fernandez-Stark, K., and analytical reports OECD, IMF, BIS, materials of the European Commission, etc.

Research Results

The price fragmentation chain has yet to lead to a worldwide dispersion of work. Thus, in management literature, the term «global value chain» is used for cases where some functions are located in other countries. However, there are restrictions in this literature on various grounds. For starters, some studies studying the geographical scope of companies' work say, in fact, that we cannot talk about mass, but only about regional dispersal (Rugman & Verbeke, 2008). Some researchers explain that creation happens in regional blocks, which can be connected to 3 «factories»: Factory Asia, Factory North America and Factory Europe (Gereffi & Fernandez-Stark, 2011.) MNEs managing mass networks are increasingly inclined to work with the smallest number of larger and more capable suppliers, operating in the smallest number of strategic locations worldwide and advocating regionalization.

In-2, the strategic management literature explains that companies are obliged to spread their own work around the world and choose the best space for themselves to obtain competitive excellence (Rogach, 2019ab). Not least, the study focused on the analysis of certain job styles and how to relate them to the characteristics of the host State. But these studies demonstrate the prerequisites for the placement of all sorts of work styles in certain States and the resulting benefits, They do not demonstrate the geographical scope of the price chain and do not take into account the complexity of the present business world or the wider range of strategic opinions of the firm. As a result, it is essential to study these components as a whole. In the unfortunate case, it would not be possible to take into consideration a certain number of points that are relevant for assessing the impact of the mass price chain configuration. Some studies use this perspective of connecting the entire system to learn the «degree of globality» chain of creation of value. Highlight 3 on the similarity of value chain configurations, taking into account the geographical coverage of MNEs – international, multinational and mass price chains. However, this vision concentrates on the study of MNEs as a unit of analysis that has the ability to hide the life of mass creation chains of the price, including the external and internal appearance of the work. (Baldwin & Lopez-González, 2015.)

More to the point, once again the significant issue that comes into play when the work is scattered all over the world, is how enterprises may need to adapt to differences in district markets, At the same time, economies of scale and scale should be applied and knowledge transfer between locations maximized (Rogach, 2019cd). Customization of the mass value chain has the ability to keep in mind the

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management of heterogeneous languages, cultures, rules, etc. D. The capabilities required in any market tend to differ, and this leads firms to more predictive and control values. Companies have every chance of balancing their own internal and external accessories in any host country. More such, the abilities and the effects of study needed to manage different objects are likely to stand out depending on the similarity of the work in question in the price chain (Gereffi & Fernandez-Stark, 2011). As a result, ancillary research is being conducted to attribute how companies deal with the difficulties they face in dealing with the abundance of tertiary institutions and to find out what nuances have a good chance of changing companies in order to mitigate the likely adverse effects.

After all, the literature explains that there are unexpected conditions that affect companies in their variants of the geographical configuration of the mass price chain. Some researchers that, in fact, the image of the branch is considered to be the moment that goes in the footsteps to take into account, because some branches are limited by input barriers that make it difficult to adjust the price chains at the mass level. The possibility of mass price chains is higher in sectors of the economy with low entry barriers to manufacture these as a garment industry, because there are more possibilities for externalization and sourcing worldwide (Magutga, 2012). From a company's point of view, it is essential that companies have a mass orientation. That not the least forthcoming studies have all chances to attribute, as companies have all chances to change «global» the own chains of creation of the price. There are companies that appear with a massive mandate and create a massive price chain from the start. However, there are companies that design a restructuring process to arrange their own price creation chains on a massive scale, or elementary because agents in the price creation chain replace their own findings of location. Differences between them, their decision-making processes and their results would be a fascinating area of study. To summarize, Table 1. offers an overview of the studies analyzing the location decisions of a global value chain configuration.

Table 1. Studies considering the geographic scope of GVCs.

Topic	Description	Studies
Degree of 'globalness'	Regional vs. global	Asmussen et al., 2007; Baldwin and Lopez-Gonzalez, 2015; Gereffi and Fernandez-Stark, 2011; Los et al., 2015; Mudambi and Puck, 2016; Rugman et al., 2009; Verbeke and Asmussen, 2016
External conditions affecting the geographic scope of global value chains	Industry factors Market differences	Magutga, 2012 Gereffi et al., 2005; Gupta and Govindarajan, 2001; Meyer et al., 2011
Capabilities required in global value chains	Organizational and technological capabilities	Eriksson et al., 2014; Levy, 2005; Murta et al., 1998; Zou and Cavusgil, 2002

Source: Hernández et al. 2014.

In the last decade, GVCs have become more concentrated, both in the geographical area, for example, and in the organizational project. Without regard to the initial expectation that the sheer proliferation and fragmentation of production work have the potential to lead to a greater role for the least developed States and small companies in the GVC, More recent data in a number of sectors of the economy, from clothing to cars, electronics, and proposals in particular, hope that GVCs are geographically concentrated in the smallest number of States, especially in emerging economies with huge domestic markets and a solid base of suppliers, such as Brazil, China, India and South Africa. The desire increased due to the massive recession, because the major GVC firms were improving their own supply chains to focus on the smallest number of large, more capable suppliers that are strategically close to the dynamic nodes of the GVC (Rogach, 2020).

The cell phone sample is good. Until the late 1990s, all mobile phone development was carried out in developed economies. The subsequent upsurge in mass outsourcing shifted the creation to developing states. The five largest exporters – China, South Korea, Hong Kong, Vietnam, and the USA – accounted for 74% of large exports in 2012, with China alone accounting for half of them. As a result, mobile phone

development is now concentrated in several Asian states, especially China, South Korea, and Vietnam. More like this, the main nodes of mobile phone GVCs are important to consolidate. The top five companies account for more than 50 per cent of the universal markets for mobile phones (56 per cent), telephones (60 per cent), contract manufacturing (75 per cent) and operating systems for telephones (99 per cent). 2 major companies control a huge share of any market, for example, Apple and Samsung in the area of telephones, which actually creates oligopolistic market structures (Gartner, 2013).

There are a number of results of this rise in concentration in the GVC. For starters, modernization capabilities are unevenly distributed among States and firms, and concentration increases outstanding connectivity and exclusion defects in GVCs. Because an important share of large manufacturing and exports is created by a handful of states, which are marginalizing the bulk of states and companies because of weak links with large branches and limited modernization opportunities. Apart from this, the rise in the number of large member countries as the weighty spaces for manufacturing GVCs forces other states to reduce costs and reduce their own competitive advantage. As a result, the geography of manufacture – to which states are or are emerging – is strongly influenced by the findings of several mass brands and their main contract manufacturers.

For RP companies, the growing geographical concentration and concentration of the value chain have increased their impact on GVCs. They clearly benefit from the concentration of manufacturing in emerging economies, while at the same time their increasing capabilities enable major large firms to relocate more manufacturing to those States. For example, East Asian contract manufacturers like Foxconn used the superiority of strong supplier bases grouped in China, what is considered to be the megacity of its supply chain and adjacent East Asian states. Because massive core firms like Apple and Hewlett-Packard want to use more capable suppliers, RP firms are more likely to serve mass companies and promote their own positions in GVCs. The emergence of large, consolidated inter-national suppliers in States with independent economies gives rise to expectations, in fact, that they have every chance of delaying the impact of major universal firms. (Appelbaum, 2008).

Conclusions

GVCs have made a strong and significant contribution on world trade, productivity growth, competitiveness, and therefore the standards of living within economies – the fundamental goal of economic progress and policy.

The concept of the GVCs originates from Porter, being further developed by Gereffi, G., Humphrey, J., Sturgeon, and other researches. Porter's value chain concept is concerned primarily with how firm strategies can be renovated by shifting the focus to the configuration of business activities. Among the latest theoretical attempts to explain global value chains are Contract theory, network theory of firms, "trade in task" theory, and other.

Worth concluding that the geographical scope of firms' activities should be studied to analyze the global value chains characteristics. Companies are obliged to spread their own work around the world and choose the best space for themselves in order to gain competitive advantage. Customization of mass price creation chain has the opportunity to hope to manage heterogeneous languages, cultures, rules, etc. Fundamentally, so that firms have mass orientation. It goes in the footsteps of remembering, actually, that there are companies that appear with a mass mandate and from the very beginning create a mass chain of value creation.

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Real Estate Industry under the Pandemic Conditions: Prospects for Development

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Abstract: The main objective of the research is to identify basic directions of the response of the developed commercial real estate markets to the shock events of the viral pneumonia pandemic during the lockdown condition of the markets and assess the prospects for the development of commercial real estate in the context of consumer sentiment.

Keywords: Real Estate • COVID-19 • Pandemic • REIT • Commercial Estate • Developing • Proptechs

Introduction

The COVID-19 pandemic has become a unique and unprecedented phenomenon of global development, forasmuch as it has made significant adjustments to most human processes of all levels and directions on the planet in a short historical retrospective time. The economic sectors at the micro-, macro- and mega-levels were affected by the new regime of their activities and were forced to rethink the stages of production and marketing of goods and services in view of the new conditions of human development. The impact of the pandemic can be conditionally characterized in two directions: first, the quarantine or lockdown regime directly and actually stopped the production of goods and services that did not belong to the emergency group and practically stopped the movement of such goods, services and labour. As viral pneumonia spread across the planet, such an initial wave regime lasted for the first three quarters of 2020 and was marked by a temporary halt in economic and social activity or its reconfiguration to a remote mode in order to keep the population in self-isolation, which, of course, was the impetus for the fall of the global stock market and the prerequisite for a new global financial crisis. Secondly, the aforementioned regime was introduced with the aim of stretching the so-called epidemiological incidence curve, which reduced the potential local pressure on the medical systems of states in its flatter form. Therefore it seems obvious that the pandemic will not disappear through this form of resistance as an exogenous factor of economic activity, and therefore the business community is forced not only to wait out the suspension of activities, but to form new approaches to doing business due to changes in demand, supply and financial conditions. In such a situation, the commercial real estate market has shown itself to be a unique example of an industry that has been mainly influenced by the phenomenon of social distancing, which in turn may become the new norm of interpersonal interaction in the corporate and commercial sectors of the global economy.

Literature Review

Analyzing the specifics of commercial real estate at the sectoral and segmented levels in modern literature the profile works of such scientists are considered: A.M. Asaual, V.I. Pavlov, I.M. Geller, E.Yu. Kolosinska, L.P. Chubuk, D.A. Corb, R.A. Giovangelo, T. Lynn, D. Sirota, A.B. Thurza, K.B. Abbott, J.R. Benett, as well as thematic reports from specialized associations and organizations and international audit and consulting companies such as Pricewaterhouse Coopers and Deloitte. Researchers are paying attention to commercial real estate as an investment tool, at the same time, which is increasingly seen as an alternative to financial assets. Aspects of this area functioning in the specified conditions of the

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pandemic are naturally variable and require further research, given the significant importance in the global investment environment and its ability to reflect global business trends.

Research Results

The global financial and economic crises naturally bring large-scale destabilization to the commercial real estate industry. Over the past decades, two main types of shocks can be traced in the framework of real estate impact: 1) economic downturn and an immediate reaction in the form of a short-term impact on the prices of commercial real estate assets, but with minimal impact on transactional real estate activity; 2) economic processes such as the global financial crisis of 2008-09, which forced the market to recover at a slow pace and was marked by both price and transaction falls (Figure 1). At the end of 2019, the commercial real estate industry held strong balance sheets, capital availability and liquidity were a good level, and companies could manage the debt maturity to longer positions (Figure 2) (Deloitte Insights, 2020).

	Asian flu; recession	**9/11 attack; recession**	**SARS**	**Global financial crisis; Swine flu**
	Q3 1957 -Q1 1958	***Q1 2001 -Q4 2001***	***Q4 2002 -Q2 2003***	***Q1 2008 -Q1 2010***
Pre-event (4 quarters)				
GDP				
Commercial Real Estate Price index				
Real estate investment trusts				
Transactions				
During the event				
GDP				
Commercial Real Estate Price index				
Real estate investment trusts				
Transactions				
Post event (4 quarters)				
GDP				
Commercial Real Estate Price index				
Real estate investment trusts				
Transactions				

Trend indicators

No color - *Data not available*	***Negative***	***Declining but positive***	***Flat to positive***	***Rising***

Figure 1. The impact of past epidemics, pandemics, and economic downturns in commercial real estate. Source: Deloitte Insights, 2020.

In this state, the industry entered the global economic system and faced unique obstacles in 2020. On December 31, 2019, China informed the World Health Organization of 40 cases of respiratory infections of an unknown virus strain in the city of Wuhan with a population of about 11 million. On January 7, 2020, Chinese virologists confirmed the isolation of a new coronavirus strain – SARS-CoV-2, which was similar to the known ones, but had not been previously recorded in laboratories. On January 11, China reports the first death from complications caused by viral pneumonia, and on January 13, the first cases of infection are reported outside China. Outside the PRC, the number of confirmed cases of infection was increasing, in particular in South Korea, the United States, Hong Kong, Singapore, Malaysia and Taiwan, France, Australia and Italy (Burak, 2020). On March 11, WHO qualified the spread of viral pneumonia COVID-19 as a pandemic (WHO, 2020). Europe, and then the United States, became a new epicenter of morbidity in the world. The leading industrial countries of the region began to introduce a quarantine regime or lockdown, according to which the population was allowed to leave the premises only when absolutely necessary. Later, other regions of the world maintained a similar form of

restrictions with variations, but the regime of self-isolation and social distancing remained a key aspect in the vast majority of cases. Financial markets reacted noticeably and sharply: The S&P 500 and Russel 2000 were down 13% and 29% respectively from the beginning of the year as of April 15, while the yield on 10-year US Treasuries fell 127 basis points to 0.6% over the same period (Deloitte Insights; Nareit Index, 2020).

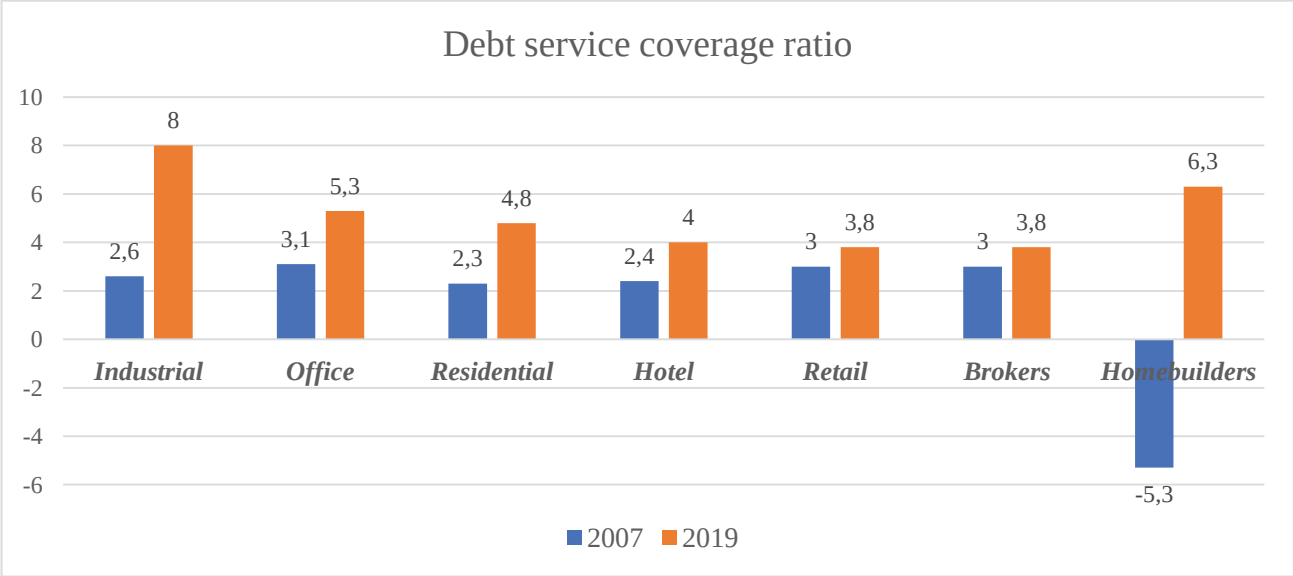

Figure 2. Commercial Real Estate Market Conditions Pre-COVID-19 (2019-end) vs Pre-global Financial Crisis (2007-end).
Source: Deloitte Insights, 2020.

