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SOME REMARKS ON THE PROPER UNDERSTANDING OF RISK PERCEPTION

Introduction

Perception is being defined as the act or faculty of apprehending by means of the senses or of the mind. Accordingly, it is associated with understanding or cognition (http://dictionary.reference.com/browse/perception, accessed: 20.05.2011). With regard to this definition, the perception of risk is two-dimensional. The first dimension addresses the understanding of risk, while the second one – the cognition of risk embodied in the entity's ability to analyse risk.

It is a common knowledge that risk is accompanying any type of the business decisions and probably thus it is often in focus as a subject of theoretical and empirical studies. The business entities are advised to take actions against risk with the purpose to enhance the value creation process. These actions are embodied in the risk management process which begins with risk analysis stage. This paper aims at supporting the thesis, that on the business entities' level the risk is perceived predominantly through the risk analysis as an element of risk management process. In particular, it aims at discussing some aspects that allow a better understanding of risk perception, with regard to both theoretical insight, and applicative approach.

The first section of the paper provides a two-tier understanding of risk perception and characterises the domain factors determining the risk perception. The second section of the paper revises risk perception in the context of risk analysis as a process conducted in the two stages: the risk identification and risk assessment. The third section of the paper provides some empirical evidence on risk perception as it discusses the results of the survey conducted in 2011 with regard to the global risk perception.

1. The domain factors determining risk perception

1.1. The understanding of risk

The understanding of risk is not a straightforward problem as numerous definitions of risk exist. Probably the most widely known definitions of risk are based on the A.H. Willet and F.H.Knight discussions. According to Willet, risk is "the objective correlative of the subjective uncertainty" and "it is uncertainty considered as embodied in the course of events in the external world" (Willet, 2002, p. 29). The degree of risk may be ascertained by the relative perfection of the knowledge of preceding conditions. According to Knight, risk is a measurable uncertainty whereas the term uncertainty should be limited to the cases of non-quantitative types (Knight, 1964, p. 20). In other words, an entity faces the risk if the outcomes are unknown, but the probability distributions are known ex-ante. Deriving from Willet and Knight concepts, the definition of risk is based on the probability of events. As a consequence, many define risk as the volatility (variation) surrounding the outcome of a future event (future outcomes around the expected) (Young and Tippins, 2001, p. 73; Banks, 2002, p. 1; Williams and Heins, 1989, p. 8; Culp, 2001, p. 7).

Such definition of risk, however, stresses that the outcomes of risk, might be both negative or positive, providing a rise for the distinction of the negative and positive concept of risk (*Zarządzanie ryzykiem*, 2009, p. 13; Culp, 2001, p. 7). The perception of risk with the negative concept is more common. Accordingly, risk is associated with a threat, and thus requires proper risk-response actions that are helpful in mitigating or at least minimising the impact of risk. The risk that results only in the negative outcomes is often referred to as the pure risk. As a consequence, risk is being defined as the uncertainty concerning the occurrence of loss (Rejda, 2001, p. 42).

The positive concept of risk assumes that risk can result in the positive outcome as well as in the negative outcome. This is specifics of the speculative risk (Rejda, 2001, p. 6). Accordingly, risk might be utilised to gain benefits and is perceived as an opportunity for the entity. Such approach to risk is typical if we deal with some kind of investments (e.g. the project or financial investments) (Hubbard, 2009, p. 88-90; *Zarządzanie ryzykiem*, 2009, p. 13). However, risk as an opportunity has also a strategic dimension – the negative outcomes of risk need to be controlled to enable a business to maximise its opportunities. Such a concept is based on the assumption, that each strategic decision inevitably bears risk, but offers some opportunities as a reward (compare Chapman, 2006, p. 5).

The perception of risk as an opportunity in the speculative sense is believed to contradict the most established understanding of risk both in practice and in the decision theory (Hubbard, 2009, p. 90). For that reason, in this study the

further development of the problem of risk perception will be under-pined on the negative concept of risk and thus concerning its negative outcomes (losses), whereas the positive outcomes are associated with opportunities in the strategic meaning.

1.2. The subjective cognition of risk

Assuming that the risk is defined as the variation of outcomes, the core problem is the assessment of the outcomes' probability. This matches directly the discussion over the ability to assess the risk by the decision-makers. A fundamental issue is whether the objective or subjective risk is revised, which moves the problem to the personal dimension.

The objective risk is the variation that exists in nature and is the same for all persons facing the same situation. The objective risk is based on the objective probability of the outcomes which is the proportion of times that the outcome would occur, assuming an infinite number of observations and constant underlying conditions. The assessment of the objective probability is the same for all persons in a given situation. The subjective risk, however, is the personal estimate of the objective risk. Accordingly, the subjective probability addresses what the decision maker believes to be true. Thus, it is estimation and a state of the mind. (Williams and Heins, 1989, p. 9-10). The problem of risk perception requires a closer consideration of the subjective nature of risk with regard to the cognitive limitations of a human being as a decision-maker.

The subjective nature of risk emphasises that each person participating in risk analysis is directed by own opinions, memories and attitudes that determine the overall world view. Most people are prejudice while making judgements about risk, rather than analysing the facts rationally and logically. Moreover, people's conclusions often differ from conclusions of others who are looking at the same information. Sutton (2010, p. 33) convinces, that even highly trained experts, who regard themselves as being governed only by facts, will reach different conclusions while presented the same set of data.

These observations allow distinction of some factors that affect a decision-maker perception of risk, as presented in Table 1[*]. These factors are mostly tied to the feelings and acceptability of risk determined by the human nature within the perception of the information about the reality.

[*] The factors presented in Table 1 feature all people (individuals) facing the risk and willing to assess somehow the impact of risk. For the purposes of this study, these factors were attributed to decision-makers.

Table 1

Factors that affect risk perception of a decision-maker

Factor	Feelings and willingness to accept the risk
Degree of control	if a decision-maker feels that has control over hazardous situation, feels less risk
Familiarity with hazards	mysterious or unfamiliar hazards are particularly unacceptable
Direct benefits	the more clear and visible benefits (reward) for risk-taking, the higher the acceptance of risk
Personal impact	the higher impact a decision-maker has (according to his or her belief), the different is the perception of the outcomes of risk
Natural vs man-made risk	natural risks are more acceptable than the man-made
Recency of events	decision-makers tend to attribute higher level of risk to events that have actually occurred in the recent past
Effects of the consequence term	decision-makers feel that high-consequence events that occur rarely are less acceptable than more frequent, low consequence events
Comprehension time	if a decision-makers are informed that a significant new risk has entered it can take some time for them to digest that information

Source: Own study based on the description provided by Sutton (2010, p. 34-36).

