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Algorithm of investment safety ranking assessment: Threats analysis

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The present study aims at the investigating of investment safety from the position of threat analysis. The main conclusion of the paper is the proposed algorithm of investment safety ranking assessment which is free of subjectivity, flexible to threat analysis, potential investment security analyses, open to periodization technique. Using the author's ranking system ("authors skating system") proposed to determine for each object firstly the assessment on the level of each statistical factor, and then - at the level of IS components (investment potential, investment activity, investment risks considered from the threat position). Periodization technique by means of cluster analyses proves the necessity to consider homogenous intervals during the investment security analysis especially while first stage of listing potential indicators. The conducted research can be useful in practice for policy makers, potential investors, analytical agencies, security analysts.

JEL Classifications: C43, F21

Keywords: Investment safety, assessment, threat, periodization, cluster analysis

Introduction

Investment policy that promotes the inward of capital in the economy is an integral component of sustainable growth of any civilized economic system. Investment is one of the fundamental categories in the economic system. As well at present one of the main driving forces behind the process of internationalization and globalization of the economy is the international movement of capital (mostly in the form of foreign direct investment). International capital flows are complex process that acts as a significant factor in economic development and at the same time has significant problems. However the term "investment security/safety" (IS) is a relatively new and unexplored phenomenon. There is still the discourse between the terms usage for this investment component: safety versus security. Not determined scientific position exists whether to consider IS as the process or as the state (Tkalenko, 2010).

Therefore, the topic of an IS is extremely important and requires further deep study. IS assessment is going to give an answer: what is the ability of a state to accept capital inwards without a significant socio-economic damage caused by the implementation of the investment (on the state policy level).

Despite highly active world investing processes, scientific papers dedicated to IS along with its measurement, listing of indicators are not in majority. If to browse Google space (accepting fact that it is not the scientific search but still) we receive about 319 th. gross results on "investment security" search keywords. Keyword combination "investment safety" search gives about 28 th. gross results. Such numbers basically prove the difference in understanding of the key term. If to browse more precisely latter Google results we can conclude that mostly we have links that consider IS at the micro level. If we use Google Scholar library: same keywords have ratio 4 th. to 733 links (and just 77/22 if we look for keywords in titles). As well, local languages (like Russian, Ukrainian, and Polish) demonstrate lower amount of links but more macro level approach to the investigation of IS. This crucial difference in usage of keyword combination proves the novelty and significance of the study proposed. As well the lack of researches on the topic is clearly represented.

Taking in account the analysis of literature in the field, our research sources its logic on the basis of most cited books and papers of such experts as Gorski (1954), Hosseinzadeh Bahreyni (2004), Kharlamova (2008; 2013), Kyrylenko (2005), Naryshkin (2010).

For research aims we declare to consider *investment safety (IS)* (Kharlamova, 2013) as the level of ability to attract investments and the level of socio-economic development of the state under the influence of investment inflows. So, *IS* can also be defined as the control of recognized hazards to achieve an acceptable level of investment risk (as for an investor, as for a recipient).

The aim of the research: to approach the detection, identification and measurement of risk factors, hazards and threats as one of the most important objectives of IS analysis. The goal involves the following tasks:

- to depict the essence of IS from the position of potential threats
- to analyze the main indicators of IS
- to propose the method of assessment objective IS of state (region, sector, industry, enterprise, project)
- to consider the necessity of periodization for IS assessment and examine method on domestic case of Ukrainian IS.

IS threats and indicators

An unambiguous determination of the nature of IS today is missing. IS is controversial term: whether to consider it as a condition/state (safety) or as a process (security). On the one hand, it describes the current level of usage of investment resources in the economy, and on the other - determines the direction and effective policy for investment activity. The focus of the research is to consider state level of this investment component (safety) (Kharlamova, 2013) and to direct assessment mechanism on the need in IS strategies to cope with troubled times.

