ИНСТИТУТ ЗА ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ НА БЪЛГАРСКАТА АКАДЕМИЯ НА НАУКИТЕ

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MARKET, FREEDOM AND JUSTICE

This article constitutes an attempt to present the market themes through the prism of the freedom of the market actor to pursue their self-interest and the associated expectations for achievement of certain justice. The freedom of the human as a market actor has a number of specific characteristics as compared to other freedoms they receive in their role as a citizen of a democratic state, such as the freedom of speech, of religion, of association, etc. The value concept of the market is embedded in the dual nature of the market actor. As a consequence, this results in duality of their interest and two qualitatively differing social environments where they strive to realise it. The freedom this market actor has in these two social environments is different, which gives rise to expectations for achievement of two dimensions of market justice. One is related to the specifics of the relationships of exchange between the market actors and the other is related to the distribution of competitive market opportunities between them.
JEL: A1; Z1

Introduction

The evaluations of the market as a value solution of the problem with production and distribution of the goods range from "hosanna" to "crucify". On the one hand, we have not only expansion of the market geography, but also its influence as a regulator in non-economic activities of public concern. It is hard to predict where the activity boundaries of the market can expand. Theoretically, all activities of public concern could fall within them and turn market exchanges into the key mechanism for integration in society. Such a great transformation (Polanyi) may seem utopian at present. On the other hand, the market is subjected to never-ending criticism and defined as one of the factors to blame for the dramatic social inequality, the economic and environmental crises, the commercialization of relationships between people and the transformation of markets into the main incentive for human activity. In essence, these also constitute evaluations about the practical implementation of one of its primary values – the freedom of the market actor to make free choices, find their self-interest and strive to realise it. It is this type of freedom that many researchers have considered as the most essential value advantage of the market as compared to all the other institutional standards for production and distribution of the goods

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among people. It is the basis of entrepreneurship, which creates innovations and leads to the production of new goods with an increasingly high quality (Schumpeter,1993). However, the same type of freedom is also defined as a form of exploitation exercised by certain market actors over others. (Marx,1999 [1848]).

Probably, as long as there is a market, there will always be controversial evaluations of it. This means that the expansion and rethinking of the market knowledge will continue to be challenged before the representatives of different scientific fields. This article shall be considered an attempt in this direction. The thesis presented by the author is that the market actor's self-interest is a social construct and may not be concluded as being purely selfish. The market actor has the freedom to satisfy their needs and to achieve their desired goals not in the way they want to, but in a particular way. In the context of this understanding of self-interest, the freedom of the market actor to strive to realise it reflects on the expectations for achievement of certain justice. The author shares Hayek's opinion that the freedom of the market actor is a negative freedom. (Hayek, 1960,1967). Since the market is an institution and a system of rules, the number and nature of these rules predetermine the "level of autonomy of market actors" (Weber, 1985 [1922]). Practical experience shows that this autonomy may be different in societies with market economy precisely because of the presence of different market rules.

The main research focus in the elaboration of this topic is the social role of the "market actor", which summarises the multitude of market subjects. The author's considerations for the choice of this research focus are as follows: First, the system of limitations (negative freedom) may be discovered to the fullest extent in social roles, which are an integral part of the institution of the market. Second, the one holding the "self-interest" is the market actor. The social role of a "market actor" may be used for recognising the entire range of self-interests of the different market subjects. Third, the significance of the social role of a "market actor" is in the specific exchange relationships in which the one performing that role is entitled to participate (Dahrendorf, 1977). They can realise their self-interest solely through these relationships. Fourth, the institutionalised rules of the relationships of exchange that market actors may perform among themselves involve an expectation for achievement of certain justice.

Through the realisation of their self-interest, the market actor satisfies many needs that are essential for their social reproduction. Therefore, the evaluation of the freedom they have to do this, as well as the evaluation of the justice achieved through this freedom, is essential for the value legitimacy of the market.

Social organization of compulsion to work through market freedom

The market is one of the main institutions of democratic society whose sense could be hardly understood outside the sense of the society itself. The society is a unique body consisting of many people connected among themselves. A member of the society is not just the physical presence of a man anywhere in space and time. It is a sign of a person's emergence from his or her being of isolation and of becoming a state of connection with others and of the perceived dependence on them. The idea about society ensues from the

non-self-sufficiency of a single individual who cannot produce by himself all goods required to meet his needs. This compels him to live with other people and to become part of a community, which has to find collective solutions for meeting the needs of goods. Society is such a form. It is the social system, which is characterized by the highest level of self-sufficiency in regards to his surroundings (Parsons, 1977). In democratic society, people build their lives together by choosing to subject to rules rather than to the will of individuals and this is what makes them free' (...) when we obey laws, in the sense of general abstract rules laid down irrespective of their application to us, we are not subject to another man's will and therefore free.' (Hayek, 1960:134) The rules of living together should find the balance between freedom and compulsion as an important prerequisite for good life worthy of human dignity, which society should try to provide to his members (Sen, 1996; Nussbaum, 1999).

The basic problem, which should be solved by the society is how the compulsion to work, through which wealth (goods and services) is produced, should be organized. This is a choice of values, which gives solutions of two issues significant for living together: who will produce certain goods and who will use them to satisfy his needs. The solution of the first problem determines the access to the organization of production of goods and the access to exercising specific type of work. The solution of the second issue determines the access to goods.

The goods that satisfy collective needs are specified as public one and are produced by the state (protection of the national security, infrastructure, internal order, legislation, etc.). These goods are usually determined by the constitution and are closely related to basic principles of justice, on which the society is based. All members of society have the right to use public goods.

The market is a solution to the problem of the production and distribution of goods that are not public in society. According to it, non-public goods could be produced by everybody that meets the terms and conditions for the organization of his production and has the ability to work required for that. Everybody who has decided that he needs them and could pay for that has access to the non-public goods. This value-conditioned solution suggests *first,* that the value- organized activities related to the production of goods compete among themselves regarding the choice of owners of capital and ability to work and, *second*, the producers of goods (sellers) compete regarding the choice of buyers. The competition is a principle that constitutes the market. In this connection, Weber thinks that 'a market may be said to exist wherever there is competition, even if only unilateral, for opportunities of exchange among a plurality of potential parties' (Weber, 1978:635). The competition makes freedom possible and turns it in a mode of building of social relation (Offe, 1998). Such relation could also be established between market actors that perceive each other as adversaries (Weber, 1985). Beckert defines markets as 'arenas of social interaction. They provide a social structure and institutional order for the voluntary exchange of rights to goods and services, which allow actors to evaluate, purchase, and sell these rights' (Beckert, 2007:7). The practical establishment of the market requires its institutionalizing. The institution represents restrictions set up by people that point out the way to conduct concrete activities and the way to produce and distribute goods (North, 1990). The institutionalization of the market suggests setting up of rules that form the structure of a

certain space of actions in a system of positions, social roles and relationships among their performers as a permanent solution of the problem for the production and distribution of money and goods. In its deepest essence, the combination of these rules aims at organizing the compulsion to work in the society by providing to everybody the freedom to choose the goods in whose production to invest his capital, the ability to work to develop and the specific type of work to exercise them in (bring them in action). This concerns negative freedom, which Hayek determines as 'independence of the arbitrary will of another (...) freedom' refers solely to a relation of men to other men, and the only infringement on it is coercion by men' (Hayek, 1960:12). The negative freedom is a state where the coercion on a single individual by others is reduced as much as this is possible in society (Hayek, 1971; Friedmann, 2002).

It could be supposed that this freedom is experienced as *self-compulsion* by all those members of society for whom the organization of production of goods and the exercising of specific type of work is the basic (and the only one for some of them) legal access to money due to the fact that the access to goods is against money. Choosing to use his capitals and/or ability to work for production of goods for others, man actually seeks to satisfy his needs regarding acquiring property rights to money and goods.

Self-interest of the market actor as part of public interest

The market rules express the public interest[2] about the way the market actors will acquire legal property rights to money and goods. Through this interest, society aims at realization of a few main common benefits: social division of labor, which to reproduce the society as a relatively self-sufficient activity system; self-compulsion to work for all members of society of employable age, for whom the basic or the only legal access to money passes through exercising freely chosen specific type of work (occupation) and competition according to rules among the producers of goods, through which to produce more versatile and of better quality goods necessary to satisfy needs of the people. Under the condition that each market actor follows the market rules, obtained is one of the principles of justice on which society is built, namely: the participation of everybody in the formation of the public funds proportionately to his property rights. Through these public funds, the state realizes its particular policies, which are also directed towards the achievement of the public interest.

The public interest from the functioning of the market is achieved practically through the realization of the self-interests of the market actors. When the self-interest of the market actor is concerned, most often Smith is quoted, according to whom: 'It is not from the

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[2] The concept of interest has a long history and refers to an euphemism of the Middles Ages. Exercising money-lending was prohibited then. (That did not mean that there was not any. Illegal exchanges dated from long time ago!) When somebody lent money to somebody else in the form of a loan, this was under the condition that the loan should be repaid in increased amount (the interest rate that is known today as the price of the borrowed funds). The concept of interest meant the continuous tendency to increase the amount of this interest rate (Hirschman, 1987). Later, the concept of interest received the meaning of profit, benefit, pursuit, depending on the quite different contexts of its use.

benevolence of the butcher, the brewer, or the baker that we expect our dinner, but from their regard to their own self-interest. We address ourselves, not to their humanity but to their self-love, and never talk to them of our own necessities but of their advantages' (Smith, 1979:27.). This interest does not include only the striving of the market actor to meet his needs of property right to money and goods but also the way it is permitted to do this. In order to be interested, one has to be aware about what is happening in a certain social game. This means that he has to acknowledge that the pledges of the game are significant and worthy to be followed (Bourdieu, 1992). Without any doubt, the market is a social game whose sense for the market actor is the possibility to acquire legal property rights to money and goods. The rules of this game *make the structure of the admissible ways* for acquiring such rights through performing some definite exchange relations. What the market actors could offer (give) and receive in these relationships in most synthesized way is reduced to the following: the employer offers jobs (performance of professional roles and the respective remuneration for that) in order to receive ability to work of specific quality (education, skills), which he needs in order to produce goods; the owner of the labor power offers abilities to work against remuneration; the sellers offer money, so that they can receive goods.

As the access to goods is accomplished through payment of their price, it is extremely important for the market actor to acquire legal property rights to money. He chooses freely the ways for access to money structured by the rules, which to take over. Interpreting the rules in understandable, logically consistent system of the admissible actions through which he will search to satisfy his needs of money, the market actor identifies his self-interest actually. He is the last instance for the estimate of what this interest represents (Habermas, 1983). Learning the rules, the market actor transforms his striving to satisfy his need for money into interest that shows him what he should give in order to receive what he needs. The rules outline the borders of his free field where he can search the realization of his self-interest. The recognition of the self-interest in the market rules is a rational action of the market actor. Sen thinks that 'the first and the most direct use of rationality must be normative: we want to think and act wisely and judiciously, rather than stupidly and impulsively' (Sen, 2004:42). The choice of the road along which the market actor wants to reach the money could be specified as rational from his point of view only. As a rule, he makes his choice without being able to envisage all consequences from it under the conditions of 'bounded rationality' (Simon, 1955).

Only the self-interest of the market actor identified in the rules and its pursuit within the frames of the freedom provided by the rules could be irreproachable from a moral point of view. The market actor could seek protection by the respective state institutions only in regards to this interest in the cases when somebody is trying by his actions to hinder its realization. This realization passes through what the market actor could offer others, what could satisfy their needs and could be part of the solution of the problem with their lack of self-sufficiency. He is aiming at being selected for exchange, as in the long run, the free choices of others decide whether his self-interest will be realized or not. In their turn, they also try to realize their interests through choices of market exchanges. This expresses the basic principle of the market that market exchanges between people pursuing their self-interests should be mutually beneficial.

Self-interest and justice

Linking justice to a society of free people, such as the market actors, is incompatible (Hayek, 1977). This thesis of Hayek cannot be considered as doubtless. Market actors have freedom that is restricted by the market rules. The competition also is a competition by rules rather than any absolutely free competition. The rules of acquisition of property rights to money and goods through exchange relations, as well as any other rules, regulating social relations, inevitably cause appraisals of justice.

The market actors realize their self-interests through exchange relations between themselves as a result of a free choice, free negotiation and achieved consent on the equivalence among exchangeable goods**.** What is supposed to stay behind each free choice for exchange is the desire of the market actor to satisfy his needs in the best possible for him way within the frames of the alternatives he knows. He is the only one who knows what his expectation (idea) is about the maximization of the utilities, which he seeks to receive within the frames of an actual exchange relation. The utility is the subjective estimate, which the market actor makes on the grounds of the correlation of the respective good (in the aggregation of utilities, which he has found for himself in it) to the needs he expects to satisfy by means of this good and to the exchange means, which it should give in replacement. Inevitable part of every free choice for exchange, as a moment of the realization of the self-interest of the market actor, is his estimate for the relationship between what he gives and what he will receive. Because of that, each actual exchange is performed after the market actors (the parties to the exchange) find a balance between their subjective estimates for the justice of the equivalency of the exchangeable goods. This equivalence is achieved rather within the framework of each individual exchange among them rather than existing outside the market actors. This gives reasons for expectations that the realization of the self-interest of the market actor passes through exchange relationships, for which equalizing (balancing) justice is typical.[3]

The way in which market actors' chances to realize their self-interest in the acquisition of property rights to money are distributed is also subject to fairness judgment. Under the conditions of competition, these opportunities are determined by the exchanges realized by the market actor. Hayek thinks that justice as distributing justice is incompatible with the market, as the market does not distribute revenues (Hayek, 2004). This is really so as far as in the case of the market there is no original wealth, including a pecuniary one, to be distributed. The market as a combination of voluntary market exchanges is a spontaneous order, which is a result of multiple difficult to forecast free choices of market actors that decide when, where, with whom and because of what the market exchanges are realized according to their criteria. How many property rights to money that the market owners (manufacturers of goods and holders of ability to work) will depend on the free choices of

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[3] The idea of levelling (balanced) justice could be found in Aristotle
http://classics.mit.edu/Aristotle/nicomachaen.html. He distinguishes between general (universal) and private justice. The general justice as a perfect virtue is embodied by the law. The private justice could be distributive and is carried out after the principle of proportion and commutative (equalizing) justice characterizing the exchange relationships between people, which are set up on the basis of their free choices and the consent on the equivalence of the exchangeable goods.

buyers and employers. Because of that, with market this concerns distribution of opportunities for realization of the self- interests of the market actors in acquiring property rights to money rather than the distribution of revenues. The concept of opportunities is used by Weber, when he determines the market as 'competition of market chances' (Weber, 1985:36). In case of equality of all market actors regarding the rules, each of them takes from the market what it gives him under the condition that he has played fair (Hayek, 1967). And what he can obtain from the market is defined by the free choices of others. These are his market achievements. If every market actor pursues his self-interest in acquiring property rights to money within the frames of the rules, then it would be fair to have the one who has achieved more market success. Practically, this justice is not realized in the cases where part of the market actors transforms their self-interests in selfish ones. A potential for similar transformation is included in the dual nature of the market actor and the two sides of his self-interest ensue from them.

Duality of the self-interest of market actor

The way in which the market provides the possibility for the satisfaction of needs of property rights to money and goods predetermines the specific ambiguity of the market actor. On the one part, he should be a seller offering for exchange goods as a condition for access to money, and on the other part, a buyer receiving property rights to goods against money. The market urges to achievements the owners of capital, of land and of ability to work. These achievements are desired by the buyers that are the same owners of capital, of land and of ability to work (Mises, 1940). The ambiguous nature of the market actor causes two relatively differentiated sides of his self-interest, which he realizes in radically different environments.

Self-interest of market actor-seller

The first side of the self-interest of the market actor is specified by his choice of a road along which he will reach the money. This is the road of a seller. The market actor decides whether this road passes through organizing his own production of goods, which he will offer for exchange against money (independently or hiring to this effect other market actors as well), or through the formation of ability to work of specific quality, which will be offered for exchange against remuneration.

The market actor-seller who wants to organize his own production of goods, compares the activities in the society, where he can make this; the conditions, which he has to meet in order to receive access to these activities; the competitive environment in each of them and their own knowledge, skills and competences. Depending on this estimate, he also recognizes his self-interest in the face of that production of goods, where he freely chooses to invest his capital (and in some cases ability to work as well). The first step to achieve this interest is the realization of the freely made choice for organization of production of goods. To this effect, the candidate for market actor-seller should receive access to the performance of the activity chosen by him. He is not competing with anybody in order to

realize this free choice of his. The only thing, which is required by him, is to meet the conditions for access to the respective activity. These conditions are determined unilaterally by the state in different regulating regimes according to which the access to performing a specific activity starts after receiving a license, permission or registration. Only after meeting the conditions for performing the activity desired by him, the market activity starts to produce and offer for sale goods in compliance with the market rules and under conditions of competition. His interest is to exchange them against property rights to money. He needs it in order to be able to continue the process of production of the good chosen by him (to continue being a seller), as well as to acquire property rights to goods, with which to meet his needs. In order to realize this interest, the market actor-seller orients his supply according to the potential activities of indefinitely big number of real or imagined competitors with their self-interests in the exchange (Weber, 1985). He undertakes actions within the frames of the field of freedom outlined by the rules, so that it could be competitive and win as much as possible free choices on behalf of buyers. It depends on the free choices of buyers to what extent he will achieve his interest. When the market actor-seller chooses the organization of production of goods as access to property rights to money, he is not interested at all how his choice will affect the social division of labor. He is free to identify his self-interest among the multitude of possibilities, which provide him the rules, led only by the desire to achieve his goals – in this case, to acquire legal property rights to money.

In the cases where the individual is aware that he cannot be a market actor-seller who organizes by himself the production of goods (because of the impossibility to meet the conditions for access to production, because of the lack of will to undertake such entrepreneur's risk or because of any other reason), his only possibility to respond to the compulsion to work is to set up ability to work, which to offer for exchange. His self-interest is to receive property rights to money through access to performing a specific type of work (exercising a specific occupation). The realization of this interest passes through making two free choices. The first is the choice of acquisition of specific ability to work as a pre-requisite for the performance of desired type of work. This choice is realized within the frames of a certain educational institution under the rules of receiving the respective educational qualifications which cannot be affected by the individual. He should perform them. The second choice is the choice of an employer with whom the market actor-seller to exchange his ability to work in order to receive access to exercising of desired type of work and the corresponding remuneration. In such a case, his free choice meets the free choice of the employer. The market rules provide freedom of choice both to the owner of the ability to work and the employer who needs it in order to produce goods. Both parties are free to negotiate the conditions of the exchange. The market actor who offers his ability to work for exchange against remuneration realizes his free choice only in the case of agreement reached with the employer about the amount of the remuneration and the working conditions. After the realization of this choice, the self- interest of the owner of the ability to work is to preserve and/or improve his position in the organization. In this part, his self-interest coincides to a certain degree with the self- interest of the employer and is directed to the protection and/or improvement of the competitive chances of the organization. This coincidence of both interests is due to the fact that under of conditions of competition, the owner of the ability to work is object to two estimates. On the one hand, his ability to work

is appraised by the employer. The estimate of the employer regarding the choice of the ability to work offered for exchange against consideration is part of his risk as an entrepreneur. This estimate reflects his expectation that the ability to work chosen by him will produce such goods, which are to be chosen by the buyers. The estimate of the owner of the ability to work in the form of the material work by him is on the other part. This estimate is made by the buyers. Because of that, both employer and owner of ability to work orient their activities to the achievement of common (corporate) interest – realization of market exchanges through winning the free choices of the buyers.

In the case of market exchange of ability to work against remuneration, which is performed after a free choice of both parties (employee and employer), and both free choices exclude the access to his resources (labor power and capital) for other employers and other market actors offering ability to work for exchange. (Both ability to work and capital are scarce resources). There is an exchange between two parties, which in their essence are in competition with others like them. The competition among the persons offering their ability to work against remuneration is much fiercer than the competition among employers seeking labor power of one and the same profile. This is due to the more alternatives for choice, which the owner of the capital has for the choice of its implementation, which should ensure him the receipt of property rights to money. This is the supremacy of money over the remaining scarce resources, which has less alternatives for implementation. This supremacy is perceived to a much bigger extent by sellers than buyers (Simmel, 1989).

The market actor-seller who chooses to exchange his ability to work against occupation of a job position, offered by an employer, is competing for this job with other owners of ability to work. Under the concrete situation he might not realize his free choice, which will compel him to make the following free choices. The compulsion to work as a condition for legal access to money could turn for this market actor-seller in a *compulsion for exchange of labor power against exercising any work,* in any organization. This is possible to happen when the market actor-seller meets the risk to remain without any property rights to money due to unrealized access to work and will not be able to compare alternative proposals for work anymore and is compelled to accept what he is offered. For this market actor, the *self-compulsion to work turns into compulsion* to work, which most probably he would not exercise under other circumstances. In this case, he accepts the conditions for exchange of ability to work against remuneration, specified by the employer, even to estimate them as unfair because there is no other alternative for access to money.

The market actor-seller can make his free choice for exchange of their ability to work against occupation of a job position in state and municipal organizations that do not conduct their activity under conditions of competition. In such cases, his free choice is implemented if he is chosen by the employer (the state, the municipality) among the competitors that have made the same free choice. (Political assignments that do not follow the rules of completion for occupation of a job position are an exception.) When the market actor-seller has made his choice to be employed by a state or municipal organization, he has accepted in advance the amount of the remuneration and the work conditions as they are specified in the respective statutory framework. After taking a job, his self-interest is expressed an ambition for career development (occupying a higher position in the organizational hierarchy) or preserving the job. As the goods produced by the state and

municipal organizations are public as a rule, and their realization is not carried out under the conditions of competition, the achievement of the self-interest of the market actor-seller depends on the conditions of career development and the appraisal of his managers. However, the employed in such organizations are subject to political (party) competition. The cases, where the change of one party or coalition in power with another leads to laying-off of state and municipal employees and their replacement with ones who are loyal to the party.

Self-interest of market actor-buyer

The second side of the self-interest of the market actor is related to his role of a buyer. This is one of the main roles through which he acquires property rights to goods to meet his needs. The market actor-buyer is interested to have the freedom to make his choice under the conditions of many alternatives of goods that compete for his money. An integral part of his self-interest is to dispose of reliable information about alternative goods through which to minimize the choices, which might not satisfy him. In this respect, he relies on those market rules that are directed to the protection of users, of information media which he chooses to trust and to non-governmental organizations of users. The goal of the market actor-buyer is to receive the best possible combination of goods (as quantity and quality) in exchange to his money. However, according to the market rules, he can acquire only those goods desired by him, whose price he can pay. His property rights to money outline the field of freedom within the frames of which he rationalizes his actions (choices) over the complicated system of comparisons and evaluation of familiar alternatives. Choosing goods, the market actor-buyer actually accepts the equivalent of the exchange, which the market actor-seller has offered through the price. In this way, *each realized free choice of the market actor-buyer realizes also the principle of the balancing justice in the concrete exchange relationship between him and the market actor-seller.*

Connection between two sides of the self-interest of market actor

The two sides of the self-interest of the market actor are connected by: *first*, other social roles, which the person performing the role of a market actor has included and/or wants to include in his ensemble of roles, and, *second*, money. In his life, man performs a multitude of roles that are interrelated. They express the need of social connections through which he makes the appraisal that he can solve the problem of his self-insufficiency. The drama of modern times ensues from the very fact that people cannot have connections among them, from which money is missing, nor connections, which have not been embodied by money under one and the same form (Moskovici, 1988). Due to this, the free choices, which one makes as a market actor-seller and a market actor-buyer are affected by his desire to perform other social roles of his (for example, the role of a spouse, parent, etc.)

Money connects both parts of the self-interest of the market actor, as they are his *quasi purpose in his position of a seller and means in his position of a buyer*. When in his position of a seller the market actor makes his free choice for organization of production of goods or for exchange of ability to work against remuneration, for him money is *an*

expectation for realization of his self-interest as buyer. This is quite natural, as money has sense only because it can turn into different goods. Neither the choice of organization of production of goods, nor the choice of exercising a specific type of work are end in itself for the market actor. They are the required means for legal access to property right of money and prerequisite (condition) for realization of his self-interest as buyer. Striving realization of his self- interest for access to money, the market actor-seller thinks about his interest as a market actor-buyer. He thinks about money as a scarce resource and as such, it is his basic motive (Luhmann, 1988). Money is necessary for the market actor- buyer not only for acquiring property rights to goods through free choice. He makes also a number of exchanges for money, where he does not have the freedom either to make them or not as far as they are compulsory for him (for example, payment of goods, which are produced by monopolists, administrative charges, taxes, etc.). Due to the exclusive variety of goods, which might be acquired against money, their utility grows, and so much at that, that it turns into absolute utility (Simmel, 1989). Because of that, non-achievement of money as quasi purpose is experienced dramatically by the market actors, particularly by the ones for whom the only or the basic access to money passes through their position of a market actor seller. The ambiguous being of money, both as quasi purpose and means in the self-interest of the market actor could cause ambivalent attitudes to the completion rules, which could transform his self- interest in acquiring property rights to money into selfish ones.

Selfish interest of market actor

However, regarding the discourse of everyday life, the selfish concept has rather negative connotation and is interpreted as the ambition of man to receive, without giving anything, what is specified under the rules of a given type of exchange. Self-love (Smith) and selfish are completely opposed rather than one and the same thing, as far as the self-seeker knows one pleasure only – to take without giving anything instead (Fromm, 1947). Cases where market actors often transform their self-interests in selfish ones could often be identified in the practical realization of the idea of a market. One of the possible reasons for that is that the market actor realizes the both sides of his self-interest in two completely different environments. When he is seeking realization of his self-interest in the role of a buyer, he is not competing with anybody for access to goods. Other market actors-sellers compete for his free choice (with some exceptions as tenders and auctions for pieces of arts). The market actor buyer is interested in having many producers of goods competing for his money, as this provides him more freedom to make choices. *He is the subject that compares, appraises and chooses.* The situation where the market actor is seller is radically different. He pursuits his self-interest in acquiring property rights to money, competing together with many other market actors like him, which turns him into *object of comparison, appraisal and choice.*

The competition is part of the value-conditioned architecture of market. It is not choice of the market actors. It is *compulsion* imposed by the market rules that does not guarantee to the market actor-seller that he would succeed to realize his self-interest. In this case it concerns not just acquisition of property rights to money, but the acquisition of the *desired amount of such rights,* through which the market actor expects to continue being both a

seller and a buyer. Each market actor-seller meets to a great or small extent the risk that within the frames of his free space outlined by the rules, he will be able to conduct those actions, which will provide him the required competitive advantages before other sellers, because of whom he would be elected for the market exchanges he needs. Due to this, some market actors-sellers seek possibilities for provision of better market opportunities for access to money. Most frequently such possibilities are different lobbyist activities through which some market actors attempt to create niches of at least temporary monopoly in which they are shielded from competition (Porter 1985; Knight 1985). Other market actors find such possibilities in their choice to produce goods in the grey economy. Third are oriented to participation in different corruption practices related mainly to the winning of public orders and tenders organized by the state. In all such cases, it concerns conscious actions through which the market actor tries to realize his selfish interest rather than his self-interest as a way to the money specified by the rules. Changing the market rules that restrict the access of the other market actors to the execution of activity, or violating the market rules he compromises the value-conditioned sense of the market that everybody has the right to pursue his self-interest rather than decrease the competition chances of the other market actors.

The transformation of the self-interest of the market actor in selfish *changes the value-conditioned sense* of the market competition. When it is conducted according to rules, it is a peaceful form of competition between the market actors-sellers for the Third party (Simmel 1989). However, when some of the market actors-sellers transform their self-interests in selfish ones, this competition becomes one for elimination of the competitors and restricts their freedom to realize their self-interests rather than winning the free choices of buyers. Market freedom suggests that all market actors-buyers to be able to participate in the competition for acquisition of property rights to money. Those, whose participation in the competition is hindered, or who, because of some reasons, are excluded from it, in practice cannot realize their self-interest as sellers. The equality before the competition rules has a significant importance, as it is the competition itself that makes possible free choices through which the market actors build connectivity between themselves. It is also a tool for bringing about solidarity between people (Homman, K., Blome-Dress, 1992). At first glance, such a thesis could be accepted as provocation. However, the constituting idea of the market competition is that through it the market actors try to realize their self-interest, understood as the chosen by them, but structured by the market rules way for reaching money by taking into consideration the interests of others. The dramatic connection between the freedom and money is expressed in this. The market actor-seller is free to seek realization of his self-interest in acquiring property rights to money, however this realization passes through the free choices of others. The assumption that the competition as a fair competition according to the rules ruins the solidarity is rather jobbery. The violation of the rules of the competition, the perception of absence of equality before the rules, the possibility of some market actors-sellers to realize their selfish interests rather than competition itself cause negative evaluations of the market functioning in the society. These appraisals could very easily be transferred on the very value-conditioned idea about market and, most of all, on the possibility the chances of the market actors for realization of their self-interests in acquiring property rights to money to be distributed fairly according to their achievements through it.

The equality before the market rules is one of the conditions for the clear distinguishing of freedom as a means of market actors for realization of their self-interests. The content of the market rules that should provide one and the same free field for action of the market actors is also important. The possibility of market actors to seek within the competition rules realization of their self-interests is both economic and social contribution to achievement of the public goals through the market. It finds expression in the fact that the people, by getting connected among themselves try to establish goods of better quality, to develop technology and to find new technical solutions of production issues, to become aware of themselves as significant for each other through what they could give to themselves. This contribution is not studied to a significant extent and is even underestimated in regards to the contribution of competition for allocation of production factors.

Conclusion

What the market actor tries to achieve is property rights to money and goods. He himself chooses the road along which to reach to this rights among the roads offered to him by the market rules existing in society. In this way he identifies his self-interest. Through it, similarly to a small window, he sees and appraises only this part of the market that has any relation to his own market choices, his self-interest and the possibility for its realization. He might not be interested by the macroeconomic indicators obtained through the functioning of the market. And he might not know what they reflect. His view reaches to what builds 'his market'. His wages or profit is there as well as his competitors, counterparts and partners, his credit obligations, his property rights to money, against which he can (or cannot) choose freely the goods necessary to satisfy his different needs are there. His everyday efforts to preserve his job, to make a career or to preserve his company are there. The sequence of the free choices he makes every time when he could not realize the previous ones, e.g. to seek job again, to start new production again, to improve his qualifications, etc. are there. Sometimes they are compulsion rather than his free choice as a result of the freedom of other market actors who have not chosen to perform market exchanges with him. In the long run, the market actor assesses the freedom through the prism of the possibility to solve through it a part of the problem of his self-insufficiency, for which he has estimated that he needs property rights to money and goods.

The pursuit of their self-interest though the occurrence of free, voluntary and mutually beneficial relationships among the market actors let them free of any excessive emotionality, empathy, compassion. The rationality, in the sense of sober calculation of benefits and costs, turns into morally irreproachable pragmatic discourse of the market. However, this is valid only and solely in the cases where the self-interest of the market actor has been taken out from the market rules and its realization is carried out only within the frames of the rules. When market actors manage to realize selfish interests, they make it on behalf of other market actors, whose freedom they violate.

The social picture of the market is born from the million actions, which the market actors perform in order to realize their self-interests. The market in a society is not some mystic

subject. It is what the market actors do every day in their pursuit to money and goods. They establish the stability of the market, when they have agreed to realize their interests according to the rules and have turned the prohibitions, compulsions and freedom ensuing from them in their culture identity. People are only bearers of the ensuing under objective norms levelling of the "you give – you receive" ratio (Simmel, 1992). Whether market actors will give what is required by them, namely – subjection to the rules in order to achieve their freedom to realize their self-interests depends on their perception for the equality of everybody before the rules and their subjective judgement about these rules as fair ones.

Under the conditions of globalization and free movement of goods, capitals and people, the countries are competing regarding the attraction of investments and ability to work through market rules (regulating regimes for access to production of certain goods; employment and tax legislation; regulation of financial institutions, etc.) This competition is taking place in a world full of risks, which seems to have only one hope remained – the peace of the market (Bolz, 2002). The realization of this hope requires efforts and political will for establishment of a market where the market actors have to achieve their self-interests rather than their selfish interests. Lack of such political will results in the replacement of society by 'Ersatz society of users rather than members, constructed from below, that appears to have grown out of a libertarian wealth of alternatives and is sold ideologically as a large adventure playground while in fact reflecting a destructive absence of social order.'(Streeck et al., 2016:.169)

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COMPETITIVENESS AND RELATED CONCEPTS: A LOGICAL APPROACH TO DEFINITION

The purpose of the paper is justification of the competitiveness concept definition as an object of quantitative measurements and related basic concepts of the theory of competitiveness based on their logical deduction from the minimum number of basic concepts and fundamentals of economic theory to ensure the internal consistency of the theory's system of key concepts.

In spite of a large number of studies devoted to the theory of competitiveness and the problem of its measurement in recent decades, the state of the conceptual and categorical apparatus of the theory and, first and foremost, the definition of the very concept of competitiveness, cannot be considered satisfactory. Based on the requirements of logic imposed on scientific concepts and systems of concepts in arbitrary scientific field, as well as on basic concepts of economic theory, the paper attempts to clarify the content and formulation of the competitiveness concept and to construct a system of key concepts of the theory through logical deduction. This has required clarification (revision) of a number of the theory's concepts formulations and, first of all, the concept of economic agent; allowed to identify and/or establish logical connections between them; determine the place of each of them in the concepts' system; to discover concepts, which scientific consistency as well as expediency of inclusion into conceptual system of the theory of competitiveness are debatable; achieve rigorous definitions of these concepts and internal consistency of the concept system as a whole; identify the range of theoretical issues to be solved and/or more in-depth study, which logically follow from the proposed wording of key concepts' definitions of the theory of competitiveness.

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Introduction

In a globalized economy and strong competition at all levels of the economy, the problem of increasing the competitiveness of economic agents occupies a central place in the management system and management theory. The solution to this problem involves the implementation of strictly defined, generally accepted in management theory steps, the initial and key among which is to measure the level of competitiveness of an economic agent – an object of management.

The theory of competitiveness is one of sections of the theory of management, in which the object of management is competitiveness of economic agents. In this regard, Typical tasks of the management theory must be considered in the theory, among which the main ones are to find out the nature of the subject management, develop methodology and methods for assessing its condition, reveal the whole set of influencing factors and study the patterns of influence of these factors on the state of the subject management, set goals and develop methods of influence on the subject management to achieve the objectives. The theoretical basis for solving these problems must be well-developed conceptual, categorical and terminological apparatus.

Despite the fact that problems of competition and competitiveness have been actively studied by scientists all over the world for more than four decades, the bottleneck is the theory concepts system, imperfection of which is one of the important sources feeding the difference of views and approaches in dealing with basic tasks of managing and often insufficient level of scientific validity of the proposed solutions. This is evidenced, first of all, by the variety of the theory's basic concepts interpretations and, first and foremost, the theory's key concept – the concept of competitiveness, a significant number of methodologically incorrect definitions of the theory's key concepts, the emergence and wide dissemination of scientifically insolvent concepts.

The lack of rigorous definitions of scientific concepts is a characteristic feature of many, even fundamental, monographic publications. The meaning the author puts into one or another concept often becomes clear only from the context of the publication. This, without generally accepted ideas and unity of views among scientists, is an obstacle to correct understanding of the authors' ideas and gives rise to non-constructive discussions from the point of view of deepening and developing the theory. Insufficient rigidity of the key concepts' definitions and some negligence in the use of appropriate terminology leads to unclear distinction between related concepts. A vivid example of this is the confusion of such concepts as competitiveness and the competitiveness factor, which was clearly demonstrated in the discussion raised by Krugman (1994 a, b, c, 1996).

It should also be considered paradoxical that the central concept of the theory – the competitiveness of an economic agent, according to the opinion of the world's leading scientists, is unsatisfactorily defined, however, nevertheless, frameworks for measuring competitiveness are developed and used for decades in practice as well as obtained with their help results of competitive comparisons (see, in particular, WEF (The Global Competitiveness Report) and IMD (World Competitiveness Yearbook) frameworks).

Generally, in the scientific publications, insufficient attention is paid to the problem of forming a coherent, internally consistent system of basic concepts of the theory of competitiveness, which leads to the emergence of debatable or even untenable concepts, the use of different terms to designate the same concept, or the same term to designate different concepts, which is due, above all, to the traditionally low level of formalization of the theory of competitiveness and insufficient rigor of reasoning.

Considering the above stated, the main goal of the paper is to substantiate a methodologically rigorous definition of the concept of economic agents' competitiveness as an object of quantitative measurements through logical deduction from the basic concepts and fundamentals of economic theory and competition theory. To achieve this goal, it is envisaged to solve such problems as determining a list of concepts and theoretical provisions that can serve as such a basis; clarification of the content and formulations of the competitiveness concept and related concepts of the theory, allowing to reflect the most important properties of the concepts being defined and to ensure their full consistency as elements of a holistic conceptual and categorical system of theory.

1. Literature Review

The most figurative assessment of situation regarding the conceptual apparatus of the theory of competitiveness is given by Reinert (1994, p. 1), who identifies the problem as follows: "Competitiveness – 'corporate graffiti' invades economic theory" and explains its essence in such a way: "Even a casual observer of the practice and science of management will not fail to notice how a continuous flow of new concepts are born, become fashionable, and then disappear from management jargon. A recent article in Financial Times (1, p.10) suggests the term 'corporate graffiti' – or 'management graffiti' – to describe the unthinking use of buzz-words. Management language is "opaque, ugly, and cliché-ridden', FT claims. The author further states (1994, p. 1; 1995, p. 24), "that, although often misused and mostly ill-defined, the term *competitiveness* properly used does describe an important feature in the world economy". A similar point of view can be found in almost every serious study on competitiveness issues.

Hatzichronoglou (1996, p. 17) considers that "One of the difficulties with which those seeking to analyse international competitiveness are confronted right from the start is that there is no agreement on how to define it. The term competitiveness may be used with contradictory meanings in various passages of the same article or report". Ketels (2016, p. 7) emphasizes: "The different views on what competitiveness is and what value it has for policy that emerged at the time were never really reconciled. … Definitions of abstract concepts like competitiveness are never true or false. They can as conceptual tools only be evaluated with regards to their ability to shed light on the particular issues that they are being proposed to address".

Alexandros and Metaxas (2016, p. 76) also talk about the complexity and inconsistency of points of view on competitiveness: "Unlike the definition of macroeconomic competitiveness… the concept itself of national or macroeconomic competitiveness raises many concerns. It seems to be a vague concept with greatly disputed importance.

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Competitiveness at the national level has not key features but there is also no consensus on whether ultimately this concept has meaning or not, namely if nations actually compete with each other or not". "America cannot address its economic prospects without a clear understanding of what we mean by competitiveness and how it shapes U.S. prosperity. The concept is widely misunderstood, with dangerous consequences for political discourse, policy, and corporate choices that are all too evident today" – Porter and Rivkin declare (2012, p. 55).

As can be seen, the opinion that concept of competitiveness, as well as other key concepts of the theory are poorly defined is widespread among scientists. Let's find out, mainly on the example of the competitiveness of nations, how this or that position is substantiated, and whether this ensures definitions' scientific credibility, as well as other concepts of the theory of competitiveness. First of all, let's consider the scientists' position, who believe that concept of the countries' competitiveness as meaningless and even dangerous.

Krugman (1994a, p. 30) makes serious arguments for the fact, "that concerns about competitiveness are, as an empirical matter, almost completely unfounded" and "that the obsession with competitiveness is not only wrong but dangerous, skewing domestic policies and threatening the international economic system". In particular, Krugman (1994b) justifies the illegitimacy of considering the competition of countries in the image and likeness of firms' competition, proves that dependence of the citizens standard of living on the international competitiveness of firms is not as obvious as the supporters of international competitiveness of countries concept imagine, and that many problems of countries caused by internal, but not external factors. Another example of such views is contained in Raik's review 1990, p. 925) on Porter's book (1990a), who wrote: "National competitiveness is one of those rare terms of public discourse to have gone directly from obscurity to meaninglessness without any intervening period of coherence".

However, analysis of the arguments of the countries' competitiveness concept opponents shows the following. As a matter of fact, not the concept of countries 'competitiveness itself is wrong and even dangerous, but (i) the interpretation of this concept by proponents of the concept and governments, and their choice of direct management objectives based on this interpretation; (ii) selection of countries' competitiveness factors, influencing which governments do not achieve the expected results. Thus, there is an ascription of definitions disadvantages (definition wordings) of the competitiveness concept to the concept itself in the arguments of the countries competitiveness concept opponents, which is methodologically incorrect and replaces the discussion about the scientific consistency of the competitiveness definitions with a discussion about the most important factors of competitiveness, leaving the question of the competitiveness concept correct definition opened.

Direct response to P. Krugman's publications was an article by Dunning (1995), whose author argues in favor of the feasibility of making comparisons of countries' competitiveness and discusses various indicators used in such comparisons. However, this study does not raise questions about the correctness of the competitiveness definition as a scientific category, scientifically based choice of indicators for competitive comparisons, as well as the impact of these definitions and indicators on the choice of management objectives and the consequences (results) of such management. At the same time, the study

contains clear signs of insufficiently careful use of basic concepts and their differentiation, as evidenced, for example, by such statements as "Competitiveness is about **benchmarking** economic performance" or "Competitiveness should not be regarded as an end in itself. It is quite possible for a country's citizens to be relatively better off than those of another country, yet, in terms of GNP per head, to be worse off" (Dunning, 1995, p. 315, 316). In the first statement, competitiveness is essentially identified with a comparative assessment, which is wrong, and moreover, with an assessment of productivity, which is also debatable. As regards the second statement, the following should be noted. Firstly, if by a country's competitiveness we mean the ability to ensure a high standard of living for its citizens, the competitiveness should be the main objective of government activity. Secondly, the example of different countries citizens' standard of living and the level of GNP per head indicates only that this indicator is an unsatisfactory indicator of competitiveness. Thus, in this case, there is a vague distinction between the competitiveness concepts and the competitiveness indicator.

Another example of strong objection to P. Krugman's views is the paper by Malcolm (1994), who claims that countries compete economically, although not in the same way as corporations; explains why it is difficult to define the competitiveness of nations; indicates that thinking in terms of competitiveness is far from being a threat to international economic system, but important for good economic policy; that clarification of ideas about competitiveness, improvement of methods for its measurement, progress in identifying the factors of countries' competitiveness and considering them in economic policy would eliminate P. Krugman's concerns.

In general, the arguments of both parties' representatives indicate that many of them do not clearly identify the basic concepts of the theory, such as the competitiveness concept, its content and definition, the competitiveness factor, the level of competitiveness, the measurement of competitiveness, etc. The problem of insufficient respect to basic scientific concepts' wording is clearly manifested in the question of defining the competitiveness concept and, in particular, the competitiveness of nations.

Porter's study (1990b, p. 76) contains the following statement: "The only meaningful concept of competitiveness at the national level is national productivity". Basically, this statement puts an equal sign between two qualitatively different attributes of the national economy, which is unacceptable in methodological terms. A clear understanding of the fact that productivity is just one of the factors of competitiveness, as well as a clear differentiation of such common concepts as an attribute and a factor, affecting the level of an attribute's manifestation, allows to avoid such inaccuracies. This disadvantage also affects such ideas about competitiveness as expressed in (Porter, 2004, p. 30): "The most intuitive definition of competitiveness is a country's share of world markets for its products". Unfortunately, despite the criticism of such views, the author of this publication does not indicate inadmissibility of identifying a characteristic inherent in the national economy as an economic agent with a market's attribute, where the agent is an operator.

It is remarkable, from the viewpoint of assessing the state and progress (to be precise, the lack of progress) in development of the conceptual apparatus of the theory of competitiveness, that two identical statements by one of the founders of this theory, M. Porter, have been expressed within years: "Competitiveness remains a concept that is not

well understood, despite the widespread acceptance of its importance" (2004, p. 30) and "there is not even an accepted definition of the term "competitiveness" as applied to a nation" (1990b, p. 76). This situation practically remains unchanged ever since. In this vein, the following very accurate remark of the study's author is important: "often the disagreement is not about the definition used itself, but about the issue to be studied and the policy implications to be drawn" (Ketels, 2016, p. 7).

An example of how an agent's attribute (a competitiveness) is determined through the level of subordinate attributes' manifestation can be the competitiveness definition as formulated in OECD (1992): "competitiveness is *the degree* to which, under free and fair market conditions, a country can produce goods and services which meet the test of foreign competition while simultaneously maintaining and expanding the real income of its people". The World Economic Forum (Cann, 2017**)** defines economic competitiveness as "***the set*** of institutions, policies and factors that determine the level of productivity of a country", i.e. as a set of qualitatively different things (institutions, policies, factors), which have just one trait in common – all these things have an impact on the country performance. Thus, in such a definition, a country's economic competitiveness is identified with a specific set of productivity factors, and the "economic competitiveness" term is introduced only for such a set of factors designation. In other words, using such a definition, the "economic competitiveness" term is defined rather than the economic competitiveness concept. The definition given in **(**IMD, n.d.), should be considered alogical in such a formulation "International competitiveness can be defined as *a process* in which higher levels of competitiveness are achieved at different levels, that is, at firm, regional and national levels". In this definition, international competitiveness is interpreted as forming the competitiveness of high hierarchical levels systems, while the very concept of competitiveness, in particular, of lower levels systems, is not defined.

It is no surprise that such an environment contributes to inconsistency in views on competitiveness and the construction of eclectic constrictions. In particular, examples of such inconsistency and the terms' eclectic application are contained in article (Bierut and Kuziemska-Pawlak, 2017). Thus, based on above definition of competitiveness as a ***degree***, the authors of the article use particular concept of technological competitiveness in relation to the competitiveness concept, which is defined as a certain ***ability* (**Bierut and Kuziemska-Pawlak, 2017, p. 1): "Technological competitiveness can be defined as **the** *capacity* to innovate, as well as to increase efficiency and reduce costs", and the term of structural competitiveness which is defined as ***a set of characteristics*** (Bierut and Kuziemska-Pawlak, 2017, p. 2): "Structural competitiveness can be defined as ***a set of characteristics*** of an economy, including human capital, infrastructure, labour and product market regulations, and the legal and institutional framework".

Currently, the most common is the competitiveness concept as a certain ability of the economic system. The differences within this concept mainly concern the characteristics of economic system ability. For example, Fagerberg (1988, p. 355) notes: "… it is rather rare to see the concept of international competitiveness of a country defined. However, few would probably disagree with the view that it refers to *the ability* of a country to realize central economic policy goals, especially growth in income and employment, without running into balance-of-payments difficulties". Unlike J. Fagerberg, Scott (1985, p. 14-15)

mainly focuses on standard of living and ways to increase it: "National competitiveness refers to a nation's ability to produce, distribute and service goods in the international economy in competition with goods and services in other countries, and to do so is a way that earns a rising standard of living".

Hatsopolous et al., (1988, p. 299) also introduce the concept of standard of living in the definition of the country competitiveness and emphasize that national economy must possess this ability on a long-term basis: "The proper test of competitiveness, then, is not simply *the ability* of a country to balance its trade, but its *ability* to do so while achieving an acceptable improvement in its standard of living".

The US Competitiveness Policy Council (1992, p. 1) adheres to the same position, which defines the country's competitiveness as: "*the ability* to produce goods and services that meet the test of international markets while our citizens earn a standard of living that is both rising and sustainable over the long run". The OECD (Hatzichronoglou, 1996, p. 20), that has defined competitiveness as "the ability of companies, industries, regions and nations or supra-national regions to generate, while being and remaining exposed to international competition, relatively high factor income and factor employment levels on a sustainable basis".

The most common and similar views of this publication's authors are definitions of the nation's competitiveness, proposed by Fagerberg in one of his later studies (1996, p. 48): "A consensus definition of international competitiveness might perhaps be that it reflects the ability of a country to secure a high standard of living for its citizens, relative to the citizens of other countries, now and in the future" and Aiginger (2006, p. 162): "competitiveness should be defined as the ability to create welfare".

Therefore, the lack of sufficient justification of the definition structure, as well as strong arguments for including certain characteristics of such an ability in the definition of competitiveness (which necessity of reflecting in the definition would follow from the very nature of the economic agent), is common to authors who pursue the competitiveness concept as a certain ability of an economic agent.

The accuracy, rigor and unambiguity requirements in the competitiveness concept definition and a number of other related concepts of the theory especially increase in the framework of the problem of quantitative measurements and competitive comparisons, a scientifically grounded solution of which involves the determination of informative indicators of the competitiveness level; factors affecting this level; developing methods for quantitative measurement of these factors' state and their compilation into integrated indicators of competitiveness.

2. Methodological Provisions Used in the Study

Theoretical foundation to clarify the content and formulations of the basic concepts of the theory of competitiveness and the formation of an integrated system of such concepts is the well-known principals of logic and economic theory.

Logical basis

The need for detailed presentation in the paper and strict adherence to the logical foundations of a theory's system of concepts formation is due to the following reasons. Firstly, in insufficiently formalized sections of economic theory and the theory of competitiveness, including non-compliance with the requirements of logic for definitions of scientific concepts is the rule rather than the exception. Secondly, the proposals of the authors of this study as to the structure of the conceptual apparatus of the theory of competitiveness and the formulation of its basic concepts strictly follow the provisions of logic as stated, and their presence in the paper's text allows us to verify the strictness of compliance with the relevant requirements.

The following fundamental principles of logic which considered in details Cornel, 1972; Getmanova, 2012; Gorsky, 1974 and shown in Getmanova's revision (2012), were taken as the basis for clarification and systematization of key concepts of the theory of competitiveness.

A concept is a form of thinking that reflects the essential attributes of a single-element class or a class of homogeneous objects.

Attributes are something in what things are similar or differ. Properties and relations are attributes (the terms "attribute", "property" further used as synonyms).

Essential attributes are attributes, each of which is necessary while taken separately, and taken altogether are sufficient so that it is possible to distinguish (allocate) with their help a given things from all the others and generalize homogeneous objects to a class.

A term is a linguistic form of a concept's expression.

Every concept has *scope* and *content*. *The content of a concept* is a set of essential attributes of a single-element class or a class of homogeneous objects, reflected in this concept. *The scope of a concept* is a class of things generalized in it.

A concept is formed on the basis of generalization of essential attributes inherent in a number of homogeneous things.

Concept definition is a logical operation that reveals the content of a concept or establishes the meaning of a term.

The concept definition explicitly indicates the essence of things reflected in the concept, reveals the concept's content of and thereby separates the range of things being defined from other things. In an explicit definition, a concept, the content of which must be disclosed, is called a *definable concept*, and the concept by which it is defined is called a *defining concept*.

Basic requirement to the concepts' explicit definitions

1. A definition must be proportionate, i.e. the scope of defining concept must be equal to the scope of defined concept.

2. A definition must not complete a circle. The circle, in the particular case of tautology, arises when the defined concept is determined through the determining, and the determining concept in its turn is defined through the defined concept.

3. A definition must be clear and precise. This means that the meaning and scope of the defining concepts must be clear and definite. The definition should be unambiguous, free from ambiguity. Its substitution by metaphors, comparisons, etc. is not allowed.

Additional requirements to scientific concepts

4. Scientific concepts must reflect objective and subjective reality under the study.

5. Scientific concepts must occupy a specific place in the system of concepts and categories of relevant science, not contradict and be consistent with other concepts of the conceptual and categorical system of this science.

Thus, the system of scientific concepts is a collection of current knowledge, a way to reflect relevant subject area. Obviously, concepts can predetermine possible areas of research in relevant subject area and be themselves objects of the study.