The subjective approach to risk is also explained by cognitive sciences. D. Kahneman and A. Tversky developed the prospect theory that addresses the human cognitive bias and handling of risk (Kahneman and Tversky, 1979, p. 263-292)[*]. The results of Kahneman and Tversky research is a set of quirks and flaws in human judgement on numbers, and in particular how decision-makers will routinely assess one risk as very high and another as very low, without making any mathematical computations. This is the reason why decision-makers commit errors when assessing the risk. The two domain reasons lie in the fact that people have limited ability to recall the relevant experiences they would use to assess the risk, and that people tend to make logical mistakes (errors) in the assessment of the height of probability. Tversky and Kahneman provide examples supporting these general findings (Tversky and Kahneman, 1974, p. 1125-1130; Hubbard, 2009, p. 100-114).

It is important to be aware that people as decision-makers commit errors and omissions in their subjective perception of risk. The estimation of risk – either objective or subjective – is a building block of properly conducted risk analysis that determines the correctness of further steps in risk management pro-

[*] In 2002 D. Kahneman won the Nobel Prize in Economics for the prospect theory. A. Tversky passed away in 1996 (but D.Kahneman admitted that it is a joint prize) (http://eu.wikipedia.org/wiki/Amos_Tversky).

cedure. The risk management procedure is here associated with the constant risk analysis followed by risk control through taking appropriate risk response actions, and the monitoring of the outcomes of the procedure in order to make all necessary improvements. (Chapman, 2006, p. 10; Vaughan and Vaughan, 2003, p. 12; *Glossary...*, 2004, p. 199; Ong, 2006, p. 3). Usually, the risk analysis is the prime element in the procedure that covers both the risk identification and the risk analysis. In these areas risk is a subject of exploration by the decision-makers and in this sense extends the understanding of risk perception.

2. The components of risk analysis

As mentioned previously, risk analysis composes a building block of a proper risk management. In general, this stage of risk management process is dedicated to learn about the risk that is accompanying the business. With the results of risk analysis, a decision-maker is able to decide about the proper method of risk control or about the risk avoidance (by taking no too risky business activities).

In general, risk analysis might be conducted with the application of either deductive or inductive techniques. The deductive techniques follow the top-down approach. The consequences of risk are being described and then the analysts work backward to deduce what combinations of events could have occurred to produce such consequences. The inductive techniques follow the bottom-up approach which works in the other direction. A single peril is postulated, then the inductive approach determines what impact it may have in the certain hazardous conditions.

Both the deductive or inductive analysis may be conducted by means of numerous techniques. In general, these techniques may be divided into three domain categories (Sutton, 2010, p. 83):

a) creative/imaginative – such techniques require “out of the box” thinking and thus the analysts are encouraged to “think the unthinkable” (imagine the low probability accident scenarios that have never occurred before but which are still plausible),
b) experience-based – based on the experience of the panel of experts or on engineering standards,
c) logical/rational – these methods are based on the principles of Boolean algebra and attempt to provide an understanding of risk in a strictly logical and rational manner.

Each approach to risk analysis is appropriate and might be solely applied. However, in practice those techniques are often combined. The above provided cathegorisation of risk analysis techniques indicates the importance of human features that support and at the same time influence the quality of risk analysis

stage. Accordingly, it highlights the aspects shaping the risk perception of particular entities.

In practice, risk analysis composes of two basic stages: risk identification and risk assessment (also referred to as risk quantification)*. The identification of risk should be a systematically and continuously driven process by which the risk of the business activity is recognised. However, properly conducted risk identification requires considering risk as a set of components, as presented in Figure 1.

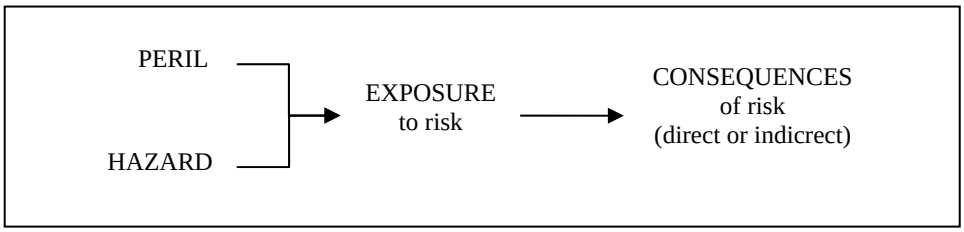

Fig. 1. The components of risk in risk identification

Source: Own study.

The first component of risk is a hazard which is a condition or a practice that has the potential to cause harmful effects. In other words, hazards elevate the likelihood and severity of a loss. Hazards emerge from the external conditions of a business activity. Recognition of hazards only partially explains the nature of risk as it does not clarify how hazardous conditions produce losses. Hazards may produce perils, which are actual causes of loss. For example, the storm is the hazardous condition which may result in the peril of fire (Young and Tippins, 2001, p. 8-9,79-80). Hazards and perils need to be addressed to the exposures of risk, that are typically associated with the business's assets (physical, financial or human) and its liability (legal and moral) (Sutton, 2010, p. 27). Finally, risk is perceived through its consequences that might be direct or indirect (consequential), where the indirect are observed after a certain period of time and are often difficult to accurate estimations. The consequences should be revised with regard to the safety of the business (e.g. the employees being hurt, the damages to the property), then the business environment and finally the economic performance following along.

* The use and understanding of the term 'risk analysis' and 'risk assessment' differs, in particular in the applicative studies of consultants. For some, risk assessment composes of risk analysis and risk evaluation, and the risk analysis of risk identification, description and estimation (e.g. AIRMIC/ALARM/IRM, 2002, p. 4). Often, risk identification and risk analysis are considered as separate stages, where risk analysis is associated with risk quantification and measurement (e.g. *Casualty and Actuarial Society*, 2003, p. 11; Banks, 2002, p. 61,77). However, in most of the classical approaches the risk analysis is a process whereby risk is first identified and then assessed with regard to quantification (compare Williams and Heins, 1989, p. 53).