The process of IS providing should be implemented on a particular algorithm. We offer the following set of rules:

1. Identification of the level of IS
2. Identification of possible threats that can impact on IS
3. Formation of indicators of IS as compounds of parameters
4. Identification of the parameters of IS that could be representative litmus of IS weakening
5. Development of a system of IS monitoring for different levels of economy
6. Monitoring of an IS
7. Development of strategic and tactic operational policy for targeted measures aimed at eliminating the neutralization and removal of threats to the IS.

Threat analysis is a critical component of the analysis and management of IS. Here we can use base of practical threat analysis popular in security study (PTA). If so, we propose to consider Practical Investment Threat Analysis (PITA) as a calculative threat modeling methodology and a threat risk assessment tool that assist invesetment safety consultants and analysts in assessing the security risks in investment system and building an appropriate investing policy. The role of PITA is to identify system vulnerabilities, map system economic assets, asses the risk of the threats and define an effective risk mitigation plan for an investment system architecture, functionality and configuration. We propose to consider threats to IS (at the state level) as obvious or potential actions that impede or prevent the implementation of national investment interests and create a risk to socio-economic and political systems. Simply saying, as threats for the state IS could be considered any events or indicators (formal and no formal) that frighten potential investor or group of investors to make their activity in the state and its regions, industries, enterprises, projects. So the investment climate worsening can be internal safety problem. The declared decreasing rating of Ukraine by some authoritative expert agencies "Moody's", "Standard & Poor's" could be considered as well as a threat to IS (external threat).

Thus, we come to the classification IS threats as internal and external with the remark on their impact specific:

- source of direction
- time period from the appearing till impacting the IS ("frightening lag")
- time period of being active for IS
- scale of the threat impact
- ability to be controllable
- level of IS that is under impact.

All IS threats are negative consequences as timely detection and removal of them is an important prerequisite for a country. But in security analysis the most important is not only to be able to remove the safety problem but to detect it as earlier as possible.

Indicative security evaluation method is the most in demand today. In comparison to other methods of safety assessment (multiple regression method, an expert method, estimate of the magnitude and probability of harm) the indicative method based on the comparison of the actual values of safety indicators with their thresholds is very popular among academics and practitioners. In order to get the answer to the question of the appropriateness of the method for estimating the indicative IS system it is necessary to analyze the indicators which it is based, to explore its possibilities, to compare the advantages and disadvantages, to consider the impact of the latter on the integrity and objectivity of the evaluation results of the IS, as well as ways to overcome these deficiencies and their impact. But the most important shortage of the indicative method in usage for ordinary policy maker or person in charge is the necessity to consider a set of indicators and thresholds. Sometimes it is adequate, but sometimes to overloading. In this work we propose the simplifying idea - to consider IS as one complex assessment (mostly objective rating base assessment).

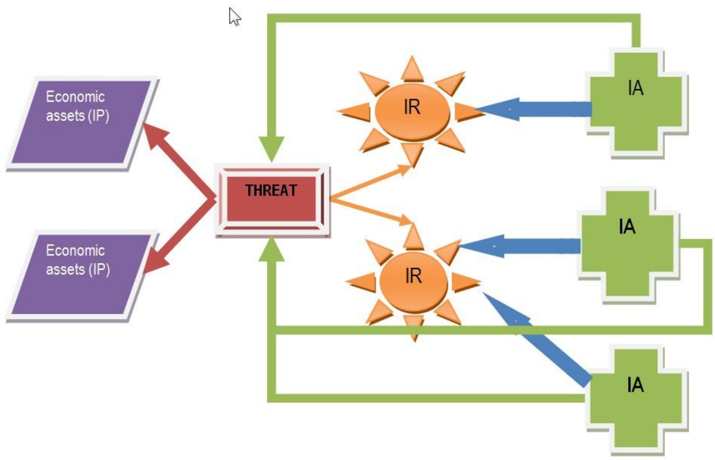
For such aim we propose all statistical indicators of a state (as well as at the levels of regions, sectors, industries) to systematize in three components of IS potential threats: *investment potential (IP)* - internal controllable threats source, *investment activity (IA)* - mostly external uncontrollable threats source and *investment risk (IR)* - internal semi-controllable threats source, which in its turn include such relevant factors:

- *IP:* PC - industrial capital, InP - innovative potential (innovation environment), InstP - institutional potential, InfrP - infrastructure potential, HC - human capital, NGP - natural and geographical potential, CP - consumer potential, FP - financial potential
- *IR:* SR - social risks, ER - economic risks, EcoR - environmental risks, CR - criminal risks
- *IA:* IF - investment inflows; RIA - indicators of retrospective investment activity.