The pandemic impact on the commercial real estate market should be analyzed through the prism of the industry sectors. A striking indicator is the Real Estate Investment Trust (REIT) indices – companies that buy or build real estate and then manage it through a collective investment tool. The REIT receives income both from the increased value of shares in the process of changing price level of real estate, and from direct rent payments of real estate.

Thus, as of April 15, 2020 REIT indices for real estate in the form of data and server centres grew by 34% compared to previous year, while the indices of retail and hotel real estate decreased by 48% and 53%, respectively. On the one hand, all other things being equal, the risks in the field of lease of commercial real estate are often significantly reduced due to the conclusion of long-term contracts. However, in this situation, the lease was associated with the most affected segments, and if its contractual volume remained the same, tenants simply stopped their economic activity and any payments. The best situation, which would not require additional negotiations, is a schematic, according to which the rent is calculated as a share of sales. In turn, the construction and real estate development sectors were affected by the slowdown in some stages of construction. Research has shown that nearly half of US construction firms suspended projects, and more than 60% faced shortages or delays in key building materials and personal protective equipment for their workers in the first half of the year. The proptech segment – digital projects in the real estate market, including both smart construction and smart city, and digital platforms for searching for real estate, were affected by different impacts due to the variety of types of products and services they provide. Office co-working space and co-living/vacation rentals were naturally significantly negatively impacted. And in this sector, it is worth considering two opposite development factors, the first of which indicates a possible change in office placement in terms of remote working, which will reduce sector growth rates. But the second is to introduce the newest digital solutions to manage both commercial and residential real estate, in turn, will stimulate the industry (Millionacres, 2020).

Thus, the epidemic outbreak of COVID-19 naturally affected the commercial real estate market. In order to further demonstrate some of the main pandemic impacts, it is worth citing the research results of the US National Association of Realtors survey October 2020 on the trends and outlook for commercial real estate and find out the changes from the same January survey. The following are the key findings that respondents reported in October compared to what they could notice in the first quarter:

- 53% reported an increase in the level of unpaid / late / partially paid apartment rent;
- 54% reported an increase in unpaid / late / partially paid rent payments for office, retail and industrial space;
- 65% reported an increase in the number of tenants who received concessions in lease agreements due to force majeure;
- 43% reported an increase in leasing operations for properties located in suburban areas compared to the central business district;
- 43% reported an increase in demand for office space such as coworking from corporate clients;
- 62% reported an increase in the number of companies that rent or move to offices with smaller footage for transferring part of their staff to remote work;
- 59% reported an increase in the share of short-term office leases;
- 52% reported an increase in the repurposing of vacant shopping centres.

At the same time, despite the above trends, the price level in the commercial real estate market continued to grow. According to the October report of the American real estate analytical and investment agency Real Capital Analytics and its RCA Commercial Property Price Indices (RCA CPPI), prices for commercial real estate in the United States have increased by 1.4% since September 2019, and this level is still noticeable below in the same period from 2018 to 2019. The main growth drivers, according to analysts, were the price level for apartments (6.7% per annum) and industrial facilities (7.4%), thereby compensating for the significant failure in the real estate sector, commercial trade (by 5.3%) and office buildings (by 1.5%). Thus, in the third quarter of 2020, the cash volume of the US commercial real estate area was 57% lower compared to the same period in 2019. Office sales declined 60%, while apartment transactions declined 51%, which meant deferred demand for prospective buyers in anticipation of greater clarity about the pandemic. Moreover, thanks to available lending, only 1% of the total cash volume of commercial real estate during the third quarter were sales of real estate after bankruptcy due to the cessation of economic activity, including the two most affected sectors: retail and hotels (3% and 9% of the total, respectively) (Real Capital Analytics, 2020).

Analyst firm IBIS World predicts that the viral pneumonia pandemic would naturally have a significant impact on the commercial real estate industry's revenues in 2020, specifying the 12.1% drop to $951.1 billion, as the profits of companies paying rents are significantly reduced. It is worth noting that the downtrend has been traced for the second year, showing a decline in 2019 of 14.1% after reaching a peak in 2018 of $1.1 trillion. After the expected final drop in 2020, the size of the commercial real estate market will be below the 2015 level (Millionacres, 2020).

As noted above, one of the main factors influencing the pricing and sales of commercial real estate in 2020 is a significant drop in demand. For example, according to the National Association of Commercial Real Estate Investment Trusts, demand for office space declined 33 million square feet (more than 3 million square meters) in the third quarter of 2020 due to an increase in remote workers. This decline is larger than that seen during the 2008-2009 financial crisis and exceeds the backlash from the office market following the 2001 dot-com crisis. Selling space demand due to the social distancing regime also showed a downward trend, with a decrease of 17 million square feet (more than 1.5 million square meters) in the third quarter. At the same time, as already partially noted, the demand for industrial real estate has become a compensating locomotive element in the overall picture, which is associated with the growth of e-commerce and the need for more space to store goods and other stocks due to the quarantine-specific chain structure. In addition, for example, the demand for industrial space still exceeds supply by about 25.5 million square feet (more than 2.3 million square meters), even in a pandemic. The association expects demand for industrial space to grow by 1 billion square feet (more than 92 million square meters) to 2025.

The situation in European markets follows the main trends in the North American commercial real estate sector. The volume of total capital has retained its strong position in contrast to the global financial crisis of 2008-2009: now it can be argued about the existence of deferred capital, which was attracted to the pandemic, but is still awaiting investment. On the one hand, the pandemic has suspended international projects for European investors and lowered the level of confidence in business in general, but the second trend is the response of governments, which have introduced mitigating measures, such as deferred tax payments or, in some cases, imposing a moratorium on payment of rent payments, such as it was in the UK, in addition, as compensation, it introduces a programme called "build, build, build", which provides

significant government preferences for the construction sector. The state moratorium instrument is radical from the point of view of the leasing holder, because in this way it can significantly affect the reputation of real estate as a 'safe' investment tool (PWC, Emerging Trends in Real Estate Series, 2020).

Indeed, with some deviation from globalization processes, investors are increasing their activity in the domestic commercial real estate market. Just as North American capital considers its market more attractive, according to surveys, European investors tend to trust the domestic market more in modern conditions, because it difficult to verify the investment object due to the specifics of such a transaction. Cross-border real estate investments have traditionally relied on international travel to view assets and manage investment logistics. Likewise, most Asian investors, lacking local representatives in Europe and the United States, have been particularly affected by the choice of investment directions.

Conclusions

The commercial real estate industry exemplifies one of the most vulnerable areas to the unprecedented shock of the COVID-19 pandemic. The US and European markets experienced a significant increase in delinquencies and a significant decrease in rental payments. This had a noticeable impact on the cash flows of leasing holders, among which the retail, office and hospitality sectors were hit hardest. Social distance, remote working hours and, as a result, an increase in the norm of working and retail space per person are becoming the new norm for the real estate market. At the same time, the epidemic situation gave impetus to the development of digital projects in such a conservative sphere as real estate, which is reflected in the growth of the segment of warehouse and server premises on the one hand, and in the development of digital solutions for managing investments in real estate on the other. At the same time, the commercial real estate market for the first time will be closely related not only to the amount of capital in the industry, but also to changes in the type of human behaviour.

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Behavioural Finance Biases: A Critical Review and Theoretical Analysis

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Abstract: This paper investigates the fundamental biases of behavioural finance and economics in the context of international financial markets. The reasons for the emergence of behavioural finance are explored. The basic assumptions of behavioural finance are identified. The components of behavioural finance are determined. A comparative analysis of different behavioural biases is conducted. The prospect theory as a fundamental theory of behavioural finance is explored. The concept of bounded rationality and its connection with the prospect theory has been studied. Herding mentality and its effects on the global economic development are highlighted. The fear of missing out effect as a new norm for modern society has been analyzed. Irrational exuberance effect and its consequences for emergence of bubbles on financial markets has been studied. Loss aversion effect and its impact on financial decisions have been explored. Overconfidence effect, disposition effect, hindsight bias, anchoring bias, representativeness heuristics bias, endowment bias, mental accounting, and their role in the performance of international financial markets have been studied.

Keywords: behavioural finance • international financial markets • prospect theory • bounded rationality • FOMO • herding mentality • loss aversion • heuristics

Introduction

Having done a long way in its development, economics, increasingly using complex econometric and statistical models, has begun to move away from the social and natural sciences in the direction of technical sciences, mathematics, physics, etc. However, the emergence of behavioural economics and finance has led to a deepening convergence of economics with the social sciences, such as neurology, psychology, sociology, culturology, and anthropology. Behavioural finance owes its emergence to the efficient market hypothesis. E. Fama and P. Samuelson independently suggested the existence of the efficient market hypothesis by studying the dynamics of prices for financial instruments (Fama, 1965; Samuelson, 1965). The efficient market hypothesis, with its relatively simple assumption that financial market prices fully reflect all available information, became one of the most empirically proven theories during the 1960s and 1970s, with hundreds of articles published in leading scientific journals. For example, in 1978, M. Jensen stated that «there is no other theory in economics that has more compelling empirical evidence than the efficient market hypothesis» (Jensen, 1978). Thanks to this large body of empirical research, the efficient market hypothesis became the dominant paradigm in financial theory in the late 1970s.

The meaning of the efficient market hypothesis is as follows. The nature of stock price changes is random and unpredictable. This characteristic is called *'random walk'*. However, random changes in stock prices are not a sign of market irrationality. On the contrary, if changes in the prices of financial instruments can be predicted, it is a sign of market inefficiency, because all available information is not included in the price of securities. This is how the efficient market hypothesis arose: the price of securities fully reflects all available information about securities. The key aspects of the hypothesis are the concept of *'information'* and how information is reflected in the stock price. In general, the efficient market hypothesis is based on the idea of perfect rationality of the investor. However, research in the field of finance using the assumptions of the social sciences has found results that are quite different from the

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basic assumptions of the theory of an efficient market, which may explain the existence of some anomalies in international financial markets. As these anomalies become more frequent and systemic, and a new paradigm of financial theory has emerged: behavioural finance.

Research Results

The science of behavioural finance is based on two main assumptions. Firstly, economic agents are not completely rational, because their financial decisions are influenced by emotions, as well as beliefs. However, it should be noted that both emotions and beliefs are formed not by objective economic conditions, but by human prejudices. The second assumption is that with the complete rationality of the subjects of financial markets, there is no possibility for arbitrage, which leads to contradictions between the efficient market hypothesis and behavioural finance (Bouteska and Regaieg, 2018).

The science of behavioural finance can be divided into two main areas: behavioural finance at the micro level, which studies the behaviour of individuals in financial markets, and behavioural finance at the macro level, which studies anomalies in individual financial markets (Alizada and Clarin, 2018; Pompian, 2012). In contrast to this approach, Igual and Santamaria suggest that the theory of behavioural finance should be divided into 1) behavioural biases stemming from the prospect theory by Kahneman and Tversky; 2) behavioural biases resulting from representativeness heuristics; and 3) herd behaviour (Igual and Santamaria, 2017; Alizada and Clarin, 2018). However, other scholars suggest that behavioral finance is based mostly on psychologies and social biases, e.g., emotional responses, social beliefs and ideas (Leković, 2020).

It is worth mentioning that behavioural finance explores the range of behavioural biases, which shape the financial decisions of economic agents all around the international financial markets. In most cases we observe the following phenomena.

Prospect Theory was developed and proposed by Kahneman and Tversky, who revolutionized approaches to the study of economics and finance. Rational choice and utility theory underlie most modern economic models, including those known as CAPM and ICAPM. Kahneman and Tversky as a result of a number of empirical studies have concluded that the decisions of most economic agents contradict the theory of utility and, moreover, lead to anomalies in financial markets. Based on their research, scientists have proposed an alternative theory of utility, called prospect theory. In contrast to utility theory, the decision-making process in prospect theory takes place in two stages: the editing phase and the evaluation phase (Seth and Chowdary, 2017). During the editing phase an economic agent chooses the reference point, evaluates the available options and decides on risk and probabilities and then simplifies the prospects. Generally, the editing phase consists of 6 subphases, such as 1) coding, 2) combination, 3) segregation, 4) cancellation, 5) simplification and 6) detection of dominance. During the evaluation phase an economic agent searches for the option (prospect) with the highest value and their final decision is based on weights which are not necessarily the same as probabilities (Seth and Chowdary, 2017).

The prospect theory states that the economic agent in decision-making takes into account both profits and losses, but his decisions are more sensitive to changes in losses (regret aversion / loss aversion) (Barberis, Jin and Wang, 2020). In addition, the economic agent takes into account not just objective probabilities, but transformed probabilities, taking into account the highest level of utility for him. It is worth noting that the prospect theory also considers narrow framing. The narrow framing is the behavioural bias when an economic agent isolates the risk while thinking of taking it. It means that an economic agent does not look at the risk from a systemic point of view but rather as an individual matter (Barberis, Jin and Wang, 2020).

The concept of bounded rationality. Bounded rationality occurs when economic agents make financial decisions, their rational choice is limited because they do not have all the completeness of information or have limitations in the form of cognitive and emotional biases (Tsaoussi, 2014). Economic analysis using limited rationality assumes that an economic agent who seeks to maximize his utility in an individual situation will eventually make a decision that will not be completely perfect but will be able to meet most of his needs (Tsaoussi, 2014). Choice in conditions of limited rationality is one of the main directions of behavioral economics and finance and is used in many areas of economics. Herbert Simon was the first to propose the term '*bounded rationality*'. He suggested a new

method of mathematical expression of the problem of rational choice in his work in the late 1950s (Simon, 1959; Schiliro, 2012). According to Simon, the rationality of economic agents is limited by the extent to which the information they possess is limited, the psychological biases they have, and the limited time to make decisions (Simon, 1959). The scientist argued that the theory of limited rationality expressed the fact that the perfect choice is not feasible, because all economic agents have partial rationality. Simon's view was supported by other researchers, who pointed out that although the classical theory of rationality created a breakthrough in economics, it did not take into account the underlying conflict between the ideas of an individual economic agent and the objective state of the market.

Keeping up with the Joneses/ Herding Mentality/ Herd Behaviour Effect. An economic agent considers that he loses his certain social status if his consumption of a certain group of goods or services that are decisive for the group of economic agents to which he belongs is below average and, accordingly, the social status increases in the case, when the level of consumption exceeds the average in the group (Ulph, 2014). It is worth noting that this pattern of behaviour is accompanied by the emergence of harmful competition, when economic objects are excessively focused on the current level of consumption, taking into account the long term, which can lead to significant macroeconomic shocks due to reduced investment and savings. Hirshleifer and Teoh noted that herd behaviour arises from the instinctive desire of economic agents to be similar to other agents in their social group (Hirshleifer and Teoh, 2003). Herd behaviour is formed under the influence of many factors, including the presence of social or financial dividends from such behaviour, punishment for failure to follow a common model of behaviour, observation of certain behaviour by a large number of economic agents, direct influence of other economic agents of choice, etc. (Hirshleifer and Teoh, 2003; Hirshleifer and Teoh, 2009).