Economic basis

According to the authors of this study, the concept of an economy agent (regardless of the hierarchical level), as well as the theoretical insights of the nature and role of economic agents in economic systems, should serve as the starting point (theoretical basis, analogue of the minimum necessary set of axioms), on the basis of which it is possible to deduce, based on logical approach, the central concept of the theory of competitiveness – competitiveness and other related concepts. At that, the ideas presented below accumulate only the most important properties of these objects, which are necessary for constructing a system of basic concepts of a formalized theory of competitiveness and are generally accepted in economic theory and, above all, in mathematical economics. The only exceptions are formulations of economic agents' definitions ***themselves***, which are adjusted taking into account the above-mentioned requirements of the logic and goals of this study.

Economic agents

Let's use the following ideas about economic agents as a basis for further consideration, highlighting four main classes from their entirety, leaving out the discussion about the concept of an economic agent, as well as a number of other common concepts used in the study, on which there is a certain consensus in economic theory at the substantive level.

Households are economic agents functioning to meet own (present and future, physical, physiological (mental), and social) needs by final consuming (for own use) goods and services, and to reproduce labor power and supply labor as well as other own resources (to agents of other types).

Firms are economic agents founded and functioning for the purpose of making money (profit) on a sustainable basis (on a long term basis) by transforming consumed productive resources into goods and/or services to sell (to other agents).

Governments (governing bodies) are economic agents founded and functioning for the purpose of providing rules of interaction and governing of economic agents forming the system by transforming consumed goods and services (productive resources) into the relevant rules and control actions.

Non-profit organizations (other agents including non-business entities, non-profit institutions, etc.) are economic agents founded and functioning for non-profit purposes by transforming consumed productive resources into goods and/or services (for own needs or other agents). (Economic agents of this type are not considered further due to their specificity and for simplification of presentation.)

Such ideas of the nature and role of households, firms, and governments are classic in macro and microeconomics (see, for example, Mankiw (2016), Nicholson and Snyder (2008)).

The above definitions reflect the following key properties of economic agents:

- an economic agent is a holistic system;

- integral component of an economic agent is a group of individuals (social entity (SE)) that animate the system;

- target behavior (objectives and the desire to achieve them) is inherent to an economic agent;

- behavior of an economic agent is rational (respect for the principle of optimality);

- observance of *going concern principle* (for enterprises) and its analogues (for economic agents of other types with the exception of management agents and public organizations initially established for a short period to solve specific problems).

It is known that economic agents can be elementary, i.e. the simplest in structure, (for example, a household, or sole proprietorship) and complex, composite (for example, an enterprise that includes other enterprises as subsystems, a territorial association of households, etc.).

This allows to introduce the concept of the national economy in the most general form without involving other economic concepts, only postulating the main goal of its functioning.

The national economy is an aggregate of economic agents of a given country in standing interaction acting as a whole serving a national population (for the public benefit).

In this definition, population is understood as the totality of societies of households, and also emphasizes the original purpose of the economy as a means to satisfy the needs of people.

The national economy is a composite and complex in structure economic agent (economic system of the highest hierarchical level within the country) and inherits all above mentioned the characteristics of the economic agent.

Considering that the issue of the nature of the economic agents' immanent goals is still debatable, the below-stated ideas of this study's authors about goals can be considered as assumptions (hypotheses), the productivity of which, in particular, can be judged by logical consequences arising from them.

Objectives of economic agents

The nature of the objectives of an arbitrary economic agent as a system is determined by the nature of society (SE) as its integral structural component and studied by Alyokhin (1993) and Savchuk (2007).

When describing the objectives of economic agents, let's distinguish between immanent objectives and the ones that set from outside. The latter will be called directive objectives.

Households. Households' objectives coincide with immanent objectives of a group of individuals, i.e. are immanent for the economy agents of this type, and to satisfy present and future, physical, physiological (mental), and social needs of the societies on a long-term basis. In economic theory, as a particular case of the consumer concept and without taking into account the time factor, utility maximization is considered as such an objective.

Firms. When considering the enterprises' objectives, it is necessary to distinguish between two types of enterprises. Let's consider enterprises in which the owner directly performs management functions to the first type. The second type includes enterprises to be managed by employees.

The objectives of enterprises of the first type, for example, a sole proprietorship, as well as the objectives of households, coincide with immanent objectives of SE of a given agent, i.e. the entrepreneur's objectives, the business's owner, and are to ensure (generate) acceptable profit for the owners of the enterprise on a long-term basis. As a special case (without taking into account the time factor), the objective of such an economic agent can be profit maximization**.** This is a classic case considered in the theory of the firm (Jones and Felps (2013, p. 207), Mankiw, (2016, p. 13), Pfarrer (2010, p. 86).

For enterprises (firms) of the second type, where the owner does not participate in management directly, the objectives are more complex.

Let's consider the objectives of the enterprise's employees, who constitute SE of the enterprise. The following reasoning is a logical consequence of the ideas about the nature of household and firms.

The main objective of the employee is to obtain a reasonable wage (wage maximization) on a stable basis. This objective is immanent for him and represents the main motive of human activity as an employee. In fact, the achievement of such an objective is one of the means to achieve the objectives of people who are at the same time elements of the household's SE

(see household objectives), i.e. means of meeting all their needs, including the need for self-realization.

Let's single out top managers among hired employees of enterprises, i.e. decision-makers. These immanent objectives (and the desire to achieve them) of top managers have a decisive influence on the activities of relevant economic agents.

The objectives of enterprises under consideration are set from the outside by the creators (owners) of such agents. For enterprises, such directive objectives are inherent objectives of entrepreneurs, owners (see the objectives of the first type of enterprises above).

In general, directive objectives of such enterprises may conflict with the inherent objectives of employees and, especially, with inherent objectives of top management. In this case, actual objectives of the enterprise (as a system) will be a certain synthesis of directive and immanent objectives, and the level of achievement of directive objectives will depend on the coherence with objectives of top management.

Thus, the objectives of enterprises are the objectives of the owner, if he performs the functions of a top manager. In this case, they are immanent for the enterprise. If an enterprise is managed by employees, objectives of the enterprise are determined by directive objectives set by the owner and immanent objectives for top management, i.e. are the result of these objectives interactions.

Governments (governing bodies). The nature of ***governing bodies'*** objectives practically coincides with the nature of the objectives of enterprises of the second type. The difference is that the directive objectives of ***governing bodies*** are determined by its founders and reflected in assigned/mandated functions.

National economy. The objective of the national economic system is to ensure quality of life acceptable (or, as a special case, the best possible) to the country's citizens on a long-term basis. (As can be seen, as the goals of the country's economy, the goals postulated in the definitions of the competitiveness concept are taken, formulated by Aiginger (2006), Fagerberg (1996), Hatzichronoglou (1996), Hatsopolous et al., (1988), Scott (1985), Competitiveness Policy Council (1992), etc.)

The objectives of the national economy, as well as the objectives of enterprises of the second type and the objectives of the ***governing bodies***, are inherently mixed. Directive objectives are formed by the efforts of SE and ideally should reflect (integrate) the immanent objectives of the country's citizens (population). However, in addition to citizens, any other economic agents can project their objectives on the objectives of the government (for example, by lobbying business interests or local governments their own interests). Therefore, directive objectives of the national economy are a certain combination of the objectives of all economic agents that are part of it. Eventually, actual objectives of the national economy are determined by the objectives inherent to the government as an economic agent and directive objectives, and the objectives of citizens (during the functioning of the national economy) are pursued to the extent that they are consistent with the objectives of the government and directive objectives as prescribed.

The ideas about economic agents as stated in this section, which act as an analogue of axioms, allow to construct by logical deduction an internally consistent system of the theory of competitiveness concepts, which is crowned with the central concept of the theory – the concept of an economic agent's competitiveness. At that, each concept, each term is defined in such a way as to meet all the requirements for scientific concepts. The proposed formulations of these concepts definitions are unambiguous and in a strict logical relationship with each other, so the defined concepts form an integral conceptual and categorical apparatus and theory thesaurus for the purposes of quantitative measurements.

The results of this deduction (conclusion) are presented in sections III-V, each of which, as a rule, contains: (i) list of specified main (viability, viability factor, competitiveness) and auxiliary (internal and external environment of the economic agent, their condition, attribute, attribute level, attribute level assessment, etc.)) concepts and the wording of their definitions; (ii) list of objects properties that are important for solving the measurements problem, which are determined using these concepts, which directly follow from the proposed formulations; (iii) list of research objectives that logically come through accepted assumptions.

The importance of the latter type of consequences is conditioned by, at least, the following reasons: (a) such consequences indicate the consistency of the totality of the initial theoretical assumptions and ideas; (b) they indicate problems whose solution within the framework of the accepted assumptions is mandatory (it does not matter if these issues are solved by modern science, whether they are under development, or were not considered at all).

3. Viability of Economic Agents and Related Concepts

The natural consequence of the ideas about the economic agents as stated above is the concepts of the enterprises' viability and national economies defined as follows. The wording of these concepts was significantly influenced by definitions that were close to the content in content to the concepts of competitiveness of economic agents (see Aiginger (2006), Fagerberg, (1988, 1996), Hatzichronoglou, 1996), which legitimacy of using as analogues is due, as will be shown below, to the close correlation of these concepts.

Enterprise's viability is the ability of an enterprise to generate net profit without outside assistance on a long-term basis. (The issue has been studied by Alyokhin (2012), Lin (2011), Savchuk (2007)).

The concept of a nation (country) viability is introduced by the authors of this study by analogy with the concept of the viability of enterprises and, in general, can be formulated as follows:

Country's viability (viability of the national economy) is the ability of nations to ensure (create) the quality of life of a population without outside assistance on a long-term basis.

In these definitions, the viability of respective economic agents is identified with their ability to perform their inherent economic roles in complete analogy with the viability concept of living organisms and their communities in biology.

The fundamental difference between the above formulations of these concepts' definitions and the well-known ones is refusal to fix level of the objectives achievement by the economic agent.

Thus, for example, according to the definitions of enterprises' viability, proposed by the authors (Alyokhin, 2012, p. 23; Lin, 2011, p. 104; Savchuk, 2007, p. 129), only the ones that are able to provide an ***acceptable*** level of profitability for their owners, enterprises that allow ***normal*** functioning on a long-term basis are considered viable, i.e. enterprises that provide a certain level of achievement of their inherent objectives. In accordance with such definitions, an enterprise can be either viable or non-viable, depending on whether or not it allows its owners to make a profit of a certain (acceptable) level, i.e. the viability of the economic agent is defined as an attribute that has dichotomous nature. However, this inevitably requires the application of a nominal dichotomous scale for measuring level of viability, which contradicts existing conception of viability in economics as an ordinal or interval attribute, does not meet the needs of managing the level of viability and established practice of measuring the viability of enterprises and nations.

In formulations of viability as proposed in this study, this attribute is not linked to the level of objectives achievement inherent to economic agents, which at the definition level does not impose any restrictions on viability indicators and their level.

The consequence of this definition of the viability concept is a number of properties of this attribute as an object of measurement. Taking these features (peculiarities) into account when developing methods for measuring and conducting the measurements themselves is an important prerequisite for obtaining scientific-based estimates of the economic agents' level of viability. In particular, main peculiarities of *viability* as an economic agents' attribute are as follows (Alyokhin, 2011, p. 24; Karapeychik, 2013d, p. 250; Savchuk, 2007, p. 318):

- absolute attribute of an economic agent, the presence of which is determined only by the fact of the economic agent existence (and functioning) itself, it is an inherent property of the economic agent;

- latent attribute, whose observation and direct measurement is impossible;

- interval attribute, i.e. an attribute defined on a certain period of time;

- conditional attribute (the level of viability depends on certain conditions and may vary from one condition to another);

- the most common (within the framework of the theory of competitiveness and, probably, in the theory of management) objective attribute of the economic agent.

A direct consequence of such a feature of the attribute, as an interval character, is the competence to consider the concepts of long-term and short-term or instant viability (as a special case of long-term viability without taking into account the time factor).

Definition of the economic agent's viability as one of its attributes makes meaningful the concept of the viability level, as well as a number of related concepts. The importance of a formally rigorous, unambiguous definition of these auxiliary concepts is due to the frequent cases of mixing these concepts in economic literature, which are unacceptable in formalized theories.

The level of economic agent viability is intensity of this attribute manifestation.

Indicator/indicators of viability (level) is a characteristic of the level of viability that can be assessed by a person.

A characteristic is a description of a feature or quality belonging typically to a person, place, or thing and serving to identify them.

The natural (arising from the needs of management) requirement for indicators of the economic agent viability is the requirement of their measurability using ordinal scales, and preferably with the help of metric scales: interval scales, ratios, and absolute values.

Assessment of viability level is the result of measuring the level of viability (the value of the corresponding indicator), presented in quantitative or qualitative form.

As can be seen, the above formulations are consistent with the wordings of well-known definition dictionaries and have uniquely defined meaning.

From the absolute nature of viability as one of the attributes of an economy agent, the requirements for viability estimates derive. The viability's assessments should ensure the comparability of any economic agents according to the level of this attribute. This means that if the viability level of various economic agents is measured independently of each other, then the corresponding estimates should be comparable, i.e. should ensure the comparability of these agents in terms of viability.

The requirement of comparability of the economic agent in terms of viability results in implying the requirement of viability level measurability in metric scales.

The predictive nature of the attribute assessments follows from interval nature of the competitiveness attribute. Competitiveness assessments should characterize the ability of an economic agent to achieve its inherent objects on a long-term basis in the future, i.e. act as a definite prediction.

The viability criterion is a condition imposed on the level (level assessment) of viability.

Introduction of the viability criterion concept makes obvious the principal difference between the viability definition considered in the framework of this study and the known ones. This distinction consists in the exclusion the viability criterion from the viability concept formulation.

4. Viability Factor's Concept and Related Concepts

To justify the definition of the concept of economic agent competitiveness (its logical deduction) it is necessary to use a number of related concepts.

Internal environment of an economic agent we define as a set of essential attributes of the economic agent (including functioning attributes).

External environment of an economic agent as a system is a set of all *things* of a *supersystem*, which properties' change causes a change in the state of the economic agent, also whose properties are changed in response to change in the state of this economic agent.

State of an economic agent is a set of indicators values (parameters of state) of essential attributes of the economic agent, including parameters of functioning.

State of the economic agent's external environment is a set of indicators values (parameters of state) of external environment essential attributes of the economic agent.

Hereinafter, the concepts of the attribute level, an indicator of the attribute level and an assessment of the attribute level are used in the sense as they defined above in relation to the concept of economic agent's viability.

As is known, the following environmental classes are important in the theory of competitiveness.

An environment is a combination of abiotic and biotic things of the environment.

Social, political, economic environment is a combination of social, political, economic things of the external environment.

In relation to any single economic agent, all other agents are things of an economic, social or political environment.

It is obvious that internal and external environments of different economic agents, even of the same type, can differ significantly. This creates significant objective difficulties in measuring the viability of economic agents and their comparison by the level of viability.

The concepts as introduced are sufficient to define the concept of a viability factor. (As a prototype, the ideas of competitiveness factors as set out in (Savchuk, 2007, p. 187) were used.)

Viability factor is an arbitrary property of an economic agent or its external environment, the change of which has (may have) an impact on the level of viability of this agent.

Due to the hierarchy of the external environment as a supersystem of an arbitrary economic agent, a combination of the agent's viability factors also has a hierarchical structure. This justifies the need to introduce in the conceptual apparatus of the theory of competitiveness the concepts of elementary (primary) and generalized (group, composite) life activity factors.

Also, the following concepts directly related to the viability factor concept are relevant:

- *level of the viability factor* is (by analogy with the viability level definition) the degree of the corresponding property manifestation of the economic agent's internal or external environment;

- *indicator of the viability level factor* (analogous to the concept of the indicator of the viability level);

- ***assessment of (assessment of state) viability level factor*** (analogous to the concept of indicator assessment of viability level).

In this study, the term "state of viability factor", which is understood as indicator's value of this attribute level, is considered synonymous with "assessment of viability factor" term.

Obviously, the combination of the viability factors of a particular economic agent is a subset of the set of all attributes of internal and external environment of the enterprise, and the level of the economic agent's viability is a function of the state of its viability factors.

From the interpretation of the viability factor proposed above, it becomes obvious that the measurement of the economic agents' viability must inevitably be based on the following problems solution, the extent of the solution by modern economic theory can serve as an indicator of its development state:

- identification of the whole combination of the economic agents' viability factors;

- development of methodologies and methods of viability factors' classification for management purposes;

- systematization (development of classifications) of the economic agents viability factors;

- problem of factors state measurement, which includes such issues as choice of indicators for each of these factors, choice of scales and units of measurement, development of methods for measuring relevant indicators.

Obviously, such classes as endogenous and exogenous factors, governable and ungovernable factors, stimuli and counter stimuli factors, etc. should be reflected in the relevant classifications.

5. The Concept of Competitiveness and Related Concepts

The concept of the viability factor opens the way to the definition of concepts that directly characterize the processes of competition. The first of these are the concepts of external environment pressure force and the competitor.

The environment pressure force (or just pressure) on the economic agent is a measure of a negative impact of the environment on the level of viability of the economic agent, i.e. impact, reducing the ability of an economic agent to achieve its inherent objectives. (Unlike Savchuk (2007), who studied the concept of competitive pressure, the authors of this study believe that the concept of pressure is primary to the concept of competitive pressure.)

The introduction of this concept into the conceptual apparatus of the theory of competitiveness immediately puts on the agenda the following issues to be solved in the framework of the problem of measuring the economic agents' competitiveness, such as:

- problem of measurement, including the problem of choosing indicators, scales, units and methods of measurement, i.e. all classical components of the measurement problem (see above);

- problem of choosing the point of reference – the level of viability of an economic agent without external negative impact of the external environment (as one of the sub-problems of the previous problem).

It is the concept of pressure that makes it possible to give a definite and unambiguous meaning to the concept of a competitor.

A competitor (of an economic agent) is an economic agent whose activity (state) directly or indirectly exerts (can exert) pressure on an economic agent, i.e. changes (can change) the state of environmental factors in such a way that leads to decrease in the ability of an economic agent to achieve its inherent objects.

From this definition, it immediately follows that this concept has the following properties.

The concept of a competitor is conditional. Under some conditions, a certain agent may be a competitor in relation to the agent, with others it may not.

A competitor of a certain economic agent is an object of the agent's external environment.

The relation defined by a competitor concept is not symmetrical. This means that due the fact that agent A is a competitor for agent B, it does not follow that agent B is necessarily a competitor for agent A.

Also natural is the set of typical problems connected with classification of any economic objects (see above about the problems of the classification of viability factors), taking into account type of the economic agent, nature and level of pressure and other essential attributes.

Easy to see that the concept of a competitive environment derives from the concepts of external environment, external environment pressure and a competitor.

A competitive environment is an external environment, the pressure of which on the economic agent is directly or indirectly caused by the activity (state) of other economic agents, i.e. competitors.

Bearing this in mind, it is possible to speak of *competitive pressure* (*competitive force pressure*) as a particular case of the external environment's pressure, in which the pressure caused by the action of other factors is eliminated.

The whole range of tasks associated with an external environment pressure concept (see above).

Based on the concepts of the economic agent's viability and the competitive environment, the concept of the economic agent's competitiveness can be defined as follows: *the competitiveness of the economic agent* is the agent's viability in a competitive environment.

As a concept derived from the concept of viability, the competitiveness as an attribute of an economic agent inherits all features of viability as noted above.

With this in mind, the following concepts directly related to the concept of competitiveness acquire a completely definite meaning:

- ***level of competitiveness*** (defined by analogy with the concept of the viability level);

- ***indicator of competitiveness level*** (defined by analogy with the concept of viability level's indicator);

- ***assessment of competitiveness level*** (defined by analogy with the concept of viability level assessment).

In connection with the last paragraph, it should be noted that assessments of competitiveness inherit all attributes of a viability assessment of an economic agent as mentioned above.

It seems quite clear that the following concepts gain obvious meaning:

- **competitiveness factor** (analogue of the viability factor, which inherits all attributes of viability factor's concept);

- ***level (state) of the competitiveness factor*** (analogue of the viability factor state);

- ***indicator of the competitiveness factor's state*** (analogous to the viability factor indicator);

- ***assessment (of level, state) of the competitiveness factor*** (analogue of the assessment of the viability level, which inherits all the properties of the viability factor assessments).

Taking into account the above stated, the introduction into the conceptual apparatus of theory of the concepts of elementary (primary) and generalized (group) competitiveness factors, which are analogous to the concepts of elementary and generalized viability factors, is also quite natural.

Obviously, in the framework of assessing the competitiveness factor, the whole range of tasks associated with assessments of viability factors (see above) is relevant.

By analogy with the attribute of viability, the competitiveness level of an economic agent is a function of the state of whole set of competitiveness factors of an agent.

The concept of the competitiveness factor's state, in turn, makes possible to define unambiguously the concept of the economic agent's competitive advantage. The expediency of introducing this concept into the concept system of the theory of competitiveness, main reasons for its occurrence will be briefly discussed below.

The competitive advantage (disadvantage) of the economic agent can be defined as more (less) preferable (*in terms of achieving the main objective of an economic agent, as regards provided level of competitiveness*) state of the same elementary or generalized competitiveness factor comparing with the competitor's factor state.

Competitive advantage (disadvantage), thus, is a comparative characteristic (assessment) of the same competitiveness factors state of competitors.

Obviously, the concept of competitive advantage inherits the hierarchy property from the concept of competitiveness factor.

In the case of two or more elementary and/or group factors, one could speak of a competitive advantage as on more preferable combination of a certain set of competitiveness factors while comparing one competitor with another.

The difference in external environments of competitors limits possibilities and also increases objective difficulties in comparing factors of competitors' competitiveness with a decrease of factors' hierarchy level. Examples are enterprises producing qualitatively different products, or enterprises using qualitatively different resources for production. In such cases, direct comparison of enterprise's competitiveness elementary factors, as well as factors with low levels of commonness, is impossible. This possibility appears only by comparing factors of higher levels of commonness. In this regard, competitive comparisons of various economic agents may require solving the following problems: (i) problem of choosing hierarchical level of competitiveness' factors that allow their comparison for compared economic agents; (ii) problem of developing methods for identifying competitive advantages (disadvantages), the appearance of which is due to the very nature of the competitiveness factor and competitive advantage, as a concept derived from the concept of competitiveness factor.

The properties of competitiveness as a specific attribute of economic agents, identified through the logical analysis, are subject to quantitative measurement, predetermine theoretically possible ways of measuring, which, therefore, are also a logical consequence of the above theoretical constructions.

The next section of the paper gives a brief description of such opportunities that may be useful for understanding the nature of existing approaches to measuring competitiveness, their capabilities, strengths and weaknesses, possible directions for improving these approaches, as well as for developing new methods of economic agents' competitiveness assessment, which would take into account the internal nature of this attribute to the full extent.

6. Key Methodological Features of the Competitiveness Measurement

Complexity and methodology of the economic agents competitiveness measuring are due to the peculiarities of this attribute as an object of measurement. The most important among them are the latent nature, the complex nature (dependence on a large number of factors of different nature), and the qualitative difference between economic agents (their internal and external environments).

Due to the latent nature of competitiveness, which excludes direct observation and measurement of this attribute, the following approaches are theoretically possible:

- retrospective analysis of actual manifestations of the economic agent competitiveness and assessment of competitiveness on the basis of the analysis results extrapolation;

- analysis of actual state of factors of the economic agent competitiveness and development of the competitiveness assessment as a certain function of these factors' state;

- mixed approach as some combination of elements of the previous two approaches;

- an approach based on quasi-direct measurement methods, which are based on economic and mathematical modeling of the economy agent and its level of competitiveness (Brutman, 2012; Karapeychik, 2013 a, b, c, Savchuk, 2004; Shpak, 2018, p. 13).

In the framework of this approach, competitiveness level assessments are the calculated values of the competitiveness indicators reflected in the models.

Therefore quasi-direct measurement methods are able to provide direct observation of the economic agent's level of competitiveness (mediated only by the model of the agent), assuming that the economic agent's model is simulated.

Let's give a brief description of these approaches, naturally arising from their nature, on the example of enterprises, assuming that the assessment of their competitiveness is based on net profit's indicator for a certain period.

The competitiveness level assessment on actual manifestations

The main assumption

The competitiveness of the economic agent is directly correlated with the average assessment of actual performance during the observation period (for an enterprise, profitability averaged over period).

Advantages

Availability of statistical data. The information base of this approach is the time series of actual values of the net profit indicator's actual values.

Statistical methods application is possible.

Disadvantages

The result of the assessment is a predictive assessment of the actual manifestations of competitiveness, rather than the level of the attribute itself.

The complexity of assessment is due to the need to extrapolate (predict) the properties of things that undergo qualitative changes (in general case) as a result of measures for their competitiveness improvement.

Lack of assessments for solving basic tasks of managing.

Evaluation of the competitiveness level on competitiveness factors

The main assumption

The competitiveness of the economic agent is directly correlated with the average assessment of the competitiveness factors state.

Advantages

Availability of statistical data. The information base of this approach is multidimensional time series of indicators actual values characterizing the state of competitiveness factors.

Disadvantages

The result of the assessment is an assessment of the competitiveness factors' combination, rather than competitiveness.

The need to solve the problem of significant factors' choice.

The need to consider future changes of the specified factor's state during the assessment, i.e. relevant forecasts.

The complexity of constructing a scientifically based integral index of competitiveness in the form of a convolution of the state of factors indicators.

Inability to take into account the interaction of factors, the complex action of factors' combination.

Assessment of the competitiveness level on actual manifestations and competitiveness factors

The main assumption

The competitiveness of the economic agent is directly correlated with the average assessment of its activities' actual results and the state of competitiveness factors.

This approach inherits the advantages and disadvantages of both previous approaches.

Assessment of the competitiveness level based on modeling methods

The main assumption

The model is adequate to the object of assessment, the possibility of transferring the results of model's analysis to a real object.

Advantages

The assessment result describes the level of economic agent competitiveness.

The advantages of this approach are determined by the advantages inherent to modeling as a cognitive method. The main ones are the possibility of taking into account the complex influence of competitiveness factors on the level of the economic agent's competitiveness and the possibility of explaining all the causal links between the model's indicators.

Provides comparability of economic agents of any type (with the right choice of competitiveness indicators), i.e. allows to make full use of competitiveness absolute nature as an attribute of the economic agent when assessing.

Disadvantages

The complexity of adequate models' development and methods of their analysis (for large dimension models, considering dynamic and optimization nature, taking into account the uncertainty factor).

The models information base involves a development of competitiveness external factors changes' forecasts, if the model itself does not include the economic agent's environment model as one of its components.

7. Some Side Consequents

1. The discussion, initiated by P. Krugman, basically has nothing to do with the competitiveness as an attribute of the national economy and availability of such an attribute of the national economy, and testifies that, firstly, competitiveness basic concepts are not clearly defined by the participants of the discussion, in particular, the concept of competitiveness, the definitions (definitions' wordings) of the competitiveness concepts, the competitiveness factor and some others; secondly, the complexity of the national economy competitiveness measuring and its management; thirdly, the presence of a large number of unsolved theoretical and applied issues of managing the countries competitiveness.

2. The concept of products' competitiveness, which is widespread in the theory of competition within the framework of the ideas presented above, is scientifically untenable. According to a competitor (a concept derived from the economic agent's concept) and a competitiveness (as an attribute of the economic agent) concepts, only an economic agent can be the carrier of the "competitiveness" attribute. The supply of a product (service) of a certain quality and at a certain price on a market by a particular economic agent leads to a change in the state of the external environment of other market participants and thus acts as a tool of competitive pressure imposed by one agent upon another economic agents – the market participants. Consumers' preference of a certain product from a certain set of identical purpose goods or substitute goods does not indicate a higher level of this product's competitiveness, but a higher product's quality.

3. Improving the competitiveness of the economic agent is possible due to a change in the set of competitiveness factors and such an impact on competitiveness's governable factors, that in aggregate leads to competitiveness's level improvement. At that, a term "in aggregate" is the key.

4. Within behavioral framework a competition (rivalry) is considered as a characteristic of economic agent's behavior, and in the line with the above mentioned, represents activities of economic agents to improve competitiveness. Therefore, the concept competition, understood as economic agent's behavioral characteristic, does not carry any additional content in comparison with the concept "improvement of competitiveness", "activity on competitiveness improvement".

Within structural framework, thanks to the use of the concepts and terms introduced above, a competition concept is strictly defined as follows: ***competition*** is a state of the economy when economic agents experience competitive pressure.

5. Assuming that the methods for measuring the competitiveness level of a single economic agent that satisfy the above-stated requirements are known, the problem of comparing different economic agents does not arise in terms of competitiveness. To compare such agents, it is sufficient to compare them by the values of the competitiveness level indicator. If measurement of certain properties of economic agents is difficult (for example, measuring the competitiveness level, which is a function of many factors of qualitatively different nature), the methods of comparative analysis based on a pair-wise comparison of factors are frequently used. Within the framework of the above concepts' system of the theory of competitiveness and their interrelations, the emergence and widespread use of the competitive advantage concept can be considered as a response to the difficulties of developing perfect methods for measuring competitiveness, as one of the ways to avoid the fundamental difficulties of measuring this attribute, which inevitably goes along with a decrease of feasibility level and accuracy of competitiveness assessments. As a rule, such methods relate to the second and third approaches of measuring the economic agents' competitiveness with their own strengths and weaknesses.

Conclusion

The logical approach is an effective tool for developing an internally consistent key concepts system of theories that have not yet reached a sufficiently high level of formalization in their development. This approach is based on the requirements of logic to scientific concepts and systems of scientific concepts and assumes, with reference to the theory of competitiveness, the formation of a concepts system by their logical deduction from a set of basic concepts and statements of economic theory.

Such a basis for the theory of competitiveness can be an economic agent's concept and the basic properties of the economic agents, where availability of immanent objectives and target behavior as key features of their vital activity takes central place, as well as the economic agents' typology generally accepted in economics, which supposed all agents to be divided into four classes: households, firms, governors and other.

Consideration of the economic agent as a system, which inherits aspirations for long-term existence makes the ability for a long-term existence as the most important attribute. Thus, the concept of economic agent viability reflects the fundamental property of economic systems and is one of the key concepts of economic management theory.

The definitions formulations of the enterprises and national economies viability proposed in the article are fairly general and unambiguous, based on a minimum number of concepts commonly accepted in economics. These explicitly specify the nature of the corresponding attribute (this is a certain ability of economic agents), its properties as an object of measurement, predetermine the range of tasks traditionally required to solve the problem of

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measuring such attributes and general requirements for the results of its solution, as well as the range of additional concepts to describe the problem and its solutions.

The logical basis for the methodologically correct definition of the economic agent competitiveness's concept can be a clear definition and logical interconnection of such concepts as the viability factor concept, the internal and external environment of the economic agent, including main components of the external environment, environmental pressures and the competitor's concept. At the same time, the concept of the competitor is a key one, allowing to introduce routinely the concepts of competitive environment and define the competitiveness as an economic agent's viability in competitive environment.

Competitiveness as a concept corresponding to an attribute derived from viability, inherits all the properties of viability and generates a range of tasks similar the ones that related to the problem of measuring and managing the economic agent viability. At that, properties of competitiveness as a certain attribute of an economic agent predetermine possible methodological approaches to its measurement, as well as problems (difficulties) related to these approaches.

From the standpoint of the logical approach and the key concepts system of the competitiveness theory proposed as a result of its consistent application, there is an opportunity to take a fresh look at some of the theories' provisions, assessment of its development state and actively discussed topics.

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THE RELATIONSHIP BETWEEN WORKFORCE MIGRATION AND THE BASIC MACROECONOMIC VARIABLES OF THE COUNTRIES FROM CENTRAL EASTERN EUROPE WITH A FOCUS ON BULGARIA

In order to establish a relationship between the labor market and migration, we consider the following 11 countries: Bulgaria, Romania, Estonia, Latvia, Lithuania, Poland, the Czech Republic, Slovakia, Slovenia, Hungary, and Croatia. The explored period is 2000-2017. The following methodology is applied: namely VAR methodology. We prove that in Bulgaria, unlike other post-communist EU Member States, wage is the foremost factor governing the international migration of the labor force. The research reveals that foreign direct investments have a strong impact on labor productivity, wages, respectively on emigration and labor immigration. In our study we advocate a policy of accelerating income growth, combined by the introduction of a tax-deductible minimum.
JEL: G32; H20; H50

1. Introduction

We live in an era of increased globalization and integration where labor migration processes are considered to be natural movements, providing a free choice of residence, professional realization and lifestyle. High unemployment, economic crises, deepening inequality in Eastern European countries, and, on the other hand, the abolition of restrictions on crossing national borders, lead to a significant increase in emigration flows from the countries of Eastern Europe to those of Western Europe. Migration of the workforce, and in particular the emigration of young people, is seen as a serious problem, related to the reduction of employment and working population, deterioration of pension system parameters, shortage of qualified staff, etc.

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One of the paradoxes of Bulgarian labor migration is that regardless of the intensity of incoming and outcoming flows the relative share of refugees is very low. This is explained by both political and economic factors (see for details Cáritas Bulgaria, 2019). The latter problems, however, are outside the scope of the present study. Another particularity of the present paper is that we do not focus our research on the particular social and psychological factors that affect the decision to stay or leave Bulgaria, as in Mintchev and Boshnakov (2018), preferring to rely on macroeconomic interdependencies.

The analysis of the impact of emigration and immigration on the workforce and vice-versa, the relationship between these processes and the dynamics of the main parameters of the Bulgarian economy, is generally one-sided and beyond the context of analogous processes in the EU. Since 2007, Bulgaria has been part of an economic community in which free movement of labor is a fundamental principle. In addition, the European Union is surrounded by countries where salaries and incomes are typically lower than those prevailing inside the community. This creates a potential for emigration of workers to the core of the EU, given the persisting large difference in wages and incomes between Bulgaria and "old" Europe, as well as immigration to Bulgaria as an EU member state.

The aim of this paper is to explore the links between workforce migration and the basic parameters of the economic development of European countries as we emphasize on the migration processes of Bulgaria. Important task of the survey is to attempt to anticipate labor migration from and to Bulgaria and to justify adequate policies in the field of income, taxation, foreign investment, regulation of the labor market, etc. The methodological and theoretical basis of the research can be formulated in the following sequence: Theoretical analysis; Development and implementation of practical econometric models. The analysis which reflects the quantitative results of the application of econometric methodology is based on VAR methodology.

Restrictive conditions of this research are determined as follows:

Time range-this research is restricted in the time interval from 2000 – 2017. The explored period is heterogeneous because it includes pre-crisis, crisis and post-crisis period;

Methodological restrictions – they are set by the statistical properties of the researched data imposing the application of specific econometric tests and models, giving an opportunity for the reflection. The implemented methodology does not claim to be the only possible and applicable when inspecting and proving the research thesis of this study. Another methodological restriction is the implementation of data from different statistical sources (Eurostat and World Bank database). We should notify however that the most part of the data in the aforementioned statistical sources is grounded on the International Monetary Fund (IMF) methodology.

Space restrictions – the analysis and the inspection of the research are concentrated on specific markets from CEE.

Due to the aforementioned facts, conclusions drawn of this research do not engage the processes and circumstances of other markets of the category of European countries.

2. Literature Review

From the point of view of this study, it is particularly important to reveal the dependencies that exist between labor productivity and wages. This is because the comparative level of pay is a key motivating factor in terms of labor migration. On the other hand, in the long run, the comparative wage level depends on the labor productivity ratio between the country concerned and the other countries.

There are two approaches to the relationship between labor productivity and wages. According to neoclassical theory, wages ought to grow in proportion to labor productivity and expected inflation, so as not to increase unit production costs and reduce the competitiveness of the producers (Meager and Speckesser, 2011). The Alternative Keynesian approach, known as efficiency wage, postulates that companies are interested in paying a salary at equilibrium market level to increase productivity and reduce costs, with the best historical example being that of Henry Ford, with his salary of $5 a day (Bradley, 2007). Proceeding from these two concepts, suggesting different strategies at micro and macro levels, the study uses such econometric tools, and in particular vector autoregression, to test the validity of neoclassical and Neo-Keynesian hypotheses in the specific conditions of Bulgaria.

Taylor (1995) investigates the immigration processes in Argentina. He applies OLS regression model in order to reveal the relationship between immigration, workforce and GDP. The main conclusion is that the immigration inflow to Argentina raises the number of workforce during the period of study up to 43% and GDP to 19% respectively. Islam (2003) applies VAR model to expose relations between real wage, immigration and GDP in Canada. He concludes that immigrants in Canada not only satiate labor shortages, but create employment via boosting domestic demand. The research proves also that a 10% increase in immigrants will lead to a 1.6% decrease in local wages.

Feridun (2005) explores the causal relationship between immigration, unemployment and economic development in Norway using Granger causality tests and Johansen cointegration tests. He concludes that when the level of immigration rises, the GDP per inhabitant also increases. In his research, he proves that immigration has no impact on unemployment, and vice versa.

Glitz (2006) applies OLS regression in order to reveal the dependence of immigration on wage dynamics, population and employment of local residents in the host country. It is proved that for each ten immigrant who started working in Germany, four take the positions for local workers and others take up new jobs. In this way, immigrants displace local workers on the labor market and increase the unemployment of local residents. The study also identifies a negative impact of immigration on wages in the host country.

Kasnauskienė, Vėbraitė (2013) apply linear regression and structural VECM to investigate the interrelationship between immigration, wage, GDP and unemployment. Through the structural vector error correction model, they demonstrate that short-term immigration has a negative impact on the UK labor market as it reduces real wages and increases unemployment. Linear regression models prove that immigration has a negative impact on unemployment and real wages in the long run.

Fromentin (2013) examines the relationship between immigration, the labor market and economic development in France. Using a system of equations for unemployment, immigration, wage and gross domestic product, the estimation of a cointegration relationship between these variables shows that there is no observed increase in aggregate unemployment due to immigration in the long run. The vector error correction model indicates that immigration influences negatively unemployment and past immigration has a small impact on increasing wages in the short run. Despite institutional differences, migration flows have weak (positive) effects on employment in the long run in France.

There are many researches for the labor markets in the countries of CEE and their relations with migration flows. Ionescu (2014) explores 6 different Eastern European countries, namely Bulgaria, the Czech Republic, Hungary, Poland, Romania and the Slovak Republic. The explored period is 1980-2010. The results showed that Romania and Poland are the most affected by the emigration of the university-educated individuals, namely "the brain drain". The factors that were significant in determining emigration were the wages (influenced by GDP) in these countries, as well as the education expenditure (influenced by the inflation). It should be emphasized that Romania and Bulgaria experienced the highest total emigration rates in 2010. A positive aspect regarding the brain drain is the amount of remittances sent in the home countries. In the research is revealed that Bulgarian emigrants send the biggest amount of remittances. All of the 6 explored countries are faced with problems in the labor market, because the emigration of their highly skilled population is not compensated by a significant enough immigration of foreign population.

Giesing and Laurentsyeva (2016) implemented a panel research based on the construction of panel regression models by examining migration, investments, GDP and interest rate. They use data constructed as a firm-level panel of ten Eastern European countries, and prove that the "brain drain" of skilled workers reduces the overall performance of firms. They also reveal that most productive companies are more adjustable to emigration flows because they are able to retain and train their workers better.

Nika (2015) examined and evaluated the negative social consequences arising from the mobility of workers, the social and economic drivers of migration, and the effect of immigration on natives' labor market results such as wages and employment. The explored countries are from CEE: Bulgaria, Czech Republic, Hungary, Poland, Romania, and Slovakia. It is proved that cost of living is the most important driver of labor migration in all six CEE countries, followed by income opportunities, and unemployment rate. The freedom of circulation of workers and higher wages are basic pillars of economic incorporation in the EU: free mobility and better payment allow EU inhabitants to look for employment in any of the EU countries. It is proved the positive influence of emigration flows, namely sending nations to undergo short-term periods of high unemployment. In periods of economic crisis, labor circulation is a powerful source of comfort for crisis-stricken economies or areas.

Critescu, Stanila, Popescu and Vasilescu (2015) explore countries from CEE. For the purpose of the data analysis, they form two groups of countries, based on their history, background and recent development. The first group is (CE5): the Czech Republic, Hungary, Poland, Slovakia and Slovenia and the second one contains the Baltic and Balkan EU members (BB5): Bulgaria, Estonia, Latvia, Lithuania and Romania. They apply a panel

data model, in order to illustrate the influence of some essential macroeconomics indicators (unemployment rate, GDP, FDI) on the labor market (real average net earnings, employment rate). The explored period is 2000-2012. They conclude that the Central and Eastern European countries have functional labor markets which are a very important step in the establishment of the single European labor market. They consider that CEE countries need to pursue decisive economic policies. In order to accelerate their growth, the CEE should focus on a prudent macroeconomic policy that would shore up the confidence of financial markets. The key reforms for the CEE countries should, therefore, focus on incentives for labor mobility, more sustainable public finances, better adapted social security systems to demographic developments and harmonized regulations across borders.

Balkanska (2010) explores the relation between FDI and remittance by the Bulgarian labor migration on the economy. The research includes two sections: analysis of the FDI growth and their influence, the second part turns the focus on the Bulgarian emigration and the importance of remittances for overcoming the impoverishment of the Bulgarian population. In the research is proved that after the global financial crisis we observe lower FDI inflows. This leads to negative economic growth. Another important result of this research is the fact that the limited FDI inflows are aggravating the competitive struggle among the CEE countries in attracting FDI.

Baleva (2016) explores the contemporary challenges for the labor market in Bulgaria. According to the analysis of the research, the increasing imbalances between labor demand and supply highlight a number of inconsistencies in educational products and learners' training as well as the need for continuous development of professional skills and knowledge. The main conclusion is that investing in human capital and institutional provision of flexible systems for vocational training and retraining of the workforce is a primary task of the state and the relevant institutions, employers and individuals at the present stage of the development of the economy and society.

Mintchev, Kaltchev, Goev, and Boshnakov, (2004) estimate the emigration potential, as well as the profile of settlers and the temporary long-term and short-term Bulgarian emigrants. They discuss the difference between the actual emigration and the generally declared intention to travel abroad. They apply the questionnaire in 2001 and 2003 and econometric approach. There are used standard cross-tabulations and binary logit-models. It is important that: the immediate emigration potential from Bulgaria does not differ dramatically from that of the countries of Central Europe; age and previous stay abroad are among the most important determinants of emigration attitudes of Bulgarian citizens; employment, education and incomes do not have the expected influence. It is discussed that migratory policies, based on restrictions and bilateral agreements, could hardly be effective under the conditions of the newly created migration networks and the business which has found a niche in the provision of emigration services.

In an interesting study Zareva (2018) scrutinizes the effects of departure and of returning of Bulgarian migrants. The research, however, is based on a sociological representative opinion survey, and not on econometric investigation.

3. Data analysis and model specification

In this research, we explore data from eleven European countries: Bulgaria, Romania, Estonia, Latvia, Lithuania, Poland, the Czech Republic, Slovakia, Slovenia, Hungary and Croatia. The explored period is 2000-2017. It includes a phase of an economic boom, years in a global financial crisis and post-crisis recovery. We observe the dynamic of migration processes during these three phases in order to capture and take into account the impact of negative economic and political events that have an impact on the labor market. As a basis of the econometric analysis, the approach of Kasnauskienė and Vėbraitė (2013) was applied. These authors use a model that includes labor migration, unemployment, wages and GDP, based on a structured vector model with error correction and a linear regression model.

Unlike this research, our study includes additional variables such as labor productivity and foreign direct investment. In addition, our model uses emigration and immigration as separate variables. Another feature of the current study is the use of panel data involving all Eastern European EU member states. The purpose of these modifications is to take into account the impact of factors specific to Eastern European countries and Bulgaria in particular, and also to highlight the differences and similarities between the migration processes in our country and the other post-communist countries.

Among the advantages of panel data analysis is a large number of observations. This contributes to:

1. Provide opportunities for more accurate assessments and results, and minimize the number of standard errors;

2. Ability to solve the problem of omitted variables;

3. Ability to track an effect over time;

4. Ability to overcome the displacement problem caused by unobserved heterogeneity.

Before we proceed to a more systematic study of the processes related to the international labor migration in Bulgaria, we will pay attention to two important trends - the connection between emigration and the relative average wage in Bulgaria (Chart № 1) and the dependence between relative wage and foreign investment (Chart № 2). These links are important because the difference in labor cost is, by definition, the most important factor determining the international migration of workers and low wages have long been considered a major attraction for foreign investment.

Chart 1 shows emigration as a non-linear function of wages. As it can be seen, in the selected mathematical form (fourth-degree polynomial), after a certain level, the rise in wages leads to a reduction in emigration. When selecting another type of mathematical relationship, however, this effect may not occur. This means that more sophisticated econometric techniques are needed to explain the relationship between wages, emigration and other variables that reflect important processes in the economy.

Chart 1

The connection between emigration and the relative average wage in Bulgaria
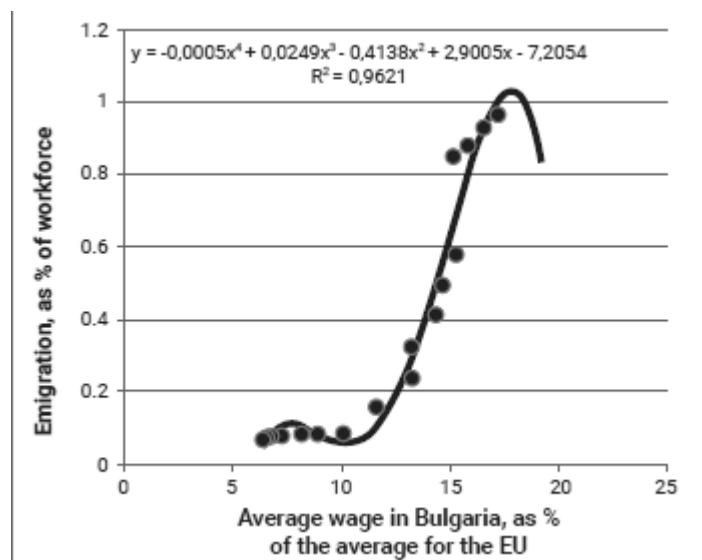
Source: Authors' calculations according to Eurostat data.

Chart 2

Dependence between relative wage and foreign investment
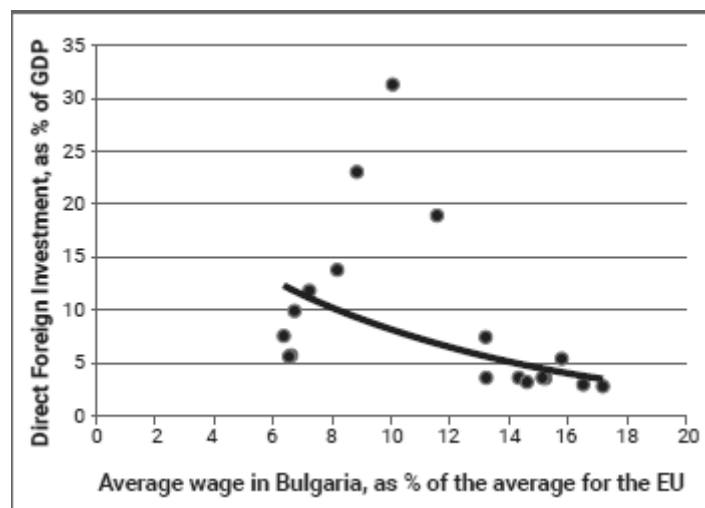
Source: Authors' calculations according to Eurostat data.

Chart 2 illustrates the relationship between direct foreign investment and relative wage. The relationship is negative, i.e. wage growth has a negative impact on investment, but with two peculiarities. First, the impact is relatively weak, and secondly, with an increase in pay, the impact on investment decreases. In other words, not so much the cost of the workforce, but increasingly the overall economic context, affects foreign investment.

The data used are from Eurostat and World Bank Database, with the missing values being generated by cubic spline interpolation (Table 1). The analyzed variables are macroeconomic, unlike the microeconomic approach used in other studies (see, for example, Giesing and Laurentsyeva, 2016). Unlike the present paper, in many cases, migration studies are limited to the impact on the wage and employment in the context of labor market (Gaston and Nelson, 2001). In the framework of the current study, the emphasis is on both the impact of migration on the main macroeconomic variables, including the labor market, and on the influence of macroeconomic processes on labor migration, on the other hand. The aim is to systematize direct and feedback links with a view of formulating recommendations for economic policy.

Table 1

Explored variables

Variable	Data source
GDP per capita	Eurostat
Unemployment rate	Eurostat
Immigration	Eurostat, Cubic spline interpolation
Emigration	Eurostat, cubic spline interpolation
Real Labor Productivity	Eurostat
Foreign Direct Investments	World Bank Database
Wage	World Bank Database, Cubic Spline Interpolation

Source: Authors' systematization.

From the point of view of the current study, it is of particular importance to reveal the dependencies that exist between labor productivity and wages. This is because the comparative level of pay is a fundamental motivating factor in terms of labor migration. For its part, in the long term, the relative wage level depends on the ratio of labor productivity between the respective country and other countries.

Another task of the survey is to attempt to anticipate labor migration from and to Bulgaria and to justify adequate policies in the field of income, taxation, foreign investment, regulation of the labour market, etc.

- **Augmented Dickey-Fuller (ADF) test and Panel Unit Root Test: Summary**

Before proceeding with the selection of the econometric method, it is necessary to apply a stationarity test. First, it is important to estimate the stationarity of the series, because it determines its conduct. Second, non-stationary data are not suitable for econometric modelling, because they give a spurious regression. Third, using non-stationary data in econometric modelling nullifies the standard assumptions of the asymptotic analysis (Kasnauskienė and Vėbraitė, 2013). In the current study we apply Panel Unit Root Test: we

give a summary of the panel for eleven European countries and Augmented Dickey-Fuller (ADF) test for exploring migration processes in Bulgaria.

The null hypothesis of the Augmented Dickey and Fuller (ADF) implies non-stationarity. The Augmented Dickey-Fuller unit root tests are completed for all series. The Augmented Dickey-Fuller (ADF) test constructs a parametric correction for higher-order correlation by assuming that the y series follows an AR (*p*) process and adding *p* lagged difference terms of the dependent variable y to the right-hand side of the test regression:

$$\Delta y_t = \alpha y_{t-1} + x_t' \delta + \beta_1 \Delta y_{t-1} + \beta_2 \Delta y_{t-2} + ... + \beta_p \Delta y_{t-p} + v_t \tag{1}$$

We apply ADF when we explore the migration process in Bulgaria. It is proved that they are integrated in a second order.

Panel unit root test is applied for the panel that includes 11 countries*: Bulgaria, Romania, Estonia, Latvia, Lithuania, Poland, the Czech Republic, Slovakia, Slovenia, Hungary and Croatia.* We establish stationarity at first difference data. We describe the panel unit root test by the following equation:

$$y_t = p_i y_{it-1} + x_{it} \delta_i + \varepsilon_{it} \tag{2}$$

Where i=1, 2...N cross- section units, which are observed over periods t=1.2...T_i; x_{it}- exogenous variables, including fixed effects or individual trends; p_i- autoregressive coefficient; ε_{it}- errors, which are assumed to be mutually independent idiosyncratic disturbance.