Involving the indicators of retrospective investment activity is an important innovation proposed. Under the terms of moving investment environment the determination of long-term rate of IS is quite problematic as the main factors are under constant changes. Though we suggest just the point ranking (for a year) of state objects (e.g., regions, sectors, industries), but in view of retrospective situation. All factors are to considered as stimulants and de-stimulants for IS: like IP and IA mostly positive directed on IS enhancing, while IR has negative impact.

The scheme of PITA below describes the interrelations between a threat and the economic assets, vulnerabilities and countermeasures of IS:

FIGURE 1. A NUTSHELL SCHEME OF PITA FOR IS



Source: Authorial scheme on the base of PTA.

In a nutshell:

- *Threats* exploit *Vulnerabilities* (IR) and damage *Economic Assets* **(***IP)*
- *Countermeasures* (like IA) mitigate *Vulnerabilities* (IR) and therefore might mitigate *Threats*.

So, assessment of cumulative level of IS on the base of latter threats system will give option to control dynamic of IS and forecast policy acts. So we look on the IS from the position of threats - whether they dramatically frighten or controllable in their impact. It is hoped to be pessimistic analysis for optimistic forecasts.

One more feature of proposed approach to assess IS is neglecting some special threshold for the IS assessment. Any movement of IS graph under monitoring on decreasing is a litmus for the policy-makers to implement some acts to safe the national interests. The levers of improvement could be found in the profile of every component of IS.

Methods of IS diagnostic and periodization

The approach for IS diagnostic mentioned latter can be realised through the procedure of integral IS assessment on the base of formalization of comparison operations according to 9 stages. The characteristics of the stages are following:

Stage 1. We form the original set of statistical indicators $\{x_{ni}\}$ that characterize the investment potential, investment risk and investment activities reflecting the object under analysis.

Stage 2. Since all parameters have different gauges and dimensions, contain some "interobject" variation, then to bring them to the comparative form we use the procedure of standardization (normalization) of their values by assigning a numerical value for each indicator to the average value of this index as a whole:

$$x^*_{ni} = \frac{x_{ni}}{x_n} \quad (1)$$

Where, x^*_{ni} - standardized value of the *n*-th partial index over *i*-th object; x_{ni} - numerical value of the *n*-th partial index over i-th object; x_n - numerical value of the *n*-th partial index in average over all objects.

As a result, after the specified procedure numerical values of all parameters are converted to dimensionless relative values.

Stage 3. Apply correlation - regression analysis to the set of dimensionless relative values received on the Stage 2. It should be noted that we firstly proposed to allocate such set of indicators for further analysis which detects the maximum degree of distress due to the performance of IS. The iterative procedure based on the use of correlation analysis is implemented (Glinskiy and Ionin, 1998; Kharlamova, 2008). In our view, the inclusion of this stage in the methodology for IS assessing makes it possible to mathematically justify the involvement of the most important indicators for research purpose.

Stage 4. To form IP component, the indicators are selected which show the most positive correlation with indicators of IA. To form the IR component, respectively, the indicators are selected which show the most negative correlation with indicators of IA. Also the set of indicators excludes containing of collinear indicators. It is not allowed to include one and the same parameters in the composition of the components that reflect simultaneously same components of IS threats (IP, IR, IA). The result of the indicated procedure is getting a compact (mathematically and logically proved) set of the most important indicators of IS. While forming the set of indicators the basic principles of a systematic approach are implemented: minimum essential adequacy, sufficient diversity, and aim-orientation. And the only (common) criterion to justify such composition of indicators is tightness of correlation.