The risk identification should be followed by the assessment of risk. Traditionally, risk assessment is a process of estimating the probability (frequency) and the severity (impact) of risk. Risk probability measurement aims at indicating the number of times that the risk occurs over a period of time. The assessment of probability, however, might be conducted by means of quantitative or qualitative. The quantitative methods are based on the examination of the relevant historical data to identify events or situations which have occurred in the past. Hence, the extrapolation of their occurrence in the future is possible. The quantitative techniques are also directed to the probability forecasts that are based on predictive techniques that are useful when the historical data are unavailable or inadequate.

The qualitative methods are based on the expert opinions and knowledge and should be drawn upon all relevant available information, including historical, business-specific data. The qualitative techniques are strongly based on the subjective risk perception (discussed above) and thus the results are endangered by errors springing from the cognitive bias. One of the fundamental methods of qualitative risk frequency assessment was developed by R. Prouty, who provided four classes of probability estimation based on the opinion of risk manager as a decision-maker. Prouty's proposal used labels such as 'almost nil', 'slight', 'moderate' and 'definite' (Williams and Heins, 1989, p. 64). The R. Prouty categorisation is widely accepted and under-pines many qualitative risk frequency assessments.

The assessment of risk severity addresses the estimation of the height of loss that may be caused by the risk occurrence. In other words, the risk severity revises the consequences of risk measured in volume. According to Williams and Heins (1989, p. 64-65), the two most common measures of risk severity (consequences) that are used in risk management are the:

a) the maximum possible loss, which defines the worst loss that could possibly happen (to one unit, per occurrence),
b) the maximum probable loss, which defines the worst loss that is likely to happen (to one unit, per occurrence).

Thus, the maximum possible loss is more that he maximum probable loss. Such an approach to measuring risk severity is widely spread in practice and numerous similar categories were developed for the purposes of analysing the severity of a particular type of risk[*].

[*] For example, A. Friedlander developed categories that address the severity of the peril of fire with regard to the reliability of protection systems. He recommended the assessment of normal loss expectancy (a loss expected when all protection systems are operative), the probable maximum loss (known as PML, a loss expected when a critical part of protection systems is out of order), the maximum foreseeable loss (known as MFL, the loss expected when none of the private protection systems are functioning) and the maximum possible loss (known as MPL, the expected loss when all private and public protection systems are inoperative or ineffective) (compare: Williams and Heins, 1989, p. 65; *Glossary*..., 2004, p. 144, 178)

The risk analysis is ended up by the construction of risk matrix (sometimes referred to as a map of risk), where the expected risk frequency and risk severity of particular types of identified risks is being visualised. In Figure. 2 an exemplary risk matrix is presented, based on the subjective categories of risk estimation.

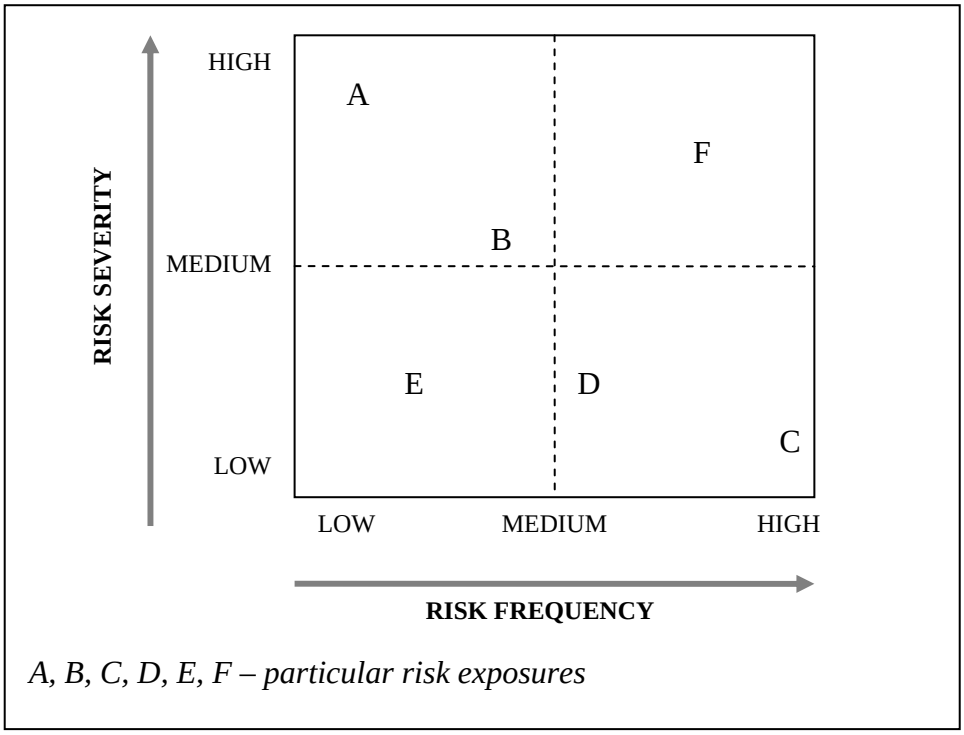

Fig. 2. Risk Matrix

Source: Own study based on: Ratliff and Hanks, 1992, p. 27).

Often the graphic visualisation of risk matrix operates with colours – red for very high risk, orange for high, yellow for moderate, and green for low. Also, particular types of risk are given a number, marked with letter (as in Figure 2) or with another graphic sign. The purpose of the construction of risk matrix is to provide clear information which risk requires taking a response action.

3. Risk perception in the global context

The problem of risk perception is a valid one also from the analytical point of view. This is probably why numerous risk service providers conduct the actions aiming at constructing the list of ten top risks that affect the business entities (*Global Risk Management Survey*, 2009, p. 9-10; *Risk Survey*, 2010, p. 9-1; *Risk Survey*, 2011, p. 9-11). One of the latest surveys was conducted in 2010 by

the World Economic Forum and the results were presented in the report titled „Global Risk 2011" (*World Economic Forum*, 2011). It was the 6th edition of the survey and the final conclusions were presented in the form of the Global Risk Landscape 2011 and Risk Interconnection Map 2011, supported by the discussion of differences in risk perception among respondents. The Forum's survey measured the perception of risk likelihood and impact, providing the respondents with the list of 37 global risks. The findings are based on 580 expert respondents.

The Global Risk Landscape 2011 revealed that the respondents in general perceive event-driven risks as having higher impact than risk that are more chronic in nature and more distributed over time. The global risks perceived as having the highest combined likelihood and impact among those addressed are presented in Figure 3.