We may conclude that:

1. If $|p_i| < 1$, y_t is considered to be trend stationary;

2. If $|p_i| = 1$, then y_t contains a unit root. The null hypothesis assumes a common unit root process.

- **Model Specification**

In order to reveal the interactions between the explored variables, we apply the following models:

$$IM_t = f(U_t, W_t, Y_t) \tag{3}$$
$$U_t = f(IM_t, W_t, Y_t, PR_t) \tag{4}$$
$$W_t = f(IM_t, U_t, Y_t, PR_t) \tag{5}$$
$$Y_t = f(IM_t, W_t, U_t, PR_t) \tag{6}$$
$$PR_t = f(W_t, Y_t, FL_t) \tag{7}$$

$$EM_t = f(U_t, W_t, Y_t) \tag{8}$$
$$U_t = f(EM_t, W_t, Y_t, PR_t) \tag{9}$$
$$W_t = f(EM_t, U_t, Y_t, PR_t) \tag{10}$$
$$Y_t = f(EM_t, W_t, U_t, PR_t) \tag{11}$$

Where

IM_t/EM_t is immigration/emigration at moment t as a share of the working population aged 20-64;

W_t represents wage as a share of the average wage in the EU;

U_t - the level of unemployment; Y_t - GDP per capita;

PR_t- labor productivity, i.e. added value or GDP per employee;

FI_t - are direct foreign investments as a percentage of GDP.

The finalized theoretical model takes the following form:

$$y_t = A_1 y_{t-1} + ... + A_p y_{t-p} + Bx_t + \varepsilon_t \tag{12}$$

where y_t is a k vector of endogenous variables, x_t is a d vector of exogenous variables, $A_1, ..., A_p$ and B are matrices of coefficients to be estimated, and ε_t is a vector of innovations that may be contemporaneously correlated but are uncorrelated with their own lagged values and uncorrelated with all of the right-hand side variables. The vector autoregression (VAR) is commonly used for forecasting systems of interrelated time series and for analyzing the dynamic impact of random disturbances on the system of variables. It estimates the contemporaneous relationship between the variables, but VAR methodology is a procedure that gives useful insights for lagged links. The VAR approach sidesteps the need for structural modeling by treating every endogenous variable in the system as a function of the lagged values of all of the endogenous variables in the system.

4. Results and Discussion

In this section of the research, we expose the results from VAR model. First, we explain the results for the eleven European countries from VAR regression. Second, we describe the significant relations for the labor market in Bulgaria.

- **Panel survey of the migration of the workforce in Eastern Europe**

A detailed panel study of the relationship between the underlying macroeconomic indicators of countries in Eastern Europe and emigration is presented in Table 2. The

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purpose of panel research is to highlight trends and patterns typical of countries as a group. The main target variable is the emigration of the labor force, measured as a proportion of the working population. It turns out that emigration is subject to statistically significant impact of the following variables: unemployment, gross domestic product, wages and labor productivity.

Table 2

Results from VAR model for Panel data. The observed process is emigration

	DUNEMPL	DEMM	DWAGE	DGDP	DRLP
DUNEMPL(-1)	1.83E-15	-7.04E-17	2.11E-16	-9.01E-15	-3.24E-13
	(2.9E-16)	(2.5E-17)	(3.9E-16)	(1.8E-14)	(9.9E-14)
	[6.21234]	[-2.84637]	[0.53742]	[-0.50423]	[-3.27393]
DUNEMPL(-2)	-1.58E-16	-6.93E-17	-6.53E-16	-5.07E-14	-1.62E-13
	(2.4E-16)	(2.0E-17)	(3.2E-16)	(1.5E-14)	(8.2E-14)
	[-0.65202]	[-3.39821]	[-2.01650]	[-3.43991]	[-1.98535]
DEMM(-1)	-3.26E-16	4.08E-17	-1.63E-16	8.35E-14	-8.35E-14
	(7.6E-16)	(6.4E-17)	(1.0E-15)	(4.6E-14)	(2.6E-13)
	[-0.42871]	[0.63838]	[-0.16071]	[1.80941]	[-0.32635]
DEMM(-2)	-4.12E-16	1.03E-16	9.88E-16	-1.69E-13	-8.43E-14
	(7.7E-16)	(6.4E-17)	(1.0E-15)	(4.6E-14)	(2.6E-13)
	[-0.53719]	[1.59984]	[0.96661]	[-3.62763]	[-0.32714]
DWAGE(-1)	-1.75E-16	5.24E-17	1.33E-15	-5.78E-14	2.32E-13
	(2.4E-16)	(2.0E-17)	(3.1E-16)	(1.4E-14)	(7.9E-14)
	[-0.73956]	[2.64303]	[4.21402]	[-4.03828]	[2.92745]
DWAGE(-2)	3.80E-17	9.14E-17	-1.52E-16	9.72E-15	-1.94E-14
	(2.5E-16)	(2.1E-17)	(3.3E-16)	(1.5E-14)	(8.3E-14)
	[0.15421]	[4.42028]	[-0.46246]	[0.65084]	[-0.23477]
DGDP(-1)	-7.65E-19	-2.09E-19	1.15E-17	-2.94E-16	-3.92E-16
	(1.2E-18)	(1.0E-19)	(1.6E-18)	(7.2E-17)	(4.0E-16)
	[-0.64199]	[-2.09120]	[7.21987]	[-4.06437]	[-0.97740]
DGDP(-2)	3.51E-18	-6.79E-19	3.40E-18	1.30E-16	1.91E-15
	(1.2E-18)	(1.0E-19)	(1.6E-18)	(7.2E-17)	(4.0E-16)
	[2.93949]	[-6.77755]	[2.13277]	[1.80094]	[4.76398]
DRLP(-1)	1.61E-18	-3.31E-19	-7.31E-18	3.75E-16	-5.76E-16
	(7.5E-19)	(6.3E-20)	(1.0E-18)	(4.5E-17)	(2.5E-16)
	[2.14430]	[-5.26854]	[-7.31492]	[8.25838]	[-2.28523]
DRLP(-2)	0.000000	5.38E-19	2.39E-18	1.45E-16	1.04E-16
	(7.7E-19)	(6.4E-20)	(1.0E-18)	(4.7E-17)	(2.6E-16)
	[0.00000]	[8.35564]	[2.34162]	[3.12793]	[0.40297]
C	2.21E-16	1.38E-17	1.10E-16	-1.70E-13	8.48E-13
	(5.6E-16)	(4.7E-17)	(7.5E-16)	(3.4E-14)	(1.9E-13)
	[0.39520]	[0.29425]	[0.14815]	[-5.00400]	[4.51260]
DUNEMPL	1.000000	4.61E-17	5.57E-16	-3.14E-14	1.63E-13
	(2.9E-16)	(2.5E-17)	(3.9E-16)	(1.8E-14)	(9.9E-14)
	[3.4e+15]	[1.90451]	[1.42357]	[-1.57936]	[1.65186]
DEMM	9.27E-16	1.000000	-3.50E-16	-5.04E-14	2.47E-13

Ganchev, G., Paskaleva, M. (2019). The Relationship between Workforce Migration and the Basic Macroeconomic Variables of the countries from Central Eastern Europe with a Focus on Bulgaria.

	DUNEMPL	DEMM	DWAGE	DGDP	DRLP
	(7.9E-16)	(6.6E-17)	(1.0E-15)	(1.8E-14)	(2.6E-13)
	[1.17833]	[1.5e+16]	[-0.33355]	[-3.05620]	[0.93131]
DWAGE	1.20E-16	4.47E-17	1.000000	-4.38E-14	7.01E-13
	(2.3E-16)	(1.9E-17)	(3.1E-16)	(1.4E-14)	(7.8E-14)
	[0.51781]	[2.27092]	[3.2e+15]	[-3.11382]	[8.98571]
DGDP	-7.21E-18	-6.37E-19	4.42E-18	1.000000	6.93E-16
	(1.1E-18)	(2.2E-20)	(1.5E-18)	(6.6E-17)	(3.7E-16)
	[-6.59313]	[- 2.48882]	[2.66188]	[1.5e+16]	[2.00495]
DRLP	-8.09E-19	-6.18E-20	7.13E-18	6.25E-13	1.000000
	(2.4E-19)	(3.2E-20)	(9.8E-19)	(1.5E-17)	(2.5E-16)
	[-3.69212]	[-2.51531]	[7.26472]	[2.00352]	[4.0e+15]
R-squared	1.000000	1.000000	1.000000	1.000000	1.000000
Adj. R-squared	1.000000	1.000000	1.000000	1.000000	1.000000
Sum sq. resids	2.31E-27	1.62E-29	4.10E-27	8.48E-24	2.61E-22
S.E. equation	3.93E-15	3.30E-16	5.25E-15	2.39E-13	1.32E-12
F-statistic	2.61E+30	2.95E+31	2.40E+30	4.13E+31	2.96E+30
Log likelihood					4287.254
Akaike AIC					-51.77278
Schwarz SC					-51.47159
Mean dependent	-0.404848	0.061388	0.929127	315.1515	550.3858
S.D. dependent	1.920391	0.441434	1.879051	463.8921	688.1184
Determinant resid covariance (dof adj.)	1.3E-138				
Determinant resid covariance	7.5E-139				
Log likelihood	25067.66				
Akaike information criterion	-302.8807				
Schwarz criterion	-301.3748				

Source: Authors' calculations.

Paradoxically, unemployment does not accelerate the leakage of labor out of studied countries, rather it slows it down. Another paradoxical aspect is that salary is positively correlated with emigration, i.e. wage growth does not decelerate labor emigration from Eastern European countries as a whole. However, this does not apply to Bulgaria, where other interdependencies are valid. The probable cause is the macroeconomic model. Bulgaria is the only country in the EU with a currency board. This macroeconomic mechanism prevents counter-cyclical regulation aimed at maintaining full employment. In other Eastern European countries, fiscal and monetary policies can be used to curb unemployment in times of recession, and therefore emigration is not affected to such an extent by cyclical and price factors, but depends on long-term structural trends, i.e. the division of labor between East and West of Europe.

At the same time, the growth of GDP has a steady negative impact on emigration, i.e. economic growth helps create new jobs that are an alternative to emigration. The labor productivity and technological progress respectively, are also slowing down the drain of the workforce from Eastern Europe. For its part, the labor force emigration impacts negatively the dynamics of GDP. Thus, the main interrelations between emigration and

macroeconomic indicators in Eastern Europe are the economic growth and the technological development. The influence of wages on economic growth is negative, which partly explains why wage growth accelerates the leakage of the workforce.

The macroeconomic interdependencies related to labor immigration to Eastern Europe are no less interesting. The links, however, are significantly different from those, related to emigration (Table 3). Unemployment, economic growth, wages and labor productivity have an impact on the dynamics of immigration. Unemployment constrains the flow of immigrants, which is natural, unlike in the case of emigration. A rise in labor productivity affects workforce inflow negatively, which is also within the ranges of what should be expected. Wages and gross domestic product have a positive influence on the immigration flow, i.e. high pay and economic development are the main factors that attract workforce. For its part, immigration also has its feedback effect. Firstly, it helps to lower wages. Secondly, it has a positive impact on labor productivity. The bottom line is that both influences affect positively the economic growth.

Table 3

Results from VAR model for Panel data. The observed process is immigration

	DUNEMPL	DIMM	DWAGE	DGDP	DRLP
DUNEMPL(-1)	1.76E-15	-5.50E-17	3.52E-16	-1.08E-13	-3.60E-13
	(2.7E-16)	(1.1E-17)	(3.9E-16)	(2.3E-14)	(1.0E-13)
	[6.60734]	[-4.92746]	[0.89509]	[-4.68001]	[-3.47998]
DUNEMPL(-2)	-3.17E-16	-9.90E-18	-3.76E-16	2.53E-14	-2.84E-13
	(2.2E-16)	(9.2E-18)	(3.3E-16)	(1.9E-14)	(8.6E-14)
	[-1.43469]	[-1.06992]	[-1.15398]	[1.32317]	[-3.30587]
DIMM(-1)	-2.78E-16	6.53E-17	-3.66E-15	2.01E-13	2.01E-12
	(1.2E-15)	(5.1E-17)	(1.8E-15)	(1.1E-13)	(4.8E-13)
	[-0.22618]	[1.27004]	[-2.01868]	[1.88478]	[4.20449]
DIMM(-2)	-1.11E-15	-3.31E-18	1.58E-15	6.78E-14	-1.36E-13
	(9.1E-16)	(3.8E-17)	(1.3E-15)	(7.9E-14)	(3.5E-13)
	[-1.22487]	[-0.08700]	[1.17535]	[0.86070]	[-0.38400]
DWAGE(-1)	-3.50E-17	1.31E-17	9.10E-16	-4.48E-15	1.97E-13
	(2.2E-16)	(9.3E-18)	(3.3E-16)	(1.9E-14)	(8.6E-14)
	[-0.15799]	[1.41384]	[2.78230]	[-0.23313]	[2.28826]
DWAGE(-2)	-6.59E-17	3.65E-17	-1.88E-16	4.82E-14	1.35E-13
	(2.3E-16)	(9.5E-18)	(3.3E-16)	(2.0E-14)	(8.8E-14)
	[-0.29062]	[3.83919]	[-0.56242]	[2.45053]	[1.53063]
DGDP(-1)	0.000000	5.34E-19	1.32E-17	-2.98E-16	-9.94E-16
	(1.2E-18)	(4.9E-20)	(1.7E-18)	(1.0E-16)	(4.6E-16)
	[0.00000]	[10.7955]	[7.57672]	[-2.91289]	[-2.16598]
DGDP(-2)	3.54E-18	-3.05E-20	-2.66E-18	-5.47E-17	-2.69E-15
	(1.2E-18)	(4.9E-20)	(1.7E-18)	(1.0E-16)	(4.5E-16)
	[3.04372]	[-0.62617]	[-1.54623]	[-0.54207]	[-5.94244]
DRLP(-1)	8.05E-19	-9.55E-20	6.60E-18	1.21E-16	-6.18E-17
	(6.9E-19)	(2.9E-20)	(1.0E-18)	(6.0E-17)	(2.7E-16)
	[1.16055]	[-3.28884]	[6.44591]	[2.01224]	[-0.22922]
DRLP(-2)	-4.05E-20	-6.08E-20	2.92E-18	-6.35E-17	-2.07E-16

	DUNEMPL	DIMM	DWAGE	DGDP	DRLP
	(7.1E-19)	(3.0E-20)	(1.0E-18)	(6.2E-17)	(2.8E-16)
	[-0.05711]	[-2.04446]	[2.78536]	[-1.03242]	[-0.75202]
	4.37E-16	-7.82E-17	-3.55E-16	-5.60E-14	1.06E-12
C	(5.1E-16)	(2.2E-17)	(7.6E-16)	(4.5E-14)	(2.0E-13)
	[0.85068]	[-3.62797]	[-0.46816]	[-1.25529]	[5.32047]
	1.000000	8.25E-19	6.08E-16	-1.35E-13	5.41E-14
DUNEMPL	(2.7E-16)	(1.1E-17)	(4.0E-16)	(1.4E-14)	(1.1E-13)
	[3.7e+15]	[0.07250]	[1.51457]	[-1.73840]	[0.51204]
	-2.24E-16	1.000000	-4.18E-15	-1.78E-14	2.85E-13
DIMM	(1.2E-15)	(4.9E-17)	(1.7E-15)	(1.0E-13)	(4.6E-13)
	[-0.19021]	[2.0e+16]	[-2.40689]	[-0.17479]	[0.62384]
	4.93E-17	4.61E-17	1.000000	5.70E-15	7.29E-13
DWAGE	(2.2E-16)	(9.3E-18)	(3.3E-16)	(1.9E-14)	(8.6E-14)
	[0.22220]	[4.95132]	[3.1e+15]	[2.29592]	[8.44954]
	-7.55E-18	4.88E-20	3.97E-18	1.000000	-1.16E-15
DGDP	(1.0E-18)	(2.3E-20)	(1.5E-18)	(8.8E-17)	(3.9E-16)
	[-7.44193]	[2.67704]	[2.64953]	[1.1e+16]	[-2.93511]
	0.000000	4.75E-20	8.11E-18	2.59E-16	1.000000
DRLP	(6.8E-19)	(2.8E-20)	(1.0E-18)	(5.9E-17)	(2.6E-16)
	[0.00000]	[2.66832]	[8.08145]	[4.40149]	[3.8e+15]
R-squared	1.000000	1.000000	1.000000	1.000000	1.000000
Adj. R-squared	1.000000	1.000000	1.000000	1.000000	1.000000
Sum sq. resids	1.98E-27	3.47E-30	4.31E-27	1.49E-23	2.99E-22
S.E. equation	3.64E-15	1.53E-16	5.38E-15	3.16E-13	1.42E-12
F-statistic	3.04E+30	3.53E+31	2.34E+30	2.36E+31	2.58E+30
Log likelihood					4276.013
Akaike AIC					-51.63653
Schwarz SC					-51.33534
Mean dependent	-0.404848	0.038109	0.929127	315.1515	550.3858
S.D. dependent	1.920391	0.274115	1.879051	463.8921	688.1184
Determinant resid covariance (dof adj.)	6.6E-139				
Determinant resid covariance	4.0E-139				
Log likelihood	25120.86				
Akaike information criterion	-303.5255				
Schwarz criterion	-302.0196				

Source: Authors' calculations.

- **Econometric study of the macroeconomic dependencies related to the international migration of labor force in Bulgaria**

The econometric study related to the emigration and immigration of the labor force in Bulgaria is set out in details in Graph 1 and Graph 2. The following variables are influenced by emigration from Bulgaria: foreign direct investment, GDP, labor productivity, wages and unemployment. The results from the applied VAR model are presented in Table 4. The strongest negative, i.e. inversely proportionate, effect of

emigration is on wages. Unlike in the panel survey, which reflects the situation in Eastern European countries as a whole, wages, measured as a proportion of the EU average, correlate negatively with emigration, i.e. the increase in relative wages limits the outflow of labor. If in the case of the other East European countries we can talk about serious long-term linking with the productive structures of the developed West European economies and about the existence of interdependence and interchangeability of the labor force, in Bulgaria the main motivation is the compensation, and respectively the effect of the law of the one price – under the conditions of competition and free movement of production factors, there is a trend towards equalization of product and factor prices. In this situation, the emigration-wage relationship is a two-way one, with emigration contributing to wage increase. We observe a pattern that we can call a paradox of wage dependent economy. The paradox is that the feedback effect of emigration on wages is about 4 times stronger than the impact of wages on emigration. In other words, if we slow down the wage growth, we will accelerate emigration, but the shortage of labor supply caused by the additional emigration will accelerate wage growth stronger, then growth, necessary to avoid the additional emigration.

In addition, the study shows that other factors that limit emigration are as follows: GDP, foreign direct investment and labor productivity, with foreign direct investment being the variable with the strongest restrictive effect on emigration. Another emigration limiting correlation that we discover from the regression equation is the impact of GDP dynamics - that is, economic growth slows the leakage of the labor force. The connection between labor productivity and emigration is inversely proportional.

Unlike the other East European countries, we find that high unemployment causes an acceleration of the labor force outflow. Emigration is something like an "option" to deal with high levels of unemployment. Through this mechanism equilibrium on the labor market is achieved as an excessive supply of labor is reduced. This means that the low levels of unemployment that we have observed in Bulgaria in recent years are related not so much to the creation of new jobs in the country, but to the depletion of the labor force. We emphasize that this is not typical for the other East European countries.

Table 4

Results from VAR model for Bulgaria. The observed process is emigration

	D(REMM)	D(RFDI)	D(RGDP)	D(RRLP)	D(RU)	D(RW)
D(REMM(-1))	-0.168882	97.07714	1642.317	-1668.083	-9.180758	3.109383
	(0.18585)	(106.912)	(2362.63)	(1479.59)	(22.0481)	(0.60106)
	[-0.90868]	[0.90801]	[0.69512]	[-1.12740]	[-0.41640]	[5.17317]
D(REMM(-2))	-0.258959	-2.471558	-117.1498	-209.9151	0.357934	0.974717
	(0.07791)	(44.8194)	(990.459)	(620.272)	(9.24298)	(0.25198)
	[-3.32368]	[-0.05514]	[-0.11828]	[-0.33842]	[0.03872]	[3.86830]
D(RFDI(-1))	-0.014073	1.942013	25.84948	-18.94395	-0.435515	-0.099306
	(0.00319)	(1.83277)	(40.5021)	(25.3643)	(0.37797)	(0.01030)
	[-4.41715]	[1.05961]	[0.63823]	[-0.74687]	[-1.15226]	[-9.63775]
D(RFDI(-2))	-0.014405	-4.818623	-33.44744	79.82070	0.500335	0.241025
	(0.00574)	(3.30432)	(73.0218)	(45.7296)	(0.68144)	(0.01858)
	[-2.50773]	[-1.45828]	[-0.45805]	[1.74549]	[0.73423]	[12.9744]

D(RGDP(-1))	-0.000215	0.074449	0.096030	-1.232047	-0.009246	0.000495
	(8.4E-05)	(0.04811)	(1.06314)	(0.66579)	(0.00992)	(0.00027)
	[-2.56847]	[1.54753]	[0.09033]	[-1.85051]	[-0.93194]	[1.83076]
D(RGDP(-2))	0.000566	0.242178	1.318514	-3.483431	-0.034288	0.011692
	(0.00032)	(0.18161)	(4.01346)	(2.51342)	(0.03745)	(0.00102)
	[1.79198]	[1.33348]	[0.32852]	[-1.38593]	[-0.91547]	[11.4515]
D(RRLP(-1))	-0.001457	0.215280	1.181767	-3.989989	-0.037211	0.012241
	(0.00033)	(0.18697)	(4.13184)	(2.58755)	(0.03856)	(0.00105)
	[-4.48410]	[1.15141]	[0.28601]	[-1.54199]	[-0.96504]	[11.6450]
D(RRLP(-2))	-0.000525	0.035361	-0.556305	-0.623609	-0.013406	0.002645
	(8.6E-05)	(0.04954)	(1.09483)	(0.68563)	(0.01022)	(0.00028)
	[-6.09895]	[0.71376]	[-0.50812]	[-0.90954]	[-1.31215]	[9.49486]
D(RU(-1))	0.028972	6.484699	36.59364	-71.09238	-1.204425	0.345768
	(0.00925)	(5.32268)	(117.625)	(73.6624)	(1.09768)	(0.02992)
	[3.13111]	[1.21832]	[0.31110]	[-0.96511]	[-1.09725]	[11.5548]
D(RU(-2))	0.035429	-5.902705	-40.43273	95.61910	0.922683	0.286907
	(0.00882)	(5.07588)	(112.171)	(70.2469)	(1.04678)	(0.02854)
	[4.01512]	[-1.16289]	[-0.36046]	[1.36119]	[0.88145]	[10.0540]
D(RW(-1))	-0.146157	-41.92806	-147.1848	710.5544	7.806427	1.852254
	(0.05394)	(31.0280)	(685.685)	(429.408)	(6.39882)	(0.17444)
	[-2.70970]	[-1.35130]	[-0.21465]	[1.65473]	[1.21998]	[10.6183]
D(RW(-2))	-0.247221	-43.42816	-189.0590	776.9314	7.542183	3.010684
	(0.06200)	(35.6678)	(788.218)	(493.619)	(7.35566)	(0.20052)
	[-3.98716]	[-1.21757]	[-0.23986]	[1.57395]	[1.02536]	[15.0140]
C	0.025152	-3.952107	-16.28962	98.82584	0.817323	0.222456
	(0.00766)	(4.40856)	(97.4243)	(61.0116)	(0.90916)	(0.02478)
	[3.28196]	[-0.89646]	[-0.16720]	[1.61979]	[0.89898]	[8.97542]
R-squared	0.997422	0.854902	0.876147	0.942169	0.896344	0.999597
Adj. R-squared	0.966486	-0.886273	-0.610083	0.248197	-0.347533	0.994764
Sum sq. resids	0.000252	83.50987	40782.87	15994.43	3.551637	0.002639
S.E. equation	0.015886	9.138374	201.9477	126.4691	1.884579	0.051376
F-statistic	32.24183	0.490991	0.589510	1.357646	0.720605	206.8057
Log likelihood	56.60072	-32.36649	-75.70386	-69.15171	-10.26360	40.16843
Akaike AIC	-6.228675	6.480927	12.67198	11.73596	3.323371	-3.881205
Schwarz SC	-5.635264	7.074338	13.26539	12.32937	3.916782	-3.287794
Mean dependent	0.002221	-0.330722	7.142857	34.22857	0.221429	0.034595
S.D. dependent	0.086777	6.653752	159.1530	145.8587	1.623471	0.709983

Source: Authors' calculations.

Since wages are the main factor that influences emigration, the disclosure of the variables that determine the salary itself is particularly important. Factors that have a statistically significant impact on wages are: foreign direct investment, GDP, labor productivity, emigration and unemployment. The variables that contribute to wage growth are foreign direct investment, GDP, unemployment, and labor productivity. The link between foreign direct investment and productivity is obvious – both factors reflect technological progress. The GDP-productivity-wage relation is within the so-called Verdoom's law (Verdoom, see

in more detail Castiglione, 2011), which postulates that economic growth is accompanied by productivity growth, proportional to the square root of GDP growth. The results of the analysis of the links between the surveyed variables reveal a marked positive correlation between the unemployment dynamics and the wage levels. The interrelation is straightforward, i.e. an increase in the unemployment corresponds to a rise in salary. This is a consequence of the phenomenon typical for the period after the global financial crisis - when demand shrinks, firms tend to get rid of less productive and lower-paid workers, which leads to a rise in the proportion of high-paid workers, and respectively to an upsurge in the average wages.

Graph 1

Significant relations between emigration and the explored variables in Bulgaria
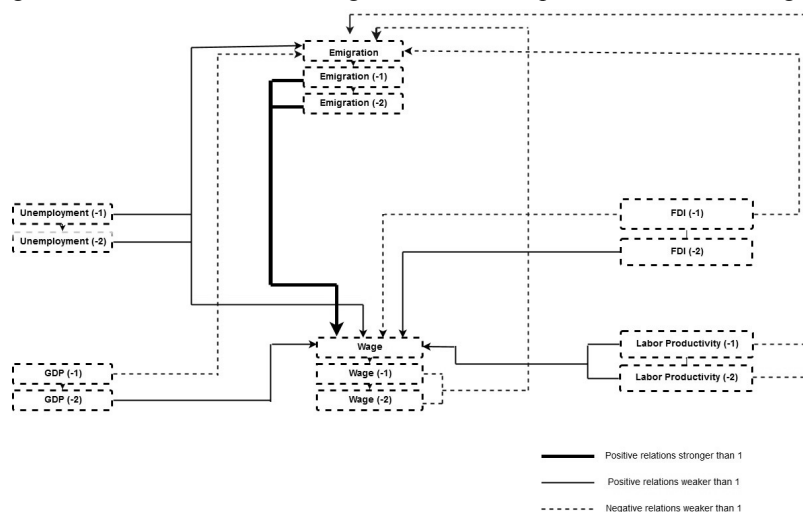
Note: The exposed results are based on the VAR model
Source: Authors' calculation.

The most important relations between immigration and other explored variables are exposed at Graph 2 and Table 5. The following variables are influenced by immigration in Bulgaria: foreign direct investment and labor productivity. The impact is positive – the increased influx of investment and the rise in labor productivity increase the labor inflow to Bulgaria. This relationship is a two-way one, because the immigration affects also the abovementioned macroeconomic variables. At the same time, immigration has a negative impact on the increase in wages in Bulgaria.

We must mention that important new patterns are revealed in the case of immigration-related interdependencies. In particular, the survey shows that wages are a factor that has a positive impact on labor productivity and foreign direct investment. This effect is strong, positive and sustainable as it retains its significant pressure over all the time lags studied. The noted dependence confirms the validity of the Keynesian thesis of effective salary, i.e. that an increase in wages contributes to strengthening labor productivity.

In addition to this, a direct comparison between the weights of the coefficients, allows us to conclude that the immigration has a significantly stronger impact on labor productivity than the opposite impact. The dynamics of labor productivity and foreign direct investment also reveal a positive two-way relationship. Unemployment is a factor that has a negative impact on labor productivity and foreign direct investment. Looking at this fact, we can assess that unemployment has a sustained positive influence on wage levels. The relationship outlined above is identical to the one involved in the case of emigration analysis, i.e. whether we evaluate the emigration or immigration, the unemployment has an impact on wages.

Graph 2

Significant relations between immigration and the explored variables in Bulgaria
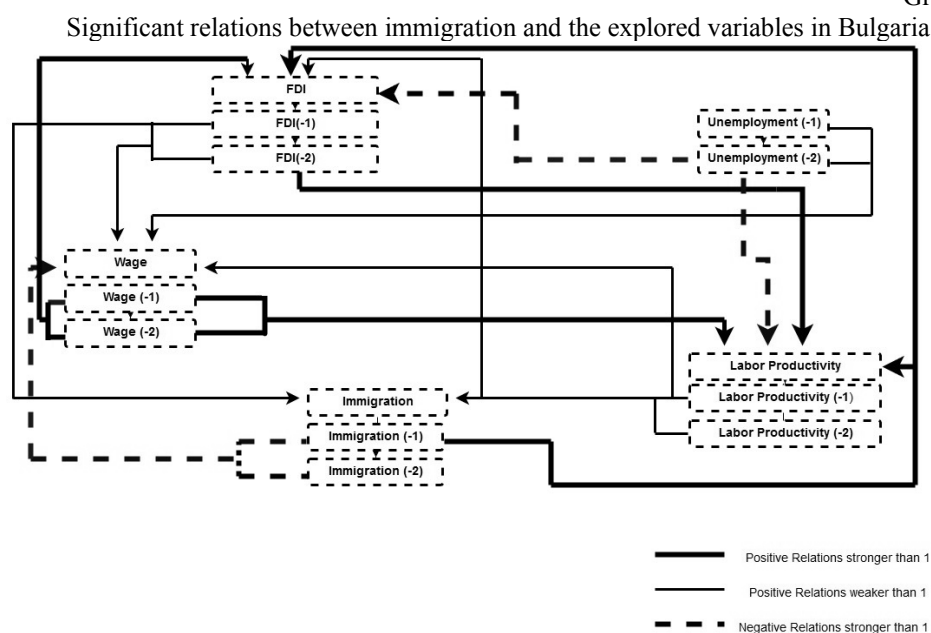
Note: The exposed results are based on the VAR model
Source: Authors' calculation

Table 5

Results from VAR model for Bulgaria. The observed process is immigration

	D(RIMM)	D(RU)	D(RW)	D(RGDP)	D(RRLP)	D(RFDI)
	-0.205320	-1.404761	-2.561944	628.0691	1432.888	92.28327
D(RIMM(-1))	(0.29442)	(16.3952)	(0.45652)	(1924.42)	(557.476)	(44.5402)
	[-0.69737]	[-0.08568]	[-5.61194]	[0.32637]	[2.57031]	[2.07191]
	-1.162441	1.717437	-1.395730	-361.1093	73.89213	-17.95790
D(RIMM(-2))	(0.14619)	(8.14067)	(0.22667)	(955.528)	(276.803)	(22.1155)
	[-7.95167]	[0.21097]	[-6.15744]	[-0.37792]	[0.26695]	[-0.81201]
	0.029846	-0.851841	0.290980	-13.55460	-52.89371	3.564121
D(RU(-1))	(0.01609)	(0.89607)	(0.02495)	(105.178)	(30.4685)	(2.43432)
	[1.85480]	[-0.95064]	[11.6622]	[-0.12887]	[-1.73601]	[1.28570]
	-0.026290	0.603064	0.230650	6.220911	-75.37460	-4.822409
D(RU(-2))	(0.01567)	(0.87254)	(0.02430)	(102.416)	(29.6686)	(2.37041)

	[-1.67786]	[0.69116]	[9.49350]	[0.06074]	[-2.54055]	[-2.03442]
D(RW(-1))	-0.124032	6.193082	1.600200	81.90138	631.2035	37.86976
	(0.10792)	(6.00964)	(0.16734)	(705.394)	(204.343)	(16.3262)
	[-1.14929]	[1.03052]	[9.56279]	[0.11611]	[3.08895]	[2.31957]
D(RW(-2))	-0.213832	5.340545	2.638614	129.0157	649.9488	36.72345
	(0.11292)	(6.28797)	(0.17509)	(738.064)	(213.806)	(17.0823)
	[-1.89369]	[0.84933]	[15.0704]	[0.17480]	[3.03989]	[2.14979]
D(RGDP(-1))	-0.000377	-0.006835	0.000470	-0.170542	-0.364328	0.084347
	(0.00020)	(0.01094)	(0.00030)	(1.28354)	(0.37182)	(0.02971)
	[-1.92051]	[-0.62505]	[1.54352]	[-0.13287]	[-1.66931]	[1.83927]
D(RGDP(-2))	0.000498	-0.022834	-0.010366	-0.224548	-0.178674	0.230428
	(0.00060)	(0.03357)	(0.00093)	(3.94092)	(1.14163)	(0.09121)
	[0.82630]	[-0.68010]	[-11.0879]	[-0.05698]	[-1.78433]	[1.52630]
D(RRLP(-1))	0.001155	-0.025119	0.010049	-0.596357	-3.174838	0.171474
	(0.00056)	(0.03110)	(0.00087)	(3.64992)	(1.05733)	(0.08448)
	[2.06825]	[-0.80781]	[11.6064]	[-0.16339]	[-3.00270]	[2.02985]
D(RRLP(-2))	0.000321	-0.012772	0.002025	-0.743786	-0.272816	0.013320
	(0.00021)	(0.01159)	(0.00032)	(1.36012)	(0.39401)	(0.03148)
	[1.54263]	[-1.10224]	[6.27541]	[-0.54685]	[-0.69241]	[0.42314]
D(RFDI(-1))	0.010310	-0.318772	0.076010	8.182396	-9.022168	1.402887
	(0.00530)	(0.29522)	(0.00822)	(34.6524)	(10.0383)	(0.80202)
	[2.04472]	[-1.07977]	[9.24656]	[0.23613]	[-0.89877]	[1.74919]
D(RFDI(-2))	-0.010687	0.284813	0.214917	-4.262079	73.87758	-4.574096
	(0.01082)	(0.60265)	(0.01678)	(70.7378)	(20.4917)	(1.63721)
	[-0.98748]	[0.47260]	[12.8074]	[-0.06025]	[3.60524]	[-2.79384]
C	-0.011006	0.563382	0.154806	25.57339	64.91014	-2.029396
	(0.01318)	(0.73385)	(0.02043)	(86.1374)	(24.9528)	(1.99363)
	[-0.83515]	[0.76771]	[7.57598]	[0.29689]	[2.60132]	[-1.01794]
R-squared	0.992781	0.876094	0.999498	0.822369	0.982253	0.945560
Adj. R-squared	0.906154	-0.610773	0.993470	-1.309198	0.769283	0.292278
Sum sq. resids	0.001369	4.245450	0.003292	58491.22	4908.452	31.33259
S.E. equation	0.037001	2.060449	0.057372	241.8496	70.06035	5.597552
F-statistic	11.46036	0.589221	165.8192	0.385805	4.612169	11.447399
Log likelihood	44.76356	-11.51267	38.62296	-78.22816	-60.88274	-25.50435
Akaike AIC	-4.537652	3.501810	-3.660422	13.03259	10.55468	5.500621
Schwarz SC	-3.944242	4.095221	-3.067012	13.62600	11.14809	6.094032
Mean dependent	0.014062	0.221429	0.034595	7.142857	34.22857	-0.330722
S.D. dependent	0.120783	1.623471	0.709983	159.1530	145.8587	6.653752

Source: Authors' calculation.

Based on the results from VAR model, we construct a forecast for the dynamics of immigration and emigration in Bulgaria for the period 2017-2022 (Graph 3 and Graph 4).

Graph 3

Forecast for the immigration process in Bulgaria for 2017-2022
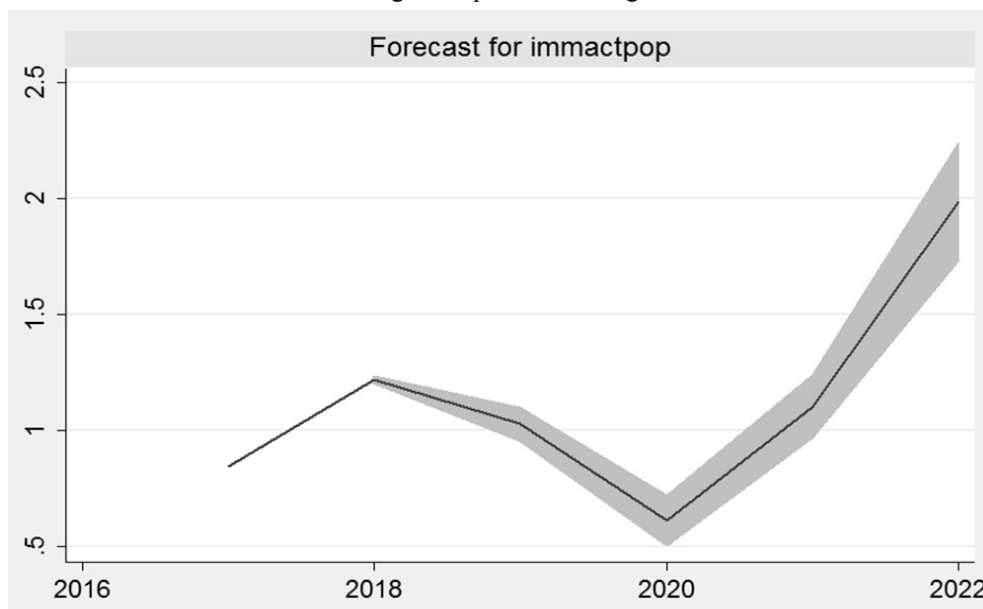
Note: The forcast is based on the results of the applied VAR model
Source: Autors' Calcualtions

On the basis of a comparison between the results of the Graph 3 and Graph 4, we may draw the following conclusions: up to the year 2020 the emigration will stay virtually constant. The immigration however is supposed to decline. Bulgarian emigrants will continue to be among the main investors in the country by transferring cash to their families in Bulgaria, thus guaranteeing an increase in the foreign currency reserves and a reduction in the current account deficit. An appropriate policy will be to keep older people on the labor market for longer periods. Increasing emigration and decreasing immigration will also contribute to low unemployment rates. After 2020, we forecast a significant increase in immigration flows. In 2022 we predict higher levels of immigration as percentage of working population, compared to those of emigration. This can be explained by the implicit virtuous circle- stronger emigration leading to higher wages, higher productivity and higher immigration.

Graph 3

Forecast for the emigration process for Bulgaria for 2017-2022
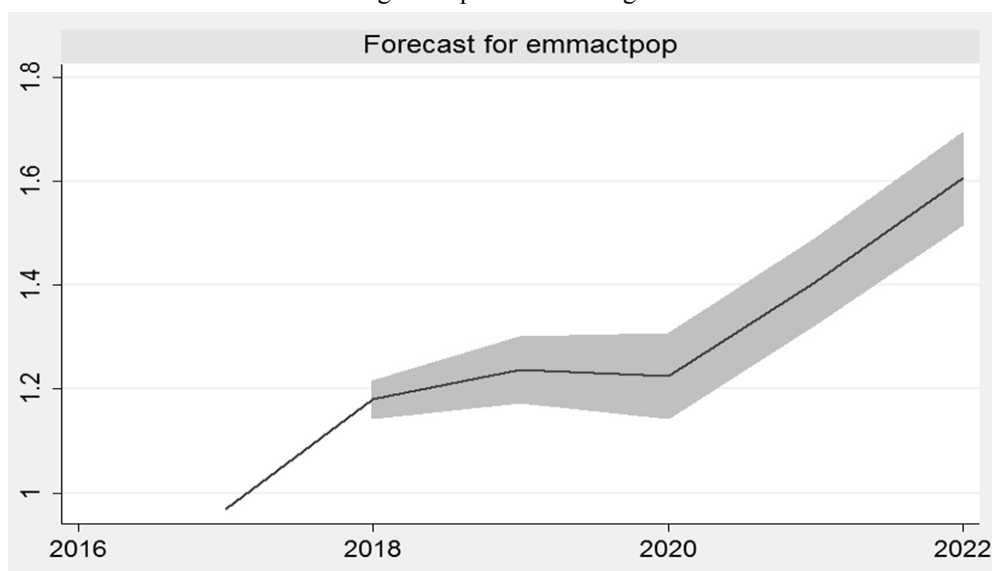
Note: The forcast is based on the results of the applied VAR model
Source: Autors' Calcualtions.

5. Conclusions on Economic Policy

As we consider the results from the current research we make the following conclusions and recommendations for Bulgarian Economic Policy:

- **Income policy**

In Bulgaria, unlike other post-communist EU Member States, wages are a major factor governing the international migration of the workforce. This is explained by three factors. First, the absence of close production links with the economies of the countries of "old" Europe and, as a consequence, insufficient synchronicity with the EU economic cycle. Second, the currency board mechanism, which prevents an active anti-cyclic policy towards maintaining full employment. Third, and perhaps most importantly, wages in Bulgaria are in the range of 17-18% of the EU average, as opposed to 35-45% for other countries, with only Romania around 20% being close to us.

Wages, measured as a proportion of the EU average, correlate negatively with emigration and positively with immigration. This means that a policy of accelerating wage growth can limit the draining of labor force and speed up the inflow of workers to the country. The growth of wages in Bulgaria in recent years ranges from 6% to 9.5% per year (IMF, 2018), without having any negative impact on the growth and financial stability of the country.

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The objections to the rapid increase in wages and the minimum wage come as a rule on the part of Bulgarian business. These are related to two main theses. First, the rise in wages is limited by labor productivity, and secondly, the increase in minimum wages leads to the blurring of boundaries between high and low incomes. Our study allows a correction of these views. Firstly, with the comparatively exceptionally low remuneration in Bulgaria, the rise in wages is a stimulating factor for the rise of labor productivity in line with the concept of effective wages. Apart from this, the slowdown in wage growth has led to an acceleration in the outflow of labor, which results in an even greater shortage of labor and pressure to boost wages. The second argument does not correspond to reality either, as Bulgaria is constantly among the countries with the highest income inequality in the EU. In this situation, ***we can recommend an orientation towards sustainable growth in earnings to the extent of 8-10% annually, until the level of payment reaches for example 30% of the EU average.*** This will boost the economy and labor productivity, and it will lead to an end of the trend of population decline due to labor migration. If the current trends of a relatively rapid increase in nominal incomes continue, and if the economy is not set back due to a crisis like that of the Corporate Commercial Bank or a global financial crisis, in the next 3-4 years the number of workers entering Bulgaria will exceed the number of those who leave.

- **Taxation of income**

Income taxation also affects the real income of those who are employed and therefore on the migration. If we limit our analysis to the income tax, we need to pay attention to the following points. First, in Bulgaria is applied the so-called flat or uniform income tax, without a minimum non-taxable income. In this situation, the impact of taxation on international labor migration must be completely different for workers in the high and low-income brackets.

Let us start with low income. With the current almost full employment, Bulgarian business relies on the influx of cheap labor, mainly from the post-Soviet economic space. Unfortunately, under the Bulgarian flat tax arrangement, which does not include a tax-exempt minimum threshold, with the same nominal salary, a worker who has chosen Bulgaria as a workplace is guaranteed a smaller disposable after-tax income. This is so because all the other EU member states, including those post-communist countries that apply a flat tax, provide for a very serious non-taxable minimum threshold. For the same reason, Bulgarian workers looking for higher incomes in "old" Europe, in reality, enjoy lower taxation despite the high tax rates on higher income levels in the countries where Bulgarian emigrants are settling. Thus, ***the flat-rate tax arrangement applied in Bulgaria in practice reduces the wage competitiveness of the country at low income levels.***

It must be expected, however, that the high-income situation is different. And this is the case. The upper bracket, i.e. the maximum taxation on high income in Western European countries is far higher, often around 4-5 times higher than in Bulgaria. This is a serious advantage that could potentially help to overcome the serious situation with the shortage of highly qualified labor force in Bulgaria, not only by attracting Bulgarians working abroad but also by drawing highly qualified specialists from all over the world. In parallel with

this, low taxation of high incomes should keep highly qualified staff on the internal market. However, both trends do not in reality exist, apart from some exceptions.

The main reason is the mindset of the private and state business in Bulgaria. According to reports of the World Economic Forum, Bulgaria is practically the last in the world regarding the ability to attract and retain talented, highly-trained specialists. This is related to the specific nature of Bulgarian capitalism, which can be characterized as being based on informal connections, or crony capitalism, in which personal contacts play a decisive role, as opposed to talent and abilities, which fade into the background.

Apart from this, the generation of a real demand for highly qualified specialists implies the existence of an efficient high-tech sector. The existence of high-tech potential depends, on the other hand, on providing adequate financing (venture capital, investment banks, developed capital market, state funds, access to EU structural funds, EIB resources, EIF, the Juncker plan, etc.), state policy in the field of education, science and research, the existence of clusters that unite businesses, universities and the financial sector, the creation of free industrial zones, business incubators, the state of the justice system, the efficiency of public administration, etc. All of these are areas where our country is not just lagging behind but is often at last place in the EU.

We can conclude that ***the presence of comparative advantages in the area of taxation is not in itself significant if the overall context of the socio-economic conditions for doing business is not sufficiently stimulating***. However, a common strategy to support high-tech business could turn flat taxation into a competitive advantage in the high-tech field in the foreseeable future, although in the longer term the evolution of the tax system should rather be in the direction of moderately progressive tax rates.

- **Foreign investment**

A study shows that foreign direct investment has a strong impact on labor productivity and therefore on labor income, respectively on labor emigration and immigration. As mentioned above, our study suggests a policy of accelerated wage growth, plus the introduction of a non-taxable minimum.

Potentially, this could have a counterproductive effect on economic growth and foreign investment. However, the survey shows that, at the current level of income, the further increase in earnings has practically no impact on foreign investment. On the other hand, high incomes have an impact on labor supply, both in terms of delaying emigration and from the point of view of attracting foreign workers. Increased purchasing power and the expansion of the internal market also have a positive impact on attracting of foreign direct investment.

Raising incomes has a limited negative impact on GDP growth in the short-term, but in the perspective of the current analysis, expanding demand and increasing labor productivity have a far stronger encouraging effect. Therefore, a policy of stimulating foreign direct investment will have net positive results in terms of labor productivity, incomes, reducing emigration and motivating labor immigration.

Unfortunately, in recent years, foreign direct investment has declined. The reasons for this are mainly related to the institutional climate, inadequate funding and the unsatisfactory functioning of the judicial system. What is necessary is a comprehensive policy for attracting foreign investment, with an emphasis on specific strategic investors in the high-tech sector with a view of integrating the Bulgarian economy into the high levels of the global value chains.

- **Administrative regulation of labor migration**

Given Bulgaria's participation in the free movement of labor force in the EU, Bulgaria depends strongly on its own regulations in the area of the immigration of workers. For now the main goals are in the sphere of attracting low-paid and low-skilled workers. Taxation in Bulgaria, however, works contrary to this objective. ***With regard to highly qualified specialists, the main problem is the existence of slow and highly bureaucratic procedures.*** Bulgaria, which offers particularly favorable conditions in the area of high incomes, should ease the administrative restrictions for attracting highly qualified workers and immigrants with significant capital. This must be an element of a ***common policy of accelerated development of the high-tech sector and luring of foreign direct investment.***

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INTEGRAL ASSESSMENT OF BANKING ACTIVITY EFFECTIVENESS AND RATING OF UKRAINIAN AND BULGARIAN BANKS

The article proposes a method for evaluating and rating the effectiveness of banks on the basis of coefficient analysis. It is proposed to calculate 24 coefficients, which allow to estimate capital-resource, credit-investment and general effectiveness of banks. According to the developed method, the rating of banks of Ukraine and Bulgaria was formed. Based on the rating, the banks of both countries are divided into 4 groups: high, sufficient, low and critical effectiveness. The rating indicators prove the higher effectiveness of the banks in Bulgaria and generally the higher stability of the banking system compared to Ukraine. The study developed an integral indicator of the bank's operation, which is a tool for a comprehensive assessment of the bank's performance and can be used to analyze the absolute effectiveness and stability of banks in different countries. Along with effectiveness, the integral indicator includes indicators of bank capital adequacy and its qualitative characteristics (customer confidence, image, transparency, comfort and simplicity). According to the results of the integral assessment, taking into account the balance of coefficients in groups, banks occupy the corresponding position in the matrix, which indicates their class (strong, mediocre, weak) and the presence of problems in certain aspects of the activity.
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Topicality

In the conditions of accelerating globalization process in the financial sector, a search for the most effective ways to organize the activities of bank establishments becomes a vital issue. The growth of competitiveness, especially through the financial globalization and penetration of foreign capital into the bank systems of the countries urge banks to enforce their competitiveness and thus their effectiveness. The task to form strong and dynamic banks makes the quality of management for every financial institution and the bank system in general especially significant. A proper analytical background is necessary for that. For this reason the elaboration of an approach to integral evaluation of the banks' activity effectiveness and methods of their ranking became the subject of our research.

Research analysis

The effectiveness of banking business is a one of the most important issues of modern banking management. The problems of finding international criteria for the country's banking system effectiveness evaluation are researched in the works of Kazarenkova and Kolmykova (2016). Banks' effectiveness in transition economies in Central and Eastern Europe and effect of geographical location on banking are researched by Degl'Innocenti et al. (2017). Many researches focus on the study of the banking business effectiveness in periods of crisis (Schoenmaker, 2017). The impact of crisis on structural change in cross-border banking and international banks direct cross-border and local affiliates' lending are studied by Bremus and Fratzscher (2015); Cerutti and Claessens (2017).

Spokeviciute et al. (2019) research activity of less efficient banks as compared to more efficient banks during financial crises in the USA. Ertürk (2016), Cohen et al. (2014) analyzed post-crisis regulatory reform initiatives and their impact on effectiveness and risks of bank institutions. The relationship between capitalization strategies, systemic risk in the banking sector and banks' corporate governance are researched by Anginer et al. (2016; 2018).

Different methods that are used in operational activity and financial indicators in private banks are compared (Sharma G. & Sharma D., 2017).

Tan and Floros are studying the interplay between the level of competition, risk and effectiveness using a sample of Chinese commercial banks. According to the research of banks in China, those banks that have higher levels of credit risk have lower levels of cost effectiveness (Tan & Floros, 2019).

The effectiveness of the Ukrainian banking system after double reduction in the number of commercial banks during 2016-2018 is researched (Prymostka O. & Prymostka L., 2018).

In general, the notion of effectiveness can be interpreted on the basis of the following two approaches: the effectiveness of any activity is measured by the ratio of the results obtained (income) to the spent resources (costs) for this activity; effectiveness as a measure reflecting the influence of the human factor (organization of work, competence of employees, management structure, etc.) on the achieved results (Tolchin, 2007).

In the scientific literature, there are many methods for determining the effectiveness of banking activities. Based on this, the definition of this indicator is quite versatile.

Thus, Buriak A. (Buriak, 2010) understands, by the effectiveness of banks, "its ability to achieve its goals through optimal use of resources, while taking into account not only the microeconomic but also the macroeconomic function of banks in a market economy". The author among the indicators that will affect the effectiveness of the bank, allocates income and expenses, but does not provide a coherent, precise methodological approach to determining this effectiveness.

O. Rybalka (Rybalka, 2007) offers a systematic approach to assessing the effectiveness of banking in the triple dimension of "profitability – riskiness – reliability". The advantage of this approach is to take into account, in addition to the indicators of profitability and other factors that affect the activities of the bank.