Under the selection procedure conducted by us (Kharlamova, 2008) during the periodic monitoring of investment climate of Ukraine it was found out the methodologically important pattern: composition of invest-valuable indicators to determine the investment situation (whether IS or Investment climate) of the region (industry) may not be the same for several years long, it is partly varies depending on the characteristics of each stage of the economy. That is why we feel the necessity to propose the periodization approach for IS assessment in parallel to IS PITA (that will be represented further).

Stage 5. Cluster analysis is the best for laying out objects in the ranking group for each analytical parameter depending on the level of this index for each object (Duran and Odell, 1974; Glinskiy and Ionin, 1998; Mandel, 1988; Tamashevich, 1999). Cluster analysis is a significant advantage compared to other methods of grouping objects that based on fairly strong formal mathematical apparatus, brings certainty to the distribution of objects with relative ease of usage. In our study, non-hierarchical (iterative) method of cluster analysis is conducted - a method of *k*-means (Mandel, 1988). Under cluster analysis using k-means the user has full control over the initial location of the centers of clusters.

Thus, applying the cluster approach we "breakdown" objects on N groups at the values of each indicator (N level depends on the PITA aims - what scale of security levels we are going to consider).

Emphasize that we deliberately produce clustering of objects for each indicator separately, and not hold a one-step clustering for the whole set of indicators. This can be proved in the following statements:

1. It is not always possible to form groups of indicators and thus clusters in the future, in one step at a set of all indicators. An example of this is the presence of such indicators as de-stimulants. Moreover, the number and composition of the indicators for the formation of each factor may vary from year to year;
2. The composition of the cluster may not be constant for each group of features. Thus, for a group of IA may be a one number of "leaders" and for the group of IR - less/more "leading" objects. In this case one-step clustering results in not quite adequate cluster representation and in a large number of "overhauled" ("unestimated").

Stage 6. Using the author's ranking system ("skating") we determine for each object firstly the assessment on the level of each factor, and then - at the level of IS components (IP, IR, IA). All indicators are based on direct action on the IS divided into positive and negative. In our methodology positive are indicators of IP and IA components and negative - IR component indicators. Note that at step 4, we considered that the best estimate of the IR component will receive the lowest index value, and the lowest grade - the highest. While in some methods researches convert the value of de-stimulants in stimulants by means of relation to minimum, or a multiplication by (-1), followed by the addition to 2 (Glinskiy and Ionin, 1998). We deliberately move away from this practice, arguing that the use of cluster analysis proposed in this study and the author's system of "skating" takes into account the direction of the impact of a parameter and avoid additional calculations.

In our study for receiving of an integral IS assessment we propose a new method for object ranking, which later will be called "Authorial Skating System" (ASS). The call-name seems appropriate from the standpoint that the basic principle of our method is taken from the sport Skating System, and also the evaluation is conducted like "sliding" style.

The basis for the ideological principle of the ASS is the Skating System, which is standard procedure for determining the results of the competition in the sport (Dawson, 1963; Richard, 1994; Mora, 2001; Mora and Braden, 2002). It is a complex technique that is used to calculate the final results of the competition of sports where athletes are evaluated by individual (or groups) judging panel with providing certain places for every athlete.

In 1938 the system, based on the criteria of the majority of the judges, was developed and proposed for wider use to solve this problem. The name "Skating" (by which it is known today) system received due to the widespread use in figure skating. Since 1956 Skating System is widely used in other sports that are alike figure skating (especially in DanceSport) (Dawson, 1963). Mathematical foundations it has acquired in works of Prof. Xavier Mora (Mathematics University of Barcelona (Spain)) (Mora, 2001; Mora and Braden, 2002). Classic Skating System conventionally consists of 2 parts. At the 1st part - the assessment of each athlete for the performance of each group of exercises is held. And the goal is in a combination of athletes' marks given to them by each group of exercises by different judges. The resulting table contains the combined (integrated) evaluation of athletes for each group of exercises. In the 2d part - these combined ratings for each group of exercises are combined altogether and serve as the final resulting table of final places for athletes on the results of all competitions. In both parts separate ranking is reduced to a single integral rating.