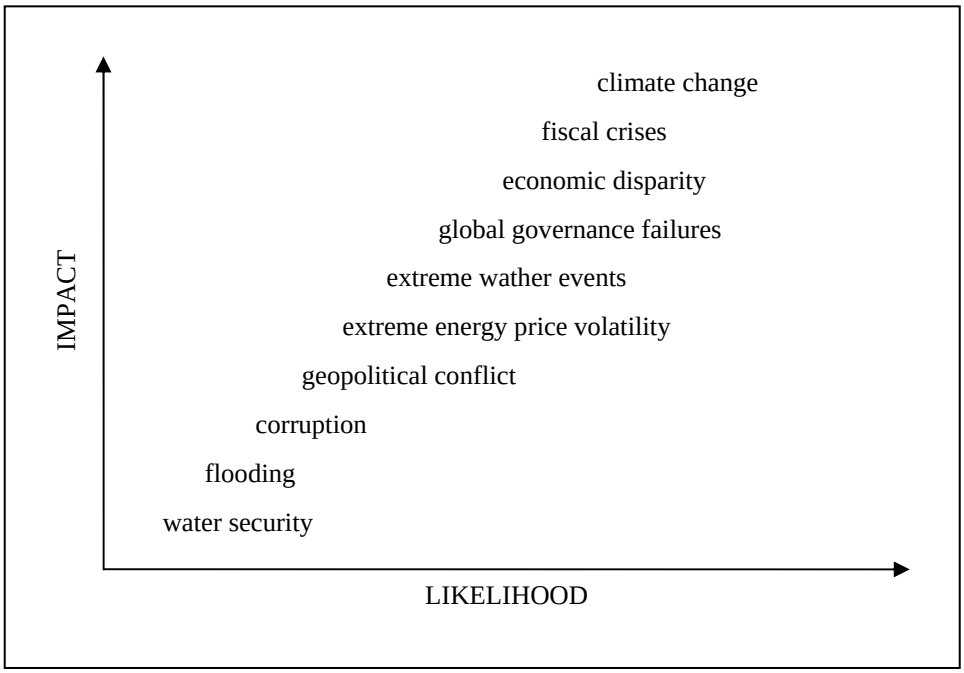

Fig. 3. The top 10 global risks by likelihood and impact combined

Source: Own study based on: *World Economic Forum*, 2011, p. 44).

In the research, the problem of risk interconnections was also examined. The top ten risks in terms of average strength of interconnections are presented in Figure 4. The research indicated that most interconnected risks are economic disparity and global governance failures. The deeper analysis of the problem indicated that the global governance failures directly impact a large number of other risks, whereas economic disparity has stronger interconnections but with smaller set of risks.

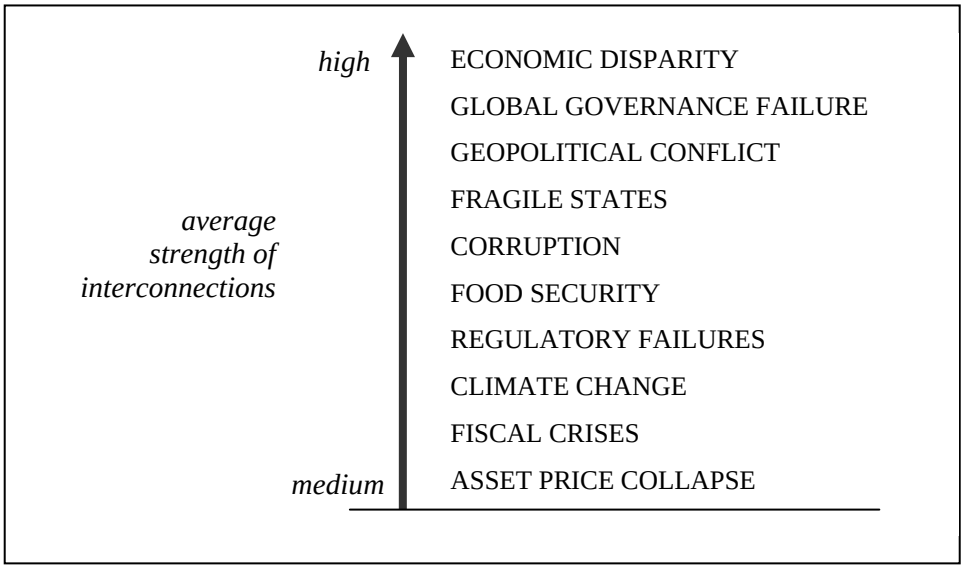

Fig. 4. The top 10 risks in terms of their average strength interconnections

Source: Own study based on: *World Economic Forum*, 2011, p. 45).

Moreover, in the report, the three distinct groups of interconnections were identified:

1) the macroeconomic imbalances nexus,
2) the illegal economy nexus, and
3) the water-food-energy nexus.

The non-exhaustive map of risk interconnections in these three nexuses is presented in Figure 5.