The fear of missing out (FOMO) effect. In the financial literature, researchers define the phenomenon of FOMO in several aspects, including the fear of the economic agent that other members of the social group to which he belongs enjoy certain benefits that he does not use. Secondly, the long-term and persistent desire of the economic agent to remain involved in the activities of other members of the reference group. The fear of missing out is not only related to the personal and psychological spheres but is also of great importance to the spheres of international finance, international business, marketing and management. It is worth noting that some researchers consider the fear of missing out effect as a potential factor in the emergence of bubbles in international financial markets. In the field of international business, it is believed that this effect can be used as a tool to encourage consumers to buy certain goods and services (Burgess, 2017).

One of the most vivid examples of behavioural biases in world economic history is tulipomania. Tulipomania is an example of the extremely irrational behaviour of economic agents. However, the factors that led to this behaviour are still the subject of research. One of the factors was the long period of economic growth of the Netherlands as a centre of trade, industry and finance which increased the optimism of the population (Deloitte, 2016). Secondly, although the effects of tulipomania have affected not only the population of the Netherlands but also other countries, only a small proportion of Dutch people, namely professional merchants, financiers and politicians, actually bought, sold and traded tulip bulbs. Economic agents that observed what the affluent part of the country's population was doing, earning huge sums of money just from the tulip trade, fell under the influence of the described behavioural effects and began to participate in the tulipomania with even greater desire and risk aversion than others (Deloitte, 2016). Mentioned behavioural effects, such as the herding mentality effect and the fear of missing out effect, led to the formation of a huge financial bubble in the Dutch market which quickly exploded. At the heart of these behavioural biases was a desire to be similar to others and not differ from their patterns of behaviour and consumption. Some researchers suggest that all the bubbles that arise in international financial markets are due to these behavioural biases. However, this position is quite categorical and needs further research and clarification. It is worth noting that a similar example at the present stage of development of the world economy can be bitcoin mania, which has captured attention of many people around the world. However, the consequences of such a bubble can be huge and extremely detrimental to the global economy, as global transmission mechanisms quickly spread the effects of a possible fall in cryptocurrencies around the world.

Irrational Exuberance Effect. Despite the periods of crisis, the situation in most international financial markets is characterized by irrational optimism. Economic agents, for example, are optimistic

about the dynamics of loan capital markets. However, it would be good if the assessment of development prospects did not lack pragmatism about the potential negative consequences and scenarios of financial markets. Irrational exuberance refers to the enthusiasm of financial market participants, which pushes asset prices to a level higher than it should be, based on objective factors. Former US Federal Reserve Chairman Alan Greenspan suggested the term 'irrational exuberance' in his speech in 1996 shortly before the dotcom bubble exploded (Shiller, 2015). When financial market participants begin to believe that the historical rise in prices in the past necessarily means the growth of such assets in the future, such economic agents act as if there are no risks and uncertainties in the market, which leads to greater increase in prices. Researchers believe that this is a significant problem for global economic development, as it can lead to the formation of bubbles in financial markets. But when the bubble bursts, investors begin to rapidly sell the once «absolutely reliable» asset, often at a price much lower than the real value. It is worth noting that the bubble can spread to other markets and asset classes and may even cause a global economic downturn. The most affected are those market participants who believe that the bullish trend will continue for a long period of time, guided by certain behavioural biases.

Reducing Regret / Regret Aversion / Loss Aversion Effect. Reducing regret effect is based on two assumptions. First, everyone experiences emotions, such as sadness, joy, anger, pleasure, etc. Secondly, a person always tries to use his sensory experience in making any decisions, including financial and investment. It should be noted that the reducing regret effect assumes that economic agents have limited rationality i.e., make decisions based on rational expectations based on their own emotional experience (Baker and Nofsinger, 2010). Thus, the essence of reducing regret effect is that economic agents, making decisions in conditions of risk and uncertainty, may in the future regret such decisions if they are wrong and lead to undesirable results (Gazel, 2015). The main practical application of this effect is how the factor of emotional experience and predictions based on it affects the financial decisions of economic agents (Pompian, 2012).

Economic agents who use the loss aversion effect try to avoid financial decisions that can potentially bring negative emotions, even if such decisions are optimal in terms of rational behaviour. This behavioural deviation is often observed in economic agents who are not exposed to risk and who do not change their financial decisions even in the event of adverse events, fearing that changing the decision will lead to even greater losses. This model of behaviour is typical of situations where in the recent past there was a decline in the dynamics of the financial market and economic agents, guided by the loss aversion effect, refuse to enter such a market (Gazel, 2015). Loss aversion effect comes from the theory of perspectives by Kahneman and Tversky. It is worth noting that economic agents evaluate their profits and losses differently. An agent that is subject to a loss aversion effect is more driven by the category of profits and tries to avoid the loss factor. With such a deviation, the economic agent believes that when he has not received losses, he has a profit, even if the price of the financial instrument is lower than fair. The effect of this effect is extremely important because it, in particular, determines the decision of economic agents to buy and sell securities and may explain the existence of some other anomalies, such as endowment bias and status-quo bias (Bouteska and Regaieg, 2018; Schmidt and Zank, 2005). In general, the emotional sensations of incurring losses are greater than those of making a profit. Thus, an economic agent tries to avoid losses rather than make a profit, which can lead to negative phenomena in international financial markets.

Overconfidence / Self-deception / Illusion of Control Effect. The overconfidence effect characterizes the state in which the economic agent overestimates his assessment of facts, phenomena, etc. This effect, in particular, occurs when the economic agent is extremely confident in their knowledge and abilities (Bouteska and Regaieg, 2018). Researchers suggest that an overconfident economic agent is an agent who overestimates his or her ability to evaluate available information about market dynamics or individual securities and makes financial decisions based on such bias (Bouteska and Regaieg, 2018). Overconfident economic agents believe that available public information is already reflected in the price of the asset and does not represent value, but private information of the economic agent, on the contrary, is a specific factor that can generate additional rate of return. Thus, an overconfident economic agent believes that it is better to follow one's beliefs and knowledge than to use information that is available to others. Glaser and Weber believe that there are three types of overconfident economic agents in international financial markets, namely 1) agents who believe they know and know more than others, 2)

agents who believe they have control over information in the market and 3) agents who overestimate the accuracy of their predictions or underestimate the degree of change in risk (Glaser and Weber, 2007).

The presence of the illusion of control effect in international financial markets determines the behaviour of economic agents, in which they believe that they know the market better than others and are able to independently and accurately predict the dynamics of market development. Based on this effect, it is possible to distinguish two types of economic agents in financial markets. First, agents who use more private information and make financial decisions based on their own beliefs. Second, economic agents who use only public, accessible information and rely on a relatively rational approach to the market. It is worth noting that some studies claim that economic agents who are prone to overconfidence receive higher returns (Hirshleifer and Luo, 2001). Hirshleifer and Luo point out that overconfident traders get higher returns because they take into account the undervalued assets that exist in the market through the actions of noise traders (Hirshleifer and Luo, 2001).

Disposition Effect. Another effect that is distinguished in the study of behavioural finance is the disposition effect which refers to the model of behaviour of the economic entity during trading of assets during a certain period (Yang, 2019). The essence of the disposition effect is that some economic entities, such as individual investors or institutional investors, tend to sell those financial assets whose price has increased during their ownership than those assets whose price has fallen (Yang, 2019). Empirical studies have found that this effect occurs in many international financial markets, including bond, stock or derivative markets. The disposition effect remains relatively poorly understood, as there are no rational behavioural explanations for the actions of economic agents in such a scenario. Typically, research and the scientific literature recommend maintaining holdings of securities that have risen in price, hoping for future growth, and selling securities that have fallen in price, avoiding greater losses in the future.

Hindsight Bias. The essence of the effect is that economic agents are not ready to admit their mistakes. If an adverse event occurs in the market, the economic agent, who does not want to admit his mistake, will assume that he knew in advance about the occurrence of an adverse event and «prepared» for it (Leković, 2020). After the event, it always seems that it could have been predicted. It is much easier to find and explain the factors of an event after its occurrence than to predict the event based on the available facts. There are many examples to illustrate this effect, such as the euro area balance of payments crisis. Prior to the crisis, all financial analysts of debt securities issuers did not see any risks of sovereign debt growth at the same interest rates. But after the crisis erupted, many experts began to point out the obvious signs of the crisis and the fundamental reasons for its onset. However, it should be noted that it does not make sense to anticipate a crisis after its onset, when it is necessary to prevent it (Leković, 2020). For international financial markets, the effect is also that economic agents will have incorrect forecasts of the return on financial assets, which may result in deteriorating macroeconomic indicators (Biais and Weber, 2009). For example, in the market of derivative financial instruments, there may be a situation when economic agents will not correctly assess the possible volatility of the instrument and will not be able to fully hedge risks (Biais and Weber, 2009). Under this effect, economic agents will also not be able to assess the validity of analytical reports and econometric models, to identify differences between the information they have and public information. Ultimately, this effect makes it impossible for such economic agents to obtain financial benefits.

Anchoring Bias or Status Quo Bias. It is worth noting that economic agents make financial decisions based on certain basic assumptions and ideas. Such basic assumptions and ideas are called anchors (Seth and Chowdary, 2017). Based on the theory of complete rationality, the economic agent is able to ignore such assumptions and base his decision solely on objective grounds. However, in the practical aspect, anchors play a very important role in decision making. For example, the historical dynamics of financial asset prices is an anchor for the investor when choosing an investment portfolio (Seth and Chowdary, 2017). In general, this means that a pre-existing economic quantity influences the decision of an economic entity when it has to estimate a certain quantity unknown to it. As a result of this effect, the estimate of the unknown quantity will be close to the estimate of the known quantity, and the economic agent will try to extrapolate the previous values to the unknown quantity (Zaiane, 2015). Anchoring bias occurs in many areas of life, for example, we estimate the true value of an object based on the price of the object we are offered. D. Kahneman, for example, believes that when we are offered any numeric solution to a problem, we consider it as an anchor (Zaiane, 2015).

Representativeness Heuristics Bias. In 1992 D. Grether was the first to introduce the term «heuristics» in behavioral economics (Grether, 1992; Boussaidi, 2013). The term «heuristics» is defined as «a rule of thumb or decision aid by which individuals may judge likelihood» (Grether, 1992). Gigerenzer and Gaissmaier suggest the following definition: «a heuristic is a strategy that ignores part of the information, with the goal of making decisions more quickly, frugally, and / or accurately than more complex methods» (Gigerenzer and Gaissmaier, 2011). Empirical studies confirm that heuristic errors significantly affect the financial decisions of economic entities and cause distortions in the perception of reality (Boussaidi, 2013). It is believed that representativeness heuristics bias is one of the most common and can explain a number of anomalies in international financial markets. However, Tversky and Kahneman note that heuristics is a highly questionable theory and can lead to various negative consequences such as errors, deviations or biases (Tversky and Kahneman, 1974; Bílek, Nedoma and Jirásek, 2018). In practice of financial markets, heuristics means that economic agents make their assumptions exclusively on the basis of historic performance of asset prices. One of the most vivid examples of representativeness heuristics bias is bitcoin mania. Traders believe that bitcoin is going to follow the historic price patterns and perform well in the future. However, there is no express conformation of this point of view.

Mental Accounting. Usually, we define accounting as a way of monitoring and controlling the economic and financial activities of enterprises and organizations. Mental accounting applies to the same actions, but which are performed by an ordinary person in everyday life. Richard H. Thaler suggests the following definition of mental accounting: «the set of cognitive operations used by individuals and households to organize, evaluate, and keep track of financial activities» (Thaler, 1985). During mental accounting, a person divides his expenses into categories, sets priorities for categories, determines the sources of income for the implementation of costs and determines the effectiveness of their costs.

Endowment Bias. In 1980, Richard H. Thaler put forward the definition of the endowment bias as «a tendency among people to demand a higher price when selling an object than the price they would be prepared to pay for it» (Thaler, 1980). This bias is one of the most important for the behavioural finance because it demonstrates the patterns of consumer behaviour. According to the effect, an economic agent would hold his ongoing position rather than modify it to make larger profits (Macedo, Marcon, Menezes and Nunes, 2007).

Conclusions

The behavioural economics and finance are of great importance for understanding the processes in the modern society. Behavioural finance owes its emergence to the efficient market hypothesis, which it contradicts. The science of behavioural finance is based on the following assumption: economic agents are not completely rational and that is why one can observe anomalies in international financial markets. The science of behavioural finance can be divided into two main areas: behavioural finance at the micro level and behavioural finance at the macro level. Behavioural finance explores the range of behavioural biases, which shape the financial decisions of economic agents all around the international financial markets. There are the following behavioural biases such as prospect theory; keeping up with the Joneses/herding mentality/herd behaviour effect; the fear of missing out (FOMO) effect; irrational exuberance effect; reducing regret/regret aversion/loss aversion effect; overconfidence/self-deception/illusion of control effect; disposition effect; hindsight bias; bounded rationality effect; anchoring bias or status quo bias; representativeness heuristics bias; mental accounting; and endowment bias. The effects in question make up the science of behavioural finance.

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Defense Industry: Innovations and International Production Networks

OLEKSANDR KHMARA[15]

New technologies are accelerating innovation while removing some barriers to entering defense markets. Due to significant defense spending, the defense industry of developed countries continues its growth trajectory. Today, accelerating the development life cycle and increasing work flexibility in order to reduce costs and time of launching new products, while strengthening the potential for cooperation with other actors in the sector, is especially important for multinational enterprises (MNE) of the defence industrial complex (DIC).

It should be noted that before the Second World War, the defense industry relied on commercial technological innovations to implement new achievements. Governments examined the technologies in the markets and adapted some of them for military use. For instance, despite the fact that the Wright brothers introduced the first airplane in 1903, it was used in the war only in 1911 by the Italians against the Turkish army. However, the widespread use of aircraft happened only a few years later. In general, there exist some more stages on the path of civil technology introduction into military use.

New and improved technologies in defence require more time to be approved in the industry. But familiar to other industries introduction period is very important to gaining a military advantage. After the last world war, the innovation pattern has been modifying. Now the stress is made on independent military R&D, not on commercial.

This is confirmed by the latest data from a survey of defense companies. For example, in a report by Jabil's Aerospace and Defense Manufacturing Trends (Jabil, 2019), 51% of manufacturers say that most innovations are made for military use and then applied in the commercial sphere. As a result, the appearance of new technologies, like artificial intelligence or augmented and virtual reality, the historically first model of innovations diffusion – from the commercial usage into the military – may be reused. These technologies are developing at a much faster pace than the defense industry is able to master, which means that it is highly probable for the industry to succeed from adapting them for military purposes, rather than trying to lead innovation.

It is now clear that R&D plays a key role in ensuring any country's national security. Research in developed economies has created the basis for new and improved technologies that underlie a wide range of their applications. It could be advanced military systems for medicine and troop support.

For more than 70 years, research related to the US military has made breakthroughs in a number of areas, including: computerisation, communications, networks, satellites, military aviation, aircraft carriers, submarines, tanks, tactical and strategic missiles, nuclear weapons, drones, modern materials for military needs, autonomy, etc. It is obvious that R&D investments bring technological advantages to a country in modern ways of war.

We are going to analyze below the dynamics of government funding for R&D in the military defense industry of developed countries. Figure 1 demonstrates the dynamics of public spending on R&D in the defense sector of OECD member countries. In total the amount of these expenses has increased by 20 billion dollars for 10 years. There was a noticeable downward trend until 2014, after which budget expenditures have been increasing, especially after 2015.