The basic principle is in the basis of Skating System: taking into account the *principle of absolute (vast) majority* (of judges' thoughts). This principle is also taken as the basis for the development of the ASS.

Note that the basis of IS is the principle of comparability: a kind of economic competition for facilities to maximum mitigation of threats / minimal threat impact. Under mentioned PITA analyses we choose strategies as judges choose best skillful sportsman, we eliminate running in front of us variants to be secure. Therefore, the involvement of ASS to determine IS assessment well reflects the estimate of the natural essence of this phenomenon. In our case the objects will act as athletes, and certain positions in groups of factors - evaluation of judges.

The downside of the classic Skating System (Mora, Braden, 2002), in mathematical and practical point of view, is the inability to solve some controversial situations. The ASS is free of such drawbacks. Our contribution to the classic Skating System is the criteria formalization of procedures of ranking assessment, based on the fundamental principle of the Skating System, and suggested procedures to resolve potential conflicting situations. Criteria formalization of ASS is following (for simplifying of explanation we use here sporting terminology as well):

Assume J - number of factors that are descriptive for objects under evaluation (number of judges, who evaluate athletes),

N - number of objects who compete to be on $\{1... N\}$ ranking places (number of athletes who compete for $\{1... N\}$ ranking places),

j_n - number of factors that gave to the object n-th position in rank (number of judges who gave n assessment to the athlete),

k_n - number of factors that gave to object n rating place and higher (number of judges who gave to the athlete assessment n and higher), so that $k_n \geq j_n$,

r - first mark n, for which k_n represents preferred (absolute) majority of factors' (the judges) ratings. The principle of the vast majority of (judges ratings) factors' rating assessment will be considered as realized if $k_n \geq \left\| \frac{J}{2} \right\|$ (symbol $\| \;\|$ means a rounded portion).

Next, we propose the introduction of the next optimizing criteria:

$n \rightarrow min$	criterion shows that the best score – "1", so 1›n.
$r \rightarrow min$	criterion shows that the smaller n while the principle of the majority opinions is realized is the better one
$k_r \rightarrow max$ $k_{r+1} \rightarrow max$ … $k_{r+N-1} \rightarrow max$	The principle of following up the vast majority of opinions at lower n

Our system provides in its procedures the resolving of all possible conflicting situations. As a contradictory situation can be considered the situation where for 2 objects (athletes) there is equal number of max k_r. To solve this situation, we propose to involve the median score (M), which shows the median spread ratings for this object (athlete). That object (athlete) which M is smaller gets top position in the ranking. If it happens that the median of the two objects (athletes) are equal too, then here we involve so-called "median average" (M_1), which is equal to the median line of assessments left to M. That object (athlete) which M_1 is less takes the top place. Thus, further modification of the criterion $k_r \rightarrow max$ in equivocal cases is:

$$\underset{M \rightarrow min}{max\, k_r} \quad \text{or} \quad \underset{\{M, M_1\} \rightarrow min}{max\, k_r} \qquad (2)$$

To ensure adherence to the principles of simplicity and compactness of ASS method the calculations of median component is impractical to do at the beginning of the procedure unless the contradictory situation appears.

Our approach is adequate to the purposes of the study. Being free of subjective "expert weights" is undeniable advantage of the ASS for integrated IS assessment because of unquestionable objectivity of the results.

Stage 7. Sequential implementation of the ASS first on the level of factors, than on the level of IS components and the receiving of integral IS assessment.

Stage 8. To check the comparability of the results of the current trend of IS we can propose to use the Spearman rank correlation coefficient (η) (Tamashevich, 1999):

$$\eta = 1 - \frac{6\Sigma d^2}{n(n^2-1)} \quad (3)$$

Where, *d* - differences between ranks of objects in the set; *n* - number of objects, $|\eta| \leq 1$. If both series ranks coincide, then $\Sigma d^2=0$ and the correlation coefficient is 1.