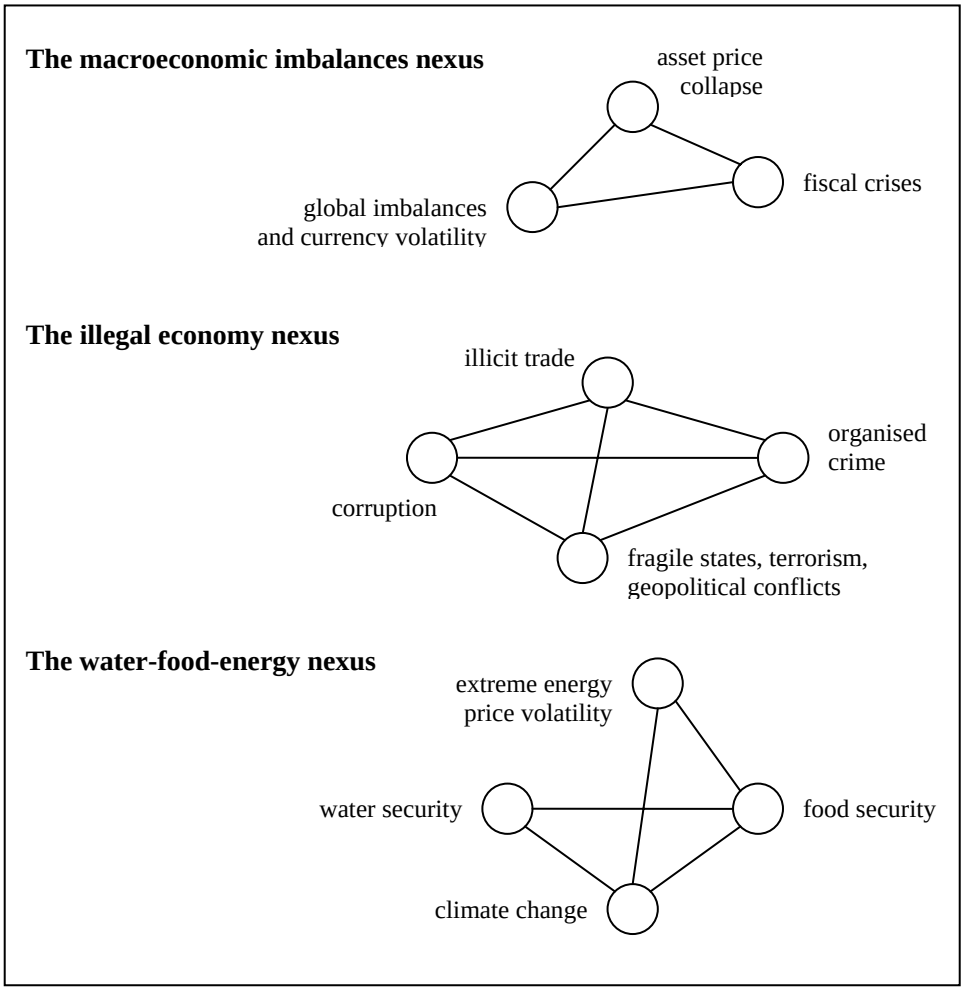

Fig. 5. The three core nexuses of risk interconnections

Source: Own study based on: *World Economic Forum*, 2011, p. 14,22,28-29).

The macroeconomic imbalances nexus is characterised by the imbalances in both the internal (within countries) and external (between countries) dimension. Internal imbalances are caused mainly by the government policies and private sector behaviour and are influenced by the stage of economic development. The external imbalances spring predominantly from the mismatch between saving and investment (*World Economic Forum*, 2011, p. 14). The illegal economy nexus includes risks that are perceived as highly likely to occur and of medium impact. There is a clear feedback loop between the illegal economy nexus and the economic disparity. It is because economic disparity creates an environment that enables illicit trade, corruption and organised crime to grow (*World Economic Forum*, 2011, p. 22). The water-food-energy nexus represent risks that are

chronic obstacles to economic growth and social stability. Economic growth and social stability are at the same time drivers for all these three risks as the improvement of living conditions in emerging economies leads to consumption patterns that are ore resource intensive (*World Economic Forum*, 2011, p. 28).

The research provides a few interesting observations within the differences in risk perception among respondents with regard to their professional perspective. The respondents of the survey were classified into four groups: governments, business, academia and international organisations. Table 2 contains the prime concerns of each group together with the perception of risk relative to other groups.

Table 2

The perception of top risks with regard to the professional perspective

Respondents	**Governments**	**Business**	**Academia**	**International Organisations**
Prime concerns:	societal risks	economic risks	environmental risks	societal risks
Perception higher relative to other groups	- climate change - fragile states - geopolitical conflict - illicit trade	- fiscal crises - slowing Chinese economy - consumer price volatility - terrorism - food security	- climate change - fragile states - biodiversity loss	- climate change - fragile states - illicit trade - food security

Source: Own study based on: *World Economic Forum* (2011, p. 46).

In general, the societal risks are the prime concern of governments and international organisations, whereas environmental risks are the prime concern of academia and economic risks – for business. Such results are understandable and typical with regard to the functions of each group of respondents. With regard to the perception of risks relative to others, Table 2 presents these risks that were indicated as of higher likelihood and/or impact as compared to any other group of respondents.

Conclusions

The perception of risk in the business entity reveals the complexity of the problem. Although the perception of risk is reflected in the results of risk analysis, including risk identification and risk assessment, it is still dependant on the personal abilities of a decision-makers acting on behalf of the business entities. In particular, there are many quirks and flaws of human being nature that influence the perception of risk and thus influence the cognition of risk. It seems that the awareness of these factors is crucial for business entities while organising the

risk management process (and perhaps the risk management division), as it strengthens the awareness of possible areas of mistakes.

In practice, risk analysis ends up with the declaration of core risks for a particular business entity, often called 'the top ten risks', that are further under a deeper consideration and constant monitoring. Thus, the risk perception from the global perspective might be assessed with regard to the top risks indicated by the larger group of respondents. The results of one of such surveys (that were discussed in this paper) revealed, that decision-makers tend to perceive risks in nexus, identifying the interconnections of particular risks. Also, the perception of risks is heavily dependant on the professional context, which influences the types of risks identified as most severe and most likely to occur.

It seems that in the future the problem of cognition of risks will be even further developed. After the escalation of the global financial crisis the quantitative risk analysis techniques are less appreciated, with a higher appreciation of subjective risk analysis, including risk assessment. Thus, the problem of risk perception will surely be extended.

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KILKA UWAG NA TEMAT WŁAŚCIWEGO POJMOWANIA PERCEPCJI RYZYKA

Streszczenie

Celem niniejszego artykułu jest uzasadnienie tezy, że w działalności biznesowej percepcja ryzyka dokonuje się głównie poprzez analizę ryzyka, która to z kolei jest podstawowym elementem procesu zarządzania ryzykiem. Uwzględniając ogólne ujęcie definicyjne pojęcia percepcji, percepcję ryzyka odniesiono do rozumienia pojęcia ryzyka (z uwzględnieniem jego dualnej natury) i poznania ryzyka (z uwzględnieniem dorobku psychologii behawioralnej w zakresie zdolności człowieka). Analiza ryzyka została przedstawiona w ujęciu procesowym, w podziale na etap identyfikacji ryzyka oraz oceny (pomiary) ryzyka. W obu etapach podkreślono znaczenie ludzkiego poznania (w kontekście metodycznym). Rozważania teoretyczne uzupełniono prezentacją najnowszych wyników badań dotyczących percepcji ryzyka w skali globalnej. Uwzględniono percepcję rodzajów ryzyka w ujęciu prawdopodobieństwa i skutków oraz współdziałania różnych rodzajów ryzyka, a także różnice w postrzeganiu ryzyka przez środowisko biznesowe, akademickie, rządowe i organizacji międzynarodowych.