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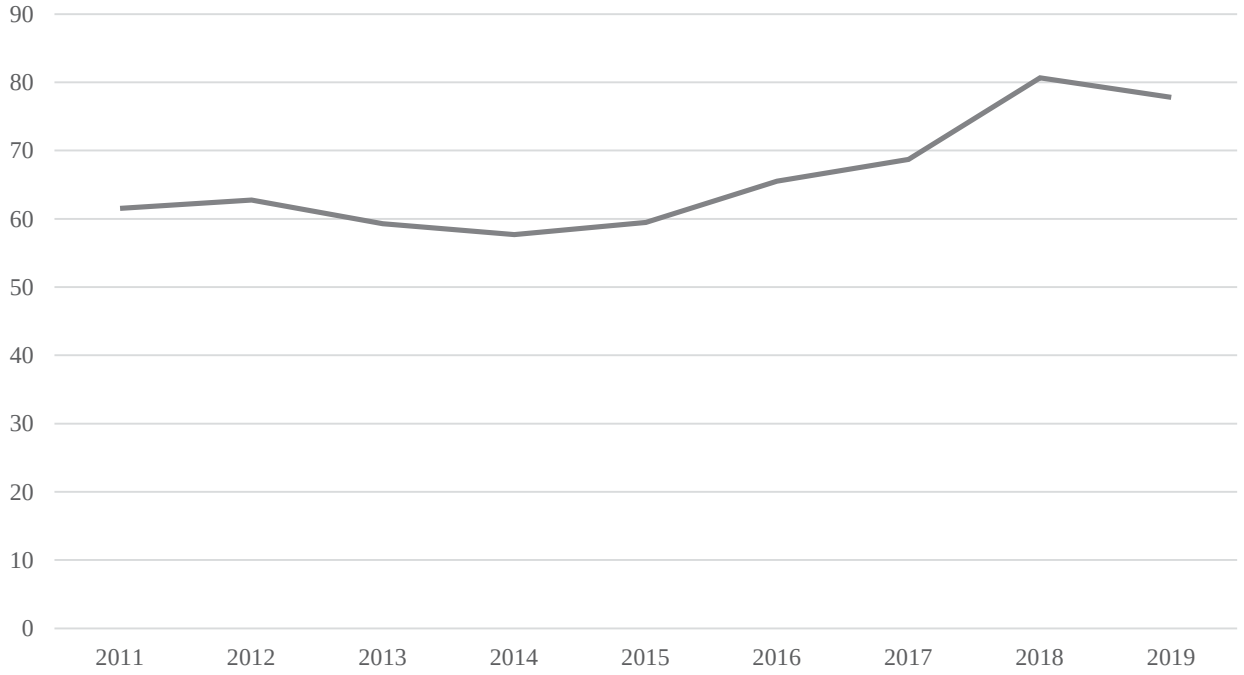

Figure 1. Budget Expenditures on R&D.
Source: OECD, 2020.

In 2019, the United States spent more than $69 billion on R&D in the defense sector, which is 19.24 times bigger than the next country – South Korea. In general, the United States spent 5 times more on R&D compared to all other countries in our paper.

Table 1. 10 Countries with the Highest R&D Expenditures in Defense, 2019 (million dollars).

Country	Amount of spending
USA	69037
South Korea	3586.41
Germany	2006.37
UK	1965.001
Turkey	1518.085
Japan	1271.21
France	1269.7
Taiwan	851.538
Australia	342.631
Poland	201.134
Others	1032.071
Total OECD	83081.15

Source: based on OECD data (OECD, 2020).

If in 2017 they accounted for more than 90% of the costs, it is already 87% in 2019. This could be conditioned by international instability in the world, and thus the need to ensure national security.

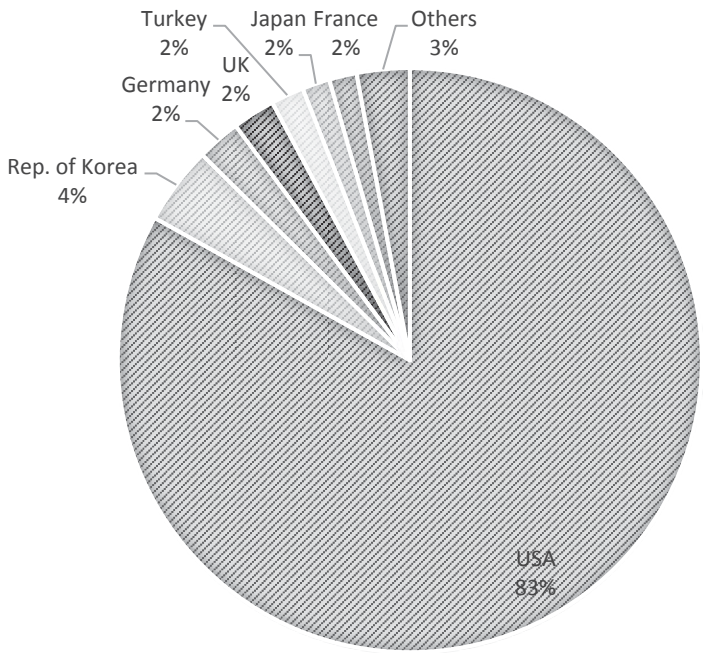

Figure 2. Share of R&D Expenditures for some Countries.
Source: OECD, 2020.

In general, countries with larger economies are able to invest more in R&D and defense. To take this into account, let us divide defense R&D expenditures by GDP. As we can see, the United States is the absolute leader in this case as well. It is followed by South Korea and Great Britain. Leaders are unchanged when using relative indicators. However, compared the results of the analysis in absolute terms, indicates a number of countries with small economies, including Estonia, Norway and Finland.

It is also worth comparing countries in terms of the share of R&D expenditures on defense to total government development expenditures.

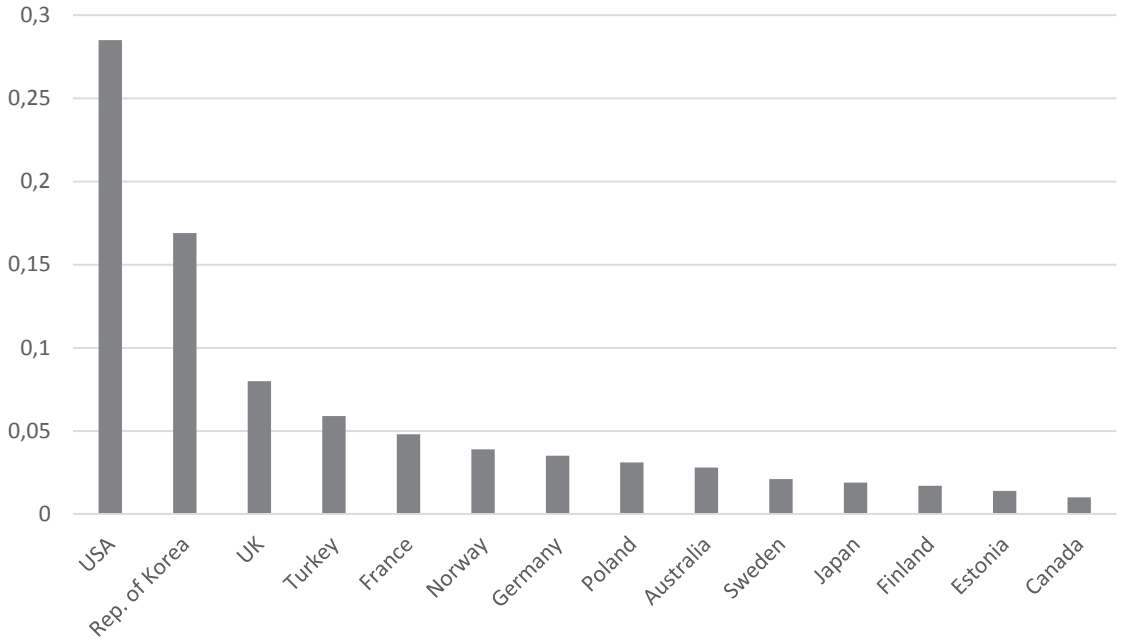

Figure 3. Countries with the Highest Ratio of R&D to GDP, 2019.
Source: OECD, 2020.

Figure 4 demonstrates the relative importance of defense R&D in each country's research and development portfolio. In 2019, the United States allocated 43.5% of government spending on R&D for defense. Turkey took the second place in this indicator among OECD countries – 17.3%.

The European defense sector is one of the most technologically advanced in the world. In addition, the EDA constantly publishes data on its technological development. Of particular interest are data on research and technology costs, which are part of the total R&D costs analysed above.

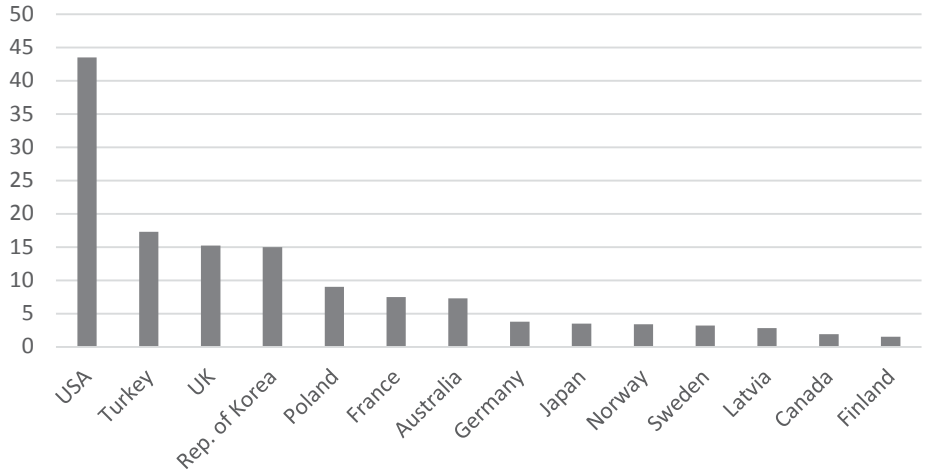

Figure 4. Countries with the Highest Ratio of R&D Expenditures in Defense to Total Budget R&D Expenditures, 2019.
Source: OECD, 2020.

Investments in defense R&D are important for the sustainable development of the defense industry and its potential to develop the capabilities of the next generation of armed forces. The total European investment in defense R&D is about 10 billion euros. The bulk of investment comes from national governments as major consumers. Private investment is very limited and only applies to research with a lower level of complexity or lower cost. R&D spending in Europe remains highly concentrated in six countries (France, Germany, Italy, Spain, Sweden and the United Kingdom), which account for 95% of investment. France and the UK account for more than half of the total, followed by Germany, Italy, Spain and Sweden.

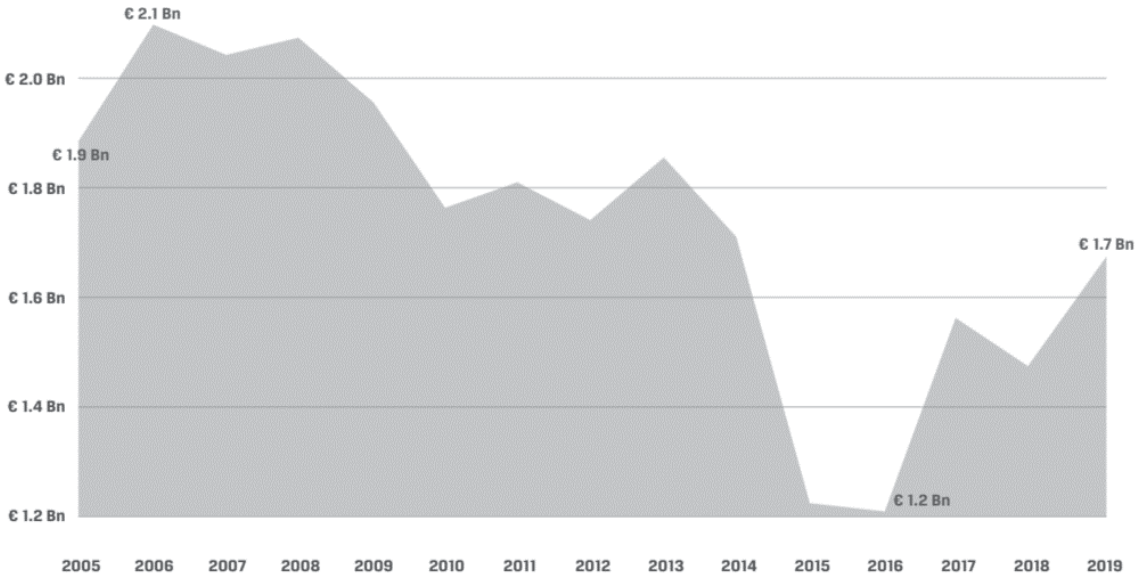

Figure 5. Defense Spending on Development and Technology, 2005-2019.
Source: EDA, 2019.

So, in 2019, the cost of defense research and technology amounted to 1.7 billion euros. Similar to defense R&D, defense R&D had declined since 2008 and only started growing again in 2017. Although

defense R&D increased by 13% compared to 2018, defense research expenditures still remain at about 380 million euros lower than in 2007 (Figure 5).

As a result, funding for defense R&D remains insufficient and Member States together do not reach the overall target of 2% of their total defense spending on R&D (EDA, 2019). In 2019, Member States allocated 0.9% of their total defense spending on R&D against 0.8% in 2018 and 0.7% in 2016.

The decline in funding, the concentration of activities in several countries, and the fact that the collective indicator of defense R&D (2% of total expenditures) has never been achieved raise concerns about Europe's long-term innovation capacity. To reverse this trend and promote cooperation, the EU has launched several initiatives to support the European DIC.

Through the Defense Research Preparatory Action (PADR) and the European Defense Industrial Development Programme (EDIDP), EU resources have been allocated to support the defense sector for the first time. EDIDP and PADR aim to intensify joint research and development, which is crucial for the competitiveness of the industry and the ability to support the armed forces with the help of advanced technologies. Together, they are paving the way for a full-fledged European Defense Fund (EDF), which was launched under the current multi-year financial mechanism.

In line with the general trend towards R&D expenditure, some Member States have only very limited progress towards reaching the baseline. In 2019, no Member State achieved the set goal, only 4 Member States spent more than 1% of their total defense spending on R&D.

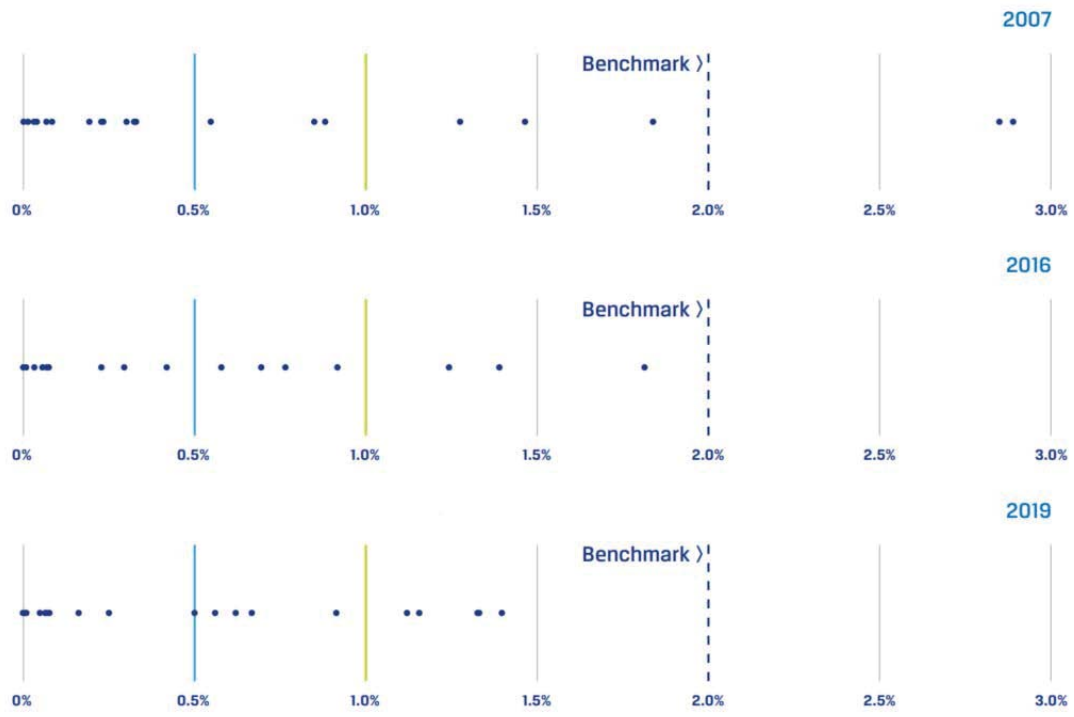

Figure 6. Defense R&D as a Share of Total Defense Spending.
Source: EDA, 2019.