L. Yeris (Єpic, 2014) measures effectiveness through the prism of managing cash flows as the main economic category in the activities of banks, while still taking as basis the indicators of profitability. In general, investigating this issue, most researchers focus on the indicators of profitability. We consider it necessary to develop and substantiate an integrated approach to assessing the effectiveness of banking activities taking into account various indicators of the bank's activity (quantitative and qualitative), but profitability indicators are the basis for the rating of banks in Ukraine and Bulgaria.

The objective of the article is to elaborate a complex approach to evaluating the bank activity effectiveness and to conduct ranking of Ukrainian and Bulgarian banks.

Methodological background

Analysis of the theoretical background of bank activity effectiveness and ways of its evaluation, strategies of abstraction and generalization, as well as induction and deduction methods are used. The coefficient and convolution methods serve as a basis for the ranking and calculating the integral index of effectiveness and stability of a bank. In order to take into consideration qualitative indicators of the bank activity, the method of expert evaluation is used. The synthesis method, matrix, graphical and table methods (approaches) were used to show the rankings of the bank results and integral index calculation. Having analyzed the results of the research of the bank systems of Bulgaria and Ukraine in the context of their activity and stability of their banks, methods of comparison and grouping are used.

Research results

To ensure the efficient functioning of the bank, first of all, the proper organization of analytical work is necessary, the results of which are the basis for the adoption of operational management decisions. The complex of indicators of the bank's performance is

summed up by the appropriate methodology, which is the basis for the formation of its rating.

For rating of banks, different methods are used, which are complex or partial. Partial methods involve choosing the coefficients for assessing the financial condition of the bank and ranking them for each of these indicators. The disadvantage of such techniques is the lack of a vision of a coherent picture of the work of one or another bank.

Comprehensive methods are mainly based on the definition of an integral indicator of the bank's activity. The variation of these techniques consists in which particular activity indicators take into account and which weight coefficients are assigned to a separate coefficient. The results of such ratings are mainly reflected in points or in the form of an index. The index method is based on multi-factor index models that characterize the relationship between the rating index and the indicators of the financial condition of banks (Kolesnik, 2012).

The most popular ballroom valuation and rating system is the CAMELS system. This system is used by the National Bank of Ukraine. This rating system is aimed at assessing the financial condition of a commercial bank to identify shortcomings in the activities and management of the bank. The biggest disadvantage of this technique is the use of indicators that constitute banking secrecy. Therefore, it is closed and inaccessible to researchers and experts. The CAMELS rating system was developed in the US and used there along with the FIMS technique. When applying the FIMS method, more than 30 factors are used, which mainly reflect the quality of assets and the state of capital of the bank. For comparison, banks in BAKIS methodology are ranked in Germany, which is based on the calculation of 47 coefficients.

Most open rating techniques do not take into account the entire spectrum of indicators for assessing the financial situation, the quality of the bank's performance and the influence of external factors, which banks are particularly sensitive to. Therefore, in most of them, they are not able to provide a complete objective assessment of the effectiveness of the bank. Standard and Poor's, Fitch Ratings, Moody's Investors' Service are the leading international rating agencies operating successfully in the European and US markets.

Rating agencies Moody's and Fitch provide individual (that takes into account only the financial condition of the bank without possible support of the state or the owners) and general (that takes into account the state or owners support) bank ratings. Standard & Poor's does not divide bank ratings into individual and general ratings, explaining that credit ratings already take into account the risks of the bank's operating environment and possible support. We agree with the last statement and offer a rating based mainly on the financial position of the bank. These leading international rating agencies use Through-the-Cycle (TTC) approach for their rating that analyses the subject during certain period of time. So Moody's rating agency takes into account the following indicators in its methodology: market share and stability of the bank, geographical diversification, stability and diversification of income, corporate governance, transparency of financial statements, propensity to take risks, quality of liquidity management, regulatory environment, quality of liquidity management, level of corruption, the legal system and regulation, the coefficients of assessment of the bank's financial condition.

Such indicators are taken into account: the ratio of profit before tax to assets, the ratio of net income to assets, the ratio of short-term borrowings and liquid assets to total assets, the share of equity in assets, the ratio of operating expenses to gross income, the proportion of problem loans, the ratio of problem loans to equity and reserves for problem loans. Each of these indicators has a weight expressed as a percentage. In general, rating agency Moody's, when evaluating the bank's "internal financial strengths," focuses on forecasting capital ratios and taking into account the expected expenditures of the bank; rating agency Fitch pays greater attention to off-balance sheet instruments, capital and liquidity risk; and rating agency Standard and Poor's assesses the quality of risk management and the ability to raise capital through profit.

Also in EU there is The European Banking Authority (EBA), an independent EU Authority that has to ensure effective and consistent prudential regulation and supervision across the European banking sector. The EBA Risk Dashboard is part of the regular risk assessment conducted by the EBA and it complements the Risk Assessment Report. The EBA Risk Dashboard summarises the main risks and vulnerabilities in the banking sector in the European Union (EU) by looking at the evolution of Risk Indicators (RI) among a sample of banks across the EU (Eba.europa.eu, 2019). In accordance with its mandate, the European Systemic Risk Board (ESRB) has engaged in developing a monitoring framework to assess systemic risks in the European Union (EU) banking sector. The ESRB is monitoring the sources of systemic risk in the European financial system and in the economy (Grillet-Aubert et al., 2019)

The World Bank analyzes the development of the banking sector in every country as a whole and takes into account such indicators as: the ratio of M2 to GDP and the ratio of private credit to GDP (Siteresources.worldbank.org, 2019). In order to provide a rating of a bank, rating agencies and other organizations need accounting and analysis of its internal information. Such information is not accessible to all market participants, and rating agencies counterbalance this information asymmetry in some way on the market and act as information intermediaries. The proposed methodology involves the use of available information, so it provides an opportunity to bypass intermediaries and evaluate the bank's activity independently.

Depending on the group of rating users and their goals, there are credit, deposit, current, and long-term ratings. Taking into account the specifics of each of these ratings, relying on factors from the methods of leading international rating agencies in relevant to individual rating, and taking the coefficient analysis as a basis, we have developed a set of indicators reflecting different aspects of the bank's activity and effectiveness of bank activity in general.

We suggest an approach to ranking the banks according to the criteria of effectiveness that is quite simple to use and is available to everybody, since the necessary data can be found in public information. In addition, this methodology can be used by investors (also individuals) and clients who do not have access to inside information of the bank. The ratio that we take into consideration reflects the financial state of the banks, the structure of incomes and expenditures, and the effectiveness of their activity, namely indicators of capital-resource effectiveness, indicators of the effectiveness of credit and investment activity, and indicators of overall performance.

It is this division of coefficients that allows taking into account all the functional elements of the bank's activity. Thus, the coefficients of capital-resource effectiveness reflect the effectiveness of the formation of own resources and the engagement of the bank's resource base (Table 1).

Table 1

The indicators of the bank's capital-resource effectiveness

	Indicator	The mechanism of calculation
K_1	The coefficient of profitability of interest expenses	The ratio of gross profit to interest expenses of the bank
K_2	The coefficient of return on equity	Net profit to equity ratio
K_3	The coefficient of profitability of attracted deposits	The ratio of gross profit to the attracted deposits of the bank
K_4	The coefficients of coverage of the bank's obligations with absolute liquid assets	The ratio of absolutely liquid assets to total liabilities of the bank
K_5	The coefficient of the security of deposit activity with absolute liquid assets	The ratio of absolutely liquid assets to the bank's deposit liabilities
K_6	The coefficient of interest rate management	The ratio of interest expense to the bank's income

The indicators of the bank's capital-resource effectiveness reflect the general structure of the liabilities balance and the activity of attracting the resource base of the bank from external sources; in particular, customer deposits (Moiseenko, 2011).

With the development of the financial sector, along with the traditional credit activities of the banks, the investment activity, which involves the formation of portfolios of the bank's securities for maintenance and sale occupies a significant place as well. These two types of activities reflect the activity of the bank in the credit and stock markets, and their results can provide high revenues and profits of the bank. Accordingly, the next group of indicators for assessing the functioning of banks is the performance indicators of the bank's lending and investment activities (Table 2).

Table 2

The indicators of effectiveness of the bank's lending and investment activity

	Indicator	The mechanism of calculation
K_7	The coefficient of interest income in gross profit	The ratio of interest income in gross profit
K_8	The coefficient of commission income in gross profit	The ratio of commission income in gross profit
K_9	The coefficient of investment effectiveness in credit operations	The ratio of interest income to the total assets of the bank
K_{10}	The coefficient of investment effectiveness in commissions and intermediary operations	The ratio of commission income to the total assets of the bank
K_{11}	The commission income ratio	The ratio of commission income to total revenues
K_{12}	The interest income ratio	The ratio of interest income to total revenues
K_{13}	The coefficient of the credit-investment activity	The ratio of the amount of loans and securities provided in the bank's portfolio to the total assets of the bank
K_{14}	The coefficient of net interest margin	The ratio of net interest margin to total assets
K_{15}	The profitability ratio of credit operations	The ratio of interest income to all loans

These indicators aim at the evaluation of the financial resources of the bank placement and usage effectiveness. The financial result of a commercial bank is profit, gross profit depends mainly on the ratio of its revenues and expenses; its formation is influenced by the structure of the institution's income (Credit Risk Modeling, 1999).

The indicators (Table 2) comprehensively characterize the effectiveness of placement of bank's financial resources, that is, its credit and investment operations.

It is worth noting that multifaceted activities require additional costs for the organization of work and customer service of the bank. All this affects the performance of the bank and makes it necessary to allocate a group of coefficients that reflect the overall effectiveness of the bank (Table 3).

Table 3

The indicators of overall effectiveness of the bank's activity

	Indicator	The mechanism of calculation
K_{16}	The return on assets	The ratio of gross profit to total assets of the bank
K_{17}	The return on revenue	The ratio of gross profit to the total income of the bank
K_{18}	The return on costs	The ratio of gross profit to the bank's expenses
K_{19}	The return on administrative costs	The ratio of gross profit to the administrative expenses of the bank
K_{20}	The coefficient of coverage of the bank's total expenses	The ratio of total income and total costs
K_{21}	The coefficient of effectiveness of credit and deposit activity	The ratio of interest expense to interest income
K_{22}	The effectiveness of using assets of the bank	The ratio of total income and aggregate assets
K_{23}	The coefficient of administrative costs	The ratio of administrative costs to total costs
K_{24}	The coefficient of coverage of administrative costs	The ratio of net operating income to administrative expenses

All the coefficients for evaluating the bank's performance suggested in the methodology combine the periodic performance indicators of the bank, that is, the indicators calculated for the relevant period (income, expenses, profit), and instantaneous rates, the absolute size of which is calculated at the appropriate time in accordance with the balance sheet (assets, capital) (Baranovskyi, 2014). The methodology can be applied as part of an absolute assessment of the bank's performance based on the integral indicator of evaluation calculation, and for comparing the work of banks within the established rating.

Formation of the banks rating presupposes taking into account the following aspects of the banking institutions rating methodology:

1. Coefficient analysis of banks in terms of the three above-mentioned groups of indicators. Taking into account different importance of individual indicators for reliable assessment of the bank's performance, different weighted indexes are given in the methodology (integers from 1 to 3), indexes that assess certain aspects of banking

operations (for example, transactions relating to securities, lending, attraction of deposits, as well as income and expenses associated with them) have less weight in the methodology, indicators that assess the bank's overall performance and also allow it to estimate its aggregate income and expenses have more weight.

2. The basis of any ranking methodology is the choice of comparison base. The choice of a "standard" bank can be done in different ways, choosing: a bank with average characteristics among all commercial banks; bank with a reference that is recommended by scientific literature values of indicators. In the offered method on the basis of separate coefficients the value of some generalized indicator of commercial bank BR level of effectiveness is calculated with the help of convolution method. In the method, such convolution was carried out by finding the relation between the ratio values of certain banks K1j ... K24j and the " standard bank". We consider the bank to be a " standard" bank, when it has the best relative performance characteristics for each of the individual ratios. The normative values of the ratios are omitted, since the aggregate of indicators for the methodology of the bank performance evaluation with certain types of transactions and in general is formed in order to make the growth (or decline) of their values correlate directly with the effectiveness level of the bank.

3. Among the above-mentioned indexes are the ones with reference best value going to the maximum (stimulants, Kse), and those whose reference value goes to a minimum (disincentive, Kde).

For the stimulants the following is true:

$$K_{se} \rightarrow \max \qquad (1)$$

For disincentive:

$$K_{de} \rightarrow \min \qquad (2)$$

For example, when the profitability indicators increase they reflect higher effectiveness of the bank activity, while banks are trying to minimize indicators that take into account the cost ratios.

4. The individual ranking index for each indicator-stimulant is calculated as the relation of the individual bank's index value to the same value for the master bank (one that has a maximum index).

$$Z_{ijs} = \frac{K_{ij}}{K_{ie}}, \qquad (3)$$

where Z_{ijs} is normalized individual rating indicator for the *i-index* of the *j-bank* for the indicators-stimulants;

K_{ij} is a value of the *i-indicator* of the *j-bank*;

K_{ie} is a value of the *i-indicator* of the "standart-bank" (maximum value in the group).

5. Taking into account, that the best value of the disincentive indexes is a minimum value among the banks with that index, in order to bring indexes for the stimulants and disincentive to the commensurable values, individual ranking index for each disincentive is calculated as a relation of the "standard-bank" ratio (that has minimum ratio) and ratio value of the individual or separate bank.

$$Z_{ijd} = \frac{K_{ie}}{K_{ij}}, \tag{4}$$

where Z_{ijd} is normalized individual rating indicator for the i-index of the j-bank for the indicators-stimulants;

K_{ij} is a value of the *i-indicator* of the *j-bank*;

K_{ie} is a value of the *i-indicator* of the "standard-bank" (minimum value of the indicator). In the methodology, indicators-disincentives serve as the three indexes; the capital-resource effectiveness bank group indicator. Interest rate management index K6 and 2 indicators for evaluating the overall performance of the bank: indexes of the credit and deposit activity effectiveness K21 and administrative expenses index K23.

6. It should be noted that moving towards maximum or minimum, the indexes can deviate significantly from average in the banking system and in terms of the individual financial indices ratio they can display wrong correlation of the two values used in the calculation of these indexes (they differ significantly from the overwhelming majority of the indexes values in the banking system). Such deviations are considered to be imbalances in the bank's indexes analysis. The values of these indexes are not taken into account when calculating the normalized individual indicators and they are assigned with the value of this indicator as a bank of the standard or bank outsider.

7. The place in the ranking of each bank is determined by the rating point of the bank BR that means the sum of the normalized individual ratings of banks Z1j ... Z24j taking into account the weight of the indexes in the rating. The total amount of points for the j-bank is calculated with the formula:

$$BR_j = \sum_{i=1}^{24} w_{zi} z_{ij} \tag{5}$$

$$\left(\begin{array}{c} BR_j = Z_{1j} + Z_{3j} + Z_{6j} + Z_{7j} + Z_{8j} + Z_{9j} + Z_{10j} + Z_{11j} + Z_{12j} + Z_{15j} + Z_{19j} + Z_{23j} + \\ + 2(Z_{4j} + Z_{5j} + Z_{13j} + Z_{14j} + Z_{17j} + Z_{21j} + Z_{24j}) + \\ + 3(Z_{2j} + Z_{16j} + Z_{18j} + Z_{20j} + Z_{22j}) \end{array} \right)$$

where: *BR* means the ranking point of the bank;

Zij is normalized individual rating indicator for the i-index of the j-bank for the indicators-stimulants;

W_{zi} means a weight (value) of the normalized individual ranking index.

The proposed methodology has been used to assess the activities of Ukrainian and Bulgarian banks effectiveness, which functioned in 2018 and to derive their rating.

For comparison, we have selected the banks of Ukraine and Bulgaria. Ukraine is an associate member of the EU and Bulgaria is a full member. This makes it interesting to compare the two countries in terms of the effectiveness in the work of individual banks and the banking system as a whole to understand the problems and challenges facing banks operating in different economic environments.

All banks reporting data was received and consolidated on the basis of official bank reporting on the websites of certain Bulgarian banks and consolidated data of the National Bank of Ukraine. Forty eight banks operate in Ukraine, in tables 4, 5, 6 there is data of 10 banks with the best total rating and 10 with the worst rating in the indicators groups of the method.

Table 4

Normalized individual rating indicators for the coefficients of the bank's capital-resource effectiveness (Ukraine)

Bank	Z_{1s}	Z_{2s}	Z_{3s}	Z_{4s}	Z_{5s}	Z_{6d}
Standard-bank	*12,63555*	*0,71871*	*0,33706*	*0,61506*	*1,78012*	*0,00062*
PJSC "Bank "Yunison"	1	0,16736	1	0,65489	1	1
PJSC "Bank Alians"	0,56174	0,31923	0,52023	0,19842	0,07254	0,00541
PJSC KB"Finansova initsiatyva"	0,04852	-0,22923	0,89556	0,01083	0,03021	0,00163
PJSC "IdeiaBank"	0,02778	0,38973	0,14884	0,11014	0,040551003	0,00205
PJSC "A – Bank"	0,04426	0,39288	0,19621	0,06272	0,02249	0,00238
PJSC "Rozrakhunkovyi Tsentr"	1	0,04196	0,59340	0,06274	0,02723	1
PJSC "Sitibank"	0,06865	0,27310	0,10456	0,08245	0,02897	0,00175
PJSC "Bank "Portal"	1	0,04849	0,99662	0,44506	0,16873	0,03512
PJSC "Europrombank"	0,01231	0,03921	0,08139	0,12295	0,04404	0,00155
JSC "Ukrsybbank"	0,15640	0,21950	0,10052	0,18402	0,07275	0,00562
…						
PJSC "Skai Bank"	-0,21137	-0,23018	-0,63534	0,08015	0,03285	0,00260
PJSC "Ukrsotsbank"	-0,12225	-0,64421	-0,32374	0,12053	0,04586	0,00161
PJSC "Megabank", Kharkiv	-0,07916	-0,84029	-0,28900	0,09285	0,03899	0,00102
JSC "Ukreksimbank"	-0,06725	-0,78893	-0,26371	0,07137	0,04245	0,00090
PJSC "Bank Kredyt Dnipro"	-0,09046	-0,98287	-0,23914	0,08558	0,03030	0,00108
PJSC KB "Pryvatbank"	-0,10353	-1,30715	-0,34155	0,13717	0,05299	0,00134
Ukr.Bank Rekonstruktsii ta Rozvytku	-0,09486	-0,06359	-9,83818	0,17668	0,62924	0,00142
PJSC KB "Tsentr"	-1,23560	-0,62039	-3,43731	0,24183	0,08818	0,01730
JSC "BM Bank"	-0,16204	-1,28910	-0,65481	0,19844	0,07522	0,00076
PJSC "BTA Bank"	-0,24752	-1,58838	-6,68266	0,16857	0,09504	0,00080

Source: Calculated by the authors on the basis of financial reporting of banks (40. National Bank of Ukraine, 2018).

Table 5

Normalized individual rating indicators for the coefficients of the bank's lending and investment activity (Ukraine)

Bank	Z_{7s}	Z_{8s}	Z_{9s}	Z_{10s}	Z_{11s}	Z_{12d}	Z_{13s}	Z_{14s}	Z_{15s}
Standard-bank	*121,40164*	*34,70761*	*0,33930*	*0,41802*	*0,81345*	*0,99788*	*0,98632*	*0,22104*	*14,63527*
PJSC "Bank "Yunison"	0,02320	0,02651	0,38771	0,10309	0,30046	0,74771	0,62415	0,59514	0,014601
PJSC "Bank Alians"	0,00619	0,01315	0,23020	0,11381	0,45881	0,61406	0,91135	0,28714	0,007562
PJSC KB"Finansova initsiatyva"	0,03527	0,00025	0,61022	0,00101	0,00252	1	0,81001	0,57996	0,01771
PJSC "IdeiaBank"	0,06732	0,03022	1	0,10444	0,13756	0,87149	0,89647	1	0,03007
PJSC "A – Bank"	0,03885	0,04728	0,75075	0,21257	0,29476	0,68883	0,93578	0,71560	0,02081
PJSC "Rozrakhunkovyi Tsentr"	0,02701	0,00274	0,30037	0,00708	0,02509	0,70368	0,63708	0,46067	1
PJSC "Sitibank"	0,02532	0,00504	0,28382	0,01315	0,06617	0,94439	0,88798	0,27229	0,01220
PJSC "Bank "Portal"	0,03406	0,00759	0,42071	0,02182	0,07263	0,92643	0,96599	0,63345	0,01594
PJSC "Europrombank"	0,12744	0,01780	0,62542	0,02032	0,04727	0,96240	0,95221	0,56137	0,01608
JSC "Ukrsybbank"	0,03259	0,00873	0,30404	0,01895	0,08153	0,86534	0,84323	0,40702	0,00926
…									
PJSC "Skai Bank"	-0,00622	-0,00688	0,19199	0,04944	0,18798	0,48297	0,35926	0,14866	0,01893
PJSC "Ukrsotsbank"	-0,00693	-0,01417	0,20253	0,09630	0,36232	0,50421	0,69102	0,07186	0,00733
PJSC "Megabank", Kharkiv	-0,01028	-0,01027	0,26019	0,06054	0,26772	0,76135	0,78491	0,07940	0,00787
JSC "Ukreksimbank"	-0,01333	-0,00165	0,22547	0,00649	0,04139	0,95058	0,76715	0,09443	0,01138
PJSC "Bank Kredyt Dnipro"	-0,00895	-0,00772	0,22668	0,04551	0,21795	0,71822	0,74049	0,06785	0,00884
PJSC KB "Pryvatbank"	-0,00789	-0,01746	0,26207	0,13490	0,45452	0,58424	0,68665	0,08143	0,03418
Ukr.Bank Rekonstruktsii ta Rozvytku	-0,00970	-0,00071	0,13897	0,00236	0,01592	0,61946	0,72342	0,06229	1
PJSC KB "Tsentr"	-0,00371	-0,03815	0,41837	1	0,91536	0,25339	0,81645	0,55100	0,01637
JSC "BM Bank"	-0,00283	-0,00345	0,15957	0,04524	0,24685	0,57606	0,72613	-0,10307	0,00516
PJSC "BTA Bank"	-0,00125	-0,00044	0,28167	0,02295	0,04535	0,36826	0,75913	-0,47147	0,02005

Source: Calculated by the authors on the basis of financial reporting of banks (40. National Bank of Ukraine, 2018).

Table 6

Normalized individual rating indicators for the coefficients of the overall effectiveness of the bank's activity (Ukraine)

Bank	Z_{16s}	Z_{17s}	Z_{18s}	Z_{19s}	Z_{20s}	Z_{21d}	Z_{22s}	Z_{23d}	Z_{24s}
Standard-bank	0.10108	0.81529	0.90239	4.73839	2.58110	0.00088	0.56140	0.00238	14.34886
PJSC "Bank "Yunison"	0.44939	0.32490	0.39095	0.21195	0.51599	1	0.31427	0.00678	0.25637
PJSC "Bank Alians"	1	1	1	0.56584	0.42882	0.00472	0.22722	0.00708	0.18687
PJSC KB"Finansova initsiatyva"	0.46524	0.28582	0.66652	1	1	0.00232	0.36985	1	1
PJSC "IdeiaBank"	0.39945	0.13051	0.20442	0.27236	0.67169	0.00254	0.69545	0.01667	0.57062
PJSC "A – Bank"	0.51964	0.17874	0.27266	0.24877	0.65413	0.00233	0.66057	0.01142	0.39596
PJSC "Rozrakhunkovyi Tsentr"	0.29909	0.26268	0.30315	0.11647	0.49488	1	0.25871	0.00481	0.17795
PJSC "Sitibank"	0.30145	0.37604	0.71172	1	0.81160	0.00236	0.18215	0.01758	0.68088
PJSC "Bank "Portal"	0.33220	0.27424	0.33872	0.19291	0.52964	0.04624	0.27524	0.00712	0.27493
PJSC "Europrombank"	0.13198	0.07613	0.11710	0.24055	0.65956	0.00213	0.39387	0.02570	0.75701
JSC "Ukrsybbank"	0.25090	0.26772	0.36010	0.21629	0.57679	0.00692	0.21294	0.00751	0.25183
…									
PJSC "Skai Bank"	-0.82966	-0.78243	-0.50501	-0.37608	0.27678	0.00178	0.24093	0.00932	0.14510

PJSC "Ukrsotsbank"	-0.78536	-0.73298	-0.56870	-0.73820	0.33271	0.00115	0.24345	0.01624	0.17791
PJSC "Megabank", Kharkiv	-0.68076	-0.74676	-0.69505	-1.16921	0.39912	0.00110	0.20713	0.02105	0.23152
JSC "Ukreksimbank"	-0.45488	-0.71894	-0.77338	-2.11829	0.46129	0.00121	0.14376	0.03428	0.32827
PJSC "Bank Kredyt Dnipro"	-0.68102	-0.80891	-0.63961	-0.63650	0.33907	0.00110	0.19129	0.01245	0.10726
PJSC KB "Pryvatbank"	-0.89280	-0.74615	-0.60096	-1.32644	0.34538	0.00111	0.27187	0.02762	0.32374
Ukr.Bank Rekonstruktsii ta Rozvytku	-0.38506	-0.64345	-0.53472	-0.30298	0.35636	0.00125	0.13597	0.00709	0.10682
PJSC KB "Tsentr"	-3.02947	-0.68788	-0.68223	-1.28347	0.42530	0.00623	1	0.02354	0.26342
JSC "BM Bank"	-1.51557	-2.05111	-0.84554	-0.57010	0.17677	0.00062	0.16789	0.00844	-0.00246
PJSC "BTA Bank"	-6.01250	-2.94696	-1.02031	-2.52411	0.14846	0.00042	0.46358	0.03096	0.00680

Source: Calculated by the authors on the basis of financial reporting of banks (40. National Bank of Ukraine, 2018).

The list of Bulgarian banks is formed according to the Bulgarian National Bank. Since the methodology takes into account the information of every single independent financial statement of each bank, rating do not include branches of foreign banks that provide financial information in the consolidated statements of their financial groups, in particular: Citi Bank Europe – Bulgaria Branch, BNP Paribas S.A. – Sofia Branch, ING Bank N.V. – Sofia Branch, BNP Paribas Personal Finance S.A. – Bulgaria Branch, T.C. Ziraat Bankas – Sofia Branch, Varengold Bank AG – Sofia Branch.

The rating lists 20 Bulgarian banks operating in 2018 (Table 7, 8, 9) by categorizing them into groups of method coefficients.

Table 7

Normalized individual rating indicators for the coefficients of the bank's capital-resource effectiveness (Bulgaria)

Bank	Z_{1s}	Z_{2s}	Z_{3s}	Z_{4s}	Z_{5s}	Z_{6d}
Standard-bank	11,14298	0,47689	1,07766	5,83137	1,36673	0,03517
DSK Bank	1	1	1	1	1	1
Eurobank Bulgaria	-0,46381	1	0,02302	0,02058	1	1
TBI Bank	0,41776	0,39000	0,06195	0,05452	0,24063	0,51469
Procredit Bank	1	0,31128	0,01908	0,01872	0,08026	1
Raiffeisenbank	0,75987	0,30928	0,02604	0,03553	0,17480	0,70794
UniCredit Bulbank	0,65222	0,21874	0,01923	0,03937	0,17084	0,65666
Expressbank	0,55013	0,29378	0,01968	0,03135	0,13772	0,53926
Bulgarian Development Bank	0,34727	0,05670	0,02505	0,04444	0,39725	0,40388
Allianz Bank Bulgaria*	0,24675	0,29220	0,01458	0,05224	0,23220	0,31779
D Commerce Bank	0,30968	0,21768	0,01706	0,04073	0,17539	0,41732
Piraeus Bank Bulgaria	0,15141	0,16667	0,01137	0,02869	0,13003	0,24475
Municipal Bank	0,00724	0,00072	0,00023	0,02938	0,12594	0,44247
Bulgarian-American Credit Bank	0,06973	0,09313	0,00711	0,03550	0,15744	0,16554
Central Cooperative Bank	0,13308	0,16723	0,00734	0,06225	0,27012	0,30258
First Investment Bank	0,00966	0,20784	0,00125	0,03180	0,14250	0,19219
Texim Bank	0,01361	0,00706	0,00061	0,03357	0,14579	0,70957
Tokuda Bank	0,03376	0,06331	0,00272	0,03402	0,15091	0,26837
International Asset Bank	0,03661	0,11894	0,00505	0,05580	0,24372	0,12109
United Bulgarian Bank	-0,36381	-0,10962	-0,00827	0,02278	0,09787	0,93033
Investbank	-0,12781	-0,40416	-0,01555	0,02810	0,12456	0,16013

* Allianz Bank Bulgaria's indicators are calculated according to the bank's reporting in 2016
Source: Calculated by the authors on the basis of financial reporting Bulgarian banks, 2017.

Table 8

Normalized individual rating indicators for the coefficients of the bank's lending and investment activity (Bulgaria)

Bank	Z_{7s}	Z_{8s}	Z_{9s}	Z_{10s}	Z_{11s}	Z_{12d}	Z_{13s}	Z_{14s}	Z_{15s}
Standard-bank	103,71590	34,21306	0,12786	0,72211	0,99898	0,91939	0,89385	0,11731	0,19550
DSK Bank	1	0,04880	0,00432	1	1	0,00083	0,04085	0,00471	0,07750
Eurobank Bulgaria	-0,14054	0,00155	0,31437	0,00149	0,02005	0,80916	0,98991	0,32646	0,25044
TBI Bank	0,02508	0,01404	1	0,03270	0,15295	0,89995	0,77481	1	1
Procredit Bank	0,01674	0,01786	0,24754	0,01543	0,23981	0,74033	1	0,25588	0,18453
Raiffeisenbank	0,01414	0,01845	0,24311	0,01852	0,26581	0,67115	0,89104	0,24366	0,24013
UniCredit Bulbank	0,01402	0,01913	0,19719	0,01572	0,25511	0,61577	0,86999	0,19460	0,22261
Expressbank	0,01450	0,01710	0,21372	0,01473	0,23423	0,65405	0,89684	0,20769	0,20093
Bulgarian Development Bank	0,02630	0,00291	0,19216	0,00124	0,03355	1	0,51115	0,18962	0,34599
Allianz Bank Bulgaria*	0,02306	0,01854	0,25726	0,01209	0,19331	0,79156	0,79641	0,23777	0,37079
D Commerce Bank	0,01921	0,02554	0,24521	0,01904	0,25441	0,63047	0,80080	0,22842	0,28653
Piraeus Bank Bulgaria	0,02160	0,02529	0,17758	0,01214	0,21007	0,59101	0,95058	0,14238	0,16114
Municipal Bank	1	1	0,18942	0,01106	0,21965	0,72353	0,84325	0,18179	0,38528
Bulgarian-American Credit Bank	0,04802	0,02154	0,24635	0,00645	0,12180	0,89431	0,80572	0,19914	0,22508
Central Cooperative Bank	0,03624	0,03974	0,20928	0,01340	0,23462	0,70488	0,63779	0,18720	0,29679
First Investment Bank	0,33467	0,34406	0,31222	0,01875	0,23230	0,74431	0,67026	0,24932	0,34918
Texim Bank	0,57103	0,69320	0,25263	0,01791	0,17852	0,48440	0,67440	0,24472	0,38556
Tokuda Bank	0,11840	0,11192	0,24812	0,01370	0,18903	0,65868	0,81179	0,21192	0,30479
International Asset Bank	0,04956	0,07487	0,19724	0,01740	0,30406	0,66294	0,66433	0,11248	0,24101
United Bulgarian Bank	-0,04054	-0,04864	0,25249	0,01769	0,25535	0,70099	0,92234	0,25908	0,22230
Investbank	-0,01776	-0,02695	0,21434	0,01900	0,28880	0,62678	0,75546	0,14458	0,35013

* Allianz Bank Bulgaria's indicators are calculated according to the bank's reporting in 2016
Source: Calculated by the authors on the basis of financial reporting Bulgarian banks, 2017.

Table 9

Normalized individual rating indicators for the coefficients of the overall effectiveness of the bank's activity (Bulgaria)

Bank	Z_{16s}	Z_{17s}	Z_{18s}	Z_{19s}	Z_{20s}	Z_{21d}	Z_{22s}	Z_{23d}	Z_{24s}
Standard-bank	0,43241	0,59821	1,48889	2,34412	2,48889	0,04731	0,72284	0,25794	5,75826
DSK Bank	1	1	1	0,96935	1	1	1	0,39366	0,65965
Eurobank Bulgaria	0,04709	0,6299	0,40611	1	0,64472	1	0,07475	1	1
TBI Bank	0,11369	0,53177	0,30088	0,29929	0,56582	0,57285	0,21379	0,40395	0,29550
Procredit Bank	0,04215	0,65515	0,43289	0,3107	0,66074	0,91559	0,06433	0,29148	0,30014
Raiffeisenbank	0,04901	0,70321	0,4877	0,38166	0,69353	0,58762	0,06969	0,31782	0,32022
UniCredit Bulbank	0,04009	0,65072	0,42809	0,66364	0,65788	0,50009	0,06161	0,62956	0,56971
Expressbank	0,04202	0,66836	0,44743	0,47418	0,66944	0,43621	0,06287	0,4304	0,36670
Bulgarian Development Bank	0,02083	0,56332	0,34137	0,61925	0,60599	0,4995	0,03697	0,73668	0,43810
Allianz Bank Bulgaria	0,03181	0,50869	0,29379	0,29169	0,57753	0,3111	0,06253	0,40321	0,33403
D Commerce Bank	0,03638	0,48617	0,27545	0,2207	0,56656	0,3254	0,07483	0,32539	0,27493
Piraeus Bank Bulgaria	0,02343	0,40532	0,21498	0,20031	0,53038	0,17889	0,05781	0,37841	0,41160
Municipal Bank	0,00054	0,01072	0,00434	0,00453	0,40437	0,39589	0,05037	0,42466	0,22522
Bulgarian-American Credit Bank	0,01463	0,27599	0,17812	0,16926	0,64537	0,1831	0,05300	0,38591	0,32867
Central Cooperative Bank	0,01646	0,28815	0,13989	0,19249	0,48546	0,26378	0,05712	0,55883	0,08759
First Investment Bank	0,00266	0,03296	0,01649	0,02138	0,50044	0,17692	0,08071	0,52656	0,34494
Texim Bank	0,00126	0,01257	0,00509	0,00428	0,40483	0,42509	0,10034	0,34161	0,23173

Tokuda Bank	0,00597	0,08243	0,03484	0,06967	0,42262	0,21862	0,07247	0,81218	0,49138
International Asset Bank	0,01135	0,19822	0,09008	0,12639	0,45447	0,09923	0,05724	0,56976	0,26304
United Bulgarian Bank	-0,0178	-0,2562	-0,08926	-0,1373	0,34839	0,80654	0,06930	0,62468	-0,05048
Investbank	-0,0344	-0,5229	-0,16004	-0,3116	0,30604	0,12413	0,06579	0,79081	0,30165

* Allianz Bank Bulgaria's indicators are calculated according to the bank's reporting in 2016
Source: Calculated by the authors on the basis of financial reporting Bulgarian banks, 2017
Ratings of Ukrainian banks (first and last 10 ratings) are given below (Table 10).

Table 10

Ratings of Ukrainian banks

Ukrainian banks	Ratings (BR)	Total assets	Profit for the year	Total equity
PJSC "Bank "Yunison"	19,24692247	553 960	25 832	214 744
PJSC "Bank Alians"	17,35205834	777 264	66 501	289 844
PJSC KB"Finansova initsiatyva"	16,86818969	13 491 669	652 345	-3 959 527
PJSC "IdeiaBank"	15,29282346	3 579 591	118 591	423 373
PJSC "A – Bank"	14,68391002	4 499 645	193 901	686 692
PJSC "Rozrakhunkovyi Tsentr"	14,23086597	263 238	6 390	211 838
PJSC "Sitibank"	14,04476145	19 001 051	357 697	1 822 352
PJSC "Bank "Portal"	13,92126085	235 154	7 272	208 635
PJSC "Europrombank"	11,23524385	641 627	8 709	309 029
JSC "Ukrsybbank"	10,7345069	46 576 672	878 946	5 571 498
…				
PJSC "Skai Bank"	-3,463318842	428 277	-37 018	223 757
PJSC "Ukrsotsbank"	-3,530390428	29 248 959	-2 387 554	5 156 639
PJSC "Megabank", Kharkiv	-4,043667963	9 129 353	-646 421	1 070 353
JSC "Ukreksimbank"	-4,258277645	171 011 254	-8 196 902	14 456 085
PJSC "Bank Kredyt Dnipro"	-4,624107116	9 411 152	-666 003	942 804
PJSC KB "Pryvatbank"	-5,775101332	259 061 473	-24 057 582	25 607 710
Ukr.Bank Rekonstruktsii ta Rozvytku	-7,821799985	210 781	-8 435	184 562
PJSC KB "Tsentr"	-9,515856978	296 132	-94 173	211 202
JSC "BM Bank"	-12,58025552	1 147 943	-230 815	249 127
PJSC "BTA Bank"	-37,49032925	1 086 290	-678 728	594 544

Source: Calculated by the authors

Analyzing Ukrainian banks' rating assessments and individual data on their financial reporting (aggregate assets, equity and profits) we can argue that the effectiveness of the bank and, accordingly, its place in the ranking relates to the level of profit or loss. Thus, more lucrative banks have high profitability indicators and show high ranking positions while unprofitable banks are the last in the ranking.

Independence of the total rating of the bank from the scope of its activities shows that proper management, balanced structure of assets and liabilities of the bank, the quality of capital, rather than its size, cost-effective credit and investment activities, optimization of administrative costs ensure the efficient work of the bank, which has the potential for gaining a significant share in the financial market.

Ratings of Bulgarian banks (first and last 10 ratings) are given below (Table 11).

Table 11

Ratings of Bulgarian banks

Bulgarian banks	Ratings (BR)	Total assets	Profit for the year	Total equity
DSK Bank	29,99944812	5 423	2 343	4 913
Eurobank Bulgaria	20,43454873	7 420 982	136 265	1236587
TBI Bank	15,86700264	688 306	30 517	164 075
Procredit Bank (Bulgaria)	14,35406137	1 975 401	32 165	216 669
Raiffeisenbank (Bulgaria)	18,18795128	7 199 157	137 304	930 898
Unicredit Bulbank	13,65275206	19 096 088	297 653	2 853 255
Expressbank	13,39932294	6 447 214	106 699	761570
Bulgarian Development Bank	11,43389222	2 472 243	20 145	745 001
Allianz Bank Bulgaria*	12,39196683	2 460 472	30 255	217 110
D Commerce Bank	10,67603077	758 501	10 730	103 359
Piraeus Bank Bulgaria	10,06206046	3 076 602	29 862	375 701
Municipal Bank	9,962177946	1 507 314	32	92 510
Bulgarian-American Credit Bank	9,306021496	1 240 099	7 830	176 285
Central Cooperative Bank	8,820679682	5411847	36814	461615
First Investment Bank	8,781109492	8 921 198	93651	944842
Texim Bank	8,25580105	220 005	120	35 629
Tokuda Bank	8,440514841	387 836	1 001	33 153
International Asset Bank	9,092546181	1 372 046	6 007	105 900
United Bulgarian Bank	6,438311075	7 358 141	-51029	976 063
Investbank	3,648800375	1 954 129	-29 333	152 187

* Allianz Bank Bulgaria's indicators are calculated according to the bank's reporting in 2016
Source: Calculated by the authors

Analyzing the scale and profitability of Bulgarian banks and their ratings, similar tendencies are observed: leaders and outsiders of the rating have approximately the same volumes of assets and equity; two banks that showed negative financial results for the year ended up at the end of the rating, while banks in the first half of the ranking have generally higher earnings than those in the second half of the rating. This again proves the direct dependence of the rating not on the volumes of aggregate assets and equity, but how effectively they are used by the banks.

Higher indicators in the rating indicate the proximity of banks to the "standard-bank" that is the leader with the highest cumulative indicator of capital-resource, credit-investment and overall effectiveness of operations. The higher density of distribution of rating points to individual banks shows both stability and homogeneity in terms of banking system performance of the country as a whole. As a result of bank's rating, we can state the general higher effectiveness of banks in Bulgaria. It should be noted that the highest performance of DSK Bank, in our opinion, is due to the fact that this bank specializes not in classical banking operations, but in the management of alien assets. Thus, the volume of foreign assets in the management of DSK Bank is 225,789 thousand levs, while the balance sheet of the bank is 5,423 thousand levs. Accordingly, the risks of DSK Bank's banking activities
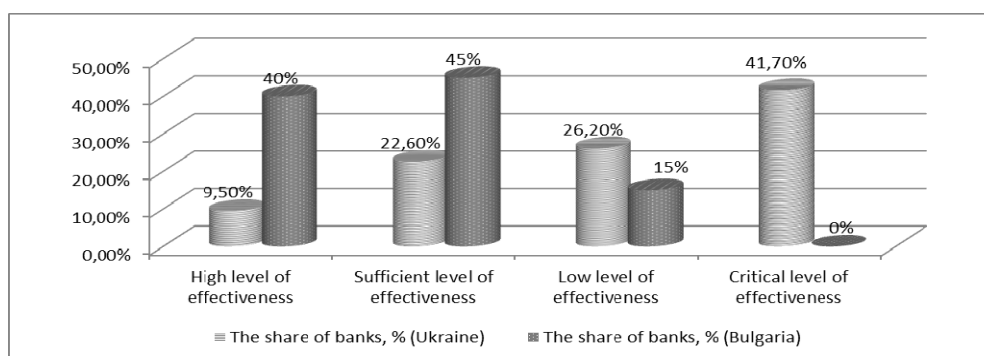
are significantly lower than the risks of banks in the same macroeconomic conditions; the ratio of income and expenditures is also significantly different. Regarding the last ten banks of Ukraine, due to the negative values of the final figures, we can talk about their low effectiveness, significant losses, and inefficient structure of expenses and incomes of the main banking activity. According to the rating results banks can be grouped according to the level of their activities effectiveness. The number of groups for the division is determined empirically, and the actual values of normalized indicators, taking into account their validity (spread of the final rating value), are the basis for grouping of banks.

There are the following levels of effectiveness of banks functioning according to the general score of BR:

1) $BR \geq 12$ – Strong bank – high level of effectiveness of the bank as a whole (profitability, optimal ratios and structure of expenses and incomes, adaptation of the main banking activity to actual market conditions);

2) $BR = [8;12)$ – Mediocre bank – sufficient level of effectiveness of the bank, capital-resource, credit-investment and overall effectiveness of the bank are at the proper level, the bank effectively invests accumulated financial resources;

3) $BR = [2;8)$ – Weak bank – low level of effectiveness of the bank, (the result of separate banking operations is negative, the structure of incomes and expenses is unsatisfactory);

4) $BR = (-R;2)$ – Loss bank – the critical level of effectiveness. (The Bank generates losses, individual banking operations, and the structure of incomes and expenses do not meet the necessary minimum values for the normal functioning of the bank). Graphically, the distribution of the number of banks in Ukraine and Bulgaria in terms of the effectiveness of operation is presented in Fig. 1, 2.
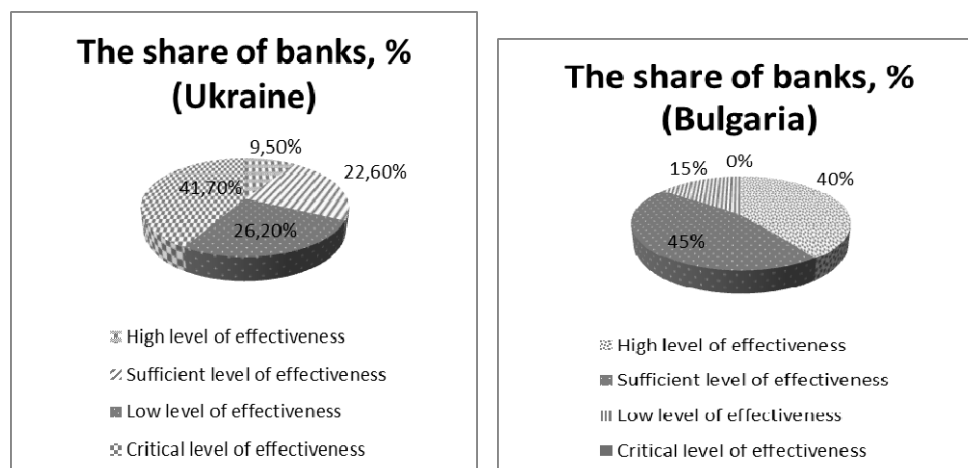
Figure 1

Distribution of the number of banks in Ukraine and Bulgaria according to effectiveness indicators

Source: Built by the authors

Rubakha, M., Tkachyk, L., Hamkalo, O., Demkiv, K. (2019). Integral Assessment of Banking Activity Effectiveness and Rating of Ukrainian and Bulgarian Banks.

Figure 2

The shares of banks in Ukraine and Bulgaria in terms of effectiveness

Source: Built by the authors

To confirm the adequacy of the received rating results, we can compare the ratings of individual banks of Ukraine with those of the international rating agencies.

Based on the results of comparisons across Ukrainian banks, we can say that estimates generally coincide with the exception of some deviations. This is acceptable given the differences in methodologies, the large number of banks in Ukraine, the polarization of their effectiveness, and the low popularity of international rating agencies' services among Ukrainian banks (Table 12).

Table 12

The credit ratings for some Ukrainian banks

Bank	Evaluation by the author's method (levels of effectiveness)	Evaluation by the rating agency
PJSC "KREDI AGRIKOL BANK"	9,63 (sufficient)	Fitch: B-
JSC "PROKREDYT BANK"	5,79 (low)	Fitch: B
PJSC "ALFA-BANK"	5,6 (low)	Fitch: B-
JSB "PIVDENNYI"	2,13 (low)	Moody's: Ca
JSC "OSHCHADBANK"	-2,45 (critical)	Moody's: Ca
PJSC "UKRSOTSBANK"	-3,53 (critical)	Fitch: B
JSC "UKREKSIMBANK"	-4,25(critical)	Moody's: Ca
PJSC KB "PRYVATBANK"	-5,77 (critical)	Moody's: C

Source: (Hrudzevych, 2017)

The credit ratings (end of 2017) for some Bulgarian banks are presented in the table 13.

Table 13

The credit ratings for some Bulgarian banks

Bank	Evaluation by the author's method (levels of effectiveness)	Evaluation by the rating agency
Procredit Bank (Bulgaria)	14,35 (high)	Fitch: BBB-
Raiffeisenbank (Bulgaria)	18,19 (high)	Fitch, Moody's: BBB-/Baa2
UniCredit Bulbank	13,65 (high)	Fitch: BBB-/-
Allianz Bank Bulgaria, 2016	12,39 (high)	Fitch: BBB+/-
Bulgarian Development Bank	11,43 (sufficient)	Fitch: BBB-

Source: (Directory and Country, 2019)

According to our ratings, 90% of Bulgarian banks show high and sufficient effectiveness in their work, which indicates the adequacy of results.

Besides assessing the relative level of the effectiveness of functioning within the rating of banks of a separate banking system, the proposed system of coefficients can be used to calculate the absolute indicator of effectiveness and stability of the bank's functioning. At the same time, giving a general (comprehensive) assessment of the effectiveness and stability of the bank's activity it is advisable to take into account, in addition to quantitative indicators, qualitative ones, which include the following: customer confidence (loyalty of depositors), image (reputation, record), comfort (respect to clients, professionalism of staff, the quality of internal communications), simplicity (clarity), transparency.Trust in the banking business is one of the key factors for successful business. Trust in terms of bank valuation will be reflected in the number of depositors and the structure of the deposit base (deposits of a large part of clients for longer terms indicate a high level of trust in the bank). Ensuring a long commercial success of a bank in a competitive market environment directly depends on its reputation (image).

Based on the openness of the ownership structure of the bank, business partners and final beneficiaries, the availability of audit findings from international companies, we can talk about such an indicator as transparency of the bank. (Gavurova, 2017). Openness to cooperation and high business activity on the national and international financial markets also testify about the transparency of the bank's operations. It is also expedient to include the comfort and ease of interaction between the bank and the clients to the qualitative performance indicators. Bank which offers a wide range of services for business and individuals, transparent and understandable tariffs, clear and flexible terms of cooperation, has branches in all regions of the country and even abroad, a large number of ATMs and terminals, developed infrastructure, established cooperation with other banks and a number of other similar characteristics – can be called simple and convenient for clients.

Given the quantitative performance indicators of the bank in the integral assessment, it is also necessary to take into account the risks associated with lack of equity capital. This is due to the peculiarities of the banking business, which is vulnerable to various economic fluctuations and is largely based on trust associated with possible risks.

In addition, banks in their pursuit to increase profit may not pay enough attention to risk management and thus, in the long run, not to be able to ensure stable activity and formulate

stress testing practices (Principles for sound stress testing practices and supervision, 2009). That is why for the formation of a balanced assessment of the bank's activities it is necessary to take into account, along with activity indicators, quality indicators of the capital-resource base. With this aim, a separate group of indicators of the bank's resource base structure, which includes the coefficient of reliability, independence and activity of deposit activity, is allocated in the integral indicator of the bank's activity.

The difficulty of defining the sufficiency of the bank's own capital lies in the calculation of its relative sufficiency that is why index analysis is the main instrument in evaluating the structure of the resource base. Therefore, we calculate these ratios as follows: the ratio of the bank's reliability – the ratio of equity to total liabilities, the index of independence – the ratio of equity to liabilities of the bank, the index of deposit activity – the ratio of deposits amount to liabilities of the bank.

The integral indicator of the bank's activity is calculated on the basis of qualitative indicators, indexes of capital-resource, credit-investment and overall effectiveness, as well as indicators of the bank's resource base structure and their value.

The integral indicator is the sum of bank points for each of the above groups of coefficients:

$$II = \sum_{j=1}^{5} Sj \tag{6},$$

Generalized assessment Sj for each group of the bank indexes can be calculated by using the formula:

$$Sj = \sum_{i=1}^{n} AijKij \tag{7},$$

Where: II is an integral indicator of the bank's activity;

S is a generalized assessment of the separate group of j indexes;

A is weight (value) of the i-financial index of the j-group.

K is calculated value of the i-financial index in the j-group. Indexes-disincentives of the methodology (Interest expenses management index, credit-deposit effectiveness index, administrative expenses index) are calculated with the mathematical symbol «-»;

In general, the higher the integral indicator of the bank's activity, the more efficient and stable the bank is, and vice versa, the smaller it is, the less efficient and stable the bank. According to the integral indicator of the bank's activity, the bank can be classified as strong, mediocre, weak or loss, the group is empirically derived from the calculation of the integral indicator of the bank's activity in Bulgaria and Ukraine (Table 14).

Table 14

Scale for determining the bank class by the integral indicator of the bank's activity

Indicator value	*Bank class*
More than 35	A (Strong bank)
Between 20 and 35	B (Mediocre bank)
Between 0 and 20	C (Weak bank)
Less than 0	D (Loss bank)

Source: Developed by the authors

However, counting the integral indicator, you should take into account the same nuances as in the ranking methodology. Thus, when calculating the integral estimate for a bank that has a significantly overestimated or understated individual coefficients relative to the average indicators in the system, one must understand that the assessment will be either overestimated or undervalued without a real financial and economic basis. Therefore, any serious imbalances in the final results of the indicator groups in the integral indicator of the bank's activity is a disturbing signal for the bank, which needs to be taken into account in future management. The matrix of the integrated assessment of banks performance is shown in Figure 3.