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A SUBJECTIVE APPROACH IN RISK MODELING USING SIMULATION TECHNIQUES

Introduction

Quantitative risk assessment basing on simulation techniques mainly concentrate on historical risk information. Financial companies have been used so far, to perform comprehensive historical data collection concerning key risks. Financial companies' information technology provides not only complex historical information, but gets the information with accurate frequency as well. Financial risk information is assessed by financial markets themselves (by proper financial institutions), thereafter shared with market participants, whereas operational and credit risk information has to be collected by financial companies on their own. Equipped with proper risk information, financial companies are able to model their behavior in volatile environment finding their actual risk exposure. Non-financial companies are even more uncertain about their future, though putting risk modeling aside. The main reason of inclining the modeling, may be historical data availability. Of course, a data collection, similar to financial companies' systems, is possible to be introduced in non-financial companies. Though bringing such the data collection into a company can be an expensive process, especially for small and medium enterprises (SME). Not knowing exact future benefits, non-financial companies, can likely incline such systems. Historical data problems should not prejudge risk modeling resignation. SMEs can introduce risk modeling approach basing on subjective assumptions involving both risks' distributions and interdependencies. Having built a valid model concerning given financial situation, one can model risk basing on special – subjectively chosen – distributions. Triangular and beta distributions work especially great when an expert opinion is the only data source (Vose, 2008). In this study, risk adjusted performance analysis, using simulation techniques with subjective assumptions, is presented. An investment projection model is used, to present both opportunities arising from making subjective assumptions and threatens arising from not taking interdependencies into account. Frequency function is presented as an easy to interpret alternative to probability density functions

and cumulative probability distribution functions in parallel. Frequency based approach is considered, when subjective assumptions arise from an expert opinion, who's statistical knowledge remains rather poor.

1. Subjective assessment better than scenarios?

Simulation techniques like Monte Carlo Simulation (MCS) or Latin Hypercube Simulation (LHS) can be considered as an evolution of classic scenario analysis. In fact, there are hundreds of thousands scenarios being randomly generated during both MCS or LHS as well. Every scenario is a set of random values of risk factors obtained compliantly to assumed probability distributions. Scenarios are processed iteratively in relevant financial model in order to gain risk variables' probability distributions. The main idea of simulation techniques is to analyze as much scenarios as possible, finding every logical situation likely to happen (Vose, 2008). In traditional scenario analysis, in turn, only a few scenarios, with subjectively attributed probability, were generated mostly showing an enterprise: fully exposed to downside risk, not exposed to risk, fully exposed to upside risk. Simulation techniques give an opportunity to consider lots of combinations when some risks gets their upside values whereas others – their downside values. Both mentioned methods obtain, in fact, a risk variable's probability distribution, but the comprehensiveness votes for simulation (Fig. 1).

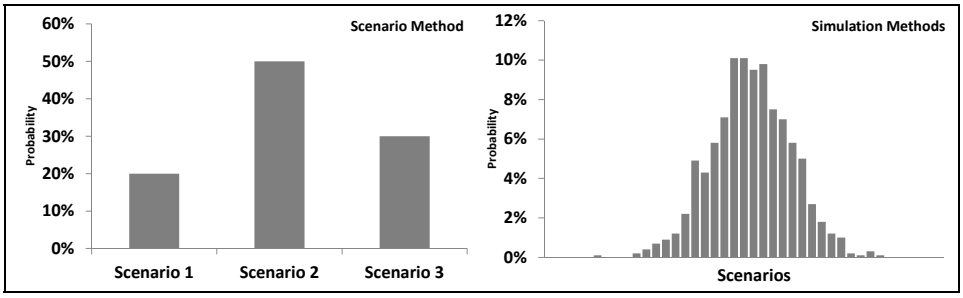

Fig. 1. The nature of the outcome – classic scenario analysis versus simulation techniques

Historical data availability poses a major issue while assuming risk factor's probability distributions. Historical values are considered as objective source of information. Vose (2008), Chapman (2006) agree on number of various situations, when objective way might have been considered as a serious hurdle:

– the data has simply never been collected before,
– the data is too expensive to obtain,
– past data is no longer relevant,
– the data is sparse requiring expert opinion "to fill in the holes",
– the area being modeled is new.

Recapitulating above, risk factors' distributions may be attributed in: objective way, quasi-objective way or subjective way, depending on both historical data availability and adequacy as well. The non-historical descent of risk factor's probability distribution doesn't cross simulation techniques out. Expert opinion can be the source of right distribution, even if the possessed information consists only of the risk factor's extreme values. There exist a number of theoretical distributions being suitable to summarize, more or less detailed information gained from experts knowing best the nature and the behavior of a particular risk factor.

2. Subjective assessment using triangular distributions

Using triangular distributions for simulation reasons doesn't seem to be particularly challenging. Simulation techniques require convenient inverse cumulative distribution functions ($G(\alpha)$), enabling the right sampling process[*]. Any professional risk software[**] provides proper triangular distribution functions, whereas popular spreadsheets don't. The best known, Microsoft Excel, provides object oriented programming using Visual Basic for Applications (VBA). Preparing suitable VBA functions could have been quite usable solution involving low budget, making subjective assessment with triangular distributions possible.

The common approach is using simple triangular distributions described only by their extreme values, with an assessment considering which of them has the highest probability of occurrence (Kaczmarzyk, Zieliński, 2010).

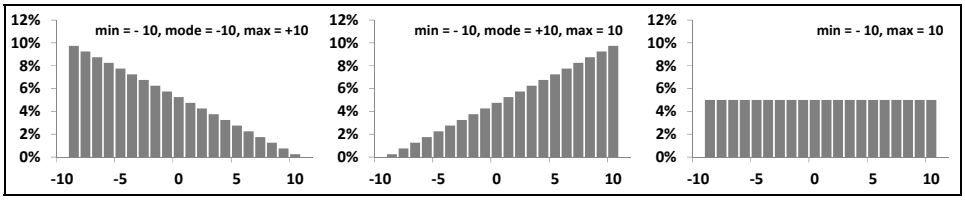

Fig. 2. Simple triangular distributions and uniform distribution

Simple triangular distributions seem to be particularly suitable solution, when the only thing the analyst can do is describe the range of possible risk factor's values. Depending on the highest expected probability, analyst should choose left or right skewness of the simple triangular distribution. Finding the highest expected probability hard to describe, an analyst may use uniform distribution, while assuming the same probability for the expected range of values (Fig. 2).