This indicates that the countries aim their efforts in the defense sector at filling the existing gaps in capacity, rather than its development in accordance with potential future requirements. For comparison, in 2016, 3 Member States spent more than 1% of total defense spending on R&D. This is not in line with the level of spending in 2007, when 2 Member States reached the benchmark and 3 more Member States spent more than 1% (EDA, 2019). (Figure 7).

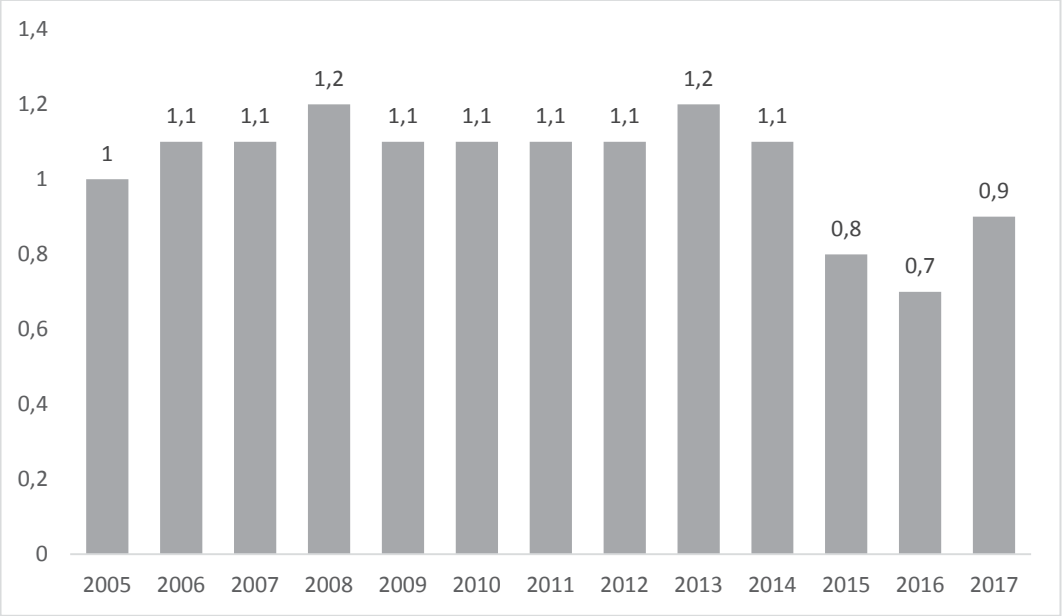

Figure 7. Evolution of the EU's Target Defense R&D Spending (EDA, 2019).
Source: EDA, 2019.

Despite some slight progress made since 2017, there has been no significant positive growth trend in recent years. In order to reverse this trend and strengthen the European DIC, as well as to develop the EU's strategic autonomy, Member States are invited to increase the share of D&T expenditure in defense budgets as part of collective benchmarks, in order to develop national and EU defense capabilities (EDA, 2019). This is stated in the recommendations of the CARD 2020 Report (CARD, 2020) approved by the Ministers of Defense at the end of November 2020.

It should be noted that in the EU, defense research projects are mainly conducted on a national level. In 2019, Member States spent €141 million on D&T projects in cooperation with other Member States. This is the lowest level of total costs in the history of EDA data collection. Compared to 2008, when the spending of this joint work in the field of defense was the highest, they have now decreased by approximately 320 million euros.

As a result, Member States have not reached the collective target of 20% of total GDP in European programmes. In 2019, Member States allocated 8.5% of their total defense spending on joint research projects with other Member States. The target in this area for funding EU research was only achieved once in 2008, when they allocated 22% of spending on European joint research projects. This share reached a record low in 2019. Even if we add the funds under the Defense Research Preparatory Action (PADR), which amount to 25 million euros for the European Joint Defense Research Programmes in 2019, the share will reach only about 10%. As a result, Member States will have to spend around €190 million more in this area to reach a collective level of 20%.

This means that the European defense industry is very competitive and provides a major contribution to the European economy. However, the European defense systems are competititve today due to past investments. In recent decades, investment in defense and research funding in Europe has declined sharply. This has led to a lack of new defense programmes, which has a negative impact on Europe's military capabilities and jeopardizes the industry's future competitiveness.

At the same time, shrinking domestic markets have increased the importance of exports to European industries. In fact, given the high cost of R&D for many defense systems, certain volumes of production are needed to maintain the industrial capacity needed to equip European forces at affordable prices and to maintain some degree of strategic autonomy in critical technologies.

Next, we will analyze the cost of R&D within the defense sector. The aerospace industry is one of the leaders in this direction. As we see from Figure 8 spending has risen over the past three years, from $29.8 billion to $32 billion. The average growth rate is 5% in two years.

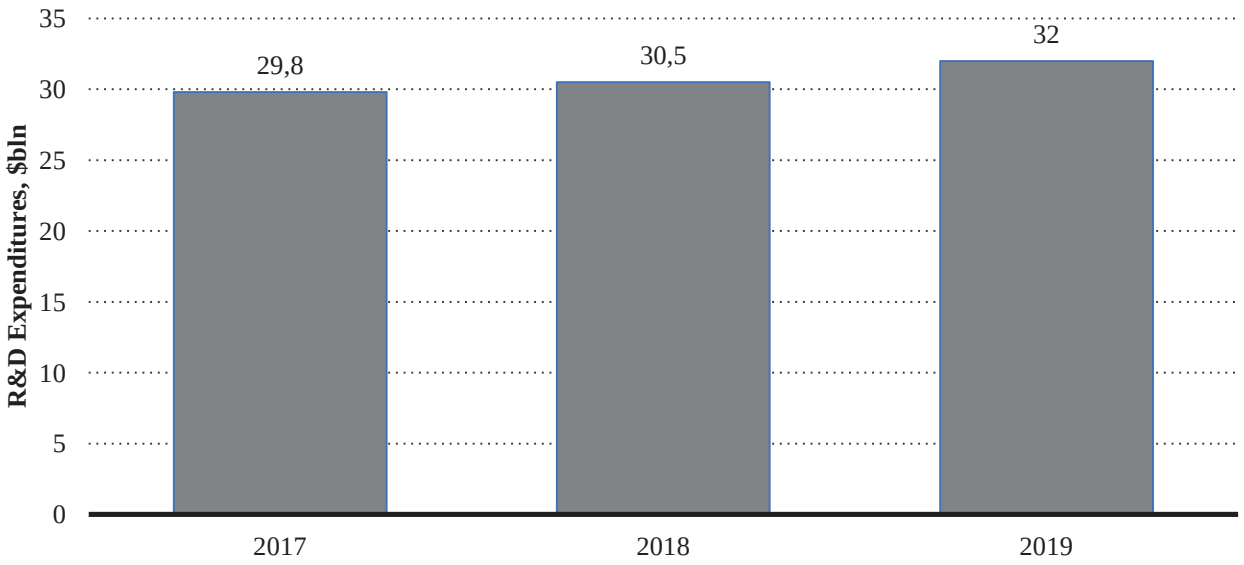

Figure 8. Aggregate Global Aerospace R&D Expenditures, 2017-2019.
Source: R&D Global Funding Forecast, 2019.

As can be seen from the figure below, Boeing ($3.18 billion), BAE System ($1.55 bln) and Lockheed Martin ($1.49 bln) spend the most on research. Raytheon Nothop Group spent less than a billion dollars in 2019.

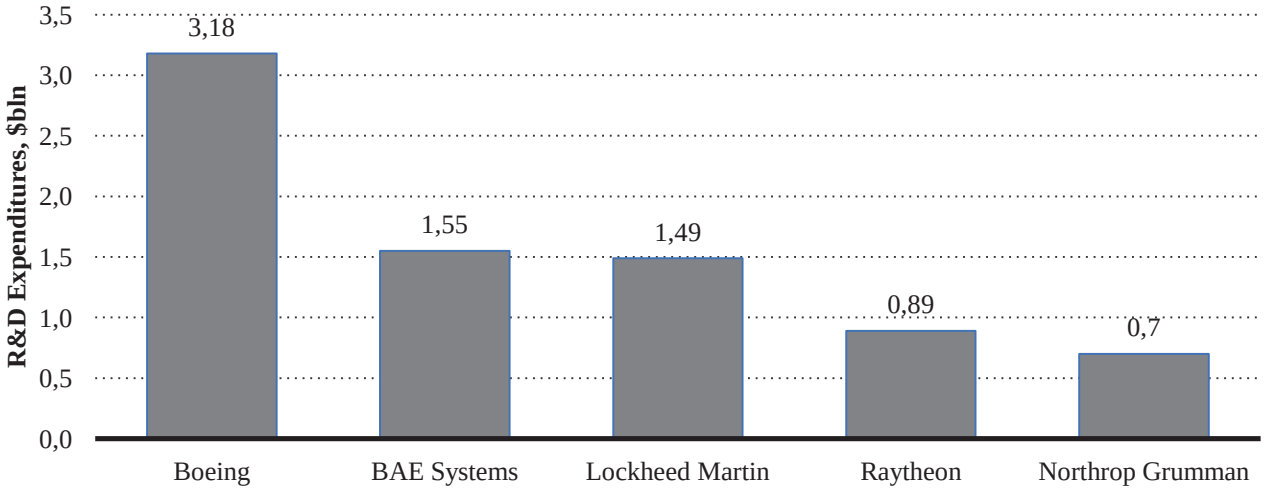

Figure 9. Aerospace and Defense Companies with the Highest Spending on Research and Development (R&D) in 2019 (in bln U.S. dollars).
Source: R&D Global Funding Forecast, 2019.

Boeing spent the most in 2009 – $6.5 billion. It is worth noting that a similar trend is characteristic of budget funding for research. The growth was in 2016, after which the costs for the coming years have been still at a stable level – just over $3 billion.

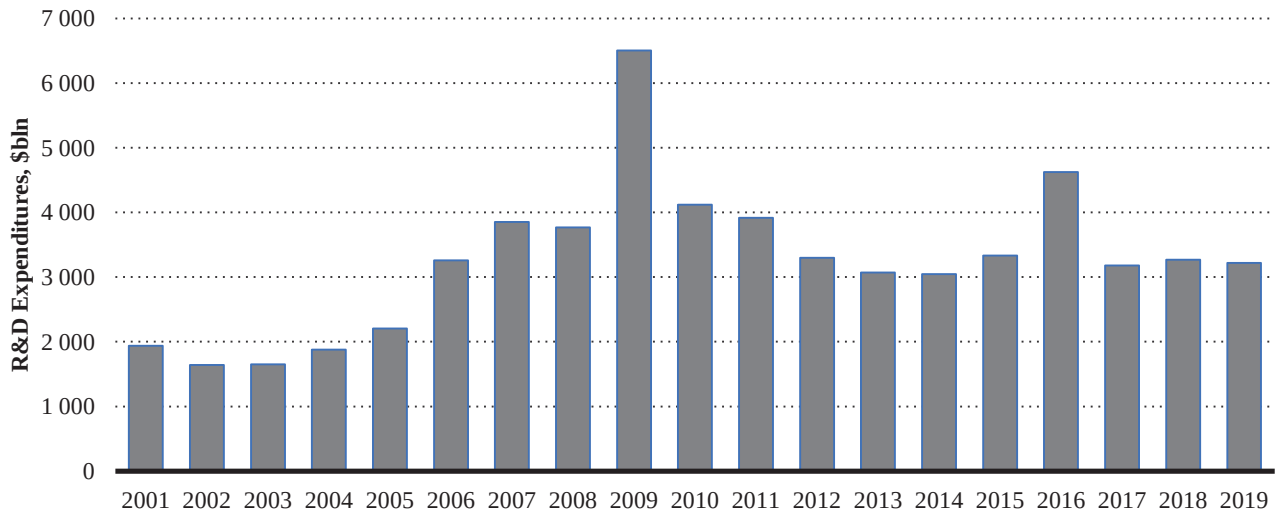

Figure 10. Boeing: R&D Expenditure, 2001-2019.
Source: Boeing, 2020.

The dynamics of scientific spending differs in another company in the aerospace sector (Figure 11). The U-shaped form of investment is notable: decline from 2005 to 2011, followed by stable growth until 2019 inclusive. But *Lockheed Martin* spent 2.2 times less than *Boeing* in 2019. This can be explained by the fact that the latter does not have a significant share of business not in the defense industry.

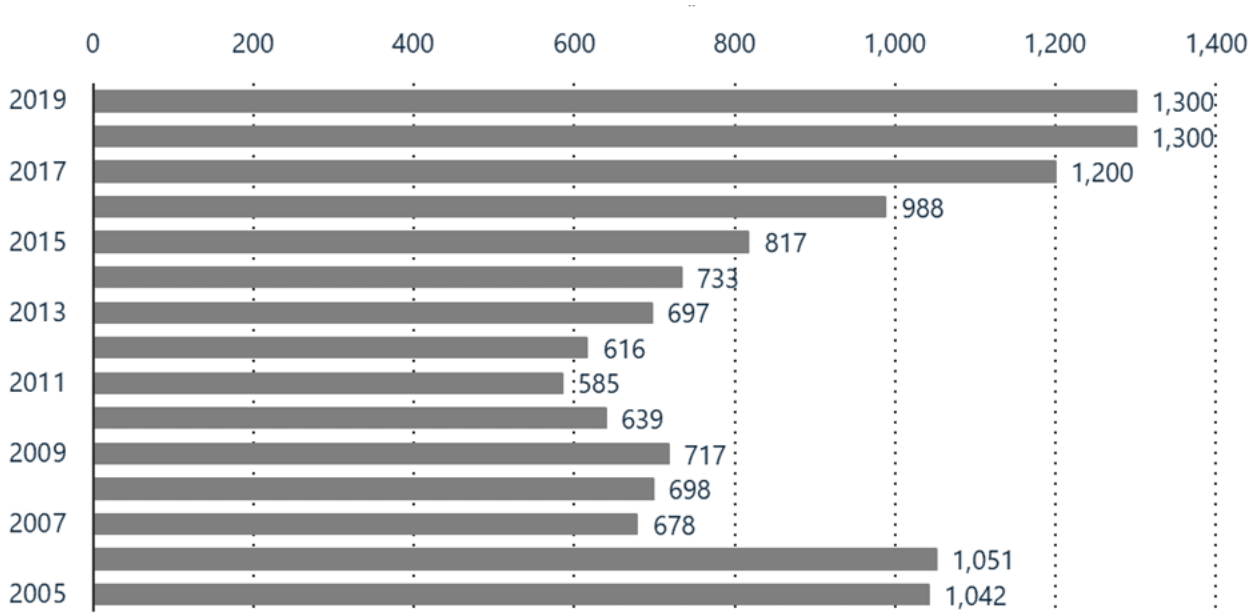

Figure 11. Lockheed Martin: R&D Expenditures, 2005-2019.
Source: Lockheed Martin, 2020.