Figure 3

Matrix of integrated assessment of banks activity
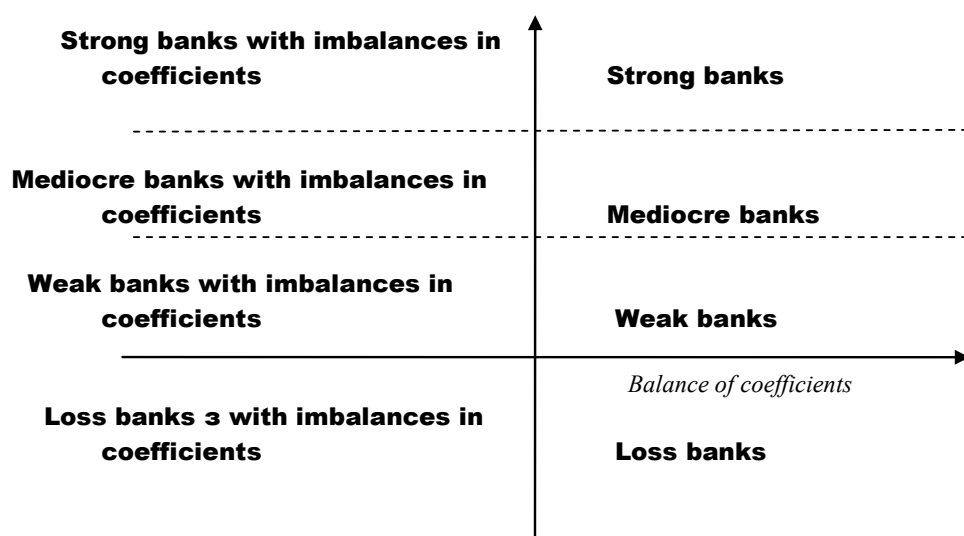
Source: Developed by the authors

Thus, a bank can be considered strong and stable, if it has a high integral indicator of the bank's activity and, at the same time, has no imbalances based on the results of the points

in the groups of coefficients. Accordingly, banks that have lower integral scores and balanced ratios refer to medium or weak banks. Those banks with negative financial results and unsatisfactory results of the overwhelming majority of the coefficients fall into the group of loss-making banks.

On the left side of the matrix are groups of banks that have imbalances with individual coefficients or groups of coefficients. Therefore, these banks need to pay particular attention to certain aspects of their activities, in particular, to increase the effectiveness or reduce the risks of lending and investment activities, to optimize the structure of the resource base, income and expenditure, or to pay attention to the qualitative characteristics of work, such as image, customer confidence, etc.

The integral indicator of the bank's activity in the example of the Ukrainian bank "Pat-A-Bank" is calculated in Table 15.

Table 15

The integral indicator of the bank's activity in the example of the Ukrainian bank "Pat-A-Bank"

№	Indicator	Theoretical value of the indicator (range of values)	Significant value of the indicator (A_{ij})	Estimated value of the indicator (K_{ij})	Indicator value for bank
I group – Qualitative indicators of the bank's activity					
1	Customer confidence	0-3	1	2	2
2	Image (reputation)	0-3	1	2	2
3	Transparency	0-3	1	2	2
4	Comfort, simplicity	0-3	1	2	2
Total in I group (S_i)					*8*
II group – The indicators of the bank's capital-resource effectiveness					
1	The coefficient of profitability of interest expenses	increase	1	*0.559292312*	*0.559292312*
2	The coefficient of return on equity	increase	3	*0.282369451*	*0.847108354*
3	The coefficient of profitability of attracted deposits	increase	1	*0.06613628*	*0.06613628*
4	The coefficients of coverage of the bank's obligations with absolute liquid assets	increase	2	*0.038578877*	*0.077157755*
5	The coefficient of the security of deposit activity with absolute liquid assets	increase	2	*0.040033774*	*0.080067548*
6	The coefficient of interest rate management	decrease	1	*0.26055962*	*(0.26055962)*
Total in II group (S_2)					*1.629762249*
III group – The indicators of effectiveness of the bank's lending and investment activity					
1	The coefficient of interest income in gross profit	increase	1	*4.716796664*	*4.716796664*
2	The coefficient of commission income in gross profit	increase	1	*1.645351008*	*1.645351008*
3	The coefficient of investment effectiveness in credit operations	increase	1	*0.254737639*	*0.254737639*
4	The coefficient of investment effectiveness in commissions and intermediary operations	increase	1	*0.08885964*	*0.08885964*
5	The commission income ratio	increase	1	*0.239775344*	*0.239775344*
6	The interest income ratio	increase	1	*0.68737402*	*0.68737402*

7	The coefficient of the credit-investment activity	increase	2	*0.92298462*	*1.84596924*
8	The coefficient of net interest margin	increase	2	*0.15817545*	*0.31635089*
9	The profitability ratio of credit operations	increase	1	*0.30461603*	*0.30461603*
Total in III group (S₃)					**10.09983048**
IV group – The indicators of overall effectiveness of the bank's activity					
1	The return on assets	increase	3	*0.054006492*	*0.162019475*
2	The return on revenue	increase	2	*0.145728992*	*0.291457984*
3	The return on costs	increase	3	*0.246048676*	*0.738146027*
4	The return on administrative costs	increase	1	*1.1787864*	*1.1787864*
5	The coefficient of coverage of the bank's total expenses	increase	3	*1.688398938*	*5.065196815*
6	The coefficient of effectiveness of credit and deposit activity	decrease	2	*0.37906527*	*(0.758130539)*
7	The effectiveness of using assets of the bank	increase	3	*0.370595382*	*1.111786146*
8	The coefficient of administrative costs	decrease	1	*0.208730501*	*(0.208730501)*
9.	The coefficient of coverage of administrative costs	increase	2	*5.68162731*	*11.36325462*
Total in IV group (S₄)					**19,91064747**
V group – Indicators of the structure of the bank's resource base					
1.	The coefficient of reliability	0,25	4	*0.180094677*	*0.720378708*
2.	The coefficient of independence	0,1-0,15	4	*0.152610363*	*0.610441452*
3.	The coefficient of activity of deposit activity	0,7-0,8	3	*0.816594035*	*2.449782106*
Total in V group (S₅)					3.780602266
Total					**43.42084246**

Source: Calculated by the authors

The integral indicator in the example of Raiffeisenbank (Bulgaria) is calculated in Table 16.

Table 16

The integral indicator of the bank's activity in the example of
the Raiffeisenbank (Bulgaria)

№	Indicator	Theoretical value of the indicator (range of values)	Significant value of the indicator (A_{ij})	Estimated value of the indicator (K_{ij})	Indicator value for bank
I group – Qualitative indicators of the bank's activity					
1	Customer confidence	0-3	1	2,5	2,5
2	Image (reputation)	0-3	1	2,5	2,5
3	Transparency	0-3	1	2	2
4	Comfort, simplicity	0-3	1	2	2
Total in I group (Si)					*9*
II group – The indicators of the bank's capital-resource effectiveness					
1	The coefficient of profitability of interest expenses	increase	1	8.467229036	8.467229036
2	The coefficient of return on equity	increase	3	0.147496289	0.442488866
3	The coefficient of profitability of attracted deposits	increase	1	0.028062921	0.028062921
4	The coefficients of coverage of the bank's obligations with absolute liquid assets	increase	2	0.20721288	0.41442576
5	The coefficient of the security of deposit activity with absolute liquid assets	increase	2	0.238904624	0.477809249
6	The coefficient of interest rate management	decrease	1	0.04968182	(0.04968182)
Total in II group (S₂)					*9.830016*

	III group – The indicators of effectiveness of the bank's lending and investment activity				
1	The coefficient of interest income in gross profit	increase	1	1.46684494	1,46684494
2	The coefficient of commission income in gross profit	increase	1	0.631233983	0,631233983
3	The coefficient of investment effectiveness in credit operations	increase	1	0.0310867	0,0310867
4	The coefficient of investment effectiveness in commissions and intermediary operations	increase	1	0.01337768	0,01337768
5	The commission income ratio	increase	1	0.265539527	0,265539527
6	The interest income ratio	increase	1	0.617053776	0,617053776
7	The coefficient of the credit-investment activity	increase	2	0.796462697	1,592925394
8	The coefficient of net interest margin	increase	2	0.02858376	0,05716753
9	The profitability ratio of credit operations	increase	1	0.0469468	0,0469468
	Total in III group (S₃)				***4,722176***
	IV group – The indicators of overall effectiveness of the bank's activity				
1	The return on assets	increase	3	0.0211929	0.06357869
2	The return on revenue	increase	2	0.4206674	0.8413347
3	The return on costs	increase	3	0.72612402	2.17837205
4	The return on administrative costs	increase	1	0.894666166	0.894666166
5	The coefficient of coverage of the bank's total expenses	increase	3	1.726124017	5.17837205
6	The coefficient of effectiveness of credit and deposit activity	decrease	2	0.080514571	(0.161029142)
7	The effectiveness of using assets of the bank	increase	3	0.05037923	0.1511377
8	The coefficient of administrative costs	decrease	1	0.81161448	(0.81161448)
9.	The coefficient of coverage of administrative costs	increase	2	1.843943143	3.687886287
	Total in IV group (S₄)				***12.99535***
	V group – Indicators of the structure of the bank's resource base				
1.	The coefficient of reliability	0,25	4	0.14850982	0,59403927
2.	The coefficient of independence	0,1-0,15	4	0.129306529	0,517226114
3.	The coefficient of activity of deposit activity	0,7-0,8	3	0.75519217	2,265576511
	Total in V group (S₅)				3,376841895
	Total				**39.9243817**

Source: Calculated by the authors

According to the results of the integral indicator of the bank's activity calculation and the results for groups of indexes, the analyzed banks can be classified as Class A (strong banks without imbalances, definitely strong banks), which indicates their high effectiveness and stability. The final value of the integral indicator and the results for individual groups of coefficients testifies to the balance of results in the areas of banking activity and in general indicates the profitability and high quality of bank management.

Conclusions

The developed rating methodology allows assessing the position of a particular bank relative to other banks in the banking system of the country in terms of the effectiveness of its activities. It is based on a multidimensional analysis of the bank's work (capital-

resource, credit-investment and overall effectiveness), which can be carried out on the basis of available public data. This rating is so valuable for the bank's management at the micro-level as it helps to determine the level of bank effectiveness in relation to other structures that operate in similar macroeconomic conditions.

The results of the methodology implementation in regard to the data about the Ukrainian and Bulgarian banks confirmed its scientific validity and applicability and made it possible to generate a rating of these countries' banks. The ratings of Ukrainian banks testify mainly to high polarization in effectiveness of their activities and a large number of loss-making banks, while with regard to Bulgaria, the situation is to an extent better: the range of rating indicator is much smaller and tight enough.

Based on the rating, banks in Ukraine and Bulgaria are divided into 4 groups: banks with high, sufficient, low, and critical activity level. It can be argued that the share of banks with high (40%) and sufficient (45%) effectiveness of activity in the banking system of Bulgaria significantly exceeds the number of such banks in Ukraine (9.5% and 22%, respectively). At the same time, banks with a low (26.6%) and critical (47.1) operating effectiveness levels prevail in Ukraine. Correspondingly, Bulgarian banks are more profitable and have an optimal revenue and expenditure structure.

Given the importance of risk and trust in banking activity, the methodology for an integrated assessment of bank's activity, in addition to the effectiveness factors, involves the inclusion of the sufficiency and qualitative indicators of the resource provision. The integral indicator of the bank's activity is a tool for the comprehensive assessment of the bank's activity and it can be used to analyze the absolute effectiveness of banks with different banking systems.

According to the number of total points a bank can be classified as strong, mediocre, weak or loss. The final points in the groups of the integral indicator and the location on the matrix of the integrated assessment of the banks' activity allow us to see what aspects of the bank's activities management should be pay attention in order to increase the effectiveness and stability of the bank.

The relevant directions for increasing effectiveness of Ukrainian and Bulgarian banks should be reducing the cost of activities; finding new sources of income through expansion of the areas of interaction between banks and economic entities; optimizing the structure of income, expenses and assets; and development of the resource base. Considerable attention should be paid to increasing the level of trust, transparency of activities, comfort and maintaining a positive image of banks in particular countries.

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STUDY OF THE DETERMINANTS OF THE ENTERPRISE'S CAPACITY TO ABSORB NEW TECHNOLOGIES

In modern times the business success of enterprises is more and more the result of the development of science and the accelerated introduction of new advances in technology. Innovations are becoming the key to success. In these conditions the importance of technological transfer also grows and it becomes a main "strategic way of meeting the challenges of globalization in business" (Mayer and Blaas, 2002). With the growth in importance of the transfer of technologies increases the interest in the theoretical elucidation and empirical research of various aspects of the absorption capacity of enterprises and its determinants, characterizing the capability for timely recognition, acquisition and use of new advances.

In view of the above, the aim of this paper is to present, in brief, an opinion on the determinants of the absorption capacity of enterprises and the factors that affect the formation of the them as well as the findings of empirical research of their state and impact on the intensity of technological transfer, innovative activity and business results of industrial enterprises in Bulgaria.

JEL: O32

Introduction

Fast developing scientific-technical progress and the formation of "knowledge economy" have made the competition more dynamic and have posed new challenges to enterprises. Deepening globalization leads to more intensive and complicated competition between firms and states. Changes in the needs and requirements of consumers, as well as the rapid pace at which current knowledge, technics and technologies become obsolete make their competitive positions unstable. New requirements to their functioning appear, at the basis of which is the necessity for constant and rapid changes and refinement. Business success is increasingly the result

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of the development of science and the accelerated introduction of new advances. Innovations become the key to success. The relative importance of non-material assets, of the social and cultural capital, as conditions for accelerated innovation and renovation, grows. Cheap natural resources and labour can be relied on to a smaller degree.

At the same time, the development of science cannot be the doing of a single person, laboratory, research organisation, university or state. It is the collective deed of people from various nations. In these conditions the innovative activity of enterprises cannot rely on the resources of the enterprise only but on outside achievements too. The enterprise will make use of them through technological transfer, which becomes a main "strategic way of meeting the challenges of globalization in business" (Mayer and Blaas, 2002).

Through the introduction of technological transfer enterprises not only make use of knowledge, experience and technical advances of others, but they accelerate and increase the effectiveness of their own innovative activity. They acquire technological knowledge tried out in practice, which reduces mistakes and failures. Through the acquisition of new advances at the appropriate stage of their life cycle, they overcome the initial, highly risky and very expensive stages of their development. This reduces investment in innovation and guarantees success and it is not necessary to have big research and development departments. At the same time, new knowledge is accumulated in enterprises and it positively impacts not only its innovation activity but also its overall activity. The transfer of new technologies in enterprises is related to the replacement of obsolete products, increase in effectiveness through the introduction of improved technological methods, new technics, cheaper components, attracting engineers and consumers, taking into consideration the specific technological requirements of the consumers (Larson, Wall, Norstrom, Crnkovic, 2006) and others. As a result, important competitive advantages are created and maintained, and high competitiveness is achieved.

Enterprises from different sectors of industry have similar access to knowledge, experience, technological capacity and technological developments of other companies and institutions. However, hardly all manage to take equal advantage of them. Thus, a question, which needs to be answered, arises "Why do some enterprises, under certain conditions of the outside environment, manage successfully and in a timely manner to adopt and use new technological knowledge and on that basis to develop well and others do not?".

The answer to that question is that different enterprises have different readiness to adopt new advances in their environment. Thus, the theory about the capacity of enterprises to adopt new technologies has evolved. This category characterises the capability of enterprises, in a timely manner, to recognise, adopt and use innovations. Its importance has been acknowledged by all authors who have done research on the issues of technological transfer.

The greater the topicality of the issues and the importance of the transfer of technologies the higher the interest in theoretical elucidation and empirical study of

various aspects of the absorption capacity of enterprises. The number of scientific publications in these areas of research is growing. However, a number of important issues need additional research, which justifies the need to conduct new studies in certain areas. Such an area of research is the study of the determinants of the absorption capacity and the factors that affect the formation of them, of how they impact the intensity of technological transfer, the innovative activity and the business results of enterprises.

In view of the above, the aim of this paper is to present an opinion on the determinants of the absorption capacity of enterprises and the factors that affect the formation of the them, and the findings of an empirical study of their state and impact on the intensity of technological transfer, innovative activity and business results of industrial enterprises in Bulgaria. The authors hope to instigate a discussion on these issues and other similar questions related to the topic, the results of which will aid enterprises in taking managerial decisions on both streamlining innovative efforts and investment, and developing strategies for further growth.

Determinants of the absorption capacity of enterprises

For the purposes of the present study technological transfer is viewed as a complex, iterative process of conscious, purposeful, common and contractual interaction between two or more organisations for transfer and implementation of new and useful information and knowledge, methods and processes, documentation, patents, software products, design, physical objects (products, machines and equipment, components, facilities, plants etc.) in the recipient organisation, which lead to an increase in the reserve of knowledge and/or to implementation of innovation in order to achieve the company goals (Velev, Atanasova, 2013).

It is also widely accepted that the capacity of the enterprise to absorb new technologies is its internal ability to identify, acquire and use external knowledge (acccording to the definition of Cohen and Levinthal, 1989). It is the result of the implementation of corporate strategies for success. In other words, the actions of the enterprises to form and develop the internal conditions for the acquisition of new knowledge is the key to success. The success comes to those enterprises, which persist and invariably create and develop the conditions needed to take advantage of the outside environment. Thus, they gain significant competitive advantages over other enterprises. That is why another important question is: "Which actions of the enterprise will lead to increasing its capacity to adopt new knowledge? That is to say, in conditions of resources limitation, where should the efforts be focused so that the results are best? This is the important question to be answered by determining the relative importance of each of the factors.

In the specialised literature there is a great variety of determinants (internal conditions) and factors that determine the absorption capacity of enterprises and affect it. According to Cohen and Levinthal (Cohen, Levithal, 1990) the absorption capacity is formed by the already accumulated knowledge in the enterprise and its staff and is the by-product of its research and innovation activities. For this reason they believe that it depends on the

individual absorption capacity of each member of staff (qualifications and knowledge staff have already acquired), it develops cumulatively through experience and depends also on the ability of the organisation to disseminate knowledge and to have communication between the members of staff. On that basis they build up a model of the absorption capacity (Cohen, Levinthal, 1990) showing the factors, which impact the amount of the allocated resources and efforts for research and innovation and the absorption capacity is the result from them. These factors are: a) technological capabilities of the environment – the quantity of available technological knowledge, potential refinements in technologies; b) characteristics of external knowledge that determine the ease with which it will be acquired by the firm – similarity with the internal needs, complexity, development; c) possibility for free dissemination of knowledge in the industry – as opposed to the degree of protection of intellectual property; d) competitiveness of the firm; e) demand – increasing demand and revenue elasticity; f) price elasticity.

The main limitations of this model are that it does not reflect capacity, as a process, which evolves and can be controlled, but looks at it as the by-product of the research and innovation activities of firms and ignores other important internal and external factors. It is focused only on the recognition of external technological knowledge but ignores its adoption and use.

The validity of the model is supported by a lot of authors (see Lane, Koka, Pathak, 2006). Other authors make an attempt to develop it further. Thus Hasan, S. et al. (Hasan, Othman, Mustafa, Wahab, Ismail, 2011) share the opinion that the absorption capacity is a function of knowledge accumulated in the enterprise through training, research and innovation and add the following determinants: a) capability of the employed in the firm, i.e. the ability of the staff to discover and acquire new information. It depends on their education, qualifications and experience; b) the ability of the firm to disseminate knowledge among its members of staff; c) corporate culture oriented at seeking for new opportunities; d) capability in the field of research and innovation. The intensity of research and innovation in the enterprise lead to the accumulation of knowledge and experience, generate a search for new technological opportunities and build up its absorption capacity; e) communication opportunities in the enterprise. They refer to the possibility to share information among the individuals and the departments in the enterprise in order to have common understanding of the assessment of new knowledge and action points.

In the specialised literature there are models of the enterprise's absorption capacity, which reflect the dynamic character of the process evolving under the supervision of the management. Thus, for example, (Volbersa, Foss, Lyles, 2009) points out the following main determinants: a) the conditions of the environment – dynamics, competition, characterisitcs of the knowledge available, mode of its dissemination; b) amount and structure of the knowledge the firm has; c) management – managerial knowledge, combinatory ability, development and dissemination of individual knowledge; d) organisation of the firm – form of organisation, system of stimuls used; information network, internal communication; e) intercompany interaction – generation and dissemination of knowledge, system of managing cooperation, network for the generation and transfer of knowledge, similarity between organisations.

The view of Lane P. et al. (Lane, Koka, Pathak, 2006), demonstrated in the model suggested by them, is similar. According to them the main factors forming the absorption capacity of the firms are: a) the conditions of the environment – they stimulate building up the absorption capacity; b) the characteristics of the available internal and external knowledge – they create conditions for broad and in-depth understanding; c) the characteristics of the relationships – they facilitate mutual understanding; d) corporate structure – it ensures focus on the recognition, understanding, acquisition and use of knowledge; e) the characteristics of the mindset model of the members of staff in the firm – it facilitates recognition, acquisition and use of knowledge; f) characteristics of the corporate structures and processes – they stimulate the efficiency and effectiveness of acquisition and use of knowledge.

As it can be seen in the specialised literature there is no unanimous position on the factors and determinants forming and developing the absorption capacity of firms. Even in cases when similar impact factors are given, their content is quite different. What is common for the models that have been developed is that they do not lay the stress on capacity as an object of management, i.e. as a category, which should be managed through the actions of the managers of the firms. Thus, they do not contribute much to defining ways for its improvement.

The variety of viewpoints on the essence and content of absorption capacity leave a stamp on the understanding of the results of its use, including the impact of the various determinative factors. Authors, who relate it mainly to the knowledge already accumulated in the enterprise and its staff, define them as accumulated new knowledge or view them as equal to the results from the research and innovation activities (Cohen, Levinthal, 1990; Nicholls-Nixon, 1993 -1; Rosenkopf and Almeida, 2003). Other authors expand the coverage of these results with increasing the competitiveness of firms. Thus, for example, Volbersa, H. et al. (Volbersa, Foss, Lyles, 2009) in their model point out that the results of the increase of the absorption capacity of the firm can be: attained competitive advantage, accelerated research and innovation activities, acquired new knowledge, improved exploitation of knowledge and assets and improved activities of the firm. In a similar way Lane P.et al. (Lane, Koka, Pathak, 2006) describes possible results, such as 1) related to the accumulation of knowledge (general, scientific, technical and organisational) and 2) commercial results (products, services and intellectual property).

Practically, the main result of increasing the absorption capacity of a firm is the accelerated technological transfer and results achieved by making it. Moreover, each transfer has a particular purpose and way of making it and that is why it has a specific result. However, it can be said that as a whole technological transfers are carried out for the purpose of introducing novelties, i.e. for the introduction of innovation and as a result of it for achieving competitive advantages and higher competitiveness. At the same time, the knowledge of the individuals and of the firm as a whole is increased. Thus, in our opinion, the results of increasing the absorption capacity and its determinants need to be observed in three stages – increase of corporate knowledge, results of the introduced innovation, enhanced competitiveness of the firm.

As a result of the analysis of the opinions of a number of authors, regarding the model of the absorption capacity of enterprises and their varying understanding of its components

and the factors, which determine it, the authors of the present publication propose the following model, developed in accordance with the definition of Cohen and Levinthal (Cohen and Levinthal, 1989).

Figure 1

Model of the capacity of enterprises to absorb new technologies
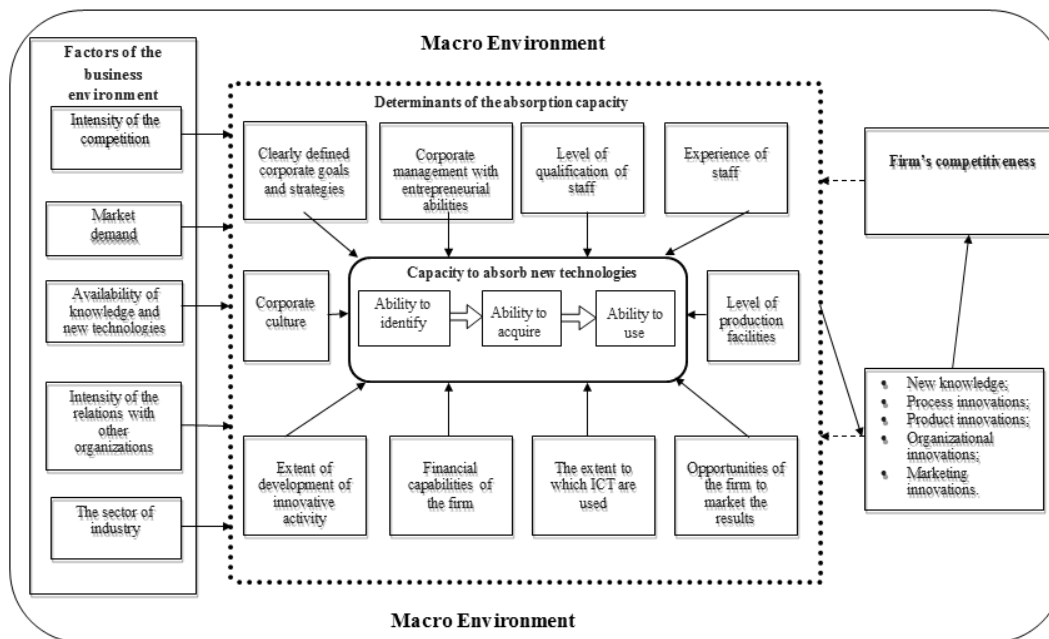
The determinants of the capacity of enterprises to absorb new technologies are internal for the enterprise factors, which create a potential for absorbing new technologies. The higher degree of their development facilitates the prompt acquisition of novelties in the enterprise and vice versa. The level of development of these factors is to a great extent the result of the development of the enterprise itself. It is a consequence of the efforts managers have made. The model uses the following system of key determinants of the absorption capacity of enterprises:

1. Clearly defined corporate goals and innovative strategies

In the first place, the clear objectives accepted by the staff, the developed innovative corporate strategies and structures guide and mobilize the staff to seek, acquire and apply the new knowledge and technologies needed to achieve them. Secondly, they are the basis for directing investment for technological transfer. Thirdly, with the defined priorities and the organisational structures, they facilitate the acquisition of knowledge and the fast effective dissemination and application of novel ideas and developments in the enterprise. In the fourth place, they are the basis for furthering the qualifications of the staff – an important condition for the acquisition of novel ideas and developments. In the fifth place,

they are the basis for establishing a mechanism for overcoming resistance and for motivating staff to acquire novel ideas and developments.

2. Availability of corporate management with entrepreneurial abilities.

It is the company management that bears responsibility for achieving the company goals and for the prosperity of the enterprise. Because of this it actively looks for ways to implement the strategies and is most sensitive to the arising opportunities for the enterprise including technological advances. To a great extent it depends on them which novel ideas and developments will be accepted and used. In order to these responsibilities company management must be highly qualified and possess entrepreneurial abilities – it must promptly recognize opportunities, take advantage of them, take the risk to implement them in the enterprise, motivate staff and bring the implementation of the technological advances to the desired end.

3. Level of qualification of staff

The acquisition of new knowledge is the result of the knowledge and qualifications of the individuals within the enterprise. The better qualified staff keeps track of novel ideas and developments, is interested in them, has ideas about how to introduce them in the enterprise, has the capability of participating actively in their successful implementation and use. It is for this very reason that the level of qualification of staff is widely accepted as one of the most important determinants of the capacity of enterprises to acquire new technologies.

4. Experience of staff

The experience of staff in the activity it performs, in innovation and the acquisition of novel ideas and developments is an indicator of the knowledge and skills accumulated in the enterprise. The more experienced the staff the more successful the introduction of new technologies.

5. Corporate culture facilitating the search for and the introduction of novel ideas and developments.

The corporate culture of the enterprise includes the practices, the expectations, the assessment, the principles and norms of behavior and activity of the staff. It affects their thoughts, feelings and interaction. It impacts the commitment, loyalty and the degree of satisfaction of staff. It influences the activity of seeking and their commitment in the acquisition of novel ideas and developments. Thus, it is of great importance for forming the absorption capacity of enterprise.

6. Level of production facilities.

The degree of development of the production facilities makes the enterprise face tasks of different complexity and forms different needs for new knowledge and technologies. It is believed that the more modern and developed these facilities are, the higher the needs for novel ideas and developments, on-going development, furthering the qualifications of staff, etc. It all positively impacts the capacity of the enterprise to acquire novel ideas and developments.

7. Extent of development of innovative activity.

Transfer of technologies leads to innovation, an innovative activity creates a need for and searches for new knowledge and technologies. Through their research and innovation companies practically acquire new knowledge and technologies. They accumulate and enhance the individual and collective reserve of knowledge of staff, which is of particular importance for the formation of absorption capacity.

8. Financial capabilities of the enterprise.

The good financial state of the enterprise provides opportunities to look for new ways of improving its activities and competitiveness. In such a situation it invests more and more resources in research and innovation and the introduction of new technologies. It brings about search for new knowledge and technological opportunities, highly qualified staff is recruited, the systems for motivating staff and furthering their qualifications are improved. That also leads to enhancement of the absorption capacity.

The financial state of the firm determines not only the amount of the expenditure for research and innovation. It is of great importance for the overall potential of the enterprise, for the scale of its activities, for its goals, guidelines and strategies for its development, etc.

9. The extent to which information and communications technologies are used.

The high degree of use of modern information and communications technologies is of critical importance for the fast acquisition, systematizing, acquisition, processing and use of external and internal information. Through them the fast dissemination and exchange of information within the enterprise is carried out. They assist in doing research and in the coordination of innovative activities. For these reasons, it is an essential determinant of the capacity of the enterprise to acquire new technologies.

10. Opportunities of the enterprise to market the results of the introduced new technologies.

The opportunities of the enterprise to market the results of the introduced new technologies aid their commercialization and the achievement of the desired economic effectiveness. Without the existence of that condition the enterprise would lose the economic interest from the introduction of new technologies and would diminish the extent to which it looks for them and acquires them. The aspiration to improve the marketing of the results itself brings about a search for new marketing methods and marketing strategies and also enhances the absorption capacity of the enterprise.

The enlisted determinants are factors, which create the potential of the enterprise to absorb new technologies, but they themselves are under the impact of some factors within the company, which also need to be taken into consideration. These are:

1. The size of the firm. The size of the firm is related to the different degree of provision with resources (human, financial, material, information resources) needed to carry out technological transfer and innovation. The lack of enough resources makes the research activity and the creation of novel ideas and developments difficult. At the same time, however, fewer bureaucratic obstacles and the flexibility of smaller enterprises are

favourable for the faster and easier acquisition and adaptation of the novel ideas and developments of others.

2. The degree of diversification of the activities of the enterprise. The degree of diversification of the activities of the enterprise – product diversification (assessed by means of the products/services provided) and customer diversification (assessed by means of the customer groups, markets, which the firm serves), without doubt complicates the activities of the enterprise. It affects the search for new opportunities for development, as well as the intensity of technological transfer and innovative activity.

3. Combination of various types of innovation. Normally, the innovative activities of enterprises are of complex nature, i.e. they simultaneously introduce several types of innovations. This is so because combining various types of innovation leads to better results. To put it in a different way there is a correlation and interdependence between them. Implementing one type of innovation brings about the introduction of yet another. That entails a search for varied new technological possibilities and leads to an increase in the absorption capacity of the enterprise.

4. Ownership of the enterprise. This is a factor of importance for countries like Bulgaria. The ownership of enterprises (Bulgarian or foreign) impacts their technological readiness and innovative activity. We can assume that foreign participation in the capital is a prerequisite for facilitated transfer of knowledge and technologies and leads to accelerated innovation.

5. Planning horizon of enterprises. Technological transfer, absorption capacity and innovative activity require clearly formulated goals and long-term mobilization of the resources and the efforts of enterprises. Quite often the results of the technological transfer and innovation are not expected immediately but after some time. In this respect it is logical to assume that enterprises which plan their activities over a long period of time are more innovative and have higher absorption capacity.

The factors of the environment impact mainly the corporate determinants of the absorption capacity and thus to a great extent create conditions for its enhancement or diminishing. Some of these are elements of the business environment and directly affect the determinants while others are elements of the macroenvironment (economic conditions, legal conditions, demographic conditions, scientific-technical progress, etc.) and directly impact the determinants and the factors of the business environment. The main factors of the business environment are:

1. Availability of knowledge and new technologies

The availability of the needed base of knowledge and new technologies for the development of the enterprises from a particular industry as well as their correspondence with the needs of the enterprises is of key importance for carrying out a technological transfer. As a source of novel ideas and developments, it is an important factor for the capacity of enterprises to absorb new technologies. It brings about an accumulation of knowledge, aspiration to identify the needed novel ideas and developments and their final implementation. This knowledge is formed at universities, research institutes and organisations, statistical institutes, in scientific literature, through results from research, etc.

The national base of scientific, technical and market knowledge is of importance but with the development of communications the worldwide base of knowledge grows in importance.

2. The sector of industry in which the enterprise operates.

The sector of industry in which the enterprise operates, influences its innovation activity mainly through the duration of the life cycle of the products it produces and the technologies it uses. The so-called "new" highly technological sectors have quite shortened cycles both of the products made and the technologies used. This necessitates the constant renewal of all aspects of their activities, i.e. the adoption of technological novel ideas and developments as well as making their innovative activity more intensive. For the opposite reasons it can be expected that the so-called "old" sectors will have a lower transfer of technology and innovation. It is logical to expect that the level of the capacity to acquire new technologies and the results of the introduced innovations due to the technological transfer are higher in the "new" sectors of industry.

3. Intensity of the competition on the markets where the firm sells.

Competition acts as an outside enforcement for enterprises to constantly perfect all aspects of their activities. In such conditions, the accelerated acquisition of novel ideas and developments and the implementation of innovation becomes the key for high competitiveness and market success. It can be assumed that the more intensive the competition, the stronger the outside push to increase the susceptibility of the enterprise to new technologies and as a result the higher the absorption capacity will be.

4. Market on which the enterprise operates.

Its export status and the market on which the enterprise operates influence its innovative activity mainly with the characteristics of the demand on the different markets. The size and the quality of the demand are of great importance for its competitiveness because they determine how enterprises accept, interpret and respond to customer needs. Demand applies pressure on firms for faster introduction of novel ideas and developments and thus creates competitive advantages.

5. Participation in professional unions and associations.

The participation of the enterprise in professional unions and associations is a prerequisite for facilitated transfer of knowledge and technologies and results in high absorption capacity and accelerated innovation. This fact has been confirmed by almost all authors, who have studied the issues of technological transfer and through a number of empirical research studies.

6. Partnership in the field of technological transfer with other firms.

Partnership with other firms is a factor of a strong impact in accelerating activity in the field of technological transfer and innovation. A number of research studies prove that the capacity of enterprises to absorb new technologies, when they have worked in partnership in the field of technological transfer with other firms, is higher than the average one for the

industry. Of course, partnerships with foreign enterprises, with Bulgarian or simultaneously with Bulgarian and foreign enterprises carry different importance.

7. Partnership in the field of technological transfer with universities.

Universities and scientific-research organisations are the main sources of new knowledge and technologies. It is expected for the absorption capacity of enterprises, which have worked in partnership with universities in the field of technological transfer, to be higher than the average one for the industry.

8. Location of the firm.

The location of the firm influences the transfer of technologies and its innovation activity mainly through the opportunity for easy and fast access to information about novel ideas and developments, through facilitated transfer of knowledge and technologies, the result of the proximity to enterprises from the same sector of industry, to suppliers or to enterprises from the servicing or supporting industries. The location also has an impact because the dwemand characteristics of the local market, etc.

The capacity of the enterprise to absorb new technologies and the technological transfers made on the basis of it lead to a number of positive results. In the first place, the innovative activity grows. The acquired new knowledge and the introduced innovations positively affect the business results of the enterprise and increase its competitiveness. They enhance its absorption capacity, which again leads to facilited acquisition of novel ideas and developments from the envronment.

Methodology

As it has been pointed out the aim of the empirical study was to 1) determine the state of the determinants of the absorption capacity of studied enterprises in Bulgaria and the factors which influence them; 2) to assess their impact on the intensity of technological transfer and the innovative activity of enterprises; 3) to assess their impact on the business results of enterprises. The findings of this research would facilitate the taking of management decisions about directing innovation efforts and investment as well as the drawing up of starategies for further development.

The approach adopted in the research is based on the collection, processing and analysis of considerable amount of empirical information from industrial enterprises in Bulgaria by means of a specially developed methodology of research and statistical methods and specialized software for processing and analysis of the information. The study was conducted with Bulgarian enterprises and covers a period of two years (2015-2016). It was carried out using the method of survey, the respondents being company managers. A specially prepared questionnaire was used and it was sent by post and e-mail to a large number of industrial enterprises. Unfortunately, because of the low percentage of returned questionnaires the chosen method had to be complemented with interviews at the workplace. The respondents shared their opinion on each of the questions using a grade system. The grade for each indicator is within the interval from 1 to 7. The lowest grade of

1 shows a very low level or importance, and the highest one of 7 – excellent state or maximal significance. The IBM SPSS Statistics 19 software product was used to process the results of the study.

The preliminary study of the literature gave us grounds to formulate the following research hypotheses: 1/ in the present stage of economic development of the country the level of the determinants of the absorption capacity of the studied enterprises is not high; 2/ there is a positive correlation between the level of the determinants and the intensity of technological transfer, innovative activity and the business results of enterprises.

In order to prove Hypothesis 1 we have studied the opinion of managers both of the level of development of the corporate determinants of the absorption capacity in their enterprises and the importance of the internal and external for the firms factors for forming them. To assess the determinant "Level of qualifications of staff" we used indicators "Part of staff with high education" and "Part of staff with technical education (secondary and tertiary)". The availability of such specialists is of importance for the introduction of new technologies in enterprises.

In order to prove Hypothesis 2, on the basis of the opinions of the respondent managers, first we assessed the importance of the determinants for making the technological transfer. It was recorded that they are of different importance for creating opportunities for enterprises to absorb various kinds of new technologies. In view of this, it was assessed separately for the following types of technological transfer (represented with T): Transfer of knowledge of importance for improving the activities of the enterprise but not directly leading to the introduction of innovation – T1; Transfer of technologies, leading to the introduction of product innovations – T2; Transfer of technologies, leading to the introduction of process innovations – T3; Transfer of technologies, leading to the introduction of organisational innovations – T4; Transfer of technologies, leading to the introduction of marketing innovations – T5.

In order to prove the positive effect of the level of the determinants of the absorption capacity on the technological transfer, innovation and business results, the enterprises in the survey were divided into two groups according to the level of development of their determinants: Group 1 – enterprises with a level below the average one for the survey and Group 2 – enterprises with a level over the average one. The aim was to compare them in terms of technological transfer and the achieved business results and on that basis to carry out a logical analysis and interpretation of the results.

Findings

The findings presented here are for 100 industrial enterprises from the whole country. The studied enterprises are not representative of the Bulgarian economy, but the results are interesting and indicative of the state of the factors affecting the absorption capacity and their impact on the corporate results. They can be discussed and serve as a basis for directing the efforts of the enterprises to improve their competitiveness.

Limitation of the size of the present paper does not make it possible to present the results of the conducted study. That is why we present only the summarized results for the whole number of studied enterprises.

Out of all the industrial enterprises in the study 60% are located in Sofia, 20% – in big cities and 20% in small settlements. The percentage of small and medium-sized enterprises in the study is 80. It was found out that in 2015 48% of the studied enterprises implemented innovation and in 2016 – 62%. This percentage is higher than the data about innovative enterprises in the industry given in the official statistics of the country (Statistical yearbook. 2016). This is mainly due to the lack of representativeness of the present research. It was found out that most of introduced innovations by enterprises resulted from technological transfer, i.e. they were introduced on the basis of acquired external knowledge, methods and processes, documentation, patents, software products, design, physical objects. Over the research period technological transfer was made by 44 of the studied enterprises in 2015 and 60 in 2016. Only a small part of the innovations are introduced from their own means and they are at a low level of novelty and importance of change.

According to the managers interviewed, the innovations introduced by their enterprises (and the technological transfers which caused them) were not at a high level of novelty and significance of change. What should be noted is that during the research period the number and the level of the marketing innovations rise. A drop in the level is observed with product innovations. The grades for the level of innovation demonstrated that in the enterprises there were usually small, insignificant changes with a low level of novelty, which require less expenditure and lead to lower effectiveness. It is logical to expect that it affected the economic results.

We can suppose that the comparatively not high level of innovation and technological transfer, assessed as a degree of novelty and significance of the change is due to the not very level of the absorption capacity and the determinants forming it. The study confirmed that supposition. The grades of the managers, who participated in the survey, when summarized for the whole study, and defined within the range from 1 (very low level) to 7 – the highest level, are shown in Table 1.

The average level of all determinants of the absorption capacity for all the studied enterprises is 3.71 for 2015 and 3.91 for 2016. For the two years, it is slightly over the average level of the assessment scale and is certainly not enough to conduct intensive and qualitative technological transfer. The major part of the determinants are not well developed in the enterprises and the efforts of the managers need to be focused on their improvement. Still there is some improvement in 2016.

The level of determinants of enterprises, which did not carry out technological transfer over the research period, is lower than that of enterprises which have made one. The average level of all determinants for enterprises, which did not make a technological transfer, is 3.22 for 2015 and 3.25 for 2016, and only one 1 of these enterprises has an average level higher than the average one for the whole study over the two years. That result is indicative of the importance of the determinants.

Table 1

The level of the determinants of the absorption capacity for the studied enterprises

Determinants	Level of determinants	
	2016	2017
1. Clearly defined corporate goals and innovative strategies	3.0	3.1
2. Availability of corporate management with entrepreneurial abilities	4.2	4.3
3. Part of staff with high education	3.6	3.7
4. Part of staff with technical education (secondary and tertiary	4.2	4.0
5. Experience of staff	4.1	4.2
6. Corporate culture facilitating the search for and the introduction of novel ideas and developments	3.1	3.1
7. Level of production facilities	3.8	4.4
8. Extent of development of innovative activity	3.7	3.8
9. Financial capabilities of the enterprise	3.0	3.3
10. The extent to which information and communications technologies are used	5.3	5.9
11. Opportunities of the enterprise to market the results of the introduced new technologies	2.9	3.2

The grades are within a range from 1 – very low level, to 7 – the highest level

The specified determinants, which create the potential of the enterprise to absorb new technologies, are affected by some internal company factors, which also need to be considered and on which the efforts of the mangers need to be concentrated so that they are improved. The study demonstrated that managers appreciate the importance of these factors. The averaged results obtained are (D1 to D11 stand for the respective determinants of the absorption capacity) (Table 2).

Table 2

Importance of the internal corporate factors in forming the determinants of the capacity of enterprises to absorb new technologies

Factors in forming the determinants	Importance of the factors in forming of specific determinant											Overall importance in forming the absorption capacity
	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	
1. The size of the firm	6.0	4.2	5.1	5.2	4.0	4.3	6.2	6.1	5.8	4.8	6.3	5.27
2. The degree of diversification of the activities of the enterprise	5.2	5.7	4.2	3.3	5.1	5.3	5.4	6.0	4.8	6.2	6.0	5.20
3. Combination of various types of innovation	5.0	4.2	4.9	4.8	5.1	4.4	4.0	6.6	5.0	6.7	5.8	5.14
4. Ownership of the enterprise	6.1	4.1	3.2	3.3	4.0	4.1	6.0	4.2	5.2	5.5	6.2	4.72
5. Planning horizon	6.6	5.2	4.0	4.1	4.2	6.0	5.2	6.1	4.3	5.5	5.0	5.11
Overall importance	5.8	4.7	4.3	4.1	4.5	4.8	5.4	5.8	5.0	5.7	5.9	5.1

The grades are within a range from 1 – very low level of importance, to 7 – the highest level of importance

Managers attach greater significance to the size of the enterprise, as a factor in forming the determinants of its absorption capacity. Apparently, they relate it to better provision of big enterprises with resources and their capability to further the qualifications of staff needed for its development, technological transfer and innovations. Such is the opinion mainly of respondents from small and medium-sized enterprises, which is 80% of the study. According to them, the shortage of resources makes research activity and innovations more difficult to happen. It is explicable that diversification of activities is also of great importance for the development of the absorption capacity. It makes the activities of enterprises more complex and acts as enforcement for the management to seek ways to improve their state. The overall impact of the studied factors is different for the different determinants. The strongest impact concerns the following determinants: "Degree of development of innovation", "the possibility for the enterprise to market the results of the introduced new technologies" and "Degree of use of ICTs". The managers who participated in the study point out different positive influence of the factors of the business environment on the formation of the corporate determinants of the absorption capacity. Their average estimates are shown on Table 3.

Table 3

Importance of the factors of the business environment in forming the determinants of the capacity of enterprises to absorb new technologies

Factors of the business environment	Importance of the factors in forming of specific determinant											Overall importance in forming the absorption capacity
	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	
1. Availability of knowledge and new technologies	3.1	3.2	3.2	2.9	3.1	4.2	4.3	5.0	1.3	6.2	4.0	3.68
2. The sector of industry in which the enterprise operates	3.2	3.5	5.3	4.2	2.5	4.3	5.4	6.6	4.0	5.6	4.4	4.45
3. Intensity of the competition on the markets where the firm sells	5.5	5.6	5.3	4.1	4.2	5.9	6.3	6.5	3.2	6.4	5.9	5.35
4. Market on which the enterprise operates	4.6	5.3	5.0	3.1	4.1	6.2	5.8	6.1	4.0	6.2	5.0	5.04
5. Participation in production unions and associations	3.1	4.2	4.1	3.2	4.0	4.3	4.8	5.0	4.5	5.2	4.9	4.3
6. Partnership in the field of technological transfer with other firms	4.1	3.5	3.1	3.0	3.5	4.2	4.0	5.1	4.6	4.0	3.8	3.9
7. Partnership in the field of technological transfer with universities	4.0	3.2	4.5	4.0	3.7	4.5	4.2	5.8	4.4	5.2	3.9	4.31
8. Location of the firm	3.8	4.0	3.1	2.2	2.5	3.7	3.2	3.9	3.0	4.2	4.0	3.42
Overall importance	3.9	4.1	4.2	3.3	3.5	4.7	4.8	5.5	3.6	5.4	4.5	4.31

The grades are within a range from 1 – very low level of importance, to 7 – the highest level of importance

According to the managers the most positive influence on the absorption capacity and its determinants is the intensity of the competition and the characteristics of the demand on the different markets. They relate this fact to the pressure, which the competition and the size and quality of demand put on the firms for faster introduction of new ideas and developments. The least importance they attribute to the location of the firms and the availability of knowledge and new technologies. That can be explained with the development of communications and the free dissemination of knowledge globally, which facilitate access to them and their transfer. We should note the relatively low importance, which is given to partnership in the field of technological transfer with other firms, which is apparently due to the insufficient development of clusters and various other forms of cooperation among organisations in the country.

The assessment of the managers who participated in the study is that the overall positive impact of the studied **factors of** the business environment is the strongest one in forming the determinants "Degree of development of innovative activity" and "Degree of use of ICT". This impact is the weakest for determinants "Share of staff with technical education (secondary and tertiary)" and "Experience of staff", the formation of which is mainly a function of the managerial efforts of corporate managers.

To prove or disprove hypothesis 2 of the research, we have studied the opinion of managers of the importance of the determinants of the absorption capacity of enterprises that form their capability to adopt new technologies. It was noted that they have a different impact both on the adoption of different types of technologies and on the capacity of the enterprise for technological transfer as a whole. The grades for the significance of the determinants of the absorption of new technologies are within the range from 1 to 7 (Table 4).

As it can be seen from the table the managers who participated in the study grade relatively high the importance of the determinants for carrying out quality technological transfer and innovation. The highest importance is attached to the availability of staff with higher education and use of ICT. However, what stands out is the lack of recognition to a certain degree of some of the determinants, which could reflect on the management efforts to improve them. What is more, the determinants of the absorption capacity do not act on their own but as a combination. The lower level of development of one or several of them would mean diminishing the level of the absorption capacity as a whole.

In the managers' opinion, the determinants of the absorption capacity are of the greatest importance for having technological transfers leading to successful product and process innovations in enterprises. It should be pointed out that the grades about the importance of the determinants given by managers of enterprises, which did not have a technological transfer during the research period, do not differ significantly from those of the managers of the other enterprises.

For the purposes of the present research the enterprises in the survey were divided into two groups according to the level of development of their determinants of the absorption capacity: Group 1 – enterprises with a level under the average one for the study, Group 2 – enterprises with a level over the average one. The aim was to compare them in terms of technological transfer and accomplished business results.

Table 4

The importance of the determinants of the absorption capacity of enterprises that form their capability to adopt new technologies

Determinants	Importance for the specific technology transfer					Overall importance in forming absorbtion capacity
	T1	T2	T3	T4	T5	
1. Clearly defined corporate goals and innovative strategies	6.3	6.0	5.8	4.3	4.9	5.46
2. Availability of corporate management with entrepreneurial abilities	4.2	5.8	5.0	4.1	4.6	4.74
3. Part of staff with high education	5.8	6.2	6.8	4.7	5.2	5.74
4. Part of staff with technical education (secondary and tertiary	3.2	4.6	4.9	3.0	2.2	3.58
5. Experience of staff	4.1	5.6	6.2	2.1	2.4	4.08
6. Corporate culture facilitating the search for and the introduction of novel ideas and developments	6.4	6.2	5.8	4.3	5.2	5.58
7. Level of production facilities	4.2	4.1	4.4	2.1	1.4	3.24
8. Extent of development of innovative activity	5.5	6.3	6.2	5.2	4.8	5.60
9. Financial capabilities of the enterprise	3.1	6.2	6.7	3.1	3.0	4.42
10. The extent to which information and communications technologies are used	6.3	5.4	5.2	5.8	5.6	5.66
11. Opportunities of the enterprise to market the results of the introduced new technologies	1.2	6.8	4.4	3.0	5.8	4.24
Overall importance for the specific technology transfer	4.57	5.75	5.58	3.79	4.1	4.76

The grades are within a range from 1 – very low level of importance, to 7 – the highest level of importance

It was established that the main part of innovations in the enterprises were the result of a horizontal transfer of technologies, i.e. transfer of technologies from one organisation to another within the same stage of their life cycle. A small part of the technological transfers were vertical, i.e. they were transfers of new technologies in different stages of their life cycle from research organisations to the place (organisation) of their adoption. This is indicative of the bad cooperation in the field of innovation between enterprises and universities and scientific-research organisations. In 2015 only 3 of the transfers were vertical, and all of them are in enterprises from Group 2. In 2016 they were only 7 and only one of them 1 is in an enterprise from Group 1.

According to the managers who participated in the study, the technological transfers made by their enterprises were of relatively low level in terms of the degree of novelty and significance of the change. For 2015 their average level is graded as 3.46 for Group 1 and

3.65 for Group 2, and for 2016 – 3.46 and 4.10 respectively. This is characteristic of innovations, caused by the respective transfers. There is a slight trend for a step-by-step transition from the introduction of insignificant technological transfers to having larger ones but the lagging behind of the enterprises in Group 1 is obvious. There is a difference in the technological transfers, which can be seen in Table 5.