[*] Sampling process – generating random numbers due to assessed probability distributions, consist of two stages. Stage 1 – generating uniform random numbers from range (0,1) (generating probability in fact). Stage 2 – transforming uniformly distributed numbers into desired probability distributions using inverse cumulative distribution functions.

[**] Fe. ModelRisk, Palisade Risk, Crystal Ball.

The more complex approach involves universal triangular distributions (Vose, 2008), enabling analysts to assume the value with the highest probability somewhere between expected extreme values (with the lowest probability).

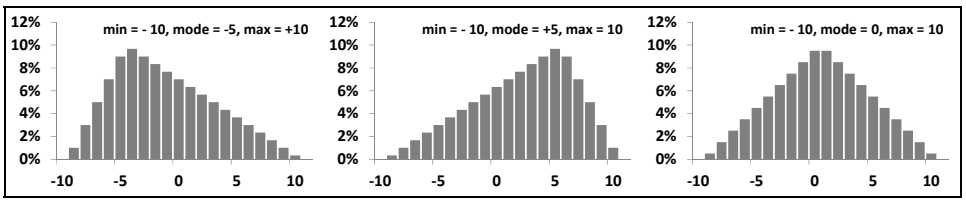

Fig. 3. Universal triangular distribution with same extreme values and different expected values

One has to magnify the nature of universal triangular distribution, which boils down to the fact, that the values nearly the extreme values have equal probability, only when the most expected value lays exactly in the middle of the expected range (Fig. 3).

In terms of financial categories, one is able to provide lots of examples when triangular distributions are a right solution. Let's assume a company considering an investment project and its investment expenditures. Typically, the company lacks of historical information being forced to simulate risk using a subjective assumption. Choosing the triangular distributions, is expected to provide the minimum, maximum and most expected value of the investment expenditures. Defining key distribution values, may necessitate some consultations with experts. In other words, one has to consult if there is a chance to decrease costs and if there is a risk of their increase. Involving brainstorming and other creative thinking techniques may provide desired information in much more effective way.

Triangular distributions are very easy to interpret, even for persons lacking of statistical experience. In other words, risk identification, even on the lowest level of an organization, can be effective, basing on information possessed from serial workers. Let's assume a company holding production lines, which doesn't have information on their actual reliability. Employees responsible for particular production line are likely to have such an information acquired automatically straight from the production process. Obviously, an immediate information won't be much more detailed than required by triangular distributions themselves. Looking for lots of details, company has to introduce special data acquisition process, involving employees from adequate level of organizational structure. Such solution could provide the most accurate probability distribution fit.

Finally, the main constraint of using triangular distributions is linear relation between risk factor's values inside expected range and their probability of occurrence. The other significant constraint of triangular distributions is inability

to differ the expected values' probabilities for different risk factor's having the same range of volatility (with both different and same expected values). Being conscious the real risk factor's nature, one may use beta probability distributions instead, able to reflect the non-linear relation and to differ the probability of the expected value.

3. Subjective assessment using beta distributions

Every theoretical distribution could be used in making the subjective assumptions. Lots of them have complicated parameters which cross statistically inexperienced experts out when it comes to simply draw the risk. Even normal distribution might cause some difficulties while realizing its true volatility range doesn't cover straight with the standard deviation. Some of the theoretical distributions are easy to parameterize instead like triangular ones. One of the most useful distributions is beta which taps the same parameters as the universal triangular distributions mentioned above. Unlike triangular distributions, beta ones are able not only to position the expected value but to set the expectancy strength as well.

Beta general distributions work with a specific set of parameters: α, β (both responsible for shape), minimum and maximum. Beta general gets symmetrical shape while shape parameters are equal (α = β), in the other cases the distribution will remain asymmetrical. Beta general is capable of forming lots of shapes, making the distribution highly universal, especially when the expert opinion is urgent to take shape (Fig. 4).

Setting the beta general distribution's parameters seems to be quite comfortable when having in mind symmetrical shape. The higher α and β, assuming α = β, the wider the distribution's volatility range. Statistical experience is highly recommended when asymmetrical shape is the key, when describing particular risk factors. Quite useful may be David Vose's (2008) approach for asymmetrical beta distributions, leading towards parameters simplification including extreme values (min and max), mode and shape. Vose's algorithm needs an addition for symmetrical cases as follows (1) and can be a perfect basis for urgent changes in existing Excel's Beta. (e.g. by creating new function on the basis of the built-in-excel one).

$$\alpha = \frac{(\mu - a)(2mode - min - max)}{(mode - \mu)(max - min)}$$

$$\beta = \frac{\alpha(max - \mu)}{(\mu - a)} \qquad \text{if } max - mode \neq mode - min \text{ (asymmetrical distributions)} \qquad (1)$$

where $\mu = \frac{min + shape \cdot mode + max}{shape + 2}$

$$\alpha = \beta = \frac{shape}{2} + 1 \qquad \text{if } max - mode = mode - min \text{ (symmetrical distributions)}$$

The shape's parameter determines its kurtosis (the distribution's flattening). The higher the shape's value the lower the kurtosis and the distribution's volatility as well. The recommended solution, when it comes to eliciting the risk distribution from an expert opinion, is to share a suitable legend, presenting beta distributions with different parameters (Fig. 4).