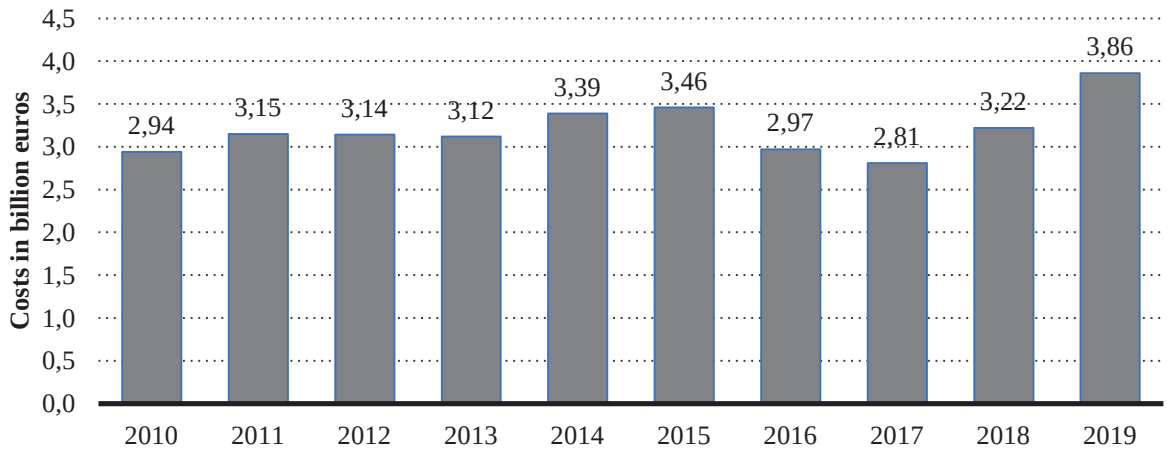

Figure 12. Airbus Group: R&D Expenditure, 2010-2019.
Source: Airbus, 2020.

Airbus Group also invests heavily in R&D, which is even greater than that of its American competitor. In particular, in 2019, $700 million more was invested than in Boeing.

We will continue to assess the innovative parameters of international production networks by analyzing the number of patents issued to companies in the aerospace industry over the past 10 years. To do this, we took three companies whose costs were analysed above, as well as 4 other companies with available data on issued patents in the US market.

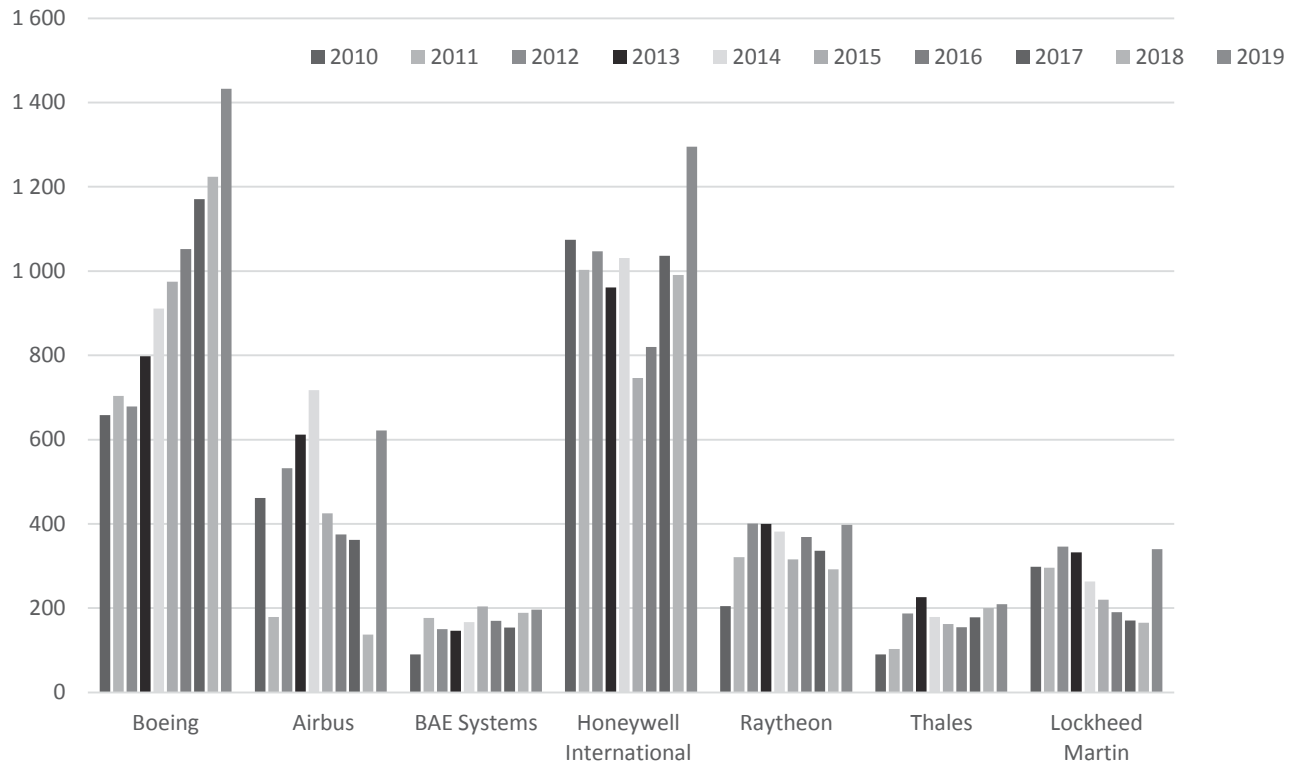

Figure 13. The Number of Patents Issued in the United States in Terms of Defense Companies, 2010-2019.
Source: IPO, 2020.

As can be seen from Figure 13 *Boeing* is different from its competitors. It has been increasing the number of patents for almost 10 years in a row. The maximum was reached in 2019 with 1433 units. *Airbus* and *Lockheed Martin* have shown a decrease in the number of new patents. This situation can be explained by the European concern's focus on the EU market. *BAE Systems* and *Raythenon* are examples of sustainability in this indicator, but the latter company registers on average twice as much each year.

Honeywell International is characterized by a U-shaped curve in the number of registered patents from this period. In 2019, it almost caught up with *Boeing*, registering 1,295 units. *Thales* also demonstrates stability in the number of new registered patents.

Thus, we have analysed the dynamics of R&D expenditures and the number of patents obtained by these companies. All companies have specific features for both values. It would also be useful to investigate whether spending affects scientific results, as well as what is a dependent variable and what is independent. We have additionally formed the following data set.

Table 2. Array for Econometric Analysis.

	Boeing		**Airbus**		**BAE Systems**		**Honeywell International**		**Raytheon**		**Thales**		**Lockheed Martin**	
	P	*Ex*	*P*	*Ex*	*P*	*Ex*	*P*	*Ex*	*P*	*Ex*	*P*	*Ex*	*P*	*Ex*
2010	658	4 121	461	2.94	90	973	1 074	2 146	205	625	90	459	298	340
2011	704	3 918	179	3.15	177	1 041	1 003	2 093	321	625	103	507	296	165
2012	679	3 298	532	3.14	150	1 138	1 047	2 040	401	451	187	554	346	171
2013	798	3 071	612	3.12	146	1 037	961	1 987	400	465	226	612	332	190
2014	911	3 047	717	3.39	167	1 343	1 031	1 892	382	500	179	641	263	220
2015	975	3 331	425	3.46	204	1 263	746	1 856	316	706	162	692	220	263
2016	1 052	4 626	375	2.97	170	1 416	820	1 864	369	725	155	736	190	332
2017	1 171	3 179	362	2.81	154	1 576	1 036	1 835	336	700	178	802	171	346
2018	1 224	3 269	137	3.22	189	1 500	991	1 809	292	841	200	839	165	296
2019	1 433	3 219	622	3.86	196	1 500	1 295	1 556	398	732	209	887	340	298

Note: P – number of patents, Ex – research funding.

As you can see, both of our variables are normally distributed.

Table 3. Checking Distribution Normality.

Exp:	**P**
Doornik-Hansen test (Doornik-Hansen) = 36.6318, with a p-value of 1.11044e-008 **Shapiro-Wilk W-statistic**s = 0.861129, with a p-value of 1.53541e-006 **Lilliefors test** (Lilliefors) = 0.173685, with p-value ~ = 0 **Jarque-Bera test** = 17.0309, with p-value 0.00020035	**Doornik-Hansen test** = 37.7674, with p-value 6.29374e-009 **Shapiro-Wilk W-statistics** = 0.850517, with a p-value of 6.9596e-007 **Lilliefors test** (Lilliefors) = 0.212648, with p-value ~ = 0 **Jarque-Bera** test = 10.7012, with a p-value of 0.00474526

Source: calculated by the author.

Before estimating regression, we use the Granger test for the causal relationship between variables. The results are presented below.

Table 4. OLS, Based on Observations 2010-2019 (T = 67). Dependent variable: Exp

	Coefficient	*Statistical margin*	*t- statistics*	*p-value*	
const	3975.77	426.472	9.322	<0.0001	***
P_1	−0.229879	0.549731	−0.4182	0.6773	
P_2	−1.45157	0.488217	−2.973	0.0042	***
P_3	−1.76542	0.400098	−4.412	<0.0001	***
Exp_1	−0.881416	0.176405	−4.997	<0.0001	***
Exp_2	−0.332371	0.199096	−1.669	0.1002	
Exp_3	0.214399	0.172063	1.246	0.2176	

Mean dependent var	1158.179		S. D. dependent var	1106.922
Sum squared resid	34039642		S.E. of regression	753.2114
R-squared	0.579073		Adjusted R-squared	0.536980
F(6, 60)	13.75710		P-value (F)	9.28e-10
Log-Likelihood	−535.2034		Akaike criterion	1084.407
Schwarz criterion	1099.840		Hannan - Quinn	1090.514
rho	0.158341		Durbin-Watson	NA

Source: calculated by the author.

We used 3 lag values for both variables. As we can see, we cannot clearly define the causal relationship. If we analyse the results, the number of patents in 2 periods affects the spending, and the spending affect in 1 and 2 periods.

Table 5. OLS, Based on Observations 2010-2019 (T = 67). Dependent variable: P

	Coefficient	*Statistical margin*	*t- statistics*	*p-value*	
const	1041,13	152.566	6.824	<0.0001	***
Exp_1	−0.124071	0.0631072	−1.966	0.0539	*
Exp_2	−0.168980	0.0712249	−2.372	0.0209	**
Exp_3	0.0960645	0.0615542	1,561	0.1239	
P_1	−0.0561213	0.196661	−0.2854	0.7763	
P_2	−0.341572	0.174655	−1.956	0.0552	*
P_3	−0.300081	0.143132	−2.097	0.0403	**

Mean dependent var	480.5405		S. D. dependent var	363.2337
Sum squared resid	4356351		S.E. of regression	269.4547
R-squared	0.499727		Adjusted R-squared	0.449700
F(6, 60)	9.989106		P-value (F)	1.25e-07
Log-Likelihood	−466.3310		Akaike criterion	946.6621
Schwarz criterion	962.0949		Hannan - Quinn	952.7689
rho	0.081470		Durbin-Watson	NA

Source: calculated by the author.

Based on the values of the information criteria, we will analyse the impact of costs on the number of patents, because this analysis is more logical. The final model is presented below.

Table 6. OLS, Based on Observations 2010-2019 (T = 67). Dependent variable: P

	Coefficient	*Statistical margin*	*t- statistics*	*p-value*	
Exp	0.269691	0.0167109	16.14	<0.0001	***
Exp_1	0.109104	0.0146913	7.426	<0.0001	***
Exp_3	0.0452377	0.0237063	1.908	0.0610	*
P_3	0.146850	0.0677508	2.168	0.0340	**

Mean dependent var	480.5405		S. D. dependent var	363.2337
Sum squared resid	1595430		S.E. of regression	160.4143
R-squared	0.934017		Adjusted R-squared	0.816785
F(6, 60)	175.5282		P-value (F)	3.15e-35
Log-Likelihood	−432.6806		Akaike criterion	875.3612
Schwarz criterion	886.3846		Hannan - Quinn	879.7232
rho	0.003696		Durbin-Watson	1.984277

Source: calculated by the author.

We have obtained significant coefficients: 2 at the level of less than 1%, 1 coefficient at the level of less than 5%, 1 – at the level of less than 10%.

The coefficient of determination indicates a strong relationship in the final model. The centered coefficient is at the level of 0.93, the centered coefficient is 0.81.

Based on the value of F statistics, the model is generally adequate and meaningful.

Durbin-Watson statistics indicates no autocorrelation of residues. This is also confirmed by the schedule of distribution of balances (Figure 14).

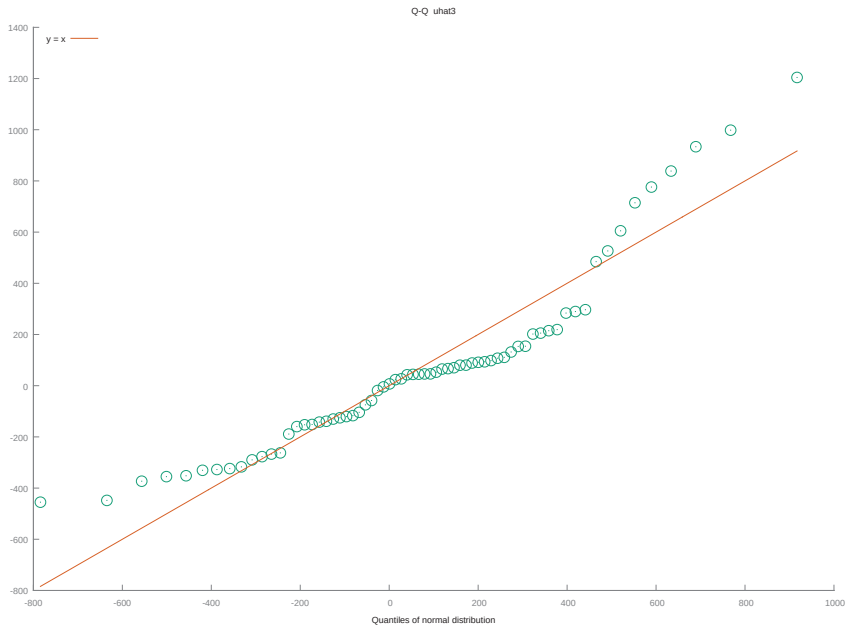

Figure 14. Q-Q graph of Model Balances.

As a result, we obtain the following regression equation:

$$\hat{P} = + 0.270*\mathbf{Exp} + 0.109*\mathbf{Exp\_1} + 0.0452*\mathbf{Exp\_3} + 0.147*\mathbf{P\_3} \quad (1)$$
$$(0.0167) \quad (0.0147) \quad (0.0147) \quad (0.0237) \quad (0.0678)$$

T = 67, R-square = 0.934
(standard margins are in parentheses)

Thus, the number of registered patents directly depends on the R&D expenditures in the same year, in the (t-1) (t-3) periods, as well as the number of patents in the (t-3) period.

The activities of networks of excellence, which have become important drivers of innovation in the EU defense industry, are of interest for the analysis. Together with clustering, they can enable SMEs to reach critical mass, increase their visibility in the EU market and their ability to compete in international markets. However, strategies promoting the development of regional clusters are usually managed and funded locally, so defense is not a direct priority. Moreover, the current fragmented state of Europe's defense industry limits the potential for bigger cross-border networks and does not contribute to the expansion of international cooperation between such clusters.