Table 5

Number of technological transfers by group of enterprises according to the level of the determinants of the absorption capacity

| № | Type of the technological transfers | Technological transfers made by the group of enterprises | | | |
| | | 2016 | | 2017 | |
		Group 1	Group 2	Group 1	Group 2
1.	Transfer of technologies, leading to the introduction of process innovations	3	6	4	9
2.	Transfer of technologies, leading to the introduction of product innovations	5	8	6	11
3.	Transfer of technologies, leading to the introduction of organisational innovations	3	4	2	5
4.	Transfer of technologies, leading to the introduction of marketing innovations	2	5	3	8
5.	Transfer of technologies, leading to the introduction of complex innovations (simultaneously several types of innovations)	1	5	2	6
	Overall	14	28	17	39

It should be mentioned that some of the enterprises have had more than one technological transfer, and some transfers have brought about more than one innovation.

The assessment of the impact of the determinants of the absorption capacity on the business results of the enterprises is based on the understanding that they are conductive to the introduction of technological transfers and innovation, which in turn improve the overall results of enterprises. In order to determine that impact we compared the grades of the managers, from the first and the second group, about the dynamics of some indicators of their enterprises. The grades for the achieved change, as compared to those from the previous year, are within a range from 1 – no improvement has been made, to 7 – a great improvement has been made. The summarized results are presented in Table 6.

These results demonstrate a positive correlation between the level of the determinants of the absorption capacity of enterprises and the business results. It becomes obvious not only from the difference observed between the indicators of the two groups of enterprises, but also by the noticeable trend for their improvement in the second year. The better level of the determinants was conductive to the introduction of successful technological transfers and innovations, which led to the improvement of the business indicators too. However, the improvement of some of these results is also due to the improving economic situation in the country. What is more, the improvements are the result of not only the innovative efforts in the two years but also of such efforts in previous years. The results from previous years

were due to the level of the determinants then, but the results have also contributed to the improvement of the state of the determinants.

<div align="right">Table 6</div>

<div align="center">Positive results for the enterprises</div>

№	Results	Enterprises from group 1		Enterprises from group 2	
		2016	2017	2016	2017
1.	Increase of the production capacity	1.2	1.6	3.2	4.5
2.	Enhancement of the flexibility of the activities of enterprises	1.0	1.3	1.5	2.9
3.	Improvement of the conformity with standards	3.1	3.0	3.2	3.8
4.	Improvement in the protection of the environment	1.3	1.5	2.7	4.0
5.	Improvement of the quality of management activity	1.3	1.3	3.1	3.5
6.	Improvement of the quality of marketing activity	2.4	3.1	4.4	5.0
7.	Enhancement of the quality of products/services	3.2	3.6	4.5	5.6
8.	Increase in sales	2,1	2,9	3.7	4.8
9.	Rise in labour productivity	1.9	2.3	3.5	4.3
10.	Reduction of costs per unit of production in enterprises	3.1	3.4	4.3	4.5
11.	Improvement of the financial results of enterprises	2.9	3.2	3.8	4.1
12.	Improvement of the competitiveness of enterprises	2.3	2.5	3.6	4.5

The grades are within a range from 1 – no improvement has been made, to 7 – a great improvement has been made.

Conclusion

The paper presents an opinion on the determinants of the absorption capacity of enterprises and the factors that affect the formation of them, and the findings of an empirical study of their state and impact on the intensity of technological transfer, innovative activity and business results of industrial enterprises in Bulgaria. Due to the limited number of enterprises, which were included in the survey the obtained results are not representative for the Bulgarian industry as a whole but are interesting and indicative of the effect of the improvement of determinants of the absorption capacity and their impact on the business results. They can be the basis of discussion and can serve to direct the efforts of enterprises to improve their competitiveness.

Hypothesis 1 of the research has been proven. It was established that the average level of the determinants of the absorption capacity for all the studied enterprises is not high. For the two years of 2015 and 2016 it is slightly over the average level of the grading scale (from 1 to 7) and is definitely not enough to have an intensive and quality technological transfer. The greater parts of the determinants are not well developed in the enterprises and their improvement should be a priority for the management efforts. Regarding the improvement of the state of the determinants, it was found out that a number of internal corporate factors have considerable impact on the formation of the determinants of the absorption capacity and managers should also put in efforts to improve them. The study has

shown the different importance of the factors of the business environment. Taking them into account is important for achieving success.

The study has confirmed the second research hypothesis that there is a positive correlation between the level of the determinants and the intensity of technological transfer, innovative activity and business results of enterprises.

According to the managers, the importance of the determinants for having a quality technological transfer and innovation is relatively high. They attach the greatest importance to the availability of staff with higher education and use of ICT. According to their grades the determinants of the absorption capacity are of the highest importance for making technological transfers leading to successful product and process innovations in enterprises.

According to the experts participating in the study, the group of enterprises with an average level of determinants of the absorption capacity at or over the average level for the study have significantly more intensive activity in the field of technological transfer and innovation than the other group. That is true for the different kinds of technological transfers, but mostly for transfers, which have led to product and process innovations in the enterprises.

It also became obvious that most of introduced innovations by enterprises were the result of horizontal transfer of technologies. Only a small part of the technological transfers were vertical and they were mostly made by enterprises with a relatively higher level of determinants.

According to the managers who participated in the study, the technological transfers of their enterprises were of a relatively low level in terms of the degree of novelty and significance of change. That is characteristic also of innovation caused by the transfers. The level of novelty of enterprises with a level of determinants under the average one for the studied enterprises is also lower.

What was also confirmed was the positive correlation between the level of determinants, the absorption capacity of enterprises and their business results. There was a difference in the indicators of the two groups of enterprises (with a level of determinants over and under the average for the survey), as well as a different tendency for their improvement in the second year of the study. The better level of the determinants was favourable for the introduction of successful technological transfers and innovation, which in turn lead to the improvement and of business indicators of enterprises.

As a whole, the research findings demonstrate the great importance of determinants of the absorption capacity for the competitiveness and business success of enterprises. The study is a good base for channelling managerial efforts in the right direction in order to ensure sustainable development of enterprises.

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CARGO FLOWS MANAGEMENT MODEL OF NETWORK AIR CARRIER

This paper describes modeling of cargo flows management of a network air carrier by a model that allows to use the advantage of well-developed packages that implement linear programming methods. Several characteristics of the underlying mathematical models are presented and the stages of the modeling process are determined.
JEL: C6; R42; L93

Introduction

The issues of simulating the networks are extensively studied in the last years (Ford Jr., Fulkerson, 2010; Vitanov, Vitanov, 2016, p. 108-114; Vitanov, Vitanov, 2018, p. 635-650). Especially interesting is the research on flows of networks connected to airports and airlines. Several examples of such research are: planning the network of air transportation, service routing and planning of the crew schedule (Schön, 2008); sequential modeling of

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airline networks (Barnhart, Cohn, 2004, p. 3-22); modeling cargo flows (Derigs, Friederichs, Schäfer, 2009, p. 370-380; Schön, 2007, p. 362-366); determining airport hubs (Alumur, Kara2008, p. 1-21); infeasibility of accounting for economies of scale in the modeling of airline networks (Kimms, 2006, p. 293-317); effect of the implementation of "SolidWorks" systems of three-dimensional parametric modeling in the organization of delivering super heavy and oversized cargoes (Lytvynenko, 2012, p. 170-175). Below we consider the problem of cargo flows management of a network air carrier on the basis of logistics and discuss a two-stage model of cargo flows management. This model includes a mathematical model of rapid response in the short-term time interval, as well as a non-linear multi-product transport flow model that allows to quickly take into account information uncertainties and the risks of decreasing demand for the air carrier services.

Models and results

The models of cargo transport flows are described in detail in (Voitsehovskiy, 2016, p. 34-41; Voitsehovskiy, 2017, p. 50-55) (especially the mathematical part of the model is discussed in (Voitsehovskiy, 2017, p. 50-55)). The model of carriage flows describes the selection of cargoes and the dynamics of their carriage at fixed prices for transport and fixed demand. The non-linear dynamic model of carriage flows' planning (Voitsehovskiy, 2017, p. 50-55) describes the process of planning the sales of carriage volumes, taking into account the possibility of variation in the prices of transportation and the impact of prices on demand. In the non-linear dynamic model of carriage flows planning many variants of cargo carriage contracts are considered. Within the framework of the contract variant, both the category of cargo and the price of carriage are taken into account, as well as the initial and final period of carriage, the time interval between the conclusion of the transaction and the carriage commencement. We note that the above models have many variables and limitations and from a practical point of view, solving a problem with such a large number of limitations and variables may be problematic. Therefore we propose to reformulate the problem of cargo flows management as a two-stage one, which has made it possible to take advantage of well-developed packages, which implement linear programming methods.

The stage-by-stage approach of modeling in the process of implementing the system of cargo flows management of a network air carrier based on logistics is presented in Figure 1.

The planning of airline operations may be conditionally divided into three stages according to the time period being covered. This is forecast, ongoing and operational planning. These variants are compatible with all three proposed models. The models from Figure 1 are linked between each other by the use of the same input information about the environment in which the airline operates, about the airline itself and information exchange, as for one model it is the input information while for the other it is the output information. The models are distinguished by the detailed nature of the information used and by the detailed description of the transport process.

Figure 1

Stage-by-stage approach of modeling within the process of implementation of cargo flows management of a network air carrier based on logistics
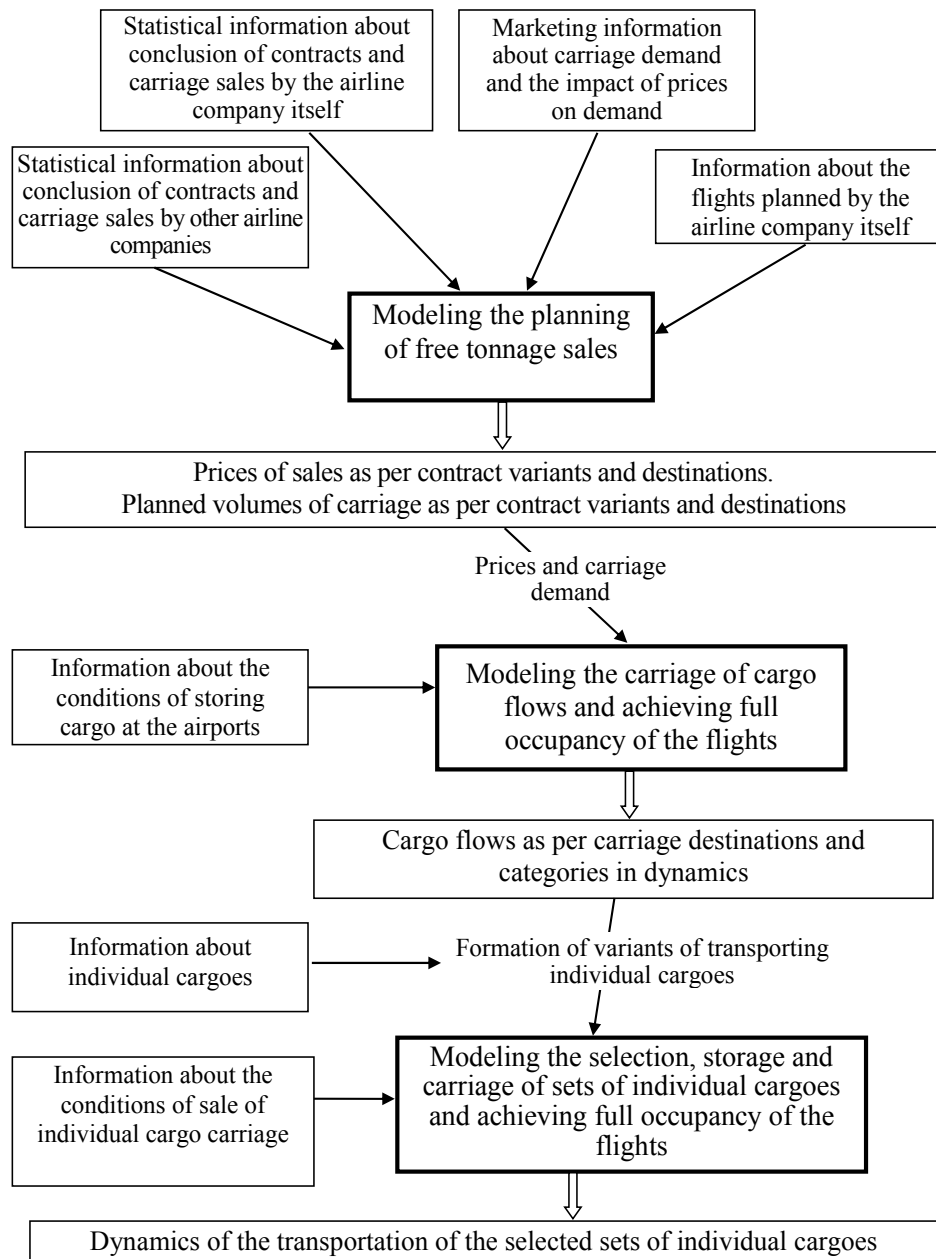
The cargo flows are analyzed in the proposed model as per carriage destinations and categories in dynamics. On the grounds of information about individual cargoes, options for carriage of individual cargoes are formed. These data and information on conditions for the sale of individual cargoes carriage comprise the initial data for modeling the selection, storage and carriage of a variety of individual cargoes. Thus achieving full occupancy of the flights on the grounds of which the dynamics of carriage of the selected set of individual cargoes is established. We note that to model the planning of free tonnage, it is necessary to provide detailed statistical information on the concluded contracts and the carriage orders sold by the airline itself and by other carriers, marketing information about carriage demand and the impact of prices on demand, as well as information about the flights planned by the airline itself. Subsequently, the carriage prices are determined subject to the contract variants and destinations, as well as the planned volumes of carriage subject to the contract variants and destinations. Based on this data and information about the conditions of cargo storage at airports, the modeling of transporting cargo flows traffic and achieving full occupancy of the flights is carried out. The characteristics of the above models are shown in Table 1.

Table 1

General characteristics of the elaborated mathematical models

Characteristic	Linear dynamical model of transport flows	Model of operational management of cargo flows in real-time mode	Non-linear dynamical model of transport flow planning
Designation	Carriage planning	Carriage operational management	Planning of free tonnage sales
Model type	Linear dynamical	Linear dynamical	Non-linear dynamical
Variable	Continuous	Continuous and Boolean	Uninterrupted
Admissible dimensions	May be large	Limited by the possibilities for solutions to problems with Boolean variables	Limited by the possibilities for solutions to the non-linear (nonconvex) problems
Carriage demand	Fixed, aggregate within the limits of the categories and destinations	Fixed, individual, per cargoes	Aggregate as per variants of contracts, manifesting as a function of the price
Prices per carriage	Fixed	Fixed	Manifesting as variables of the model
Cargo	Considered as part of the flow along the network for cargo categories	Available individual path and transport means	Considered as part of the flow along the network for contract variants
Storage	In aggregate for the airport	In aggregate and in aggregate per categories	Not to be considered
Carriage order withdrawal	Not to be considered	Admissible, with fines	Not to be considered
Cargo limitations for flights	Per categories and in general	Per categories and in general	In general

The model (Voitsehovskiy, 2017, p. 50-55) determines the optimal price under certain conditions, the periods of such conditions, and yet not in all cases these are all the possible conditions that should be taken into account, and therefore, other additional conditions may be added. It is determined by the function what the demand under these conditions will be, depending on the price. As a result, when these queries are combined between each other, the model compares and sets the optimal prices of the carrier. In model [12] there are two important variables: how much cargo the air carrier transports and at what price. Also there is one more function, namely time indexes, and hence for different indexes there will be different functions that depend on the price in a certain way. The condition that the greater the price the more we earn will also be valid here, and yet the demand for the capacity offered by the air carrier will then diminish. Table 2 shows a fragment of initial data of the cargo flow management model according to the data of the "Ukraine International Airlines" for 2016.[9]

Table 2

Fragment of initial data of the cargo flow management model

Route	Number of packages	Actual weight, kg	Departure date	Paid weight, kg	Tariff, USD	Other charges, USD	Revenue, USD
JFK-KBP	1	1	02 Jan 16	1	SERVICE		0
JFK-KBP	1	3	02 Jan 16	3	SERVICE		0
JFK-KBP	1	1	02 Jan 16	1	SERVICE		0
JFK-KBP	1	1	02 Jan 16	1	SERVICE		0
KBP-PEK	32	13,805	03 Jan 16	13,805	0.90		12,425
KBP-PEK	12	459	03 Jan 16	500	1.00		500
JFK-KBP	6	1,940	03 Jan 16	1,940	1.15	0.7	3,589
JFK-KBP	2	250	03 Jan 16	377.6	1.35	0.7	685
PEK-KBP	1	136	04 Jan 16	136	4.45	0.2	632
PEK-KBP	65	1,170	04 Jan 16	1,327	3.50	0.2	4,879
KBP-PEK	21	199	05 Jan 16	200	1.75		350
KBP-JFK	18	445	06 Jan 16	500	1.40		700
KBP-PEK	23	543	06 Jan 16	543	1.00		543
PEK-KBP	107	2,505	06 Jan 16	2,505	3.50	0.2	9,269
KBP-JFK	1	10,2	07 Jan 16	10.2	SERVICE		0
KBP-TBS	2	67	07 Jan 16	67	1.50	5.0	106
JFK-KBP	1	167,8	07 Jan 16	179	1.35	0.7	359
JFK-KBP	4	895	07 Jan 16	1,728	1.15	0.7	2,614
JFK-HEL	1	49	07 Jan 16	49	2.20	0.7	142
JFK-KBP	1	1	07 Jan 16	2	SERVICE	0.7	0
JFK-KBP	27	2,200.9	07 Jan 16	2,201	1.15	0.7	4,072

The necessity of use of a two-stage model of cargo flows management comes from the fact that the use of a non-linear model is difficult to optimize, and because of this we propose to divide this optimization into two stages:

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[9] "Ukraine International Airlines" PJSC. Annual financial statements of the emitter. (2016). Available at: https://smida.gov.ua/db/emitent/year/xml /showform/98863 /165/templ.

1. In one of the stages to change a part of the variables;

2. In the other stage to change the variables.

For instance, if prices are fixed in the model, then a linear model is obtained at a fixed price. Then if it is linear, a double variable must be calculated, as these double variables indicate what the best change in the price is in order to improve the solution of the problem derived at a fixed price. Prices are further adjusted, the solution of the problem is modeled again, and then we again individualize these double variables, as by analyzing same, we can see that with a slight price adjustment in a certain direction we are able to obtain an even more optimal solution. Therefore, it is necessary to solve the problem in two stages – firstly considering that the prices are fixed, and then after having received information about the optimal solution, and having accordingly adjusted the prices, we make an iteration as per new prices, and solve the problem again. All this is being solved in such a cycle, until stabilized, thus resulting in a two-stage problem.

Concluding remarks

When managing the cargo flows by using the proposed two-stage model, the air carrier will be able to manage revenues and expenses when performing passenger-cargo flights in real time. Since the costs of loading cargo on a passenger flight are very difficult to measure accurately, and since it is practically impossible to separate the cost of transporting cargo load from passenger load, it is necessary to use assumptions.

In general, it was found that upon transporting additional cargo loads the expenses will change insignificantly, the fuel costs will increase slightly due to the increase in commercial load. Revenues from loading cargo are measured more accurately while taking into account the known freight tariffs and the size of the load of flights. An increase in the cargo load of a passenger flight will allow for a significant net profit of the network air carrier, as the costs will increase at insignificant rate, and the revenues from cargo transportation will increase significantly.

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Ekaterina Tzvetanova[1]

ADAPTATION OF THE ALTMAN'S CORPORATE INSOLVENCY PREDICTION MODEL – THE BULGARIAN CASE[2]

Having an adapted model for prediction of Bulgarian corporate insolvency is a useful tool for a wide range of financial statement users. In the past sixty years, plenty of papers was published in this field. However, a statistically significant insolvency prediction model hasn't been constructed based on Bulgarian financial ratios. The purpose of the study was to solve this task. Linear Discriminant Analysis was used to select variables and to quantify the coefficients of the insolvency financial indicators for Bulgarian companies. The classification tests were applied to initial and test samples. Analysis of the classification accuracy was made comparing the adapted model and the revised Altman's Z-score model in 2000. The result confirmed the need for adaptation of Altman's Z-score model.
JEL: C51; C52; C53; D22; G33

Introduction

Entering in insolvency proceedings is a significant problem all around the world. Moreover, it has generated high social direct and indirect costs (Lensberg et al., 2006). An accurate forecast is needed to make informed decisions. It is a tool which may prevent entering in insolvency proceedings.

Since the early 1930s, the studies that investigate the importance of insolvency prediction has been discussed. The Altman's study, published in 1968 (Altman, 1968), is the first that analyses the interaction between several financial ratios, constructing an insolvency prediction model based on Multiple Discriminant Analysis (MDA). He published a new methodology applying a method typically used in biology and chemistry. During the 70-es the researchers started to use other statistical methods such as logistic regression and probit analysis (e.g. Martin, 1977 and Zmijewski, 1984, respectively). Driven by the computers' development, the intelligent models became the most used one during the '90s. The most popular self-learning method in the area of insolvency prediction models was neuron networks.

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The current studies related to insolvency prediction are focused on building both scoring models (e.g. Matsanov, 2014; Stefanova, 2016) and models for prediction of 12-months or lifetime Probability of default (PD). The latter is mainly driven by the implementation of the International Financial Reporting Standard (IFRS) 9 "Financial Instruments" which came into force on the 1st of January 2018. In the lifetime PD models have to be implemented the macroeconomic scenario of the country (e. g. Jovic, 2015). One of the most affected economic sectors by the new models for assessing a significant increase in credit risk is the banking sector. The Russian and Slovakian bank sector analysis confirms the significance of liquidity, capital adequacy, and assets quality (e. g. Lanine and Vennet, 2005; Fidrmuc and Hainz, 2009). Mehmed (2014) evaluates the Bosnia's bank sector liquidity using linear regression, while Derviz and Podpiera (2008) make synchronization between the Czechs regulatory credit ratings and those of Standard and Poors using logistic regression.

The other stream of the studies in the transition economies is to apply an already built model with/ without corrections. Lace and Koleda (2008) analyse 14 popular models using four characteristics to assign a weight to any of them (Koleda and Lace, 2009). They claim that the integration and modification make the non-adapted models applicable for Latvian companies. The statement is confirmed in Sneidere and Bruna's (2011) study in which they test Altman's Z" – score (2000) for non-public companies and Fulmer's H model. It is worth mentioning that these two models are also included in Lace and Koleda's research (2009). Both models achieve better accuracy results than the Latvian adapted model.[3] Moreover, Pavlović et al. (2012) achieve the same accuracy rate applying Zmijewski's model (1984) on Serbian companies like the one achieved by Zmijewski using his initial sample. However, the accuracy results weren't satisfying using Zmijewski's model to predict the Croatian companies insolvency. Pavlović et al. (2011) apply the Argentine dataset based model of Sandin and Porporato[4] to Serbian companies. The result is not satisfying. Muminović (2013) confirms the conclusion derived in previous studies (e. g. Muminović et al. 2011; Panayotova and Dobreva, 2014) that Altman's Z-score (1968) is not applicable to predict the Serbian companies insolvency. The Borlea and Achim's (2014) study shows that Conan and Holder (1979)[5] model works better than Altman's Z-score (1968) for Romanian metallurgical companies. Bulgarian authors (e. g. Todorov, 2014; Timchev, 2011; Mladenova, 2016; Yovchev 2016; Dimitrova, 2013) use already built insolvency prediction models (Altman (1968), Taffler (1982), etc.) with acceptable accuracy. It hasn't escaped my notice that the used samples include relatively large, active, and financially sound companies (e.g. Kaolin AD, CCB Real Estate Fund REIT-Sofia, Bulgarian Real Estate Fund REIT-Sofia, Sofia Commerce-Pawn Brokerage AD-Sofia, etc.).

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[3] Šorins, R., and Voronova, I. (1998). Uzņēmuma maksātnespējas novērtējums. Ekonomiskās problēmas uzņēmējdarbībā, RTU Riga, pp. 125-131. [Source: Sneidere and Bruna 2011]
[4] Sandin, A., Porporato, M. (2007). Corporate bankruptcy prediction models applied to emerging economies: Evidence from Argentina in the years 1991-1998. International Journal of Commerce and Management. 17(4), pp. 295-311. [Source: Pavlović et al. 2011]
[5] Conan, J., Holder, M. (1979). Explicatives variables of performance and management control, Doctoral Thesis, CERG, Universite Paris Dauphine. [Source: Borlea, S. and Achim, M. (2014)]

Männasoo (2007) concludes that Estonian companies' size has a significant influence on company success. Moreover, Estonian industrial companies are much more resilient than companies in other sectors. He also confirms that the companies met higher insolvency risk in their first few years. Fijorek and Grotowski (2012) apply above 1500 different models on a large sample of over 13 000 Polish companies. The most significant financial ratios for insolvency prediction are the same as the most commonly used such as Current Assets on Total Assets, Return on Sales, and EBIT on Total Assets. They stress that in one country could be built several statistical significant models with high accuracy based on financial ratios.

However, it hasn't been published an analysis of the appropriate methods for Bulgaria. The predictability of the financial ratios using Bulgarian companies' data also hasn't been analysed. The analysis's first step is to select the appropriate method. The method choice is fundamental in a building of insolvency prediction models. The appropriate method should meet several criteria. It has to be applied frequently enough in case of insolvency prediction. It is needed to ensure high accuracy with a relatively small sample. The lack of a publicly available database with Bulgarian companies' financial statement makes the model construction based on very large samples a much longer process. In addition, it should have a clear calculation algorithm which is a good basis for the following data interpretation. The method should generate a clear, unambiguous result which allows a clear and accurate interpretation of the results. The latter instil more confidence in the potential users of the constructed model. Moreover, the financial ratio's dynamic over time requires periodic revision and therefore efficient and effective revision is needed characteristic. The latter also allows being build models for specific Bulgarian economic sectors. The dependent variable should not be discrete because it should be determined intervals with different probability to enter in insolvency proceedings – high, medium and low. The selection of the most appropriate method was made based on an analysis of studies published between 1966 and 2014 using the criteria mentioned above. It was included 113 studies, with 232 models to 124 authors. The insolvency prediction models' analysis covered models build on corporate data from 19 countries on 5 continents – Australia, Asia, Europe, South, and North America. The included countries are with different economic and social development, degrees of economic freedom and economic growth. As a side note, during the analysed period there were 4 big economic recessions: the 2 major oil crises in 1973 and 1978; the bursting of the so-called "dotcom" bubble in the USA in 2000; and Global Financial Crisis in 2007. MDA was the most appropriate method for the Bulgarian conditions by virtue of the following reasons: (i) it was the most popular method; (ii) the models based on it were the most accurate; (iii) it had a clear algorithm; (iv) despite both the need to meet several assumptions and its intuitive interpretation, it was one of the models which allowed efficient and effective revision.

In addition, it was analysed insolvency prediction models using data set from European countries which passed from centrally planned to a market economy.[6] The purpose was to analyse the models constructed in transition economies like Bulgaria. The methods used in countries such as Bosnia and Herzegovina, Croatia, Czech Republic, Hungary, Poland,

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[6] Studies published in English for the following countries: Bosnia and Herzegovina, Croatia, Czech Republic, Estonia, Hungary, Latvia, Poland, Romania, Russia, Slovakia, Serbia and Ukraine.

Russia, and Serbia are mainly MDA, logit regression, probit analysis, and neuron networks. Generally, the models' accuracy was lower than the reported in the analysis mentioned above. Moreover, they did not provide a test sample accuracy or Lachenbruch (1967) test. The models were built using large samples (more than 1000 companies) which allows to include more independent variables (e. g. Fedorova et al. 2013; Memić, 2015). However, the authors select the variables from a very short list of financial ratios. It is not clear how they made the selection. They didn't include significant financial ratios such as Earnings Before Interest and Taxes (EBIT) on Total Assets (e. g. Memić 2015; Pervan et al. 2011). In transition economies and emerging markets are applied mainly statistical methods to construct an insolvency prediction models despite the used large datasets. There is a hypothesis that in some countries can be applied an already built model without corrections. However, the poor accuracy results of Altman's Z-score (1968) model application provides evidence that the Altman Z-score model has to be adapted.

Despite the worldwide development of the insolvency prediction models in the last century, in Bulgaria, there are no studies that investigate a statistically significant insolvency prediction model for Bulgarian companies based on financial data[7]. In this study, it was solved this task as it is presented an insolvency prediction model using linear discriminant analysis and Bulgarian dataset.

Methodology

In this section is presented the methodology that was applied to construct an insolvency prediction model using discriminant analysis. The aim was to achieve at least 90% correctly classified companies of the initial sample and 80% of the test sample. The methodology includes five major steps as follows:

Insolvency definition

The first step was clearly to define the meaning of insolvency. The determination of the company's insolvency date affects data collection and model validation. The Bulgarian Commerce Act (Ciela, 2015) provides the following three possible definitions: (i) actual insolvency – at the time of filing the application for opening of insolvency proceedings; (ii) formal insolvency – at the time of the court judgment to open insolvency proceedings based on submitted application, and (iii) final insolvency – at the time specified in the court decision for company insolvency based on expert analysis. In the study was adopted the actual insolvency considering it 1) is the earliest data which can be determined and, 2) undeniably shows the moment when the company can't pay its obligations. The actual

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[7] Georgiev and Petrova (2014) published adapted Altman (1968) Z-score insolvency prediction model for Bulgarian public companies. They use the same financial ratios but calculate the new discriminant coefficients. Their model accuracy is 70% correctly classified out of 40 companies included in the initial sample. The discriminant function quality is unsatisfying. There is a number of methodological flaws. Moreover, they don't meet the LDA method's assumptions. The latter raises doubts about the stability and accuracy of the presented model.

insolvency definition was to determine: (i) the financial statements' year of the insolvent companies included in the initial sample; (ii) the industry in which they operate.

Sampling

Usually, the authors (e.g. Altman, 1968 and Tam, 1991) use criteria such as company size (expressed by total assets amount) to select the companies' sample. However, the Bulgarian companies' structure (NSI, 2016) is different compared with other Western countries characterizing with more than 90% share of the micro-business (up to 9 employees). Thus, it was decided not to apply any criteria for company grouping.

It was used two samples to be constructed reliable and as accurate as a possible model. The model was built with an initial sample, while it was validated using a test sample.

First, the initial sample was collected using a matched pair sample.

Companies in actual insolvency (insolvent companies). It was used the APIS Law Web system where 528 companies met the definition of actual insolvency. ***Only 87 of them were published non-zero financial statements in four consecutive years before entering in insolvency proceedings.*** It was used the four-year financial statement criteria by reasons of: 1) long-term model validation and 2) to exclude the companies which are established for other reasons than to develop a profitable business.

The financial statements were mainly reported after 2007 so a longer period than four years will significantly affect on the sample size. It is worth mentioning that the companies remained only 87 from 528 due to the following reasons: (i) a lot of companies didn't publish their financial statements in four consecutive years; (ii) a lot of companies didn't publish a financial statement at all; (iii) some of the companies didn't provide their Cash Flow statements; (iv) some of the companies published zero financial statements.

The 87 insolvent companies were separated randomly into two groups – 43 in the initial sample and the remaining 44 – in the test sample. Later on, two companies were moved from the initial sample to the test sample as a result of the extreme figures. Thus, it has remained 41 and 46 companies, respectively in the initial and in the test sample.

The companies' economic sector in the year before the companies enter in actual insolvency was determined in line with the National Classification of Economic Activities (NCEA-2003).

Solvent companies. As mentioned above, the method of sample collection was matched-pair. The decision was taken based on an analysis on about 232 insolvency prediction models published between 1966 and 2014 (Tzvetanova and Kostov, 2016). MDA based models with a high accuracy rate were constructed based on matched-pair samples (e.g. Altman, 1968; Altman et al., 1977; Moyer, 1977; Tam and Kiang, 1992). Thus, for any insolvent company it was selected a solvent one which met the following criteria: (i) have the same amount of total assets (± 10%), (ii) operates in the same industry and (iii) published a financial statement in the year before the insolvent company enter in actual insolvency. The solvent companies also should have a published financial statement for at least four consecutive years. It was used consolidated financial statements in case of available consolidated and unconsolidated figures.

Second, it was collected test sample to verify the model accuracy:

Insolvent companies. The remaining 46 companies identified as actual insolvent companies but not included in the initial sample.

Solvent companies. It was exported all active companies by sector for the period between 01.01.2006 and 30.06.2016 from APIS Law Web system. The following procedure was performed: (i) for any economic sector all companies were arranged in alphabetic order; (ii) for any observation it was generated a random number; (iii) all companies were sorted from the smallest to the largest random number and (iv) it was analysed first *n* rows to collect a sample with 44 companies (8 of them didn't publish a Cash Flow statement).

The companies met the following criteria: (i) published financial statements for at least three consecutive years; (ii) the company has operational activities. In the sample was included the last published financial statement without taking into consideration the year.

In addition, 10 solvent companies were included in the test sample even if they were collected using a matched pair sample.

Multiple Discriminant Analysis

In this study, it was applied Multiple Discriminant Analysis as a construction method because: *(i) it was the most popular method; (ii) the models based on it were the most accurate; (iii) it has a clear algorithm; (iv) despite both the need to meet several assumptions and its intuitive interpretation, it was one of the models which allowed efficient and effective revision.*

Linear Discriminant Analysis (LDA) is a statistical method used to classify an observation into one of several a priori groups. After the groups' establishment and the observations' classification, the method calculates liner combination of tested characteristics which "best" discriminate between the groups and MDA determines a set of discriminant coefficients.

LDA has the advantage to reduce the analysis space dimension from the number of different independent variables to $G - 1$ dimension, where G equals the number of original *a priori* groups. In this study, the *a priori* groups are two – insolvent and solvent companies. The LDA function will be the following:

$$Z_i = V_0 + V_1 X_1 + V_2 X_2 + \ldots + V_j X_j,$$

where Z is the value based on which the observation *i* is classified observation where *i* = 1, 2, 3 ... n (number of companies), $V_1, V_2, \ldots, V_j$ are discriminant coefficients and, $X_1, X_2, \ldots, X_j$ are independent variables. LDA computes the discriminant coefficients V_j, while X_j are actual values where, $j = 1, 2, \ldots, n$.

It was used a standard discriminant function in statistical software SPSS. There is a significantly lower insolvency rate in Bulgaria (Stoyanova, 2013) but the *a priory* probability of insolvency was determined on 50%. Some authors criticise this approach considering it may influence on the model accuracy. However, the models based on 50% *a*

priory probability to enter in insolvency proceedings were one of the most accurate. There is no evidence which clearly to prove the hypothesis that the models based on *a priory* probability closer to the real population are more accurate than the one with 50% a priory probability.

All independent variables were entered together instead of using a stepwise selection method. The first approach was preferred because it provides the opportunity to include variables that aren't statistically significant enough but nevertheless they complemented the model.

Acceptable was the model which can pass accuracy tests described below and met the following criteria:

- To be rejected the hypothesis for equality of the group means – insolvent and solvent.

- A high correlation between the discriminant coefficient and the groups.

- Test of the discriminative power of the constructed function to be passed with the lowest possible Wilks' Lambda value

- To be achieved at least 90% correctly classified of the initial sample and 85% of the cross-validation (each case is classified by the functions derived from all cases other than that case).

Model validation

The purpose of the study was to build a model which can predict the insolvency achieving the highest accuracy as early as possible. To be ensured the latter, the model passed the following tests:

Preliminary classification test. This test evaluates the Type I and Type II statistical errors. Type I error is when the model classifies insolvent as a solvent company. Type II error is when the model classifies the solvent as an insolvent company.

Ex post classification. This test evaluates the accuracy of the model on the test sample which covers the same period as the initial sample (Altman, 1978). It was applied only this test because it was not possible to collect a test sample from a different period than the covered from the initial sample. Ex post-classification (using new data from the same sample period) provides a crude test of the stationarity of the model and its individual component measures and parameters (Altman and Eisenbeis, 1978). In addition, ex post-classification provides an indication of the confidence one can have with respect to the observed group overlap among the variable distributions in the groups being investigated (Altman 1978, Winter). The Z_{BG}-score of all companies included in the test sample was calculated using the already received discriminant coefficients and the financial ratios of the test sample.

Long-Range Predictive Accuracy. The results from the validation tests described so far ensure enough evidence to be concluded that the initial sample is suitable to be constructed a model based on it. In order to verify the stability of long-term predictive accuracy, the

model was tested on the initial sample with financial ratios for four consecutive years before entering in insolvency proceedings.

Comparative analysis. Analysis of the classification accuracy was made comparing the adapted model and the revised Altman's Z-score model in 2000 (Altman, 2000). The purpose was to prove the necessity of adaptation. The analysis covered both the initial and the test sample. Discriminant equations of the adapted model (Z_{BG}-score) and the revised Altman's Z-score (Z-score) were applied.

Empiric Results

Individual statistical analysis

It has never been published studies related to the forecasting ability analysis of the financial statement for Bulgarian companies. Moreover, Laitinen and Suvas (2013) conclude that the most used financial ratios for insolvency prediction aren't enough accurate for Bulgarian companies. The latter is due to specific country factors which have a strong influence on the forecasting ability of the model. Thus, it was needed a thoughtful and in-depth selection of the appropriate financial ratios starting from a large group of financial ratios. The analysis started with 60 financial ratios divided into five groups: Cash Flow; Profitability; Turnover; Liquidity and solvency; Leverage. The companies' financial ratios were calculated from the initial sample for both one and two years before the actual insolvency. They were selected based on the following criteria: (i) data availability; (ii) popularity in empirical research; (iii) avoiding both overlapping and interdependent financial ratios.

It is important to note some of the input data characteristics. The companies included in the initial sample have an average assets amount of BGN 7 683 thousand. The companies have a wide range of total assets amount – from BGN 115 thousand up to BGN 61 664 thousand. However, it was not applied some bounds considering it would remain a few observations. The samples cover the non-financial sectors of the Bulgarian economy. The economic sectors with more than one observation were Building Constructions, Hotels and Wholesale of milk and other household goods – sectors that were significantly affected by the Global Financial Crisis that hit in 2007. Bulgarian companies have to publish their financial statements in line with the National or International Accounting Standards. Nevertheless, most of the companies included in the sample published their financial figures filled in the National Statistical Institute Template. In addition, the Bulgarian companies can have operating activity even if they have reported negative equity in several consecutive years. There is no legislation which defines the period in which some company can have operating activity even if it has negative equity. It was included 16 companies in the sample which reported negative equity but are solvent. Another characteristic was that the Intangible Assets had an insignificant share in the Non-Current Assets' structure. Moreover, there were Intangible Assets only after reaching a certain amount of assets (above BGN 4 000 thousand). So, it wasn't needed to apply some corrections to the financial ratios which include Non-Current Assets. Furthermore, the companies made their revenues mainly from their core business (99% of their revenues on average). The remaining insignificant share was thanks to Interest Revenues. In terms of costs, the significant share of the operating

expenses was taken by: (i) amortization and impairment losses, (ii) the book value of assets sold and (iii) provisions. The financial expenses are mainly interest payments – 8% from total insolvent companies' expenditures and 2% from total solvent companies' expenditures on average.

As mentioned above, it was needed a thoughtful and in-depth selection of the appropriate financial ratios to be performed. The latter ensures to be collected the appropriate variable to build an accurate and stable insolvency prediction model. The purpose of the analysis was to collect those financial ratios which: (i) are able accurately to predict the insolvency of Bulgarian companies; (ii) are relatively independent of each other.

The evaluation is based on the following criteria:

- clear difference between the two groups – insolvent and solvent companies;
- distribution which doesn't overlap significantly between the two groups;
- low correlation coefficients.

The individual statistical analysis of the 60 financial ratios was performed in two stages.

In stage 1, the sample passed through the following analysis: (i) descriptive statistics (mean, min, max, variance, standard deviation), (ii) frequency distribution histograms of the financial ratios in both groups – insolvent and solvent companies, and (iii) correlation analysis. Base on them it was derived the basic statistical characteristics of the sample. It allowed deriving a conclusion if the financial ratios are appropriate for the statistical method – was there a clear difference between the two groups, was there any extremums, which is the variables' distribution. The main findings were the following:

- *It was identified financial ratios with low standard deviation and with a clear difference between the groups' mean, which indicated that these variables had a discriminative ability.*

- *The lack of normal distribution function led to the need for the data transformation (Tzvetanova, 2018) and the exclusion of some observations from the initial sample. The use of methods such as MDA and Neuron Networks allows applying this approach because they examine the relationship between the data, not the data itself.*

- *Five financial ratios were excluded due to the high correlation with the other one. The decision was based on the results from the descriptive statistics and how close is the distribution function to the normal one.*

In stage 2, both the original and the transformed initial sample was analysed applying the following tests: (i) normality test; (ii) test of equality of the group means; (iii) Identification of the variables which follow one direction between the groups (linearity testing). The results showed those financial ratios which have characteristics to meet the assumptions of the MDA method which is obligatory to be constructed a significant discriminant function with stable results and acceptable accuracy.

At the end of the individual statistical analysis of the variables, it was identified 24 financial ratios (table 1) with appropriate characteristics to build a statistically significant

insolvency prediction model. The result is similar to Altman (1968) who used 22 financial ratios. None of them was related to the cash flow statements.

Table 1

List of the financial ratios included in the variable list for the model

Group		Financial ratio
Profitability	1	EBIT[8] on Total Liabilities
	2	EBIT on Total Revenues
	3	EBIT on Current Liabilities
	4	EBIT on Total Assets
	5	Operating Revenues on Operating Expenses
	6	Retained Earnings on Total Assets
	7	EBITDA[9] on Non-Current Tangible Assets
	8	Net Interest Payments[10] on Net Profit/ Loss
	9	EBIT on Net Interest Payments
Turnover	10	Total Revenues on Non-Current Tangible Assets
	11	Total Revenues on Total Liabilities
	12	Total Revenues on Current Liabilities
	13	Total Revenues on Total Assets
	14	Net Assets[11] on Total Revenues
Liquidity and solvency	15	EBITDA on Total Revenues
	16	Cash and cash equivalents on Current Liabilities
	17	Cash and cash equivalents on Total Assets
	18	Cash and cash equivalents on Total Liabilities
	19	Working Capital[12] on Total Assets
	20	Equity on Total Liabilities
	21	Equity on Total Assets
Leverage	22	Total Liabilities on Total Assets
	23	Total Financial Debt on EBIT
	24	Retained Earnings on Total Liabilities

The model

Based on the analysis and the empirical research it was built the following standardized model:

$$Z_{BG} = 2.213 * X_1 + 0.243 * X_2 + 0.760 * X_3 + 2.821 * X_4,$$

where the financial ratios are:

X_1 – EBIT on Total Assets

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[8] EBIT is equal to Net Profit plus Taxes plus Net Interest Payments.

[9] EBITDA is equal to EBIT plus Amortizations.

[10] Net Interest Payments is the difference between Interest Revenues and Interest Expenses.

[11] Net Assets is the difference between Total Assets and Total Liabilities.

[12] Working Capital is the difference between Current Assets and Current Liabilities.

X_2 – Total Revenues on Total Assets

X_3 – Equity on Total Assets

X_4 – Cash and cash equivalents on Total Assets

Z_{BG} – Overall Index

X_1 – *EBIT on Total Assets*. It shows the operating profitability of the company's assets. It measures the company's overall profitability which makes it an appropriate indicator for credit risk evaluation. Moreover, the financial ratio is very important by reason of it evaluates the current income isolated from the leverage effect. The latter determines the current profit as a key to long-term financial stability (Timchev, 2011). EBIT is equal to the sum of net profit, taxes, and net interest payments. EBIT on Total Assets was the most significant ratio in the model. Actually, it is one of the most-used components of the insolvency prediction models (e. g. Hopwood et al. 1994; Theodossiou, 1993; Kahya and Theodossiou, 1999; Zavgren, 1985).

X_2 – *Total Revenues on Total Assets*. The financial ratio which measures the company's turnover and shows: (i) the level of fulfilment of the company's obligations; (ii) and is the company uses its assets efficiently to increase its revenues. Total revenues included all revenues considering the revenues from non-core activities were an insignificant amount. Another aspect is that this ratio has a weakness to vary significantly across different sectors. Hence, this ratio is not an appropriate indicator when comparing companies which operate in different sectors. Total Revenues on Total Assets is with both the lowest correlation with the discriminant function and the lowest statistical significance.

The financial ratios mentioned above coincided with those of Altman's discriminant function (1968). However, the following two financial ratios are structure indicators based on Balance Sheet statement. They largely reflect the specific factors and practices applied in the country.

X_3 – *Equity on Total Assets*. It compares the company's equity to total assets, indicating its financial independence. It is a key financial ratio that stands on the balance sheet and shows the relative share of equity capital in the entire capital. Equity on Total Assets is an important indicator based on which it can be determined the degree of the company's financial stability. It is a statistically significant variable in many insolvency prediction models (e. g. Lee, et al., 1996; Altman and Lavallee [Source: Altman, 1984]).

X_4 – *Cash and cash equivalents on Total Assets*. The financial ratio measures the share of the assets held as cash, in bank accounts, and cash equivalents. It also evaluates the company's financial stability – higher liquidity means lower risk in the short term. Cash and cash equivalents on Total Assets is statistically significant variable according to a number of studies (e. g. Jones and Hensher, 2004; Hopwood, et al. 1989; Hopwood, et al. 1994; Tam and Kiang, 1992; Zavgren, 1985; Salchenberger, et al., 1992; Gombola, et al., 1987; Libby, 1975). It was the second most significant ratio in the model after EBIT on Total Assets. I may perhaps be forgiven for calling attention here to the fact that this financial ratio was affected by different practices for tax evasion and the accumulation of these amounts in cash.

Defining the new model's areas

It was proposed new risk criteria Z_1 and Z_2 (Tzvetanova, 2018, p. III.3.3.2., p. 100), based on the calculated discriminant function for any single original (non-transformed) observation (Z_{BG}-score). Z_{BG}-score of all original observations, which were included in the initial and in the test sample, were used to classify the companies according to the level of the risk to enter in insolvency proceedings in the following areas:

- [Z_{BG}-score $\leq Z_2$] – 95.12%, very high probability to enter in insolvency proceedings in the next year;

- [$Z_2 < Z_{BG}$-score $\leq Z_1$] – 53.66%, the company has a medium probability to enter in insolvency proceedings;

- [Z_{BG}-score $> Z_1$] – 12.2%, low probability to enter in insolvency proceedings or the company has 87.8% probability to survive.

Model validation

It was used the original data (non-transformed) to perform the model validation. The models' cut-off point were individually determined.

Preliminary classification test

Preliminary classification test evaluates the Type I and Type II statistical errors. The adapted model correctly classifies 91.5% of the initial sample companies (table 2). The model is relatively conservative because Type II error was bigger than the Type I error.

Table 2

Preliminary classification test results

Sample		Actual state	Predicted state		Total
			Insolvent	**Solvent**	
Initial sample	Number	Insolvent	39.00	2.00	41.00
		Solvent	5.00	36.00	41.00
	%	Insolvent	**95.12**	4.88	100.00
		Solvent	12.20	**87.80**	100.00

Ex post-classification

The ex post-classification evaluates the accuracy of the model on the test sample which covers the same period as the initial sample. The test was made on two test samples: sample with included companies with extremums; sample without the identified companies. The accuracy of the model decreased to 79 and 84%, consecutively (table 3). In addition, the results showed a better prediction of the solvent companies.

Table 3

Ex post-classification results

Sample		Actual state	Predicted state		Total
			Insolvent	Solvent	
Test sample with exceptions	Number	Insolvent	33.00	13.00	46.00
		Solvent	8.00	46.00	54.00
	%	Insolvent	**71.74**	28.26	100.00
		Solvent	14.81	**85.19**	100.00
Test sample without exceptions	Number	Insolvent	29.00	7.00	36.00
		Solvent	6.00	38.00	44.00
	%	Insolvent	**80.56**	19.44	100.00
		Solvent	13.64	**86.36**	100.00

Long-Range Predictive Accuracy

The previous results give evidence that the companies are appropriate to determine the overall effectiveness of the discriminant model for a longer period of time prior to insolvency. The long-range predictive accuracy test evaluates the initial sample for the second, third and fourth year prior to insolvency. Table 4 shows that the accuracy of the model is decreasing when the time prior to insolvency increases. The reason was an increase in wrong classified insolvent companies.

Table 4

Four-year predictive accuracy of the model

Year prior to insolvency	Total companies	Correct classified	Wrong classified	% Correct classified
First	82	75	7	91
Second	82	68	14	83
Third	82	60	22	73
Forth	82	56	26	68

Comparative analysis

Analysis of the classification accuracy was made comparing the adapted model and the revised Altman's Z-score model in 2000 (Altman, 2000). The purpose of this analysis was to prove the need for adaptation of the model.

The revised Altman's Z-score (2000) has the following discriminant function:

$$Z = 0.717 * X_1 + 0.847 * X_2 + 3.107 * X_3 + 0.420 * X_4 + 0.998 * X_5,$$

where the financial ratios are:

X_1 – Working capital on Total Assets

X_2 – Retained Earnings on Total Assets

X_3 – EBIT on Total Assets

X_4 – Equity on Total Liabilities

X_5 – Sales on Total Assets

The results of the comparative analysis between the adapted model accuracy (Z_{BG}-score) and the revised Atman's model accuracy (Z-score) showed that in the short term the adapted model is more accurate for the Bulgarian companies than the Altman's one (Table 5). One of the reasons is that the model was revised in 2000. Moreover, the financial ratios are selected based on American companies figures from the beginning of the 1960s. Test sample results confirmed the hypothesis that the adapted model is more accurate than the Altman's one. Furthermore, the achievement of 91.5% correctly classified companies versus 81.7% according to the Altman's model clearly showed the need for adaptation of both the financial ratios and the discriminant coefficients.

Table 5

Comparative analysis between the adapted model accuracy and the revised Atman's model accuracy

Sample		Actual state	Predicted state, %		Total, %
			Insolvent	Solvent	
Initial sample	Z_{BG} – score	Insolvent	**95.12**	4.88	100.00
		Solvent	12.20	**87.80**	100.00
	Z – score	Insolvent	**95.00**	5.00	100.00
		Solvent	32.00	**68.00**	100.00
Test sample	Z_{BG} – score	Insolvent	**71.74**	28.26	100.00
		Solvent	14.81	**85.19**	100.00
	Z – score	Insolvent	**76.00**	24.00	100.00
		Solvent	24.00	**76.00**	100.00

Conclusion

In this study was presented an insolvency prediction model for Bulgarian companies. It was selected financial ratios with appropriate characteristics from a large group of potential variables which ensures a stable and accurate model based on Linear Discriminant Analysis. The achieved accuracy is 91.5% correctly classified companies.

In the example below is shown the model's financial ratios of the three analysed companies which are multiplied by the discriminant coefficients of the presented function. Their sum shows with an accuracy of 91.5% in which of the defined risk areas the company falls.

	EBIT on Total Assets	Total Revenues on Total Assets	Equity on Total Assets	Cash and cash equivalents on Total Assets	Z-score	Insolvency risk
Coefficient	2.213	0.243	0.760	2.821		
Company A	-0.306	1.090	-0.560	0.010	-0.810	Very high probability
Company B	0.012	0.538	0.294	0.184	0.900	Medium probability
Company C	0.102	6.610	0.169	0.023	2.026	Very low probability

Company A has a very high probability to enter in insolvency proceedings due to its Z-score is significantly below 0.4. On the other hand, Company C has a very low probability to enter in insolvency proceedings reporting Z-score above 1.5. Company B falls in medium risk area being its Z-score between 0.4 and 1.5.

As a side note, the long-range predictive accuracy falls to 68% in the fourth year prior to insolvency. The latter is mainly due to the increase in wrong classified insolvent companies. Moreover, the model should be revised over a period of time.