The degree of closeness of correlation between the integrated IS assessment and IS assessment or investment activity statistics in the next period may be the objective criterion of correctness to use ASS for assessing the IS. The higher will be the degree of correlation, the more fully realized the potential of the method. If the correlation coefficient is less than 0.5, it may indicate the inadequacy of the monitoring.

Stage 9. We believe that it is appropriate to publish the results in the dynamics of change: tomonitor annual IS assessments, to get new charts, and to measure the movement of IS integral assessment as a "enhancing" (or "weakness"). In general, the construction of dynamic ratings is reasonable from the point of view of not only the state at a particular time, but the dynamic changes that have occurred over time. This approach allows a more thorough conclusions concerning retrospective, current, and hence forward-looking investment situation in the state (on the level of region, sector, industries etc.).

Threats/PITA/SWOT analysis can be easily implemented to the results obtained as we can receive IS assessment not only as integral indicator, we have it in the scale of objects of a state (whether it to a level of regions, sectors, industries, particular enterprises and projects). That is the main novel and force feature of the method proposed latter. Same method can be approached for cross-states ranking analysis of IS.

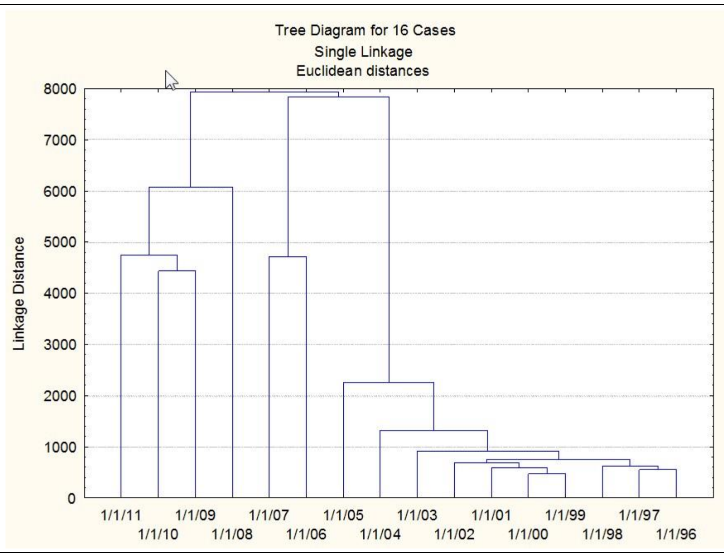
The forgotten in recent studies but important for security analyses part is the periodization analysis. It should be noted that the problem of periodization (especially of IS), despite the fact of its importance that is recognized for a long time, still had not found the proper reflection in the books and scientific papers. Besides receiving some gross level of IS it is important to understand to what period of the situation we can date in retrospective to compare results and to see the similarities. As well, we address periodization diagnostics to be sure in the set of factors we choose for latter method of integral IS assessment.

At the heart of periodization there is a rule that a continuous qualitative change in the phenomena priors to a leap forward in the dynamics of the process that change the consistent patterns (Kovtun, 2005). Thus, the study of time series covering a considerable period of time, we should distinguish them on homogenous intervals. Moreover, the dynamic modeling of a complex process as IS is impossible without a detailed retrospective analysis, a significant aspect of which is the selection of similar periods and stages of development. Periodization of IS and investment activity in general is an important in the historical perspective as the process of determining the homogenous periods of similar socio-economic development of the country in general and investment in particular. Periodization of IS, on the one hand, provides important information on the process, on the other - lays the groundwork for further analysis of the dynamics because provides the ability to use multivariate statistical methods, adequate use of which is possible only in homogeneous environments.

The main condition for the implementation of statistical calculations is uniformity of data. In other words, the typology of the initial information is the original, binding step of the analysis. Uniformity of the set is implemented using typological grouping (cluster analysis, pattern recognition methods, etc.). There is a trend to consider as homogeneous following chronological indicators that can be planned (Glinskiy and Ionin, 1998). This definition that is quite correct from the theoretical positions gives nothing for a practical sense, because it has no formal background. Therefore, further we assume as a homogenous the time period that meets any of the following criteria that has a specific interpretation:

1. Kernel equality (hereinafter equality is considered in the statistical sense)
2. absolute equality in growth (constant rate of change of levels)
3. Equality of other absolute differences (constantly accelerated or slowed down a change a number of levels)
4. Equality of continued growth rates.