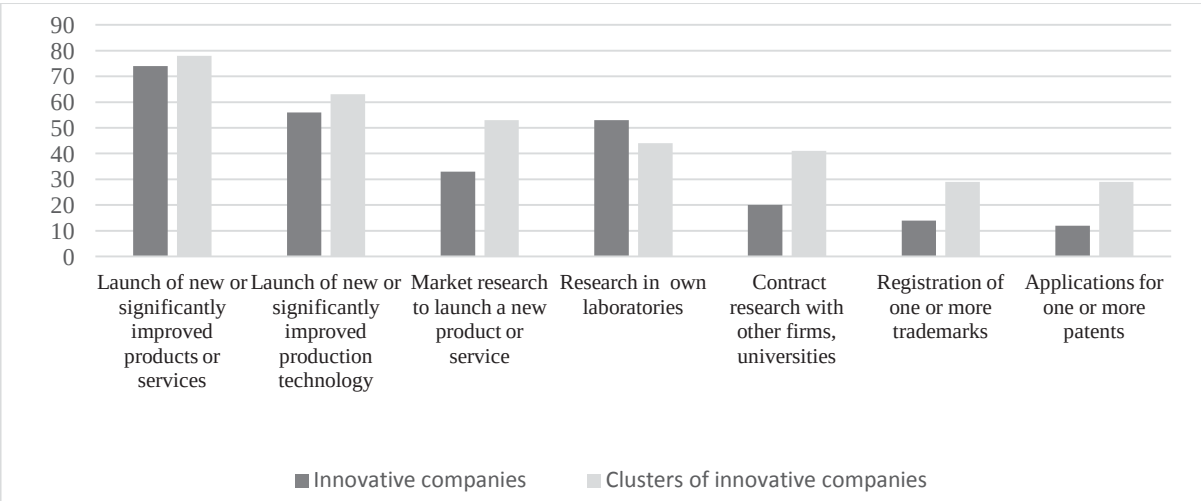

Figure 15. Comparison of Innovative Companies and Clusters of Innovative Companies.
Source: CARD, 2020.

In the context of the development of Industry 4.0 and of the importance of innovation for the defense sector, it is important to assess the impact of breakthrough innovations. As we have mentioned at the beginning, economic and technological development has gradually changed the defense sector in recent decades. As a result of interstate competition for the effectiveness of weapons systems and exponential advances in technology, the complexity of major military platforms has increased dramatically over the past 50 years. A characteristic feature of the defense sector over the past decade is that the operational need for uninterrupted and simultaneous operation of different platforms – as part of a "system of systems" (nodes, sensors, firing points, etc.) – added new levels of complexity ultimately making weapons production a complex process.

Another feature is that the software of defense systems begins to prevail over the technical component in its importance. In all modern advanced weapon systems, the software already has millions of lines of code. The software is going to play a greater role with the sharp increase in the availability of digital information, on the one hand, and the introduction of robotic systems, on the other (and therefore the associated need to integrate with other manned and unmanned systems).

The growing miniaturisation of processors and exponential increase in their power, along with the ever-increasing R&D spending, have gradually changed the relationship between military and commercial technology. The commercial sector is currently the main source of technological innovation and, therefore, the integration of commercial innovations in the defense industry has become the main challenge.

These trends have a significant impact on the research, production and purchase of weapons.

First, the system integration capabilities needed to overcome the sharp increase in technological complexity observed in recent decades, which is a major source of competitive advantage for MNCs, are becoming increasingly difficult to develop and maintain. As a result, markets with the greatest potential, such as jet fighters or submarines, are characterized by continued concentration, and eventually, competition becomes stiffer. The "second era of machines" with its emphasis on network efficiency and reduced marginal return is likely to reinforce these trends and thus further expand the leadership of innovators, giving them the advantage of a pioneer.

Second, load increases (such as missiles or sensors) occur much faster than platforms (such as aircraft or warships). The focus on payload requires modular designs of basic weapon systems and a competitive load market, which in turn is possible through common standards and harmonized interfaces.

Third, due to the high level of innovation, commercial companies or non-traditional suppliers can more quickly offer solutions for the operational needs of the armed forces. The advent of remote-controlled aircraft over the past two decades and SpaceX's recent success in the space launch market are two important cases for the military industrial complex. First of all, commercial markets can drive innovation and save money. But they do not necessarily address all operational needs or issues related to the acquisition and production of weapons through image and intellectual property rights.

An important consequence of this is the development of cooperation between companies and countries in the defense industry. Cooperation is an important component of defense development, but it can only take place among partners who share common goals, financial and technological capabilities. Thus, coordination is a prerequisite for creating ways of cooperation, especially when countries choose the trajectory of their development – the full range of weapons, niche potential, multi-function, single-function or modular weapons systems. In this context, NATO and the European Defense Agency (EDA) serve this purpose and help countries and companies jointly meet their needs or complement their assets.

Given the current technological developments, traditional multinational cooperation in arms production is likely to remain the most effective solution for the development of modern sophisticated weapons programmes, such as single military branch platforms or traditional weapons systems. It can also be a viable solution for minilateral programmes involving countries with integrated defense companies (e.g. MBDA and Airbus, Thales and Leonardo). In other cases, in our opinion, it may not work.

For example, highly advanced military platforms demonstrate a high level of technological complexity, which makes it impossible to significantly transfer technological know-how among partners. This increases the procurement risks associated with multinational armaments cooperation, as some partners may not have the necessary technological capacity to participate in the enterprise. Maintaining the current technological dynamics will require either transnational consolidation of the defense industry at the level of system integrator companies or hierarchical industrial partnerships, so that system

integration activities are concentrated in one company, while companies (from other countries) work as subcontractors. Both options are cost-effective and industrially efficient, but politically contradictory, as European countries in particular may disagree with either the loss of influence in their industry or its decline.

European R&D funding can be a possible solution to this dilemma. Weapon systems evolve through generations, from third-generation fighter jets such as the *Tornado Panavia* to the fourth-generation *Eurofighter Typhoon*, to the fifth-generation *F-35/Lightning II Joint Strike Fighter*. Each generation requires R&D funding to make a technological leap forward (mostly in terms of architectural change). After that, production begins. The debate over the US defense industry highlights two important aspects in this perspective. Firstly, although industry consolidation can serve efficiency relatively well, its effects are more ambiguous when it comes to innovation. Secondly, data from both non-military (PC and photolithographic alignment equipment) and military sectors (fighter industry) show that when products are passed from one generation to another, the operating states sometimes struggle to preserve their market positions because they do not have the technological know-how needed for new architectural structures.

Commercial technologies offer important opportunities. However, they also present significant challenges. Two are especially noteworthy. At the beginning of the R&D stage, the existing intellectual property regimes do not protect the long-term commercial interests of commercial firms or civilian research laboratories, thus deterring them from joining defense programmes. At the product level, both the current procurement norms and the employees of the procurement departments of the Ministries of Defense are not ready to work with commercial technology, mainly due to its difference from military equipment (from time cycles to its specific features).

International experience, especially in the United States and Japan, shows that preparing buyers to work with commercial technologies is extremely important. Initiatives in the EU in this regard are insufficient, limited and uncoordinated. The EU institutions can intervene to promote coordination, harmonisation of cooperation and integration in this area. Thus, innovation is an important factor in the transformation of the defense sector. In the current technological dynamics, the defense industry can return to the initial model of innovation, i.e., to adapt innovations emerging in the commercial sector.

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Variability of the Global Labor Market under the Robotization Process

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Abstract: Technological progress can increase planetary well-being, and subsequent technological changes will only have a positive long-term impact on the global labour market. Countries that cannot acquire new skills and create the conditions necessary for such transition are at risk of significant unemployment increase and real wages decrease, while workers are fundamental to new sectors of the global digital economy. Current and future trends in the global labour market are mainly determined by demographic processes and, in turn, scientific and technological progress. Robotics is a growing global economic trend characterized by the replacement of labour by robotics. This process can be positive for international business due to increasing labour productivity and reducing labour costs. To assess the state of robotics, we have developed an econometric method for evaluating the robotics index. We have measured the level of innovative potential of countries and ranked them according to indicators: quantity of issued patents; quantity of Internet users, quantity of companies that provide Internet, quantity of researchers involved in R&D; state and private companies expenses on R&D; highly innovative products in export; quantity of bureaucratic procedures, needed for the establishment of start-up; quantity of time, acquired by the companies' management for the settlement of bureaucratic procedures. Robots may replace traditional engines of economic growth in the middle of 21 century. Despite the long-term negative demographic trend in all developed and some developing countries, they are likely to become the main deterrent to the development of the global economy in the future.

Keywords: labour market • robotization • automation • specialties • innovation • R&D • global economy

Introduction

At the beginning of the XXI century the history of the development of our civilization occurs within the deployment of global impact factors, which determined the current state of society and is explained by the different paradigmatic approaches (five periods of global dynamics of human resources development, three states of industrialization, five technological revolutions, four industrial revolutions, six waves of innovations, five existing and four hypothetical technological structures, etc.) (Sardak et al., 2017; Sardak et al., 2018).

Accordingly, the world labour market, which is now becoming global as a result of the globalization of the global economy, has a driving force, among which demographic changes, unemployment trends and technological changes (especially the growing role of artificial intelligence and robotization) can be identified as key factors. However, it should be borne in mind that the number of jobs, their structure and potential substitution varies significantly between countries and groups of countries.

The extent of future job creation, taking into account the robotization of production, depends on a number of factors, including the level of wages, rising demand, demographic trends, sectoral features of the economy in each country. Despite the expected gradual replacement of standardized work by the

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robots in the global labour market, it cannot be said that technology is an autonomous negative factor affecting the human workforce.

Even in the first half of the twentieth century Mahatma Gandhi opposed mechanization in the light industry, because "behind machines is not love to the human, but predation", if production is concentrated in the hands of a limited number of people, it is a mass production, not production for the masses (Mind of Mahatma Gandhi, 2018). This statement is also relevant at the new stage of technological progress in the 21st century.

If the goal of technologizing process is to increase the level of planetary well-being, then technological changes will have a positive long-term effect on the global labour market only. Adequate levels of economic growth, innovation and investment in the new technologies will provide an adequate basis for job creation to replace the robotization effect.

However, it is of fundamental importance for workers to acquire the new skills that will be needed to move into the new sectors of the global digital economy, and countries that neglect the creation of the necessary conditions for such a transition are at risk of experiencing a significant increase in unemployment and lower real wages.

1. Literature review

A review of scientific publications shows the global labour market variability under the robotization. For instance, Klaus Schwab (Schwab, 2018) described the scale of change currently occurring as unprecedented in history. The fourth industrial revolution has enormous potential, capable of raising the standard of living of the world's population, and solving many problems, but allowing the emergence of new ones.

The current and future trends in the global labour market are induced mainly by the demographic processes, and, on the other hand, by the scientific and technological progress. Among the main demographic trends in global demographic processes are: population growth, increase in migration, increase in tourism, changes in age, religious, cultural and socio-economic structure of the world's population (Sardak, Sukhoteplyi, 2013). Scientific and technological progress is accompanied by revolutionary and evolutionary changes, within which there is a deployment of global trends, including such determinants as: internationalization, intellectualization, internet of things, 3D printing, informatization, digitalization, dehumanization and virtualization of work, etc (Stakanov, 2017; Stakanov, 2019).

A number of researchers (Autor, Levy and Murnane, 2003; Michaels, Natraj and Van Reenen, 2014) noted that there is existing evidence that the robotization of a range of low- and medium- skills contributed to inequality in wages and employment polarization. Modern information technology and artificial intelligence-driven machines have a significant impact on the global labour market today. The information economy is developing exponentially and manifesting actively in manufacturing based on economies of scale. According to J. McCarthy, the "father" of artificial intelligence, every aspect of learning or any other feature of intelligence can be so clearly described, that it can be imitated (Childs, McCarthy, 2011).

According to the International Federation of Robotics (International Federation of Robotics, 2017), the installation of industrial robots is estimated at 1.7 million units worldwide by 2020. The increase in the use of artificial intelligence, especially such as robots, computers and other machines occurs due to the replacement of medium and low skilled workers (Hajkowicz et al., 2016). R. Stephane (Stephane et al. 2016) notes that, although machine learning is getting better due to the emergence of more comprehensive information about workers, however, human behaviour algorithms that deal with many emergencies today are too complex for complete and comprehensive replacement by the robots. In turn, this is the reason why the newly developed robots are not able to interact in the social environment.

According to D. Deming (Deming, 2017), jobs that require soft skills will continue to attract people, while, at the same time, employment caused by the widespread use of technical skills will be replaced by robotics. As noted by M. Hicks, robots are gaining ground in a number of sectors (such as translation, reporting, the arts, creation and transmission of music), although people still have a weight over the work they will hold for the next 20 years (Hicks, 2018).

2. Results

Robotization is a growing trend in the global economy, characterized by the replacement of human labour by robotics. This process can be positive for international business because of rising labour productivity and reducing labour costs, increasing profits, filling deficit jobs in the companies. At the same time, it can lead to structural unemployment, reduce the overall level of income of labour owners and, significantly reduce the demand for consumer goods, consequently.

The use of robotics has increased significantly after 2009, when companies tried to balance cash flow by optimizing their payroll costs. Thus, the automotive industry used actively robotics for the first phase of recovery since the Great Recession (2009-2011), and increased the participation of robots in the production process by 55%.

If Japan and South Korea are the traditional largest users of robotics, the United States, China and Germany are the most significant drivers of theirs further growth. Advances in robotics and artificial intelligence opens a new era of automation, as machines are capable of performing on the same with the human, and sometimes even higher, productivity in a wide range of work area, including those requiring cognitive abilities. The dynamics and degree of automation are determined by technical, economic and social factors.

The most suitable for automation areas for automation include physical work in a structured and predictable environment (81% of work can be automated), as well as collection (64%) and data processing (69%), especially in the areas of production, nutrition , retail, as well as certain professions types of secondary qualifications.

According to the World Economic Forum, the number of jobs that can be fully automated with already available today technologies totals up to 10%, while in some categories of secondary qualifications the current potential level of automation is at least 20% (World Economic Forum, 2017). The volume of work performed by machines will increase from the current 29% to 42% in 2022 and exceed 52% in 2025. However, along with the release of some 75 million jobs, the global job market is expected to generate 133 million new jobs.

The key investment trends will be greater investment in high-speed mobile internet, Big Data, and cloud technologies in the short term perspective. Investment in robotics will have niche nature, instead, while it has a considerable positive dynamics. First of all, investment will be directed to stationary robots and to non-humanoid land-based robots (automotive, space industry), while the use of humanoid robots has increasing demand when investing in financial services (World Economic Forum, 2018).

About half of all jobs in the world are theoretically able to be automated through the use of existing technologies, which totals to about 800 million workers. However, the share of human workers actually replaced by robots by 2030 may be about 15 percent in average (McKinsey Global Institute, 2017b). From 3 to 14% of the total workforce in the world (75-375 million workers) will be forced to change employment, by the same year, and the rest will have to adapt to work together with robots. In particular, this will require improving the level of education, social adaptability, creativity, development of cognitive abilities, etc.

Developed countries are more likely to be inclined in robotics, and will have higher labour replacement rates, that will average 33% (in Japan - up to 46%). Developing countries rate of robotization in the 2030s will be more moderate and may reach up to 9% (China - up to 13%, Mexico - up to 10%, India - up to 6%). However, by 2030 it can be expected that 8-9% of the demand for labour will constitute a demand on those types of specialties that either do not exist at present or just emerging.

According to McKinsey Institute (McKinsey Global Institute, 2017a), robotic manufacturing processes can increase global productivity by 0.8-1.4% annually. The cost-savings potential of robotization can be up to 50% of the global payroll, which is around 32 trillion US dollars per year and can affect 1.1 billion workers in the global economy (more than half of this figure is in 4 countries: US, China, Japan and India). Automation can occur in more than 2000 occupations and will affect 800 occupations by 2055. Although less than 5% of all professions can be automated entirely at the current level of technology, approximately 60% of all professions have at least 30% of processes that can be automated.

Already in the short term (3-5 years) the negative impact of robotization (and job losses for individuals in these professions) will be felt by the data entry professions, accountants, auditors,

secretaries, workers of plants and factories, information support staff, business services managers, postal service workers, and more (World Economic Forum, 2018).

By contrast, there will be an increase in demand for jobs that are largely technology-based and complementary. Such professions will be the database analysts and scientists, software and application developers, e-commerce and social media specialists, artificial intelligence experts, Big Data learning and usage specialists, digital transformation and information technology professionals, sales and marketing specialists and others.