Analysis of the classification accuracy was made comparing the adapted model and the revised Altman's Z-score model in 2000 (Altman, 2000). *The achievement of 91.5% correctly classified companies versus 81.7% according to the Altman's model clearly showed the need for adaptation of both the financial ratios and the discriminant coefficients.*

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IMPACT OF ELECTRICITY CONSUMPTION, FINANCIAL DEVELOPMENT, TRADE OPENNESS ON CO₂ EMISSIONS: EVIDENCE FROM NIGERIA

This paper has explored the role of electricity consumption financial development and trade openness on the CO_2 emissions. The study utilizes annual data from 1972 to 2014 and employs various robust econometric techniques. Our analysis reveals that there is no long-term relationship financial development, trade openness and CO_2 emission. However, the short-run analysis indicates significant relationship among the variables. The results also reveal that the bidirectional relationship between electricity consumption and CO_2 emissions, and a unidirectional causality from financial development to CO_2 emissions. Our results imply that policies that will promote renewable energy consumption and financial development can be pursued concurrently.
JEL: C32; G0; O44; Q43

1. Introduction

Carbon dioxide (CO_2) emissions contribute 76% of the world's greenhouse gas emissions, of which, 68% comes from energy-related sources (IPCC, 2014). Over the next 25 years energy consumption and energy-related CO_2 emissions are projected to rise by 56% and 46%, respectively (EIA, 2013). As a result, Nigeria has announced climate change commitments by initiating GHG inventory system, CDM projects, and the largest gas gathering in Africa (LNG). The main aim of CDM projects is mandatory reduction of emissions by 20% of JVs (Awojuola, 2015). The project will use clean energy technologies to meet up with the target.

Therefore, the country is focusing on increasing the share of renewable energy in total energy consumption. This can be seen in the recently established Renewable Energy Association of Nigeria (REAN), which intends to be a strong voice to advocate favorable conditions for the growth of renewable energy in Nigeria. Among others, $300 million loans have been secured to implement solar projects that will generate up to 1.15 gigawatts (GW) of electricity. Further, government has shown commitment, with ratification of

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Intended Nationally Determined Contributions (INDCs) declaration, which commits companies to reducing greenhouse gas (GHG) by 20 percent unconditionally and by 45 percent conditionally by 2030. Also, the issuing of sub-Saharan African's first Sovereign Green Bonds in 2017 will be used to raise additional capital to fund "low emission" energy projects and facilitate implementation of the INDCs. Lastly, Central Bank of Nigeria (CBN) issued the Nigerian Sustainable Baking Principles (NSBP), which mandate all commercial, merchant and development banks in the country to incorporate environmental and social principle in their operations (Atuluku, 2017).

The administration of Dr. Goodluck Jonathan presented a Roadmap on the Power Sector Reform to the stakeholder in the industry on 26 August 2010. The reform aimed to address the problem of inadequate electric power supply in Nigeria (VETIVA, 2010). In the light of this, Clean Technology Fund (CTF) Investment Plan (IP) was endorsed by the CCTF Trust Fund Committee (TFC) on 12 November, 2010 with a wonderful offer of US$ 250 million in CTF funding. CTF IP basically focused on three projects in the Transport, Renewable Energy, and Energy Efficiency sectors, with a total of US$135 million of CTF funding released. As of May 2014, US$26 million CTF funding has been approved by the CTF Trust Fund Committee for two AfDB's projects, including US$1 million project preparation grant for Nigeria Urban Transport Project – Abuja Mass Transit and US$25 million for project proposal titled Nigeria: Line of Credit for Renewable Energy and Energy Efficiency Projects (Clean technology fund investment plan for Nigeria, 2014).

These government policies demonstrate that financial development and CO_2 emissions growth have become more pronounced in recent years. In addition to other vital factors, the long-term environmental health is correlated with the degree of financial development. There are different indicators to measure financial development such as size, depth, access, efficiency and stability of a financial system. The financial systems include markets, intermediaries, range of assets, institutions and regulations. A strong financial system guarantees the high capital accumulation (the rate of investment), trading, hedging, insurance services, diversified saving and portfolio choices etc. which facilitate and encourage the inflow of foreign capital and technological innovation such as renewable energy devices. The greater financial development leads to reduction of pollution, through the purchase of none – emission energy sources. Thus, in this paper financial development refers to the domestic credits provided by the banks to the private sector in the economy.

Electricity consumption is essentials for a healthy environment and economic development. Hence, we used electric power consumption to explain the total amount of fossil fuel and other none – renewable energy consumed in a given period of time. Most electricity today is generated by burning fossil fuels which drive a stream turbine that, in turn, drives an electrical generator. More serious are concerns about the emissions that result from fossil fuel burning. Switching to renewable technologies can have significant environmental benefits, by generating electricity and fuel without releasing significant quantities of CO_2 emissions and other forms greenhouse gases that contribute to climate change.

Trade openness is the sum of exports and imports (both on goods and services) as a share of GDP. Trade openness can improve environmental qualities in two ways. Firstly, an increase in trade can lead economic growth, development, and social welfare, contribute to a greater capacity to manage the environment more effectively. More importantly, open markets can

improve access to new technologies that make local production processes more efficient by diminishing the use of inputs such as energy, water, and other environmentally harmful substances. Secondly, trade and investment liberalization can provide firms with incentives to adopt more stringent environmental standards. As a country becomes more integrated within the world economy, its export sector becomes more exposed to environmental requirements imposed by the leading importers. Changes needed to meet these requirements, in turn, flow backwards along the supply chain, stimulating the use of cleaner production processes and technologies

Given the significance of energy use, prior studies have investigated the determinants of CO_2 emissions in Nigeria. In this context, there are three categories studies; first, the nexus between energy consumption and CO_2 emission in Nigeria. Notably, Chindo et al. (2015) concluded that there is no correlation between energy consumption and CO_2 emissions using autoregressive distributed lag (ARDL) approach. On the contrary, Akpan and Akpan (2012) found an increase in electricity consumption led to an increase in carbon emissions in Nigeria. Second, on the nexus between financial development and CO_2 emissions; Ali et al. (2018) used ARDL approach and report that financial developments have a positive impact on carbon dioxide emissions. However, Abdulrashid (2016) reported financial development stimulates energy demand, but lower CO_2 emissions. Third, the nexus between trade openness and CO_2 emissions; Ali et al. (2016) found that trade openness negatively affects CO_2 emissions. Abdulrashid (2016) reported similar results whereas financial development stimulates energy demand, but lower CO_2 emissions.

It appears there have been considerable literature on determinants of CO_2 emission in Nigeria, however there are still some limitations on these studies which create gap for our current study. For instance, Akpan and Akpan (2012) argued that electricity consumption impact on CO_2 emissions in Nigeria, however, they failed to consider the interaction of trade openness in their model. We argued that trade openness is crucial to Nigeria as both developing and an oil-producing country. As a developing country, Nigeria imports most of its consumable from other countries invariably making it less industrial pollutant. As an oil-producing country, Nigeria is on high side of $C0_2$ emission. Second, Chindo et al. (2015) reported that energy consumption does not affect CO_2 emission. This result steered controversy as it failed to consider the source of energy (non-renewable energy) in Nigeria. Thirdly, Ali et al. (2018) and Abdulrashid (2016) reported on the impact of trade openness, energy consumption, financial development on CO_2 emissions, however, they failed to use more robust econometric model, they all use autoregressive distributed lag approach. Autoregressive distributed lag (ARDL) often uses non-stationary which is unpredictable and cannot be modeled or forecasted. The results obtained by using non-stationary time series may be spurious in that they may indicate a relationship between two variables even if there is no relationship. Also, their studies are challenged by the period covered. It neglected the period of implementation of the Roadmap for Power Sector of August 2010. The implementation that led to the privatizations of the power sector on November 1, 2013, with the formal handover of the successor companies to private investors as six generation companies (GENCOS) and 11 distribution companies (DISCOS) and establishment of the Transmission Company of Nigeria (TCN), (Adeniji and Osisiogu, 2014).

Against this background, the present study considered trade indicator (i.e., trade, which refers to the sum of exports and imports (both on goods and services) as a share of GDP) in the model to reflect the export and import in Nigeria. Further, the study uses Vector Autoregressive (VAR) model in order to show clearly the relationship in the variable either is in long or short term. Also, VAR model is designed for stationary variables and allows the use of unknown cointegration structure. More so, VAR model is natural tools for forecasting; their setup is such that current values of variables of a set of variables are partly explained by the past values of the variables involved. Lastly, our study is different from the previous studies as it expands period cover by prior studies from 1972-2014. This ensures our study captured the significant reforms that occurred between the 2010-2014 (Roadmap for Power Sector of August 2010 implementation). Our approach is of importance for policy and decision-makers to better apprehend the determinants of carbon emissions to develop effective energy policies that will palliate the impacts of human activities, and thereby contribute to the curbing of carbon emissions.

Using the VAR and Granger causality models on data from 1972 to 2014, our analysis demonstrates a significant short-run negative relationship between CO$_2$ emissions and electricity consumption, but positive relationship in the case of financial development and trade. The Granger causality test indicates a weak significant bidirectional causality running from CO$_2$ emissions to electricity consumption and in turn, from electricity consumption to CO$_2$ emissions at 10% level. However, the findings from financial development and trade openness indicate unidirectional causality running from financial development to CO$_2$ emissions and financial development to trade openness and no feedback relationship. These findings suggest the promotion of renewable energy technologies through development of financial system and trading with rest of the world should be favored in policymaking.

The present study makes following contributions to the existing body of knowledge. As our findings reveal that both trade openness and financial development play an important role for the promotion of renewable energy, policymakers should initiate effective policies that will encourage financial institutions to provide funding for the purpose of obtaining renewable energy projects. This will increase the renewable energy share in the total electricity consumption and ensures sustainable economic development in African countries including Nigeria. Our study also adds value to the literature in terms of identifying the role of trade openness on CO$_2$ emissions. These findings will assist the policymakers to take additional initiatives to promote the renewable energy consumption and financial sector development to mitigate the CO$_2$ emissions.

The paper is set as follows. Section 2 presents an overview of the literature. Section 3 introduces empirical methodologies, data and preliminary statistics of our variables. Section 4 reports the empirical findings in detail. Final section summarizes our findings with policy suggestions.

2. Literature Review

We review the literature under three subsections, viz. electricity consumption and CO$_2$ emission; financial development and CO$_2$ emissions; and trade openness.

2.1 Electricity consumption and CO_2 emission

The existing literature offers a wide range of perspectives and insights into the issue of the energy consumption – CO_2 emission nexus, which, however, report contradicting results. For instance, Alam et al. (2012) document a unidirectional causality from energy consumption to CO_2 emission for the short-run but feedback causality in the long-run in Bangladesh. Yang and Zhao (2014) examine the linkages among economic growth, energy consumption, and carbon emissions for India during the period 1970-2008. Their results reveal energy consumption unidirectional Granger causes carbon emissions. However, Shahbaz et al. (2014a) found electricity consumption to reduce the incidence of CO_2 emissions in United Arab Emirates (UAE), from 1975 to 2011. The authors also found bi-directional causality between electricity consumption and CO_2 emissions. Similar results were reported by Farhani and Shahbaz (2014) in the case of 10 Middle East and North Africa (MENA) from 1980 to 2009.

On the contrary, Shahbaz et al. (2014b), found that electricity consumption contributes to CO_2 emissions in Bangladesh. The authors also found unidirectional causality running from electricity consumption to CO_2 emissions. Similarly, Lean and Smyth (2010) found a unidirectional causality from emissions to electricity consumption in the short-run. Cowan et al. (2014) explored the causal link between electricity consumption, economic growth and CO_2 emissions in the BRICS countries (i.e., Brazil, Russia, India, China, and South Africa) for the period 1990– 2010. Their results indicate that causality runs from electricity consumption to CO_2 emissions in India, while there is no causality between electricity consumption and CO_2 emissions in Brazil, Russia, China, and South Africa. Another study by Chang (2010), reported that coal consumption and CO_2 emissions bidirectional affect one another.

Omir (2013) adopted simultaneous-equations models for 14 MENA countries spanning the period 1990–2011. The author found unidirectional causality from energy consumption to CO_2 emissions without any feedback effects. Using Johansen method of cointegration, Nasir and Rehman (2011) found energy consumption to have positive effects on emissions in Pakistan. For a panel of BRIC countries; Pao and Tsai (2010) investigated the dynamic causal relationships between pollutant emissions, energy consumption, and economic growth. They found the long-run relationship between the series. Energy consumption has positive impact on energy emissions, and the EKC hypothesis also exists in BRIC region. The panel causality analysis revealed the feedback effect between energy consumption and CO_2 emissions and same is true for economic growth and energy consumption. They suggested that in order to reduce CO_2 emissions and not to affect economic growth, increasing both energy supply investment and energy efficiency and speeding up energy conservation policies to reduce wastage of energy can be initiated for energy-dependent BRIC countries.

In Nigeria, Chindo et al. (2015) employed autoregressive distributed lag approach and find in both short and long- run, an increase in CO_2 emissions facilitates GDP growth. On the other hand, energy consumption negatively impact on GDP in the short run and found no correlation between energy consumption and CO_2 emissions. On the contrary, Akpan and Akpan (2012) found that in the long run, economic growth correlate with increasing carbon emissions, while an increase in electricity consumption leads to an increase in carbon

emissions. Similarly, Alege et al. (2016) adopted the maximum likelihood Johansen cointegration technique; normalized long-run estimates show that fossil fuel consumption enhances the level of environmental degradation in Nigeria by increasing more than proportionately the concentration of CO_2 emissions. Contrary, electric power consumption varies inversely with carbon emissions and the causality test shows a unidirectional causal relation exists from electric power consumption and indicator of human capital GDP per capita and CO_2 emissions, respectively.

2.3 Financial development and CO_2 emissions

The branch of literature which emphasizes the relationship between carbon emission and financial development (domestic credit to private sector by banks) considers the fact that pollution is generated in the production of goods, and consumption, which in turn lead to higher pollution, when such production relies heavily on non-renewable energy or heavily emitted process. For instance, Ozturk and Acaravci (2013) examined the causal relationship between financial development, trade, economic growth, energy consumption and carbon emissions in Turkey for the 1960–2007 periods. The results confirm that financial development does not relate to per capita carbon emissions in the long- run. The authors also found a unidirectional causality from financial development to per capita carbon emissions. On the contrary, Boutabba (2014) found financial development to have long-run positive impact on carbon emissions in India, implying that financial development improves environmental degradation. Moreover, Granger causality test indicates a long-run unidirectional causality running from financial development to carbon emissions.

Shahbaz et al. (2013) explore the linkages among economic growth, energy consumption, financial development, trade openness and CO_2 emissions throughout 1975-2011. Results indicate that financial development compact carbon dioxide emissions. As for the Granger causality, the study confirms financial development to granger causes CO_2 emissions. Similarly, Shahbaz et al. (2013) studied the effects of financial development, economic growth, coal consumption and trade openness on environmental performance using time series data over the period 1965-2008 in case of South Africa. The results show that financial development improves environmental quality by reducing the growth of energy pollutants. In the case of 19 countries, Al-Mulali and Binti Che Sab (2012) found causality running from financial development to emissions in the countries under investigation based on the long-run causal relationship and the positive short-run causal relationship. In Nigeria, Bello and Abimbola (2010) found that stock value traded have significant positive impact on carbon emissions.

Tamazian and Rao (2010) investigate the linkage between not only economic development and environmental quality but also financial development and institutional quality for 24 transition economies and panel data for 1993-2004. The author's findings support the EKC hypothesis while indicating the importance of both institutional quality and financial development for environmental performance. Also, they found that financial liberalization may be harmful for environmental quality if it is not accomplished in a strong institutional framework. On the contrary, Haseeb et al. (2018) confirmed financial development contribute to the carbon dioxide emissions but supported the EKC hypothesis in BRICS

economies. Further, the study reveals bi-directional causality exists between financial development and CO_2 emissions. Based on panel data for 29 Chinse provinces from 1995 to 2012, Hao et al. (2016) found that the direct effects of financial depth and financial efficiency on environmental quality are positive and negative, respectively. This suggests that the influences of the financial development on environment depend on the level of economic development. Specifically, at the early stage of economic growth, financial development is friendlier to the environment, but when the economy is highly developed; financial development is harmful to the environmental quality.

In Nigeria, Ali et al. (2018) uses an autoregressive distributed lag bound testing technique for the period 1971-2010 to examined the dynamic impact of financial development, energy consumption, trade openness, and economic growth. The authors found that in the long run, economic growth, financial development, and energy consumption have a positive impact on carbon dioxide emissions, whereas trade openness has negative impact on carbon dioxide emissions. Using similar method, Abdulrashid (2016) reported financial development stimulates energy demand, but lower CO_2 emissions. Economic growth lowers energy demand but increases CO_2 emissions. Further, the study revealed that trade openness increases energy consumption but improves environmental quality by lowering CO_2 emissions. On the other hand, energy consumption increases CO_2 emissions. The result from Granger causality shows a bidirectional causal relationship between financial development and CO_2 emissions. However, Maji et al. (2016) also employed similar method but found financial development and national income negatively related to CO_2 emissions in agricultural sector.

2.3 Trade openness and CO_2 emissions

Economists have been analyzing for decades on how trade intensity affects environmental quality. However, both the theoretical and the empirical literature on trade, economic development, and the environment are largely inconclusive about the overall impact of trade on the environment. Openness to international trade is expected to have both positive and negative effects; Managi et al. (2013), found that both in the short and long run, trade reduces emissions in OECD countries. On the other hand, the study also found that trade has a beneficial effect on BOD emissions all over the world in both the short and long terms. Similarly, Gul et al. (2013) report that foreign trade and the use of foreign investment to cause CO_2 emissions to increase rapidly in the long run. Authors also found a unidirectional causality from foreign trade dependency to carbon dioxide emissions, while the causality between FDI dependency and carbon dioxide emissions is bidirectional.

Sharif Hossain (2011) reported no evidence of a long-run causal relationship, but there is unidirectional short-run causal relationship from trade openness to carbon dioxide emissions. In supportive, Hohler (2013) found that South Africa trade liberalization has not contributed to a long-run growth in pollution-intensive activities nor higher emission levels. On the contrary, Yang and Zhao (2014) reported that trade openness is one of the important determinants of energy consumption and carbon emissions in India from 1971 to 2004. While, Omri (2013) modeled CO_2 emissions and its drivers by applying Gaussian Mixture Modelling (GMM) to data of 14 MENA countries over the period of 1990-2011. The paper

calculated a negative and statistically insignificant impact of trade openness on CO_2 emissions for individual countries (13 out of 14) and the entire panel. More recently, Hasanov et al. (2018) uses PDOLS, PFMOLS and PMG methods and found that exports and imports have impacts of opposite signs on Consumption-based CO_2 emissions in both the long- and short-run and that the effects of changes in the trade-CO_2 emissions relationship will fully be absorbed around three years. However, exports and imports are statistically insignificant for Territory-based CO_2 emissions.

Al Mamun et al. (2014) studied CO_2 emissions by utilizing data of 136 countries over 1980-2009 and used Mean Group (MG) and Pooled MG (PMG) methods. They divided countries into different samples based on income level. The study concluded that the impact of income on emissions is higher in high-income countries than in low-income countries. Based on the estimation results, Al Mamun et al. (2014) concluded that trade openness generally exhibits negative impact on emissions in most of the country groups, but these results are statistically significant only for low-income and high-income OECD countries. On the contrary, Mrabet, and Alsamara (2019) studied the validity of the EKC hypothesis by applying the Autoregressive Distributed Lags Bound Testing approach to Qatari data over 1991-2000. They estimated an effect of trade openness on emissions that was statistically significant in the long-run (the elasticity is 1.2), but insignificant in the short-run. Sohag et al. (2017) studied the impacts of trade openness, economic growth, population growth, and energy use on CO_2 emissions for 82 middle-income countries over 1980-2012, by employing the MG, Cross-Correlated MG, Augmented MG methods. The authors estimated that a one-unit increase in openness led to a 0.003-unit reduction of CO_2 emissions in the case of upper-middle-income countries. The results for the impact of trade openness were inconclusive for the full sample countries and lower-middle-income countries.

In Nigeria, Ali et al. (2016) used autoregressive distributed lag bound testing technique (ARDL) approach and found that trade openness negatively affects CO_2 emissions and consumption of energy is among the main determinant of CO_2 emissions which is directly linked to the level of income. Ali et al. (2018) also used autoregressive distributed lag bound testing technique for the period 1971 -2010 to examines the dynamic impact of financial development, energy consumption, trade openness, and economic growth. The authors find that in the long run, economic growth, financial development, and energy consumption have a positive impact on carbon dioxide emissions, whereas trade openness has negative impact on carbon dioxide emissions. Using similar method, Abdulrashid (2016) reported financial development stimulates energy demand, but lower CO_2 emissions. Economic growth lowers energy demand but increases CO_2 emissions. Further, the study reveals that trade openness increases energy consumption but improves environmental quality by lowering CO_2 emissions. On the other hand, energy consumption increases CO_2 emissions. The result from Granger causality shows a bidirectional causal relationship between financial development and CO_2 emissions.

It is clear from existing literature that the findings are inconclusive regarding the relationship between energy consumption, financial development, and pollution and this could be as a result of the stages of economic development and environmental regulations are different in different countries. Research methods and designs also differed. Further,

literatures on Nigeria are very scanty; these show little has been done in this area concerning Nigeria. These studies employed similar methodology that is autoregressive distributed lag (ARDL) approach. The results may be biased due to varying regional regulations causing unobserved heterogeneity and behaviors affecting CO_2 emissions.

3. Data and methodology

3.1 Data and sources

We used annual data from 1972 to 2014 of the Nigeria economy. Data was sourced from the World Development Indicators (WDI, 2015). Before starting the empirical analysis, we transformed all the variables into natural logarithms which assist to avoid the problems associated with the data measurement (Kutan et al. 2017; Paramati et al. 2016; Paramati et al. 2017).

3.2 Model Specification

The focus of this research is to explore the role of electricity consumption, financial development and trade openness on CO_2 emissions. To achieve these research objectives, we framed the following models using the existing theoretical and empirical approaches:

$$CO2_t = f(EC_t, FD_t, TP_t, \upsilon_t) \qquad (1)$$

The variables of the study are described as follows: CO_2 emissions (CO_2) in thousand kilotons (kt), Electric power consumption (kWh per capita) (EC), Domestic credit to private sector (% of GDP) (FD), and Trade (% of GDP) (TP).

The model in equation (1) provides a general specification, which aims to examine the role of electricity consumption, financial development and trade openness on CO_2 emissions. Where, CO_2 emission is treated as a dependent variable while electricity consumption, financial development, and trade openness are treated as explanatory variables in the model. υ_t represent error term and, period are indicated by the subscripts t.

As the first step of the empirical analysis, we employ Augmented Dickey-Fuller unit root tests to investigate the stationarity and order of integration of the variables as this determines selection of econometric models for the analysis. If all the variables are integrated in the same order, i.e. I (1), then this indicates that all the variables are non-stationary at levels and stationary at their first order differentials. This finding may suggest that these variables, as a group, may have a cointegration relationship in the long-run, then VECM model will be adopted. However, if the residuals are not cointegrated, meaning no relationship in the long-run, then unrestricted VAR model will be adopted. Finally, we aim to identify the direction of short-run dynamic; Granger causality will be used to estimate the variables in the model.

3.3 Descriptive statistics

We presented the descriptive statistics of variables in Table 1. The CO_2 emission growth rate is very low, at 0.65%. Among others, electricity consumption growth rates are significantly higher at 88.82%. However, the growth rates in the financial development are drastically low, as its speed is at 13.48 annually. While, trading in the country has recorded significant growth, with average growth rates at 48.92. Overall, the results suggest that electricity consumption growth rates are very high.

Table 1

Descriptive statistics

Variable	Obs	Mean	Slt.dev	Min	Max
CO2 emissions	44	44.648	0.190	0.325	0.10
Energy Consumption	44	88.823	33.320	28.571	156.7333
Financial development	44	13.479	6.378	4.700	38.387
Trade openness	44	48.924	15.710	22.764	81.813

Note:The growth rates were calculated using original data

4. Empirical findings and discussion

4.1 Unit root test

The ADF unit root test works under the assumption that null hypothesis of a unit root (non-stationary) is tested against the alternative hypothesis of no unit root (stationary).

The ADF unit root tests' results are presented in Table 2. The results show that the null hypothesis of a unit root cannot be rejected for all of the variables at levels. However, when these tests are applied on the first difference data series, then the null hypothesis is rejected for all of the variables at the 1% significance level. This implies that the variables are stationary at the first-order difference. The findings confirm that the order of integration for all of the variables is I (1). Since all the variables are integrated of same order, then there may be a long-run association among these variables, which is explored in the following section.

Table 2

Result of ADF Unit Root Test

Variable	Level Value	Difference Value
CO2 emission	-2.487(0)	-7.607(0)***
Energy consumption	-3.048(0)	-8.728(0)***
Financial development	-2.966(0)	-5.812(0)***
Trade openness	-2.382(0)	-9.084(0)***

*Note: *** indicate the rejection of the null hypothesis of a unit root at 1% significance levels.*

4.2 Long-run equilibrium relationship

Given the findings of ADF unit root tests, we explore the long-run equilibrium relationship among the variables of equation (1), using the Fisher-Johansen (1991) cointegration test. The appropriate lag length for the analysis has been selected using the (FPE, AIC, HQIC, SBIC) criterion. The results of the cointegration test are reported in Table 3. The findings confirm no long-run equilibrium relationship among the variables of equation (1).

Table 3

Results of the Test for Optimal Lags

Lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	17.173				.0303	-.659	-.598	-.490
1	34.896	35.446*	1	0.000s	.0132*	-1.495*	-1.419*	-1.284*
2	35.403	1.014	1	0.314	.0135	-1.470	-1.379	-1.217
3	35.496	.186	1	0.667	.0141	-1.425	-1.318	-1.129
4	35.719	.447	1	0.504	.0147	-1.386	-1.264	-1.048

*Note: * Indicates the corresponding optimal Lags to be Selected*

Table 4

Results of Johansen Tests for the Number of Cointegrating Ranks

Variables	CO2 emission	Energy consumption	Financial development	Trade openness
CO2 emission	.7319227 (7.59)***	-.0011141 (-1.85)*	.0010259 (0.35)	-.0008046 (-0.68)
Energy consumption	17.72669 (1.77)*	.9056174 (14.48)***	.2276881 (0.76)	.2118062 (1.73)*
Financial development	8.024791 (2.13)*	.0347502 (1.48)	.5771913 (5.12)***	.0899299 (1.96)*
Trade openness	-8.255527 (-0.88)	.0150136 (0.26)	-.3018082 (-1.08)	.7007912 (6.15)***

Note: Both Trace Statistic and Max suggests no cointegrating rank.

4.3 The short-run elasticities of emissions, electricity consumption, financial development, and trade openness

The results of the VAR model in Table 5 explain the short-run relationship between dependent variable, CO_2 emissions and independent variables comprising electricity consumption, financial development, and trade openness. The finding confirms the relationship between CO_2 emissions and energy consumption at 10% significance level. On other hand, financial development and trade openness have no relationship with CO_2 emissions. These results show that the growing consumption in electricity negatively contributes to CO_2 emissions. The results also show that development of financial sector and inflows of goods and services do not increase the CO_2 emissions. Therefore, fossil fuel electricity consumption is the cause of rising CO_2 emissions in Nigeria. This implies that renewable energy source of electricity consumption will favor Nigeria.

Table 5

Vector Autoregression model

Variables	CO2 emission	Energy consumption	Financial development	Trade openness
CO2 emission	.7319227 (7.59)***	-.0011141 (-1.85)*	.0010259 (0.35)	-.0008046 (-0.68)
Energy consumption	17.72669 (1.77)*	.9056174 (14.48)***	.2276881 (0.76)	.2118062 (1.73)*
Financial development	8.024791 (2.13)*	.0347502 (1.48)	.5771913 (5.12)***	.0899299 (1.96)*
Trade openness	-8.255527 (-0.88)	.0150136 (0.26)	-.3018082 (-1.08)	.7007912 (6.15)***

Notes: Figures in parentheses are Z calculated values, significant at 1% (***); 10% (*)

4.4 The direction of causality

In the final step, we explore the direction of causality among CO_2 emissions, electricity consumption, financial development, and trade openness. For this purpose, we make use of Granger causality test. This test can only be applied on the series, which is stationary; hence we converted the data series into first-order difference. The results of causality test are reported in Table 6. The findings show bidirectional causality between CO_2 emissions and electricity consumption while we also found unidirectional causality that runs from financial development to CO_2 emissions. We also found a unidirectional causality that runs from financial development to trade openness. However, we could not establish any causal relationship between trade openness and CO_2 emissions and on electricity consumption. Overall, our short-run causality test results imply that the financial development affects CO_2 emissions and trade openness.

Table 6

Granger Causality Tests

Dependent Variable	Independent Variable	Chi Square test Statistics
CO2 emission	Energy consumption	4.0393 (0.044)*
	Financial development	.79904 (0.371)
	Trade openness	.09724 (0.755)
Energy consumption	CO2 emission	2.8119 (0.094)*
	Financial development	.81856 (0.366)
	Trade openness	2.4281 (0.119)
Financial development	CO2 emission	5.0707 (0.024)*
	Energy consumption	1.1867 (0.276)
	Trade openness	4.5128 (0.034)*
Trade openness	CO2 emission	.49485 (0.482)
	Energy consumption	.22435 (0.636)
	Financial development	.93289 (0.605)

Note: indicate the rejection of the null hypothesis at 1% significance level.

5. Conclusion and policy suggestions

This study has investigated the long run and causal relationships between CO_2 emissions and electricity consumption in Nigeria. The study used annual time series data set for a sample of 44 years from 1972 to 2014 on the basis of the data availability. To achieve the objective of this study, VAR model, and Granger causality test have been applied.

While, it is clear that there is a significant negative relationship between CO_2 emissions and electricity consumption in Nigeria in the short run, with no evidence of long-run relationship. Similarly, from the results, it is concluded that there is no significant short-term relationship between CO_2 emissions, financial development and trade openness in Nigeria. We conclude that electricity consumption contributed greatly to the environmental degradation in Nigeria. However, we also argued that financial development and trade openness plays no role in promoting clean environment in Nigeria.

The results of Granger causality test indicate a weak significant bidirectional causality running from CO_2 emissions to electricity consumption and in turn, from electricity consumption to CO_2 emissions at 10% level. This implies that policies that will reduce CO_2 emissions such as hydro fuel electricity consumption may be pursued in Nigeria. The government can spend more money for the provision of renewable energy technologies and welfare and ensure steady use of renewable energy technologies by utilizing the abundantly solar and wind resources in Nigeria. Our analysis also highlights unidirectional causality running from financial development to CO_2 emissions and financial development to trade openness. Since the pursuit for clean electricity consumption is influenced by the renewable energy technologies, government should ensure the development of financial system; such development will provide more funds for individuals and firms to obtain renewable energy devices and also transact in the area of renewable energy technologies with the rest of the world.

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VALUE ASSESSMENT OF NATURAL MINERAL SPRINGS WATER USED IN SPA FACILITIES

*Defining the value of mineral water when using it in spa facilities includes two components: on one hand is the meaning that mineral water has for guests when they are using spa procedures and on the other the resources which are being saved from not heating regular water. The subject of this study is to show the results of the development of a mathematical model created to evaluate the cost of using natural warm and hot mineral water springs compared to artificial warming of water in spa facilities. The research objective is mineral water as main asset source for spa users and economic source for spa facilities. An interesting topic is the level of influence of the water component for the choice of the consumers. The contemporary consumers of spa services change their requirements for the spa facilities and the availability of mineral water is additional advantage for them. Mineral water springs provide a natural resource that can improve the quality of life of many people. Spa tourism is one of the effective ways to use those springs, and it has the potential to become a key element of our vacation planning, choice of tourist destination and lifestyle. The main purpose of the study is to present a model for determining the value of the mineral waters, thus quantifying the potential benefits of using them in the spa facilities, which is the seeked and desired characteristic of spa services from tourists, and showing losses caused by the waste of such waters. Explaining the nature and significance of the mineral water springs gives the base on which we can say that besides a natural resource that can have beneficial properties for human health, the springs can be a valuable source of savings that can be achieved by using their thermal potential.
JEL: Z32; Q26*

Introduction

The reasons for the promotion of spa tourism can be sought in the entry of *new information and communication technologies* into the economic activity. The next factor in the development of spa services is the constant redefining and new *interpretations of the term "spa"* and its entry into activities different than tourism. Spa tourism also provides

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maximum profitability with a minimal negative impact on the environment. The user of spa services is intelligent and interested in his health and is therefore inclined to pay a higher price for the services provided. He invests more to preserve the cultural resources of the visited destination and takes into account the local features both to preserve nature and to provide quality and natural ingredients and materials for the future consumption of the spa services concerned. Today, the key issue that spa managers face is how to link a spa with business and, in particular, with tourism, how to maintain and enhance the quality of the service offered, based on industry specificities. This question can be answered in many ways, but the guidelines for its solution go through *two main directions: improving the perception of customer service quality; reducing the cost of the service provided.*

Improving the quality of the service offered can be based on *a survey of consumer preferences for spa services and the reasons for taking a spa vacation*. Taking these features into account, tourist businesses can provide amenities that better meet consumer expectations. Spa companies offering spa services, on the other hand, can realize significant benefits, in our opinion, if they choose to use natural spas. The deployment of this potential is directly related to the culture, traditions and marketing of products and services. *The model we have developed focuses on cost-cutting opportunities using warm and hot mineral water springs.*

The main objective of the study is to clarify the importance of mineral water springs for spa tourism and on this basis to present a model for determining their economic potential when spa facilities use those springs instead of regular water. The specific goal of the study is reached by solving specific *problems*: clarifying the importance of mineral waters for spa tourism and their interconnection, defining the profile and motivation of the spa users, drawing up a model for calculating the potential economic effects of the mineral springs.

The scientific study aims to prove the *thesis* that there is a expressed economic benefit from the use of warm and hot mineral springs in spa facilities. Our hypotheses are: the use of warm mineral springs (37-60 °C) can bring significant savings from the cost of warming water in spa facilities; the use of hot mineral springs (above 60 °C) can eliminate the cost of warming water; waste of thermal mineral water leads to significant economic, environmental and other loss of benefits; there are significant measurable additional benefits of time savings and travel costs that tourists make when visiting nearby spa sites.

Achieving the goals and proving the research thesis implies the use of a corresponding set of approaches and methods. The applied methods are: comparative analysis and synthesis; induction; deduction; expert analysis; mathematical analysis. By their nature, they are instruments of the dialectical, historical, inductive-deductive, and systemic approach.

The study aims to create methodological tools to facilitate the planning of investment projects in spa tourism. Those tools will empirically identify and compare the predicted economic effects of using warm or hot mineral springs in spa facilities. The methodology has been expanded with further approaches to water consumption in spa facilities by creating a tool that calculates the amount of spa treatments that can be performed with an available water resource. A method has been developed to determine the maximum number of consumers that can utilize a spa for a certain amount of quantity and temperature of water. This method is indicative because there are a large number of variables that are

specific to the different spa facilities but can be used in combination with the method of determining the number of spa procedures to predict the optimum volume of potential and real spa facilities. In any case, the determination of the economic effects of mineral springs in spas should be done on a non-discriminatory basis in order to make them more visible. Isolation of other factors of influence in real conditions is a difficult and impossible task.

State of the Problem

Today, the term "spa" is used as a word that provokes association with health, beauty and rest. Researchers say it has nothing to do with the idea of healing water in the 19th century. [Velikova, 2015: 86-87] The spa is erected in a "cult of its own" by all those who want to take better care of themselves and take adequate measures to preserve their health. Spa is an idea of the 20th and 21st centuries that is revolutionary for the traditionalists. Researchers of the phenomenon point out that in today's context, based on 2500 years of experience, it is believed that ***spa necessarily involves water procedures*** [Benge, 1999: 25-33]. *In most spa resorts, the procedures that are offered use regular water. According to Cohen and Bodekeer [2008: 10-18], this is the main reason for the terminological difference between spa tourism and balneology. It is therefore* **important to determine to what extent mineral water brings economic benefit to facilities that do they use it, and are there any economic reasons why is it appropriate for spa tourism facilities to be built near mineral springs.**

The modern spa tourist does not need a precise definition for spa service or resort. They recognize the spa services at the moment they see them. The discussion about the spa definition was officially closed when SRI International launched its first report in 2007 about the "The Global SPA Economy". While studying this global case, SRI International analysts concluded that the following ***broad definition*** will satisfy customers, allowing professionals in the work field to meet the stated goals: *"Spas are establishments that promote wellness through the provision of therapeutic and other professional services aimed at renewing the body, mind, and spirit."* [SRI International, "The Global SPA Economy", 2007]

Nowadays all over the world the spa resort is a place of rest and recovery with a comprehensive approach to the harmony of mind, body and spirit. According to Ellis [2009] serious health problems can be treated in spa resorts or they can be used for pleasure and rest. Therefore, ***the combination of therapies and experiences is infinite*** and the debate about what spa is and where the term comes from will continue. The definition for SPA in the XXI century is health, beauty and relaxation and it will probably tell us ***how spa resorts will be considered in the future*** – as two types, ***such as those with and without mineral water.*** A possible modern definition, which can be accepted unanimously by all participants in the sector, may be: *spa is a place that is visited to deal with everyday problems and illnesses in a welcoming environment.* [Velikova, 2014: 57] *In today's concepts spa is a wellness complex offering treatments based on the use of water – mineral, fresh, marine, as well as seaweed and salts, curative mud and healing plants.* It is a new type of tourism supply. Technologies using natural products as well as Oriental techniques

are the main features of these new spa places. Spa procedures are increasingly entering the mass market and shift activities like thalassotherapy and balneotherapy.

Research in this area is still not very thorough, which makes it difficult to define the concept, as well as to provide a general definition of spa tourism. [Lazarus, 2000: 23-50] *The attempt to clarify the term is beneficial to both theory and practice, as tourism businesses can identify the services they will offer more clearly.* Such a clear differentiation of terminology will also facilitate **legal initiatives** in the sphere of spa services from the point of view of categorizing and licensing spa facilities. Despite the changes introduced in the **Law of Tourism in Bulgaria**, *the term "spa" is still used extensively as a marketing name that seeks to attract tourists rather than clearly designate the nomenclature and range of spa services, facilities and amenities offered.* The introduction of uniform tourism standards worldwide is a difficult task that has not yet been resolved. Therefore, this omission is somewhat minimized by additional instructions from tour operators that define the supply standards of the hotels they work with, according to their own classification criteria. These differences inevitably affect spa tourism as the lack of uniform terminology further disturbs the creation of common criteria for the standardization of spa services. Defining these criteria is from extreme importance for offering the right services to tourists, as well as for forming specific expectations which in turn create the satisfaction level that the tourists have from visiting a spa facility. It is also important that we clearly state if mineral water is being used.

The spa industry is emerging as a global phenomenon, through convergence from industries, traditions and therapeutic practices. Spa therapies have existed since ancient times in many different forms, reflecting on the cultural, social and political environment in which they are integrated. These practices are now rediscovered, borrowed and branded to create a new global industry that matches and attracts other industries. They include beauty, massage, hospitality, tourism, architecture, construction, landscape design, fashion, food and drinks, fitness and recreation, personal development as well as complementary conventional and traditional medicine. In this aspect, the use of mineral water contributes to a considerable extent.

Although there are no established standards of what water should be used in spa procedures, it is of utmost importance that mineral water is used in the spa industry, which is also necessary in the historical context. Various studies have been conducted to determine the healing qualities of mineral waters, their composition, useful properties, diseases for which they can be used, etc. For obvious reasons, many spa resorts have emerged in places where this extremely useful natural resource is available. ***Spa tourism also benefits from the use of mineral water in the different procedures it offers. This is why it is important for us to identify the main economic effects that tourist businesses achieve in using mineral water.*** On this basis, spa companies can make informed decisions about what kind of water to use.

In our opinion mineral springs have effects of a **mixed character**. Besides the health effect, which is undisputed, the mineral water can also be used to increase the economic efficiency of the tourist enterprise. Therefore, besides establishing the basic consumer preferences for the spa industry, we are developing a model for determining the economic efficiency of mineral water and applying it to specific sites to determine the economic effects of mineral

water applications in spa facilities. In this way, the extra effects that may be beneficial for the business development are derived.

Tourist businesses offering spa services do not yet use the full capacity of the mineral springs by omitting certain benefits from the availability of this resource near the place where they operate. Apart from spa procedures, mineral water can also be used for other purposes in spa facilities, and we will try to prove this need and the opportunity to increase the economic performance of tourist companies. As a result of the analyses and research we made, we give specific recommendations for the development of the spa businesses. ***In our opinion, the economic effects from the construction of spa facilities near mineral springs are significant. Such springs can be found throughout the whole territory of Bulgaria.***

Previous economic analyses and assessments regarding spa tourism emphasize the fact that mineral water is not needed in spa facilities. The scientific literature even claims that spa tourism is invented by countries where mineral springs are not available in order to benefit from the popularity and benefits of this industry. No attempts have been made to evaluate the effects that tourist sites may have when replacing regular with mineral water. ***Demonstrating the benefits of the natural mineral springs' water reveals new opportunities for the business expressed in concrete values.***

The application of the model we developed aims to determine the economic benefits of the use of mineral waters in spas. As well as to establish the additional time and logistics costs and to propose a method of determining the maximum number of consumers. The determination of these benefits should be done all other things equal. *The other benefits of mineral water, such as its medicinal properties, as well as chemical or physical characteristics that have a beneficial effect on visitors, including the overall effect of spa visits, are an additional advantage beyond the scope of the present study.* ***That is why we believe that the use of warm and hot mineral waters in spas is a significant economic resource that will become more and more important in the future.***

Role and Importance of Natural Mineral Spring Water for the Spa Industry

Bulgaria has over 240 major mineral water springs. Their resources are estimated at more than 5600 l/sec. Their composition and quality vary greatly and the temperatures are in the range of 20°C-100°C according to Lichev [2011, p. 15]. Significant quantities of mineral water exist in many countries around the world, with varying levels of resource utilization. This is a substantial and widespread resource that can be used and help the improvement of the quality life and economic growth. Its effective use can not be achieved without a clear understanding of what and where the value of thermal waters is. The market determines the purchase value of the spa services offered through the use of tap or mineral water, but the value of the resource behind the service is basically determined on the basis of state regulations and commission decisions (such as the EWRC in Bulgaria).

There is a need to clearly distinguish between the value added by the company (through marketing, advertising, the provision of a desired product) and the value of the resource itself. There is also a clear understanding that high market profit is not necessarily

associated with high efficacy. For example, bottling companies manage to market the product they offer at a high price (and with high profits). This does not mean, however, that they do not waste the thermal component of mineral water, which often has significant value, although it is usually difficult to be used beyond the spa services and sometimes for heating purposes. *Therefore, what is happening is significant amount of waste due to high perceived value of one product over another.* ***The same waste is avoided when combining spa services with thermal springs where the thermal and water components can be used effectively.*** On the other hand, the market evaluation of a liter of water is far lower when used for spa services than for bottling. ***This creates a clear need for research, first for the value assessment of this resource, that will lay the ground for mathematical and philosophical analysis through the prism of various usage alternatives- spa, bottling, heating.***

In our opinion, the use of natural mineral springs water can lead to significant positive economic effects in spa tourism. They range from ***indirect effects*** caused by improved health and working ability of spa users to the ***direct effects*** of using mineral water as a renewable resource. In order to stick to the measurable economic effects, we assume that the different benefits from the point of view of improving the health and working capacity of natural mineral springs and ordinary, heated tap water are insignificant. For this reason, the focus is on the economic effects associated with: ***savings from water heating; environmental friendliness of spa; diversification of the investment focus due to the location of the mineral springs.***

The saving of resources from warming mineral waters depends on many factors. In general, we can divide them in the following way: characteristics of the thermal (warm or hot) mineral spring; conditions of the concluded concession contract or contract for use; fuel or electricity prices; efficiency of heating facilities; losses caused by specific factors such as distance from the thermal mineral spring, pipe insulation and others.

Knowledge of current trends and opportunities for spa tourism development is of fundamental importance to the strategic planning of the sector and can help spa centers find their way to a better investment position, guarantee a competitive advantage and increase the benefits levels and customer satisfaction. ***The continuous development, growth and enrichment of spa service*s** can be defined as the most striking trend towards the end of the 20th and the beginning of the 21st century. This is valid for many places around the world, especially in Europe where traditionally such services are offered in historically established spa centers like Baden-Baden, Budapest, Bath, Spa, Karlovy Vary. Despite the economic crisis of 2008, ***spa centers continue to be a popular way of spending leisure time in many developed and developing countries.*** This development is related, first of all, to the changes in the world economy that are relevant to all countries in the world – both developed and developing and, secondly, changes in customer and consumer profiles – the situation is related to change in the characteristics of visitors to spa centers.

While in the late 1980s and early 1990s, every proposed "good" thing contained the prefix "eco", in the late 1990s it was largely displaced by the magical word "spa". This is particularly true for tourism, where up to 2001 the number of tourists choosing a spa holiday more than doubled each year. ***The 21st century can be seen as the spa era or even as a completely new era in tourism.*** Due to this fact, the question of the nature of this

"new" form of tourism and of "spa clients" is emerging as being different from "normal" tourists. *It is therefore important to determine the specifics of the spa and to study the consumer's behavior so that we can determine **whether the use of mineral water in spa facilities will lead to satisfied tourists**, which will also increase the economical efficiency of spa facilities.*

Spa Services Consumers

Earlier, the main group of spa services users were families and couples. Nowadays these are more and more unwed men and women. In addition, programs are offered for women with children (childcare) as well as training programs for improving the state of health. Changes in customer profiles are also very important for the spa industry. The largest group of spa users in the last decades of the 20th century are women and the primary segment of spa visitors are middle-aged and elderly people. It is noted that there is an increase in the number of visitors from a lower age group (less than 30 years). The teenager segment is the fastest growing in the industry. There have been changes in gender comparisons, with the number of men recently increasing at high speed. [Pearce, 2005: 67-72] ***The continued growth in demand, as well as an increase of the range of the consumer segments, has turned the spa industry into a significant economic sector generating significant worldwide revenue.***

Compared to well-developed segments and markets in the industry, studies aimed at examining the behavior of the spa user are relatively new and scarce. They show that the segment prefers mostly ***health and spa packages and products*** (eg healthy / functional / natural / organic food, vitamins, etc.) instead of spa services. [Hanel et al, 2016] This in itself shows that there is still no clear understanding of the spa industry in the business environment, in economic studies or the market itself. Further analyses are needed in this area to extend the knowledge for the profile and motivation of the spa user and to gain a better understanding from a global perspective. Existing studies give us a basic understanding of the key segments, behaviors and trends [see Tsvetkova, 2014].

In a broad sense, the user can be classified into two categories when it comes to his relationship with the spa industry. The first group is the *spa-oriented users, actively enjoying spa services*. This includes people interested in a healthy lifestyle – fitness, health or wellness. These users have the skills and knowledge and their profile is quite similar to that of a typical spa visitor. They are open to new and different ideas of health, exercise and beauty, have time, and have enough money for such activities, and for them spa services are not unnecessary luxury. Many of these types of users are motivated by the first signs of aging, both in terms of appearance and health. The second group is *consumers who respond to health problems, not particularly active spa visitors*. This includes people who suffer from illness or have health problems looking for new and alternative approaches to treat their condition or alleviate symptoms. These users are disappointed with the inability of traditional medicine to solve their problems and, as a result, explore alternative methods and non-standard treatment approaches. This segment is potentially a much larger part of the population, and is also a large group of people who are not fond. In fact, going for a

facial massage (or using another spa service) can combine for those users the pleasure of spa treatment and alternative medicine, according to the SRI International report, [2010: 25-34].

Among the most important **target groups** of the future spa market are: *elderly* but still involved in the work process and the workload and therefore need energy and balanced rest to deal with constant stress; people with *growing social and family problems* in the modern world (divorce, heavy work, etc.) need help, inner strengthening and problem-solving competencies; people with *increasing demands in work and personal life*, need new techniques to increase their mental capabilities, whether they are managers in order to achieve optimal career results, or elder people struggling with weakening memory; people dealing with the confrontation *of a world full of norms, boundaries, constraints and coercion*, and are seeking ways of development towards the internal eradication of borders; this affects all societal strata and can become a major challenge in the future in terms of climate change and its associated lack of resources; people seeking *satisfactory and meaningful ties and relationships* in a world devoid of values, and disaster-filled world, but also, those who want to retain and *maintain "constant" attractiveness* in competitive struggle [Friedl, 2006].

To sum up, we can say that rising turnover and positive outlook for the future of spa tourism can be explained by the following factors:

- Today the population put greater emphasis on good health than a few years ago. The increase of health self-awareness leads to more spending on health care and treatment. In the future, we can even expect that individual responsibility for health will increase even more and that will increase the availability of spa services.

- As a result of demographic change and an aging population, there is an increased need for more health products and services.

- Both healthcare policies and healthcare funds in the future will increasingly stimulate prevention along with rehabilitation. That is why the spa tourism market will be gaining more and more momentum.

- Within the spa sector, there is considerable effort to improve the quality and transparency of supply. If the implementation of these events succeeds, consumers' interest in spa supply will increase.
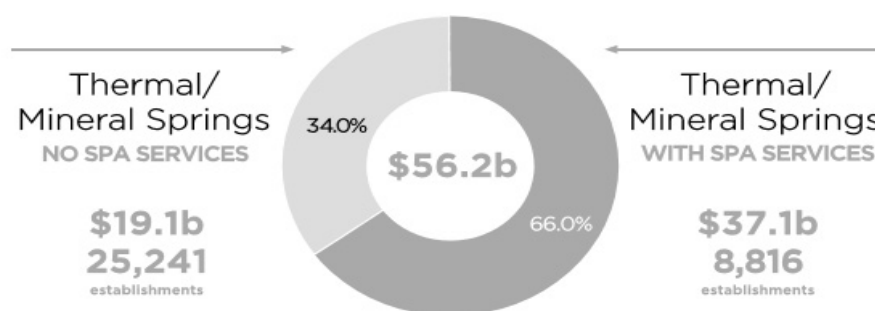
The growing importance of spa tourism and the inclusion of more and diverse activities inevitably leads to an increase in the number of consumers who will benefit from its services. As we have seen, a significant part of the importance of spa tourism is due to its health contribution. Without further exploring the health effects of mineral waters, as there are significant studies devoted to them, we can conclude that ***offering spa services based on mineral waters will greatly contribute to increasing the popularity, image and attendance of the spa who offer them.*** GWI [2018, p. XV] established that thermal/mineral springs bathing experiences appeal to a growing segment of consumers who are seeking to connect with nature, experience cultural traditions, and pursue alternative modalities for healing, rehabilitation, and prevention. Responding to these trends, both private investors and governments are investing in the sector. In countries with long-established thermal

bathing traditions, governments are increasingly promoting these as a key wellness tourism offering. They are investing in renovation and reopening of primitive, outdated, and closed-down facilities, as well as upgrading service standards and training to meet the expectations of international tourists. The presence of mineral springs in Bulgaria has created an image for the country in the balneology field and the combination of this natural good and the trends in demand can be used as a competitive advantage for Bulgarian spa facilities.