FIGURE 2. DENDROGRAM OF PERIODIZATION OF IS COMPOUNDS FOR 1996-2011 (CASE OF UKRAINE)



Source: Authorial scheme on the base of data (Kharlamova, 2013)

The feature of short time series with multivariate periodization is the inability to use sophisticated techniques. Usage of factor analysis, dendrites method requires a sufficient number of observations to guarantee the reliability of the results. Therefore, for periodization of a short dynamics of individual indicators (like IS for the case of Ukraine) we offer on the base of the progressive time interval and coefficient of variation to select homogenous periods. This method has the following steps:

1. The average is calculated for the first two levels of the series
2. Their standard deviation is estimated

3. The coefficient of variation is calculated and concludes the homogeneity of given period of time
4. the average is calculated for the first three levels and the coefficient of variation is estimated for this period of time.

Once the ratio exceeds 33.3%, the latter level would refer to another time period and determination of the next period will start from this level on a similar scheme. This approach will reveal some homogenous periods that characterize the state of the IS phenomenon.

Still one of multivariate statistical techniques that allow a multidimensional periodization is a method of cluster analysis. To implement the procedure of cluster analysis the neighbor -to- neighbor method is more suitable on the base of Euclidean distance (Duran and Odell, 1974). Peculiarity of cluster analysis for periodization is to select units of the set: the units will perform a set of years and as features - different indicators characterizing the IS (or the IS components assessments). The result of cluster implementation on the example of the research made for Ukraine is the construction of cluster dendrogram under hierarchical agglomerative cluster analysis (Figure 2).

In Figure 2, at the first phase of clustering it is clearly visible separation of the 3 most periods - 1997-2001, 199-2003 and 2005-2009 periods that are similarly homogenous on their IS levels. Within the allocated period we can notice the existence of other homogenous periods but they are not so numbered. That gives us understanding to develop strategies and further methods that will base on the similarity of periods and will help PITA to develop secure matrix for every homogenous period.

Conclusion

The conceptual proposals and mechanisms to ensure IS (on the levels of regions, sectors, industries etc.) under levels of threats are investigated. The approach represented in the article is the implementation of the proposed definition of "investment safety", disclosed its nature and place in the system of the economic security of the country. Classified factors of IS proposed to divide into groups of threats. That is helpful for objective defining the current level of IS, its threats, their systematization and most important to investigate latter in dynamics.

The approach for IS diagnostic mentioned latter is proposed to realize through the procedure of integral IS assessment on the base of formalization of comparison operations according to 9 stages characterized in the paper. Our ASS method of IS diagnostics propose some novelties and is adequate to the purposes of the study. Being free of subjective "expert weights" is undeniable advantage of the ASS for integrated IS assessment because of unquestionable objectivity of the results.

The periodization of IS process (on the case of Ukraine) has allowed to show the ability of such technique to allocate homogenous periods for further PITA analyses on the base of IS assessment estimated by means of ASS. The study of IS dynamics should be accompanied with the consideration of the methodology of periodization, especially methodology of periodization of complete series to study the patterns of investment processes. This diagnostics can be helpful in retrospective analysis of corresponding periods characterizing changes in major trends in the investment process. Thus, the results of the study can conclude that for the short time series the usage of complex multivariate techniques and methods of periodization is not possible to obtain reliable results. Under such conditions separate statistical methods can be used enough effectively for the analysis of variation, as well as hierarchical cluster analysis.

In the future, with the enough dynamics length, periodization will allow not only to learn the patterns of the investment process and its impact on the effectiveness of social and economic development, but also provide opportunities to expand the boundaries for reliable long-term forecasts. Dynamics of a complex process as investment safety is impossible without a detailed retrospective analysis, an important aspect of which is the selection of homogeneous periods or phases of development.

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