At the same time, the replacement of human labour by machine does not imply a systematic transition of the dismissed workers to the unemployed, but is more characterized by their transfer to other service sectors, as it was in the case with the change in the employment structure under the transition to post-industrial society. On the way to complete robotization, some specialties may be partially automated at first, which may have different effects on low- and highly skilled workers. For low-skilled workers, this process will be accompanied by a decrease in the level of wages in the absence of a proportional increase in global demand, which is possible in the medium term.

The demand and income levels of highly skilled workers primarily related to the introduction of new robotic technologies will grow faster than the global supply of such workers is generated, that will further enhance a global race for talents.

The effects of automation are also distinctive for different groups of countries. Thus, for developed countries typical trend is an aging population while reducing the absolute growth rate of the working age population, in this case automation will provide significant productivity gains as a key growth accelerator, which can reverse the upward trend of developing countries compared to developed countries. Savings on wages are significant for developed countries with their high wages. Thus, when the cost of labour hours in the automotive industry in Germany stands at the level of 40 Euros, the use of robots to perform similar tasks will reduce costs to 5-8 Euros per hour (Sirkin et al, 2015). Thus, this group of countries is the most motivated to maximize the involvement of robotics in the production processes.

The second group includes developing countries with an aging population (most emerging markets, particularly China and Russia), which are expected to limit economic growth as a result of reducing working age. For these countries, robotization is more a retention element of the sustainable economic growth rather than achieving its higher trajectory. The third group comprises developing economies with young people (India, Indonesia, Mexico, Nigeria, etc.). In these countries, there is a growing working-age population growth, which helps to maintain the pace of economic development. In such countries robotization can have locally segmented effects, which can assist economic growth in the medium term.

In the five ASEAN countries (Cambodia, Indonesia, Philippines, Thailand, and Vietnam), which account for 80% of the workforce of this regional trade agreement, approximately 56% of the total employment is at risk of losing their jobs through robotization over the next 10-20 years. The key areas of employment where the workers can be replaced machine-work in the region are the hotel and restaurant business, wholesale and retail trade, construction and manufacturing sectors.

Education, healthcare, and social work are to a lesser extent at risk of the automation. Some specialties in ASEAN countries face excessive risks of automation. In Cambodia about 0.5 million operators of sewing machine could be replaced by robots, where manufacturing sector is dominated by the light industry. The risk of automation is particularly acute for 1 million of retailers in Thailand. 1.7 million office`s workers in Indonesia are similarly vulnerable.

Another risk of robotization is the lack of perfect social security systems in developing countries where it is economically justified (China, India, and Thailand). Conducting mass robotization can affect the destabilizing of the labour market and create additional incentives for large-scale emigration (IBA Global Employment Institute, 2018).

The probability of labour force replacement by robotics depends on the systematic nature of the work performed and the manual vs. mental labour ratio. Table 1 shows the categorization of specialties in terms of probability of their automation. Those professions related to the implementation more standardized tasks are more susceptible to automation (Categories 1 and 3). Those specialties that involve abstract thinking, judgment, and creativity in the process of doing the work are less subject to automation (Category 4). Certain specialties that involve non-standardized manual labour are also partially resistant

to automation processes (Category 2). However, for Categories 2 and 4, robotics can be complementary rather than substitutive by nature, extending the productivity of workers in these specialties.

Table 1. Categorization of typical specialties by the range of tasks and required skills

		Simplicity of automation	
		High (standardized work tasks)	**Low (non-standardized work tasks)**
Simplicity of complementarity	**High (intense physical work)**	***Category 1*** Cashiers, stenographers, machine operators	***Category 2*** Landscape designers, home doctors, security system workers
	Low (intense mental work)	***Category 3*** Librarians, Proofreaders, Officers	***Category 4*** Medics, lawyers, managers

Source: Compiled by authors on the base of (Chang, Huynh, 2016; IBA Global Employment Institute, 2018).

In the medium term full or partial robotization is not justified for a number of developing countries, because of the high investment costs compared to relatively low labour costs in these countries. However, due to the constant cost reduction in the robotics technology, it will be beneficial in the vast majority of countries at different times. Replacing the people on the robots economically justified in the labour deficit countries, where the cost of human labour by at least 15 percent higher than the cost of robots activity (Sirkin, 2015).

According to Boston Consulting Group, that will occur in such countries as Mexico (by 2025), while Chinese companies are starting already to build the factories where 90 percent of workers could be replaced by robotics (Schultz, 2016).

The skills required to perform most of the work will undergo significant changes in the coming years. The average global share of remaining basic skills required to do the job will be around 58% and the proportion of skills that are changing – 42%. Purely "human" skills (creativity, originality and initiative, critical thinking, etc.) will maintain or even enhance their value.

The list of skills that will be required under the accelerated technologyization of the labor market include active learning and training strategies, technological design and programming, critical thinking and analytics, leadership and social impact, complexity of problem solving, system analysis and evaluation, etc. (World Economic Forum, 2018). At the same time, demand for such skills as physical labour, verbal, visual, oratory skills, financial and material management, personnel management, reading, writing, active listening, and more will decrease.

With the purpose of evaluation of state's robotization level we developed the econometric methodology of robotization index assessment (RI) that includes determination for every country under consideration the following factors:

- quantity of issued patents per 1 million of people;
- quantity of Internet users, % of the whole amount of citizens;
- quantity of companies that provide Internet per 1 million of people;
- quantity of researchers involved in R&D per 1 million of people;
- state and private companies expenses on R&D, % of GDP;
- highly innovative products in export, % of the whole export;
- quantity of bureaucratic procedures, needed for the establishment of start-up;
- quantity of time, acquired by the companies' management for the settlement of bureaucratic procedures, % of the whole working time of management of company.

The specified factors are widely used in the appropriate experts' calculations of the World Bank, World economic forum and others. There is the theoretical reasoning in the scientific literature that the detected factors directly influence on the innovative development and economic potential of country and are the main factors that restrain the implementation of innovations. The part of the listed factors are

relative indicators that are measured in the percentage from the whole amount, the other part of factors are absolute figures that have dimensions in a few units.

The transfer of appropriate figures in the single scale is executed with the application of mathematical approach of normalization of general totality in dependence of fluctuations oscillation:

$$Z=\frac{x-\mu}{\sigma}, \quad (1)$$

where:

Z – the final score;
x – appropriate figure for each country on the factor under consideration;
μ – medium value;
σ – standard deviation of variants from the average value in totality.

The use of the developed methodology lets us correctly locate the calculated figures in the final totality of scores, especially including the fact that among the factors under consideration. The use of developed methodology lets us correctly place the obtained figures in the final totality of estimations, especially taking into consideration the fact that among the factors under consideration there are those factors which higher values signify the higher level of robotization (the amount of researchers engaged in R&D and those which higher values are negative factors (the quantity of bureaucratic procedures, needed for the establishment of start-up).

The use of formula (1) allows to range the values for each country within the established interval – one standard deviation, so such marks are correct and representative

The statistical base of research was formed (table 2).

Table 2. Factors that influence the innovative potential of a country

Country	Quantity of issued patents per 1 mln of people	Quantity of Internet users, % of the whole amount of citizens	Quantity of companies that provide Internet per 1 mln of people	Quantity of researchers involved in R&D per 1 mln of people	State and private companies expenses on R&D, % of GDP	Highly innovative products in export, % of the whole export	Highly innovative products in import, % of the whole export	Investments in innovative sectors of economy, % GDP
Great Britain	17,6	76,1	32,3	4430,6	1,6	21,0	14,1	3,1
South Korea	24,9	92,7	41,1	7119,2	4,2	14,5	9,7	5,2
Poland	1,04	73,3	19,2	1363,4	0,9	7,7	11,1	2,2
Russia	0,7	76,4	19,4	2979,3	1,1	11,5	28,4	3,8
Slovakia	1,1	80,4	14,4	2599,8	0,8	10,1	14,2	2,1
Slovenia	7,2	75,4	18,2	3899,2	2,0	6,4	15,9	1,8
USA	18,1	90,8	35,6	3130,8	2,7	13,8	12,8	4,4
Turkey	0,3	71,8	8,2	304,6	0,8	2,5	8,8	2,6
Ukraine	0,9	90,6	9,2	1037,2	1,7	4,9	17,1	1,1
Sweden	31,7	91,5	36,2	7216,3	3,2	13,2	9,6	5,3

Source: Developed by authors with the use of materials published in World bank.2018a, 2018b, 2018c, 2018d, 2018e, 2018f, 2018g, 2018h, 2018i; UNESCO, 2018

On the next stage the obtained figures (table. 2) are normalized with the use of formula 1 the respective figures were arranged within the intervals [-2,7555…3,145061] (table 3):

Table 3. Normalized estimations of factors that influence innovative potential

Country	Quantity of patents	Quantity if Internet users	Quantity of Internet providers	Quantity of R&D researchers	R&D expenses of companies	Innovative products in export, %	Innovative products in import, %	Investments in innovative sectors
Great Britain	1,4	0,3	0,8	0,9	0,1	3,1	-0,3	2,1
South Korea	2,3	1,2	1,5	2,2	3,1	1,6	-0,4	2,5
Poland	-0,5	0,2	-0,2	-0,5	-0,7	0,1	-1,5	1,1
Russia	-0,5	0,3	-0,2	0,2	-0,5	0,9	-2,2	1,2
Slovakia	-0,5	0,5	0,2	0,1	-0,9	0,6	-1,5	0,5
Slovenia	0,2	0,3	0,5	0,6	0,5	-0,1	-1,8	0,4
USA	-0,6	-0,9	-1,2	0,3	1,3	1,5	-0,4	2,2
Turkey	-0,6	-2,4	-1,6	-1,1	-0,8	-0,9	-1,9	1,2
Ukraine	-0,5	1,1	-0,6	-0,7	0,2	-0,5	-2,1	0,2
Sweden	3,1	1,1	1,2	2,3	1,9	1,3	-0,2	2,6

Source: Developed by authors.

Each obtained mark for each country was placed on the coordinates, with each point representing a pair of specific coordinates (x;y). Robotization index was calculated as the ratio of obtained polygon to the area of the reference polygon. The peaks of the polygon are the maximum values in each of the group of marks:

$$I_{i.p.} = \frac{S_i}{S_{ет}}, \qquad (2)$$

where:

$I_{i.п.}$ – robotization index

S_i – the octagon area for a specific country

$S_{ет}$ – area of the reference octagon

The coordinates of the reference octagon are the maximum values in each group of estimation factors (Figure 1):

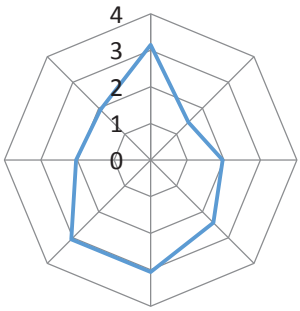


Figure 1. The reference octagon.
Source: Developed by authors.

The area of octagon was calculated using formula:

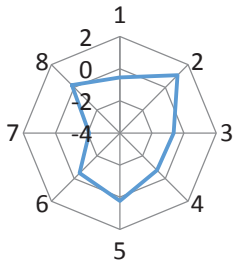
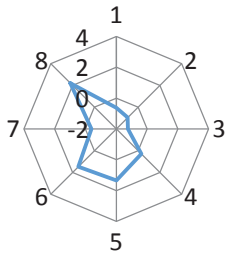
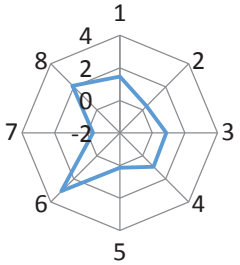
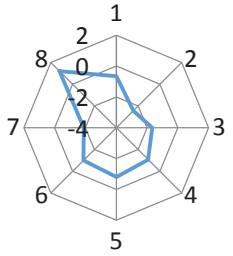
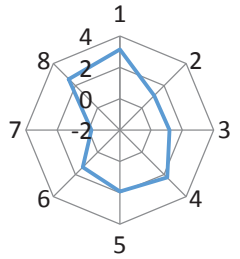
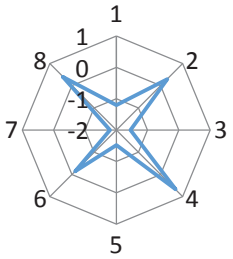
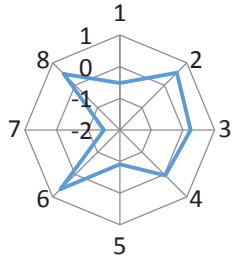
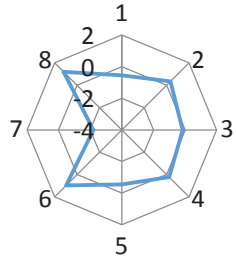
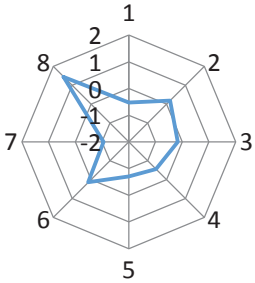
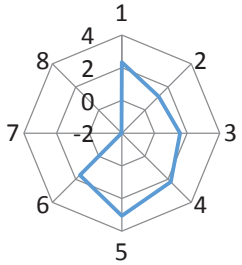
$$S = \frac{1}{2}\left|\sum_{i=1}^{n-1} x_i y_{i+1} + x_n y_1 - \sum_{i=1}^{n-1} x_{i+1}\, y_i - x_1\, y_n\right|, \qquad (3)$$

where:

S – area of polygon;
n – quantity of peaks;
$(x_i;y_i)$ – coordinates of polygon.

Area of the reference polygon is 18,03976. The appropriate octagons were drawn for Ukraine, the USA, Great Britain, Turkey, Sweden, Slovakia, Slovenia, Poland, Russia and South Korea (table 4):

Table 4. The evaluated factors that influence innovative potential of countries under consideration

The appropriate octagon for a country and its area	The appropriate octagon for a country and its area
Ukraine 3,11255	**USA 3,65895**
	
Great Britain 4,15863	**Turkey 2,78541**
	
Sweden 6,98546	**Slovenia 2,760258**
	
Slovakia 1,98568	**Russia 2,13586**
	
Poland 4,12546	**South Korea 8,25698**
	

Source: Developed by authors.

On the basis of executed calculations (formula 2 and 3) the values for robotization index were obtained (table 5):

Table 5. Innovative potential of countries index.

№	Country	Index of innovative potential
1	South Korea	0,47
2	Sweden	0,44
3	Great Britain	0,28
4	Poland	0,26
5	USA	0,25
6	Turkey	0,18
7	Slovenia	0,16
8	Ukraine	0,13
9	Russia	0,13
10	Slovakia	0,12

Source: Developed by authors.

The highest level of innovative potential have South Korea and Sweden, Ukraine is a comparatively undeveloped country.

Conclusions

Given the long-term negative demographic trend in all developed and some developing countries, which in the long run can be a key limiting factor for the global economy development, the robotization will be able to replace the traditional drivers of economic growth since the middle of the XXI century. At the same time, if for advanced economies and the global economy as a whole, robotization seems to be a useful process, for some labour-intensive developing countries, large-scale automation can be a significant shock on the local labour market.

A methodology of calculating the robotics index of individual countries economies avoids many significant problems associated with standard algorithm for constructing of any index. The above evaluation index value is a ratio of polygons area for individual countries to "reference" polygon highest ratings of relevant indicators index methodology. It can simplify the various estimates of the phenomena which are not directly linked. In the standard case a necessary stage of development of any index is calculation of each components weight, which uses different, often quite complex methodology - method of principal components, Delphi and others. In this article, this problem is solved using the methodology described above.

The obtained index values for the analysed countries are the conditional estimation of the national economies level of robotization, which can be properly used, first of all, to compare the levels of innovation and knowledge intensity of individual countries, if a certain country has a much higher index value, then the economy of that country has a higher level of robotization and innovation. In our opinion, the corresponding groups of countries can be combined into corresponding clusters - more robotic economies (Republic of Korea, Sweden) and countries with the lowest level of robotization and innovation (Ukraine, Russia, Slovakia).

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