GWI [2018, p. XIV] defines also the thermal/mineral springs industry as encompassing revenue-earning business establishments associated with the wellness, recreational, and therapeutic uses of waters with special properties. The majority of thermal/mineral establishments around the world are rustic and traditional bathing and swimming facilities. They target their local markets and charge relatively low admission fees. About a quarter of the establishments are higher-end, targeting tourists and offering value-added spa services. Those that offer spa services account for a much greater share of industry revenues (66%), and also experienced higher revenue growth (7.4% average annual growth versus 0.5% for those without spa services, over 2015-2017).

Figure 1

Thermal/Mineral spring industry in 2017

Thermal/
Mineral Springs
NO SPA SERVICES

34.0%

$56.2b

66.0%

Thermal/
Mineral Springs
WITH SPA SERVICES

$19.1b
25,241
establishments

$37.1b
8,816
establishments

Note: The thermal/mineral springs revenue estimates include all revenues earned by these establishments, from bathing/ swimming offerings, spa/wellness services and other treatments, other recreational activities, food & beverage, lodging, and other services. See Appendix A for additional definitions and descriptions of categories.

Source: Global Wellness Institute

Our studies and experience show that ***the use of mineral water for spa procedures brings additional benefits to the spa in the form of a positive image, additional health effects on visitors, marketing benefits, environmental benefits.*** In addition, warm and hot mineral waters can be used to heat buildings (hotels, spa centers), as well as economies from heating of the water in the pools and other spa facilities (Jacuzzi, baths, hydrostorms, etc.). All this leads to significant additional potential that can be realized as a result of the construction of the spa facilities near an available thermal spring.

Model To Study the Potential Economic Effects of Natural Mineral Springs Water

The model is *a description essay and theoretical simulation of the use of mineral springs in spa facilities*. It examines both *ideal and realistic scenarios to evaluate their benefits and problems*. Mineral water is considered as a direct substitute for water coming from the water supply network and the economic value is divided into three components: water, thermal, and mineral, gas and biological (considered as one component).

The model application can happen in *two ways*. The first is by introducing the characteristics of the spring, the flow, degrees in °C and others resulting in: how many different procedures can be performed with the available water; whether it can save costs by using thermal springs; how many procedures can be made simultaneously (from a list of different procedures) with the available water from the source; what would be the cost if the water available from the spring should be replaced by an alternative source with the same water flow and temperature; and others. The second way, based on the desired spa procedures (bath, hydrostorm, shower Vichy, etc.), focus on the characteristics of a suitable mineral spring to be used for possible investment activities.

This model can be applied to different mineral water sources in Bulgaria and abroad, thus easily and conveniently revealing the possibilities for their application in the spa sector. It can also help with considering various alternative options for the use of mineral water as well as assessing alternative options. The model seeks to cover the basic and most important features of the mineral springs through the prism of the spa industry and the economic benefits of using a mineral spring in a spa. It seeks *measuring or presence of certain quantitative characteristics, in order to create quick and easy a clear picture about the potential for the development of a mineral spring*. Thus, creating **the basis for measuring the economic effects arising from the use of mineral springs water in spa facilities.**

The limitations of the model are as follows: it does not consider the health benefits potentially associated with mineral waters and the economic effect associated with it; does not consider the benefits of advertising and promoting spa facilities using mineral water; does not consider effects of increase eco-friendliness of the spa facilities using mineral spring water; does not consider specific conditions for the construction of spa facilities near mineral springs as well as the potential additional costs associated with them, with the exception of additional transport costs for consumers; does not consider the composition of the water thoroughly, merely by considering expert opinion (if any) that the water is suitable for use for balneological and drinking purposes. To avoid overestimating the potential of mineral springs water when using them in spa facilities, we assume that mineral waters are equivalent to non-mineral springs.

The full look of the model can be viewed through the following link: https://bit.ly/2LoHai8. It is a collection of 6 complex tables with over 3750 variables and over 120 formulas, currently covering 27 springs and collection of springs in Bulgaria and around the world. The model is a *convenient and flexible base and can be a useful tool for quantitative-economic presentation of the potential of the mineral springs*. It can be useful for investors looking for economic reasons to invest as well as for researchers who

can develop it further and formulate conclusions based on the indentified quantitative economic effects.

The water quality is determined by the water quality characteristics – Physical, Chemical, Microbiological, and Biological characteristics according to Laboratory of Echohydrology [ECHO]. For the developing of the model the in-dept characteristics of every aspect of the wates are not necessary. The reason is that for the creation of this model (and every economic model) the main focus is on the usage of the mineral water and the mandatory conditions for that usage. Through the prism of spa tourism, it is important that the mineral water can be used for therapeutic needs. For that purpose, we will present the water characteristics in different groups: water component; thermal component; biological and chemical component. ***The water component is the main component*** of every water source. Its quantity is essential for its development. ***The thermal component*** is indicative for the thermal energy that is contained in the water. More energy content in the water means various different options for its use are available, but there is a higher danger of various contaminants of chemical and biological origin to contaminate it. ***The biological and chemical component*** represent all other properties of the mineral water. Including different organisms, mineralization, gasses and others. They can be of main importance when deciding hot to use the water. Also, they impact the way the infrastructure is maintained.

Water component includes the physical characteristics of water including its flow rate, static pressure, speed of flow and others. The temperature is not included as it is a part of the thermal component. Most important from economics point of view are: ***the flow rate in l/sec.*** – it is determined by the quantity of water that can be used and can be determined quantitatively; ***the static pressure in MPa*** from ground zero – which determines if the water can be used directly or there is a need for additional expenses for pumps, which will increase the expenses and add some complexity to the usage of the mineral spring.

The flow rate of a mineral spring as a water volume have its monetary value, that can be determined as equivalent to the value of water flowing in the water supply network, before its additional treatment. It is important to point out, that water no matter if it came from a spring or dam, is equal right of every citizen of the country. The latter does not mean that it does not have value. On the contrary, the usage has to be paid. For example, "Sofiiska voda" JSC values the delivery of 1 m^3 of water on 1st may 2016 – 1.04 levs without VAT, and "V I K" – 0.78 levs or 1.48 levs when the water is pumped [EWRC]. In this price the maintenance of the water system is included, and this is the price of the closest alternative when there is an investment in a balneological (spa) facility. The price for sewage can be accepted as equal. In Bulgaria legally there are two ways for a mineral spring to be used. Under a concession or right of use. The prices of mineral water under concession is determined individually, but under right of use is the following:

Table 1

Price in leva per **m**^{3} mineral water

	Under 30 °C	30-50°C	Over 50 °C
Water supply use	0.031	0.030	0.029
Health related use in specialized hospitals for treatment and rahabilitation	0.04	0.045	0.05
Other uses	0.15	0.35	0.50

Source: authors

This means that if we have a hypothetical mineral spring with flow of 1 l./sec.:

Table 2

Price of using a mineral spring with total flow of 1 l./sec. in leva for different peridos

Health related use	Total flow in l.	Under 30 °C	30-50°C	Over 50 °C
Daily	84600	3.38	3.8	4.23
Montly	2538000	101.4	114	126.9
Yearly	30879000	1234	1387	1544

Source: authors

If we consider the law as a base point for evaluation, we can say that water + mineral content = 0.15 lv/**m**^{3} and the price is increased with 0.2 lv/**m**^{3} for the thermal waters between 30 and 50 °C and 0.15 lv/**m**^{3} for temperatures over 50 °C [MOEW].

There is a possibility that due to the different characteristics we can have an additional need for pumping of the water and creating the pressure for its usage. The minimal pressure over the ground zero for the communal water supply network is: for one story building – not less than 0.1 MPa (1 bar); for more floors – 0.04 MPa (0.4 bars) per floor; maximum allowed pressure in the water supply is 0.6 MPa (6 bars). [Darjaven vestnik, 2005]

Taking into account these regulations we can use the formula to calculate the required energy for pumping water. [Engineering toolbox, 2019; Sharon, 2010]

$$P_{h(kW)} = \frac{q * \rho * g * h}{3.6 * 10^6}$$

Where $P_{h(kW)}$ = hydraulic energy in kW

q = flow in **m**^{3} per hour

ρ = liquid density in kg /**m**^{3}

g = gravitation (9.81 m/sec)

h = needed water column.

If we accept that the spring reaches ground zero of the terrain, we will need pumping only to bring the water to its destination over the terrain. If we accept that the building where the water will be used for spa treatment is four flors high, we will need a pressure that can

reach 22 meters or around 0.22MPa (2.2 bars). This complies with the minimal requirements by the law. To simulate a real situation, we can use a spring flowing with 1 liter per second or 3.6 m^3 per hour. We accept that the water is used 100%, and is pumped constantly. This way we can see what is the maximum potential electricity spent for the pump.

$$P_{h(kW)} = \frac{3.6*1000*9.81*22}{3.6*10^6} = 0.21582 kW$$

The achieved value by this formula is ideal. In order to be closer to the real values, it is mandatory to take into consideration the efficiency of the pump. The additional friction cannot be taken into account, as it is highly dependent on each system, so we accept that it is insignificant.

The overall efficiency of the pump is a combination of the efficiency of the motor (usually electric) and the efficiency of the propellers (in case of a centrifugal pump) that increases the pressure of the water. The standard electromotors have efficiency around 90%. [Foray, 2014: 5] The efficiency of the pumps may vary dependent on the revolutions of the pump, the kept pressure, flow and others. Highly efficient industrial centrifugal pumps have efficiency around and higher than 80% [Foray, 2014: 5, DAB pumps, 2019]. Smaller pumps for personal use can have efficiency even less than 60%. For the current model we will use efficiency of 75% because we accept that the pump would not always be working at its optimal efficiency. This leads to the following:

$$\frac{0.21582}{0.75} = 0.28776 kW$$

Consequently, 0.28776 kW is the energy, that the pump will need for 1 hour to pump 3.6 m^3 of water with a pressure of 2.2 bars. The price of the spent electrical energy can be monetarily valued on the base of the prices given by the Energy and Water Regulatory Commission. According to them, kWh of electrical energy for non-household needs, delivered by CEZ Electro Bulgaria without considering night, day and peak electricity usage cost 0.14131 leva [EWRC, 2019] + 0.01745 for access and + 0.02933 leva [EWRC, 2019] for distribution = 0.18809 leva before and 0.22571 after tax.

In this case, if the pump works for 8 hours per day the price for a day will be 0.37 leva/day, 11.06 leva for a month and 132.75 leva yearly. We did not include the price of the pumping installation and additional expences for the infrastructure that may occur because of the usage of mineral water. We accept that those additional expences are important but impossible to calculate due to the different nature of every pumping installation. That is why they are not included in the calculations.

In the model the part for the water component will look like this:

Table 3

Characteristics of the water component

Water flow in l./sec.	°C	Static pressure in MPa	Needed pressure in MPa	Water pump efficiency
1	37	0	0.22	0.75
Price of electricity for kW in BGN	Price for mineral water for m^3 in BGN	Price of water from the watter supply system in m^3	Sewage price for m^3 water in BGN	Resource usage in %/100
0.22571	0.35	0.75	0.57	0.7
Results				
Time in minutes for filling 25-meter (400 m^3) pool	Time in minutes for filling 50-meter (2000 m^3) pool	Price in leva for filling 25-meter (400 m^3) pool	Price in leva for filling 50-meter (2000 m^3) pool	Alternative (water supply price) for filling 25-meter (400 m^3) pool
111.1	694.4	60 BGN	375 BGN	300 BGN
Alternative (water supply) price for filling 25-meter (400 m^3) pool	Price for pumping 100% water flow for a year. (4 story building)	Price for pumping 8 hours a day 70% of the water flow.	Price of the mineral water 100% usage	Price of water supply water 100% usage
1875 BGN	569 BGN	133 BGN	4730 BGN	23652 BGN
Price in leva for 8 hours a day 70% of the mineral water flow.	Price in leva from the water supply for 8 hours a day, 70% water flow.	kW for pumping 100% usage	Price for 100% usage of mineral water + pumping+sewage	Combined price for mineral water and pumping 100% usage
1104 BGN	5519 BGN	2521 KW	25173 BGN	7197 BGN
Combined price for mineral water and pumping 70% usage 8 hours a day	Sewage price 100% usage	Sewage price 70% 8 hours a day usage	Total price per year for 70% usage 8 hours a day	Total price for using water supply[3] 70% usage 8 hours a day
1679 BGN	17976 BGN	4194 BGN	5874 BGN	21196 BGN

Source: authors

In conclusion, we can say that the water component in the model is difficult for totally accurate economic evaluation, because there are a lot of variables that can significantly alter the results. There are basic variables like water flow and static pressure that have significant economic effect and are essential when evaluating an investment in mineral water spa.

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[3] For example will be used the price of water in Sofia supplied by ViK, which is 0.78 BGN per **m**^{3}

Thermal component can have a significant economic effect. This effect come from the economy of fossil fuels or electricity for water heating. ***The economy from thermal mineral water depends on multiple factors.*** Overall, we can separate them in the following manner: characteristics of the thermal (hot or warm) mineral spring; conditions of the concession contract; price of fossil fuels and electricity; efficiency of the heating installations; losses caused by specific factors like distance from the thermal mineral spring, pipe insulation and others; others.

To reach universal conclusions the main focus will be put on the characteristics of the thermal mineral spring and the efficiency of the heating installations. Thermal mineral springs with temperature over 100°C can be used efficiently for producing electrical energy, as well as for heating purposes. Such hot mineral springs are a rarity, especially those that have high flow rate. The artificial creation of such springs is usually very expensive and economically efficient only on certain locations. ***The efficient usage of thermal mineral springs with temperature under 100***°C is a difficult task. Only by using them for spa all three components of thermal mineral water can be used. The mineral component (included in the chemical composition of water) can be used for bottling usually if the water contains relatively low mineral composition. If there is a high mineralization it is possible for the minerals to be extracted for use in the cosmetic industry. In spas the usage of low and high mineralized water is possible.

There are different types of concession payments, that are paid to the state or different municipalities, depending on who is the owner of the thermal mineral spring. As an example of concession, we can review the one for bottling water in Gorna banya [National concession register, 2019]. There the payments for 1 m^3 of water is $2,6 and $10700 initial payment. The maximum permitted usage of water is 186 000 m^3 of water per year [Petrov, 2019]. Another example is the concession in Hisarya, where for bottling the prices are $2,65 per m^3 and 6000 leva initial payment, with maximum of 62200 m^3 water per year. [National concession register – Hisarya, 2019]

There is another way for the mineral water to be used called – permission of use. Their price of m^3 water according to the Ministry of Environment and Water is 0.35 leva for m^3 for waters under 50°C and 0.50 leva for waters over 50 °C. [MOEW, 2019] For comparison sake, we will use 0.35 leva per liter as a price of mineral water. This can be compared to the price of cold water in Sofia supplied by "ViK" – Sofia, that according to the Energy and Water Regulatory Commission costs 0.75 leva without VAT [EWRC, 2019]. This price will be used as a reference price from now on, that way we can compare price results as well as find different tendencies that otherwise will be heavily influenced by the different prices depending on location. Heated water will be used for comparison of the price of consumed electricity or natural gas with 90% efficiency boiler. The comparison with the prices of a city heating system would not be proper, because the prices cannot be universally applied.

The characteristics of thermal mineral springs**,** as we mentioned are: flow rate, temperature and chemical composition. The same are the characteristics of water in the water supply network. The maximum flow is determined by the cross-section of the pipes and the pressure inside the pipes. We will accept that the water supply can deliver the same quantity of water as the thermal mineral spring. The average temperature of the cold water

depends according to the source and the geographical location. Overall in temperate climates this average varies between 10 and 13 °C [GFX Technology, 2019: 1-2]. We will use a reference temperature of 10 °C. The chemical composition of water is relevant, but because our goals are to develop a universal system, this factor would not be taken into account.

For water heating we can use the formula, used since the time of Lavoisier for calculating the energy content of water: [Drake and Kim, 2019]

$$\frac{Q \times 4 \times \Delta T}{3412} = kW/h$$

Q – quantity of water in liters;

ΔT – desired temperature increase;

4/3412 – coefficient for specific heat capacity of water;

KW/h – kilowatt per hour electroenergy, needed for heating the water to the desired temperature.

In one cubic meter natural gas there are around 11,16 kWh energy [Utilitessavings.co.uk, 2019]. This way we can determine that for heating 1000 liters of water (m^3) with 27 °C – from 10 °C to 37 °C we need 31.65 kW/h. energy or 35.17 kW/h. if we consider 90% efficiency of the boiler. That way we can determine that for heating 1000 liters of water from 10 to 37 °C we need around 3 m^3 natural gas. For price for 1 m^3 natural gas we will accept the prices according to Overgas, one of the biggest suppliers of natural gas in Bulgaria. The prices are the following:

Table 4

Price of natural gas according to Overgas

Up to. m^3	Price in BGN non consistent usage	Up to. m^3	Price in BGN consistent usage
5000	0.781	50000	0.658
50000	0.76	100000	0.65
100000	0.75	200000	0.642
200000	0.74	400000	0.635
400000	0.729	600000	0.63
600000	0.723	800000	0.627
800000	0.719	1000000	0.624
1000000	0.715	5000000	0.606
Над 1000000	0.691	5000000	0.598

Source: Overgas, "Prices of natural gas for Sofia and Bojurishte municipality":
https://www.overgas.bg/documents/16421/28553/Актуални+цени+за+разпределение+и
+снабдяване

The consumption when heating the water would be non consistent, so in the model we will use price in leva non consistent usage. For heating of 10000 m^3 water we will need around 30000 m^3 natural gas, or 316500 kWh energy (1139 GJ). This means that the heating of water (including the efficiency loss of 10%) would cost: $\frac{1139 \times 100}{90} \times 22,69$ = 28 716 BGN. The same way, for heating from 22 °C to 37 °C we will need 17=59 kW for heating 1000 liters of water. For 10000 m^3 we will need 175900 kWh or 633 GJ, $\frac{633 \times 100}{90} \times 22,69$=15 958 BGN. (90% efficiency).

The consequences for the environment are also significant. The natural gas produces 56.1 grams of CO_2 per MJ (megajoule) [University of Helsinki, 2019] or 56.1 kg CO_2 per 1 GJ. This means that in the first case 63898 kg of CO_2 are produced, and 35511 kg CO_2 in the second case. In 2014 the average new car exhaust in the atmosphere 124,6 grams CO_2 per kilometer [USEPA, 2019]. This means that we need to drive a car for 512825 km to produce the same pollution as in the first case given (63898 kg of CO_2). If we accept that an average car is driven for 10000 km per year, this means that those are the equivalent emissions of 513 cars.

The problem with the thermal energy is that it is difficult to be used efficiently. The water law in Bulgaria gives an convenient way for the thermal water to be used – the right of use, but it incentivizes the drinking and household usage as well as the specialized medical centres, while the spa services are taxed with the highest prices. [MOEW, 2012]

Several features of the thermal component of mineral water have to be taken into account. Firstly, the efficient extraction of thermal energy from mineral water is a complex process requiring temperatures above 150 °C. [Georgieva, 2010] The highest temperature spring is in Sapareva Banya 103 °C, and also in Bulgaria there is no place favorable in terms of volcanic activity and shallow presence of terrestrial layers with high temperature. Thus, ***the establishment of efficient thermal power plants is highly unlikely***. Secondly, ***if the thermal mineral water is used for bottling, the latter loses its thermal component***. Although, according to the legal framework the prices for the use of thermal waters for "other purposes" implies relatively high price, it should be noted that this also includes spa facilities. Thirdly, ***the use of thermal mineral water for heating purposes in building heating systems requires a high temperature (above 80 ° C) using the classic two-circuit principle***. The direct use into the system is efficient for temperatures over 40 °C but may cause forming of mineral and other deposits along the pipes that need extra-investment for cleaning.

The cost of the thermal component of mineral water in the current model will be based on several key elements. The thermal energy contained in the water, is equal to the energy required to heat 10 °C water to the temperature of a thermal mineral spring with the same flow rate. A 90% efficiency boiler is used for heating, taking the latest gas price data from a relevant source to calculate the water heating price. On the basis of the energy content of the natural gas used, the amount of energy in kW is determined. The CO_2 produced as a result of heating is equal to the pollution that can be avoided by using thermal mineral springs. Two more variables, has to be taken in order to calculate realistically the values. These two are: resource load and water usage time. The mineral water usage can only be a

certain percentage of the total flow. The reason for this is that some of the thermal component is wasted, and this process can only be slowed down, but not prevented. The water outside the spa's working time can be used for other purposes as well. For example, its use is effective for warming greenhouses, for filling pools or bottling, but in the latter case the thermal component is wasted. The economic cost of the thermal component using a test spring with 1 l./sec. water flow and 37°C, would look like this:

Table 5

Characteristics of the spring

Water flow in l/sec.	Temperature of the water °C	Price GJ (NSI, 2016)	Mineral water usage percentage in %/100
1	37	21.07	0.7
Boiler efficiency	Hours of usage per day	System losses in %/100	
90	8	0.1	

Source: authors

Taking into account the characteristics of the test spring, we can calculate ***its potential to save natural gas.*** Respectively, this potential is absolute, 100% of the usage.

Table 6

Potential of the spring (absolute units)

Heating per year in GJ	Cost of heating per year (in BGN)	Consumption for water heating per year (in kW/h)
3594	75710	998209
Consumption of natural gas for 70% load and 8 hours a day usage		
Natural gas in GJ	Natural gas in m^3	Price of natural gas in BGN per m^3
754.65	19348.89	0.532 (EWRC, 2016)

Source: authors

Therefore, the amount of natural gas per year would be equivalent to over BGN 10000 per year.

The chemical and biological component also includes gases, microbiological and other pollutants. They are essential for the spa facilities as far as they provide a chemical composition that is or is not suitable for different spa treatments. They could have additional benefits for the consumers that are outside of the scope of our analysis.

The biological component is as essential as the other two since even the minimum quantities of biological elements in water are indicative of its purity. The presence of biological pollutants can make the water unusable in spa and wellness centers. Since water safety and suitability assessment requires special expertise and is not quantifiable, in the model these components will be presented as ***factors to be taken into account before using any spring for spa purposes.***

Table 7

Assessment of the biological and chemical component

Mineralization in g/l.	pH	Biologically suitable for spa usage	Chemically suitable for spa usage
0.33	9	1	1
Result: The water has low mineralization, thus suitable for usage in spa facilities.			
Mineralization in g/l.	pH	Biologically suitable for spa usage	Chemically suitable for spa usage
Low mineralization	Moderately alkaline 8.5	Yes, organic pollutants within acceptable norms	Yes

Source: authors

Through "1" we can determine that the test spring is biologically and chemically suitable for usage whereas when we have "0", it is not. That has to be done by specialists and after a thorough study of the specific springs. Such research is done regularly on the various mineral springs used for drinking and spa needs.

To determine accurately, how much water is needed for each procedure turns out to be a complicated process. Spa procedures often use a wide range of water consumption, and the amount is rarely used evenly during the procedure. Some of the assumptions of Stevens and Smolenaars's study [2007] will be used in the model, and we will also make some conclusions. We will look at the different procedures and how much water is used for them, because we will then be able to identify how many and what procedures can be performed with waters of a given mineral spring.

Table 8

Consumption of water for several spa treatments and their duration.

Procedure	Values used in the model (liters per procedure)			Duration of the procedures	
	Low	Medium	High	Duration (minutes)	L/s per procedure (maximum)
Hydrostorm	350	350	350	10-20	0.5833
Foot soak bowls	4	4	4	5-10	0.0133
Saloon basins	40	50	80	5-10	0.267
Manicure bowls	1	2	3	1-3	0.05
Pedicure bowls	2	4	14	1-10	0.2333
Stone heaters	2	4	7	10-30	0.0117
Spray booths	3	6	12	10-30	0.02
Vichy	70	375	750	20-30 (Calthorp, 1931)	0.6250
Tubs	170	350	650	5-20	2.1667
Spas	150	340	600	5-20	2.0
Showers	50	70	170	10-30	0.5667

Source: Adaptation of Stevens, D., Smolenaars, S. (2007) ASPA Water Wise Project. Physical Audits, Australian Spa Association, Carlton South Victoria, Australia.

This table is important for determining of the necessary mineral springs flow rate through the prism of the proposed spa-investment project in the future. Its precision is largely indicative, as the empirical study of Stevens and Smolearas does not go into detail and is limited to the quantity of water used. For further refinement, a more in-depth study is needed to provide more data on the amount of water and the nature of its consumption, the duration of procedures, and more. The quantities of water are averaged but have a different character. For example, when using a bathtub, there is a great deal of water consumption when filling the bathtub. Subsequently, this consumption decreases and may even be stoped until the end of the procedure. According to the EU standards, the maximum flow rate of kitchen faucets should be no more than 8 l./min., for bathtubs and sinks – no more than 7 l./min., and for showers – no more than 9 l./min. [Calthorp, 1931]

Reviewing *Table 9* we can notice that there are some discrepancies between the mean values and the maximum possible ones. This is due to the limits imposed by the EU on the maximum allowable flow of fountains and showers sold within the Union. These values, however, provide us with a good basis, because they limit the peaks in water use. The problem is that it is very difficult to calculate how many spa procedures of a certain type with uneven water use will max out the available flow rate. For example, when filling water, in the presence of taps without a legal limitation of the flow rate and the only limitation is the water supply pipes, it is possible even for one of the smallest size pipes used for the DN20 (internal diameter ~ 22.3 mm) at a sufficient pressure the flow rate to be in excess of 0.40 l./sec. This would fill a bathtub (~ 200 liters) for 8 minutes and 20 seconds. With water limitations in place, 0.117 l./sec would fill the bathtub for 28 minutes and 30 seconds, which would be too long, but would provide a lower load on the water supply network and the provided available flow rate.

Table 9

Water consumption for spa procedures

Procedure	Even use of water	Even average consumption (l./sec.)	Maximum legal consumption (l./sec.)(JRC, 2019)
Hydrostorm	Yes	0.3889	-
Foot soak bowls	Yes	0.0089	0.117
Saloon basins	No	0.1111	0.15
Manicure bowls	Yes	0.0167	0.117
Pedicure bowls	Yes	0.0121	0.117
Facial bowls	Yes	0.0039	0.117
Stone heaters	Yes	0.0033	-
Spray booths	Yes	0.0050	-
Vichy	No	0.25	-
Tubs	Yes/No	0.4667	- /0.117/
Spas	Yes	0.4533	-
Showers	Yes	0.0933	0.15

Source: authors

Even consumption can be achieved through a reservoir of mineral water, so the peaks of consumption would be flattened by it. In direct use, knowing the water consumption peaks is particularly important, because they can lead to water pressure and water flow reductions, even with sufficient water resource capacity. The legal limitations help to limit these peaks and respectively, to save water. In some cases, however, the presence of that constraint could lead to problems, for example when filling a bathtub, it is necessary to fill it for a reasonable time. If we use a limited water supply, it would mean that to fill 350-liter bath, it would take nearly 50 minutes, which is extremely inefficient.

By combining the different aspects of mineral water and its consumption in the spa facility, we create a holistic model that we can apply to different mineral water springs. Which would allow an empirical research on the mineral springs to verify and regulate the model. In table 10 is examined a test spring with a flow rate of 1 l./sec. and a temperature of 37 °C. With the implementation of this model, water prices from the water supply network, electricity and natural gas, will be used as a constant. The reason for this is to create a comparative idea on the same basis for the potential of the mineral springs. Having a spreadsheet for calculation allows us to easily enter other values that in turn gives a more precise idea which would be useful while applying the model.

Table 10

Characteristics and theoretical usage of mineral springs – test spring

Name of thermal mineral spring	Location	Water flow in liter per second.	Temperature °C	Static pressure MPa
Test spring	Test	1	37	0
pH	Mineralization	Acceptable biological properties	Acceptable chemical properties	Price in BGN Per m^3 from water main
7	0.75	Yes	Yes	0.75
Price of mineral water in BGN. Per m^3	100% water flow in m^3 per year.	Price of electrical energy in kW	Price of natural gas in BGNPer m^3.	Needed water pressure MPa
0.35	31536	0.22571	0.76	0.22
Efficiency of the water pump in %	Price of sewage in BGN Per m^3.	System losses in %	Base temperature $°C$	Boiler efficiency %
0.9	0.57	10%	10	90%
Hours of usage	Resourse usage in %	Working days	25m. pool volume in m^3	50 m. pool volume in m^3
8	70%	7	400	2500
Comparison between a mineral spring and water mains water usage				
kW for 1 year heating of mains water to the mineral spring temperature	Natural gas yearly in GJ	Natural gas yearly in m^3	Price in lv. For heating for 100% usage	Price in lv. For heating with assigned load
998209	931.66	27815.44	81594	20942
Time in hours to fill a 25-meter pool	Time in hours to fill a 50-meter pool	Price in BGN. for filling a 25-meter pool with mineral	Price in BGN for filling a 25-meter pool with mains	CO_2 emissions saved in kg. in 100% use of

Name of thermal mineral spring	Location	Water flow in liter per second.	Temperature °C	Static pressure MPa
		water	water	mineral water
111.1	694.4	163.98	300	201598
CO2 emissions in kg. 8 hours a day 70% of available water used	Number of average cars emissions not released in the atmosphere (100% water usage)	Number of average cars emissions not released in the atmosphere (8 hours 70% water usage)	Price of water per year in BGN (8 hours 70% water usage)	Price of mineral water per year in BGN (8 hours 70% water usage)
51743	162	42	5519	2575
Price of water in BGN per year (100% water usage)	Price of mineral water in BGN per year (100% usage)	Pumping and mineral water price in BGN (100% usage)	Pumping and mineral water price in BGN (8 hours 70% water usage).	Sewage price in BGN (100% usage)
23652	11037.6	11749	2741	17975.52
Sewage price in BGN (8 hours 70% water usage)	Electrical energy used in kW yearly for pumping (8 hours 70% water usage)	Maximum kW/h electrical energy used (100% water usage)	Total price + heating in BGN tap water (8 hours 70% water usage)	Total price + heating in BGN mineral water (8 hours 70% water usage)
4194.29	735.23	0.360	30655	6935.68
Number of possible spa procedures with the available water flow				
Hydrostrom	Saloon basins	Manicure bowls	Pedicure bowls	Spray booths
3	8	15	15	200
Vichy	Capsules	Tubs	Spas	Showers
4	7	2	2	8

Source: authors

Determining what volume of water on average a person uses in a spa is a difficult task, which need consistent and in-depth empirical researches. Different authors give different data for the used quantity of water per person. The quantities of water given in such way can be used as a way to determine the quantities of water used for a spa facility. We have to point out that the given quantities are for the water usage in the whole hotel, and they are divided by the number of guests. We can see the tendency in Europe that the water usage is significantly lower. As previously mentioned in the recent years the European regulations help to limit the water sewage. According to the European standards in European Union the maximum flow rate of the kitchen sinks should be no more than 8 l/min, those for bathtubs and other sinks no more than 7 l./min., and 9 l./min. for the showers. [Calthorp, 1931] This means that one 10-minute shower can use between 50 and 90 liters of water, which corresponds to the low figures given by Stevens and Smolenaars (see table 8). The specialized hospitals for rehabilitation – National Complex give the figure 200 liters per person per day [SHFR – NC, 2019]. Another way to decide the water used per person is to rely on the report created by the architectural and urban planning subdivision of Sofia Municipality. They determine the potential usage of water between 100 and 250 liters per person. [Sofia municipality, 2019] We will use 200 liters mineral water per customer, and

from now on we will use these figures for determining the maximum number of customers that can be served with given quantity of water.

The research of using mineral springs waters in spa facilities is not enough for determining exhaustively the economic effects, that can be caused by them. There are additional factors that can give additional value to the usage of mineral water rather than tap water. Therefore we can summarize that mineral waters have significant economic value, even if we do not consider other than the most direct metrics to evaluate them.

Approbation of the Model Towards Real Mineral Springs

The desire of spa tourists to receive services that include mineral water makes us want to try and define the options for building spa centers in proximity to mineral springs. This means that spa facilities will be remote and thus creating more transport expenses. Investments in real estate also create significant costs but that is a subject-matter for a different study. [see Stefanov, 2018]

In order to determine the costs, as time and money for the road, we must first determine which are the main modes of transport used to move to spa destinations. Following the analysis of the logistics market in Bulgaria for the period 2010-2016 [Vodenicharova, M., 2016] in this study, we consider only the most popular travel option, namely, a personal car. Moreover, according to Gutovski [2013: 320], road transport has a very big advantage over other modes of transport, it is extremely flexible. Yordanov [2012: 53] says that auto transport takes a significant part when it comes to short-distance trips.

Table 11

Costs and duration of travel by car to some spa destinations in Bulgaria

Starting point: Sofia		Automobile expenses lv.			Diesel expense + 50.00% lv.		Gasoline expense + 50.00% lv.	
Spa destination	Km.	Diesel	Gasoline	Time	For 2/5 People	For 5/5 people	For 2/5 people	For 5/5 people
Varshec	93.9	11.11	13.19	01:36	8.33	3.33	9.89	3.96
Hisarya	175	20.71	24.57	01:49	15.53	6.21	18.43	7.37
Velingrad	136	16.09	19.10	01:54	12.07	4.83	14.32	5.73
Momin prohod	70.1	8.29	9.84	00:58	6.22	2.49	7.38	2.95
Haskovo mineral baths	223	26.39	31.31	02:33	19.79	7.92	23.49	9.39
Pavel Banya	221	26.15	31.03	02:33	19.61	7.84	23.28	9.31
Sandanski	171	20.23	24.01	02:10	15.17	6.07	18.01	7.20
Burgas mineral baths	374	44.25	52.52	03:31	33.19	13.28	39.39	15.76
Albena	477	56.44	66.98	05:06	42.33	16.93	50.24	20.09
Total	1941	229.66	272.56	22:10	172.24	68.90	204.42	81.77
Average	216	25.52	30.28	02:27	19.14	7.66	22.71	9.09

Source: authors

From Table 11 we can see the time and cost of traveling by car to some popular destinations in Bulgaria. We can note that, depending on the characteristics of the road, there are significant deviations between the distance to the different spa resorts. For example, the time of travelling 93.9 km to Varshets is an hour and 36 minutes, while for travelling 175 km to Hisarya takes 13 minutes more. An average car traveling to Varshets goes one kilometer for one minute and one second while traveling to Hissarya for only 37 seconds.

Nowadays, using a variety of commonly available tools, such as GPS navigation, Google Maps, and others, we can accurately calculate the time needed to travel between two points. Google Maps even provides the capability to track real-time random events, such as traffic jams and incidents. This allows you to reach your desired destination on an efficient route. Consideration of the average values in Table 12, therefore can not provide high accuracy but covers possible scenarios that may be the basis for extrapolations.

Table 12

Features and average travel prices to certain destinations by car.

Price per liter gasoline	Average expense per 100 km.
2.05	6.85
Price per liter diesel	Average expense per 100 km.
2.04	5.8
% maintenance	50
Filled spa resorts	Average time per kilometers
9	0:00:41
Average price for liter per kilometer for 2/5 people	
Diesel	Gasoline
0.08874	0.10531875
Average price per liter per kilometer for 5/5 people	
Diesel	Gasoline
0.035496	0.0421275

Source: authors

When 9 spa resorts are filled, the average time per km journey is 41 seconds. As mentioned earlier, there is a significant variation, depending on the specific conditions. However, this base allows us to understand approximately how long an arbitrary journey would take us. The sampled average is intended to serve as a guide when precise information about a particular route is missing.

On the basis of the exported data, we can claim that the travel to mineral springs outside the territory of Sofia leads to significant time and money investments. That is why the described resorts are visited mainly during the holidays, weekends and when on leave. The fixed position of the mineral springs leads to the fact that spas, which are close to a large number of consumers, often use tap water and are usually combined with a gym. There is also a perception that the use of mineral baths is purely hygienic or curative. This has resulted in the decline of many public baths since the Second World War due to their replacement by widespread domestic baths.

To demonstrate the efficiency of the model we ***apply it to the springs in Velingrad***. The simulation helps us to find out what potential savings can be made using the spring of mineral water for the purposes of spa tourism. The model can easily be applied to other potential spa resorts domestically and abroad.

Velingrad is a town in Southern Bulgaria, founded in 1948 by the merger of the villages Ladzhene, Kamenica and Chepino. It is located in Pazardzhik region and it is the second largest in the area after the regional center. The town is an administrative center of the municipality of Velingrad. In the following table, you can observe results from the model we developed, which describes and evaluates the available mineral water resources in the town of Velingrad and the possibilities for their use in spa facilities:

Table 13

Assessment of the potential of the mineral springs in the town of Velingrad

Name of spring	Location	Flow rate l/sec	Temperature°C	Static pressure in MPa
Velingrad (total)	Velingrad	114.83	56.3	0
pH	Mineralization	Eco. Appropriate	Healing appropriate	Tap water price in BGN per m^3
8.2-9.2	Low	Yes	Yes	0.75
Price of mineral water	100% flow rate per year in m^3	Price of electricity per kW in BGN	Price of natural gas per m^3 in BGN	Pressure required in MPa
0.35	3621279	0.22571	0.691	0.22
Effectiveness of electric water pump in %	Sewerage cost per m^3 in BGN.	Energy losses of the system in%	Base temperature in °C	Heater efficiency in %
0.65	0.57	10%	10	90%
Hours of use daily	Water resource load in%	Working days of the week	Pool volume 1 (25m) in m^3	Pool volume 2 (50m) in m^3
8	70%	7	400	2500
Comparison of mineral springs and use of water from the water supply network				
kW of energy for one year of heating the tap water to the temperature of the mineral spring	Natural gas per year in GJ	Natural gas per year in m^3	Price in BGN for heating at 100% load	Price in BGN for heating at set load
196559452	183455	5477199	3784744	971418
Time in hours needed to fill pool 1 (25м)	Time in hours needed to fill pool 2 (50м)	Price to fill pool 1 (25 meters 400m^3 in BGN with mineral water	Price to fill pool 1 with tap water	CO_2 emissions saved in kg. in 100% use of mineral water
1.0	6.0	163.98	300	39697144
CO_2 emissions saved in kg. at a set load of mineral water	Emissions from vehicles per year for 100% use of	Emissions from vehicles per year with specific	Price of water for one year at a set load from the water supply	Price of water for one year at a set load of

Name of spring	Location	Flow rate l/sec	Temperature°C	Static pressure in MPa
	mineral water	mineral water usage	network in BGN.	mineral water in BGN
10188933	31860	8177	633724	295738
Price per year at 100% load from the water supply network in BGN	Price per year at 100% mineral water load in BGN	Pumping water + mineral water 100% load in BGN	Price for pumping water + mineral water set load in BGN	Sewerage Price at 100% Load in BGN
2715959	1267448	1342833	313328	2064129
Price of sewerage at set load in BGN.	Electricity in kW per year for pumping at set load	Electricity in kW / h maximum for pumping at 100% flow rate	Total price + heating at specific load of tap water in BGN	Total price at specific mineral water load in BGN
481630	77932	38.127	2086772	794958
Number of possible spa treatments with available water flow rate				
Hydrostorm	Washbasins	Manicure	Pedicure	Water jets
295	880	1718	1779	22966
Shower Vichy	Water capsule	Bathtub	Jacuzzi	Shower
459	787	246	253	944

Source: Authors

With the proven flow rate of mineral water at an average of 200 liters per person, an 8-hour working day and 70% water efficiency usage, up to ***11575 people can be served daily***. This makes Velingrad the resort with the largest potential capacity in Bulgaria. The relatively high temperature and abundant water resources allow you ***to save up to 40,000 tons CO$_2$***, equivalent to the emissions of an average 8177 cars a year. From the table you can see many more advantages of the mineral springs compared to the use of tap water. It should be noted, that the mineral waters could not be stored easily. The reason is that, when using shut-off valves (as is the case with tap water), there is a serious danger of development of dangerous bacteria in the water. Therefore, the efficient use of mineral springs, such as those in Velingrad, means the distribution of available water, and inevitably wasting the water that is not used. In other words, ***not using the mineral springs leads to waste of significant resources and potential.***

Conclusion

The study of the economic efficiency of mineral springs is important in terms of their development. The quantitative measurement of the usable characteristics of this gift from nature leads to a better understanding of its economic value and supports the planning of the costs and potential future revenue from its use. The rapid development of computer and information technologies gives us an unprecedented opportunity to handle quantitative measures and formulas quickly and easily, with the possibility of dynamic data management and access everywhere.

Mineral springs are a gift of nature, the use of which is important in order to save resources. With the advent of the 21st century, attention is increasingly drawn to the economy in its essence, namely resource-saving in order to achieve high efficiency and minimal impact on nature and people. This new trend gives the opportunity for the development of the mineral springs, especially the thermal ones. In recent years, there has been a growing interest in mineral water not only for their use for bottling, but also for spa treatments. According to many sources, the interest in the sector is steadily increasing, within Europe (including the countries of the former USSR), revenues from thermal mineral water projects exceeding 20 billion dollars.

There are a variety of economic effects from the use of mineral water, which can be grouped into three main groups: effects caused by the use of the water component; effects caused by the use of the thermal component; effects caused by the mineral, biological and chemical composition of water. By applying the proposed model, we can determine the key positive effects, and present them through quantitative measures. Each of these effects groups is presented in detail in the model, with a number of measures being developed. An exception is the last group for which expert judgment is required. The reason is that the use of water for spa purposes is determined by its appropriate biological, chemical and mineral characteristics, as potential contamination or preservation of water can lead to serious negative effects.

There is a need for current empirical studies related to spa procedures. Creating an accepted and constantly developing a system for the quantity of water needed for each spa treatment, as well as the actual ways to use it, would greatly enhance research opportunities. This necessity is justified by the creation of additional efficiency in the use of mineral waters and the achievement of additional economic efficiency in the use of mineral waters in spa facilities. Such research would support efforts to save water, which would contribute not only to the lower cost of services but also for a smaller environmental footprint.

As a result of the evidence presented in this study and in the model, we could conclude that:

- the use of hot springs (37-60 ° C) (with a sufficient flow rate) can result in significant savings in the cost of warming water in spa facilities, even springs with temperatures below 37 °C, such as in Ovcha Kupel lead to appreciably lower costs;

- the use of hot mineral springs (above 60 °C) with sufficient flow can eliminate the cost of warming water in spa facilities;

- the waste of thermal mineral water leads to significant economic, environmental and other loss of benefits, as observed in Velingrad example, these missed benefits amount to nearly 1 300 000 leva as well as saved emissions of up to 40 000 tons of CO_2;

- the hypothesis that there are additional benefits of time-saving and transportation costs that tourists make when visiting closer spa sites is confirmed.

All of those enable us to conclude that the mineral springs water is a valuable natural resource, which used in the right way could lead to significant economic effects in short, medium and long term. We can clearly state that given the natural mineral waters available in Bulgaria, every year millions of euros are wasted. Due to the increasing popularity of the

spa services among the consumers, in the future investments in thermal mineral springs could be quite profitable.

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SUMMARIES

Vyara Stoilova

MARKET, FREEDOM AND JUSTICE

This article constitutes an attempt to present the market themes through the prism of the freedom of the market actor to pursue their self-interest and the associated expectations for achievement of certain justice. The freedom of the human as a market actor has a number of specific characteristics as compared to other freedoms they receive in their role as a citizen of a democratic state, such as the freedom of speech, of religion, of association, etc. The value concept of the market is embedded in the dual nature of the market actor. As a consequence, these results in duality of their interest and two qualitatively differing social environments where they strive to realise it. The freedom this market actor has in these two social environments is different, which gives rise to expectations for achievement of two dimensions of market justice. One is related to the specifics of the relationships of exchange between the market actors and the other is related to the distribution of competitive market opportunities between them.
JEL: A1; Z1

Burkynskyi Borys Volodymyrovich
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COMPETITIVENESS AND RELATED CONCEPTS: A LOGICAL APPROACH TO DEFINITION

The purpose of the paper is justification of the competitiveness concept definition as an object of quantitative measurements and related basic concepts of the theory of competitiveness based on their logical deduction from the minimum number of basic concepts and fundamentals of economic theory to ensure the internal consistency of the theory's system of key concepts.
In spite of a large number of studies devoted to the theory of competitiveness and the problem of its measurement in recent decades, the state of the conceptual and categorical apparatus of the theory and, first and foremost, the definition of the very concept of competitiveness, cannot be considered satisfactory. Based on the requirements of logic imposed on scientific concepts and systems of concepts in arbitrary scientific field, as well as on basic concepts of economic theory, the paper attempts to clarify the content and formulation of the competitiveness concept and to construct a system of key concepts of the theory through logical deduction. This has required clarification (revision) of a number of the theory's concepts formulations and, first of all, the concept of economic agent; allowed to identify and/or establish logical connections between them; determine the place of each of them in the concepts' system; to discover concepts, which scientific consistency as well as expediency of inclusion into conceptual system of the theory of competitiveness are debatable; achieve rigorous definitions of these concepts and internal consistency of the concept system as a whole; identify the range of theoretical issues to be solved and/or more in-depth study, which logically follow from the proposed wording of key concepts' definitions of the theory of competitiveness.
JEL: B41; D01; E00

Gancho Ganchev
Mariya Paskaleva

THE RELATIONSHIP BETWEEN WORKFORCE MIGRATION AND THE BASIC MACROECONOMIC VARIABLES OF THE COUNTRIES FROM CENTRAL EASTERN EUROPE WITH A FOCUS ON BULGARIA

In order to establish a relationship between the labor market and migration, we consider the following 11 countries: Bulgaria, Romania, Estonia, Latvia, Lithuania, Poland, the Czech Republic, Slovakia, Slovenia, Hungary, and Croatia. The explored period is 2000-2017. The following methodology is applied: namely VAR methodology. We prove that in Bulgaria, unlike other post-communist EU Member States, wage is the foremost factor governing the international migration of the labor force. The research reveals that foreign direct investments have a strong impact on labor productivity, wages, respectively on emigration and labor immigration. In our study we advocate a policy of accelerating income growth, combined by the introduction of a tax-deductible minimum.
JEL: G32; H20; H50

Rubakha Mariya
Tkachyk Lesia
Hamkalo Olena
Demkiv Khrystyna

INTEGRAL ASSESSMENT OF BANKING ACTIVITY EFFECTIVENESS AND RATING OF UKRAINIAN AND BULGARIAN BANKS

The article proposes a method for evaluating and rating the effectiveness of banks on the basis of coefficient analysis. It is proposed to calculate 24 coefficients, which allow to estimate capital-resource, credit-investment and general effectiveness of banks. According to the developed method, the rating of banks of Ukraine and Bulgaria was formed. Based on the rating, the banks of both countries are divided into 4 groups: high, sufficient, low and critical effectiveness. The rating indicators prove the higher effectiveness of the banks in Bulgaria and generally the higher stability of the banking system compared to Ukraine. The study developed an integral indicator of the bank's operation, which is a tool for a comprehensive assessment of the bank's performance and can be used to analyze the absolute effectiveness and stability of banks in different countries. Along with effectiveness, the integral indicator includes indicators of bank capital adequacy and its qualitative characteristics (customer confidence, image, transparency, comfort and simplicity). According to the results of the integral assessment, taking into account the balance of coefficients in groups, banks occupy the corresponding position in the matrix, which indicates their class (strong, mediocre, weak) and the presence of problems in certain aspects of the activity.
JEL: C13; G21

Mladen Velev
Siya Veleva
Anka Tsvetanova

STUDY OF THE DETERMINANTS OF THE ENTERPRISE'S CAPACITY TO ABSORB NEW TECHNOLOGIES

In modern times the business success of enterprises is more and more the result of the development of science and the accelerated introduction of new advances in technology. Innovations are becoming the key to success. In these conditions the importance of technological transfer also grows and it becomes a main "strategic way of meeting the challenges of globalization in business" (Mayer and Blaas, 2002). With the growth in importance of the transfer of technologies increases the interest in the theoretical elucidation and empirical research of various aspects of the absorption capacity of enterprises and its determinants, characterizing the capability for timely recognition, acquisition and use of new advances.

In view of the above, the aim of this paper is to present, in brief, an opinion on the determinants of the absorption capacity of enterprises and the factors that affect the formation of the them as well as the findings of empirical research of their state and impact on the intensity of technological transfer, innovative activity and business results of industrial enterprises in Bulgaria.
JEL: O32

Wang Bo
Mariya Grygorak
Viktor Voitsehovskiy
Sergiy Lytvynenko
Tetiana Gabrielova
Dmytro Bugayko
Yatchko Ivanov
Andrija Vidovic

CARGO FLOWS MANAGEMENT MODEL OF NETWORK AIR CARRIER

This paper describes modeling of cargo flows management of a network air carrier by a model that allows to use the advantage of well-developed packages that implement linear programming methods. Several characteristics of the underlying mathematical models are presented and the stages of the modeling process are determined.
JEL: C6; R42; L93

Ekaterina Tzvetanova

ADAPTATION OF THE ALTMAN'S CORPORATE INSOLVENCY PREDICTION MODEL – THE BULGARIAN CASE

Having an adapted model for prediction of Bulgarian corporate insolvency is a useful tool for a wide range of financial statement users. In the past sixty years, plenty of papers was published in this field. However, a statistically significant insolvency prediction model hasn't been constructed based on Bulgarian financial ratios. The purpose of the study was to solve this task. Linear Discriminant Analysis was used to select variables and to quantify the coefficients of the insolvency financial indicators for Bulgarian companies. The classification tests were applied to initial and test samples. Analysis of the classification accuracy was made comparing the adapted model and the revised

Altman's Z-score model in 2000. The result confirmed the need for adaptation of Altman's Z-score model.
JEL: C51; C52; C53; D22; G33

Abdulrasheed Zakari
Vincent Tawiah

IMPACT OF ELECTRICITY CONSUMPTION, FINANCIAL DEVELOPMENT, TRADE OPENNESS ON CO$_2$ EMISSIONS: EVIDENCE FROM NIGERIA

This paper has explored the role of electricity consumption financial development and trade openness on the CO$_2$ emissions. The study utilizes annual data from 1972 to 2014 and employs various robust econometric techniques. Our analysis reveals that there is no long-term relationship financial development, trade openness and CO$_2$ emission. However, the short-run analysis indicates significant relationship among the variables. The results also reveal that the bidirectional relationship between electricity consumption and CO$_2$ emissions, and a unidirectional causality from financial development to CO$_2$ emissions. Our results imply that policies that will promote renewable energy consumption and financial development can be pursued concurrently.
JEL: C32; G0; O44; Q43

Elenita Velikova
Ivo Anev

VALUE ASSESSMENT OF NATURAL MINERAL SPRINGS WATER USED IN SPA FACILITIES

Defining the value of mineral water when using it in spa facilities includes two components: on one hand is the meaning that mineral water has for guests when they are using spa procedures and on the other the resources which are being saved from not heating regular water. The subject of this study is to show the results of the development of a mathematical model created to evaluate the cost of using natural warm and hot mineral water springs compared to artificial warming of water in spa facilities. The research objective is mineral water as main asset source for spa users and economic source for spa facilities. An interesting topic is the level of influence of the water component for the choice of the consumers. The contemporary consumers of spa services change their requirements for the spa facilities and the availability of mineral water is additional advantage for them. Mineral water springs provide a natural resource that can improve the quality of life of many people. Spa tourism is one of the effective ways to use those springs, and it has the potential to become a key element of our vacation planning, choice of tourist destination and lifestyle. The main purpose of the study is to present a model for determining the value of the mineral waters, thus quantifying the potential benefits of using them in the spa facilities, which is the seeked and desired characteristic of spa services from tourists, and showing losses caused by the waste of such waters. Explaining the nature and significance of the mineral water springs gives the base on which we can say that besides a natural resource that can have beneficial properties for human health, the springs can be a valuable source of savings that can be achieved by using their thermal potential.
JEL: Z32; Q26