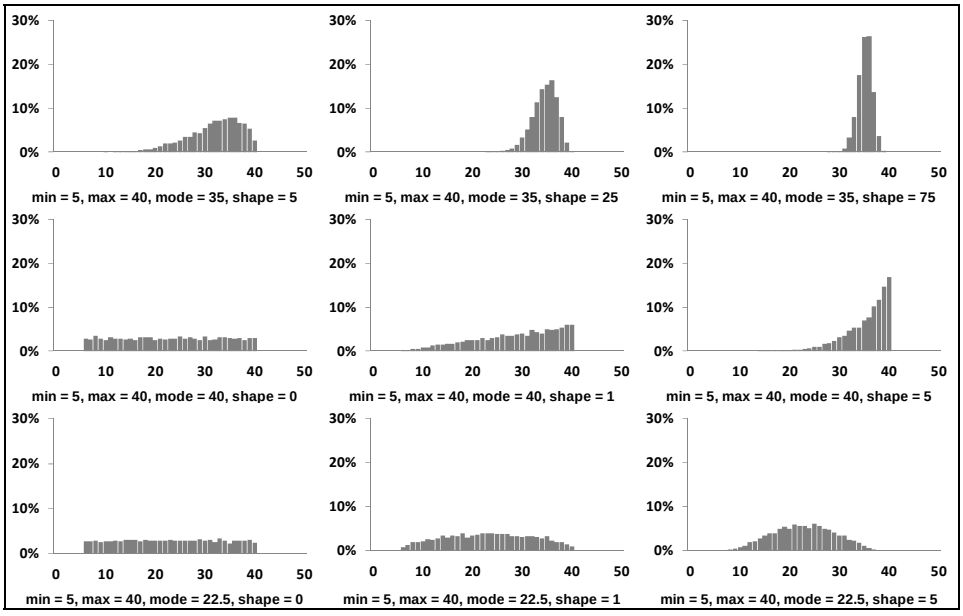

Fig. 4. Beta distributions with the simplified set of parameters

4. Interdependencies' dilemma

There is a huge problem with reflecting interdependencies between risks in risk analysis. Likewise assuming the risk distributions subjectively, the interdependencies may be elicited from an expert opinion, while historical data is inac-

cessible or unavailable. Having in mind the interdependencies seems to be essential. The previously recalled investment project, can be a suitable example once again. Presumably there are two different goods' production lines to be launched. Expected revenues from the production lines won't be independent from each other. As a consequence of diversification level, the revenues changes may exhibit positive or negative correlation as well. Furthermore the omission of interdependencies is going to be, in fact, an assumption reflecting particular level of diversification.

The relevant method of reflecting the interdependencies should work with most common correlation measure such as the Pearson's coefficient (or its conversion as the coefficient of determination[*]). One of the simplest and the most universal methods, is the Cholesky's decomposition providing so called normal copula[**]. Either bivariate (Jäckel, 2002) or multivariate interdependencies' (Cherubini, Luciano, Vecchiato, 2004) problem is easy to be solved using the decomposition. Turning towards the mechanism, the Cholesky's decomposition converts standardized bivariate or multivariate normal distribution with independent vectors into a relevant distribution with dependent ones.

Choosing the right copula is the another significant challenge in the subjective risk modeling. The normal copula achieved with the Cholesky's method doesn't reflect interdependencies nature properly in some circumstances, especially when it comes to the financial companies activity and tail dependence between distributions (Melchiori, 2003; Kole, Koedijk, Verbeek, 2007). Knowing best the right type of the copula, forces the copula fitting process which absolutely requires the historical data.

5. Subjective assumptions and correct charts

Experienced statisticians or financials have embedded-by-experience ability to understand probability density function (PDF) and cumulative distribution function (CDF). The experts whose statistics remains rather poor, may find useful a frequency distribution function (FDF), especially when denominated in percentage points. One supposes the FDF to be clear for nearly anyone, while using "percent from population within range" in fact. The experts are going to fully understand and properly choose, when presented the possible FDF's examples instead of the PDF's or CDF's.

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[*] Using the coefficient of determination maybe actually quite comfortable solution while making the subjective assumptions. Stating the value of the determination's coefficient is much clearer The only thing one has to state is the part of the risk factor's changes which contribute to changes of the another.

[**] A copula is a particular kind of interdependency between probabilities of the risk factors. The normal copulas form characteristic elliptical shapes. Looking for the best fitted copula is looking for the right shape in fact.

6. Subjective assumptions in practice

A simple profitability model is presented for illustrating the subjective assumptions idea (Fig. 5). The model calculates return on equity (ROE) within one year horizon for two production lines financed partially with debt. A risk analysis is conducted with taking into account market risk appearing in the products' prices. The MCS sampling is used with the Cholesky's decomposition for reflecting possible interdependencies between the prices.

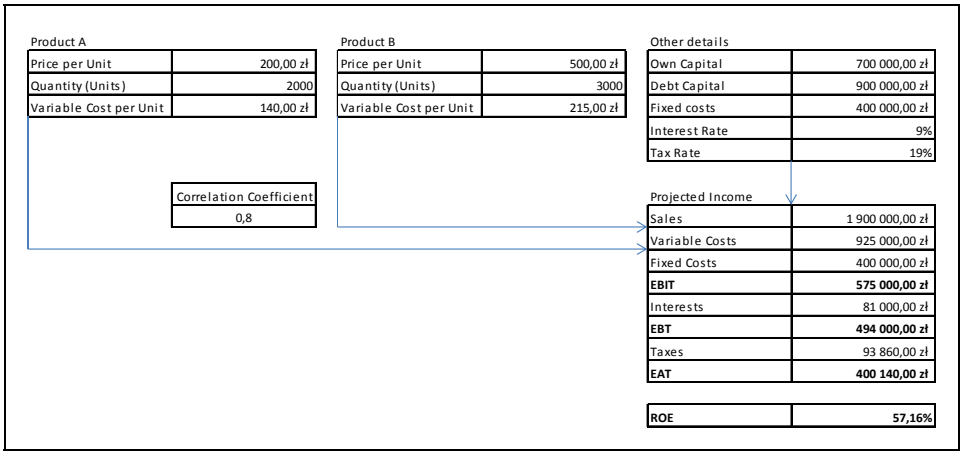

Fig. 5. Simple profitability model, considering return on equity

Let's assume the company is expecting the price for the product A can change within a range of 150,00 zł to 290,00 zł with the most expected price's level at 200,00 zł. Relevantly, product B can change within a range of 300,00 zł to 550,00 zł with the most expected price's level at 500,00 zł. The MCS brings the ROE's distribution, which differs seriously when changing correlation strength between the prices. Checking the ROE at risk with 10% level of significance, one gets following results for different level of the correlation coefficient (ρ):

1. For ρ = +0,8 (the prices behave rather similarly), the ROE is going to be higher than 7,6% with 90% probability (Fig. 6).
2. For ρ = 0,0 (the prices behave independently), the ROE is going to be higher than 14,2% with 90% probability (Fig. 7).
3. For ρ = -0,8 (the prices behave rather contrariwise), the ROE is going to be higher than 22,1% with 90% probability (Fig. 8).

Making traditional scenarios wouldn't have brought the ROE's related information with probability level in such detailed way. Calculating the ROE with simulation techniques brings more comprehensive image of risk when managing finance in a company. Even the triangular distributions enable an analyst to simply consider as much scenarios as possible.

The interdependencies are also crucial. Supposing an analyst is not going to take interdependencies into account while there is a strong positive (or negative) correlation between risks. Missing the interdependencies is going to provide underestimated (or overestimated) risk (e.g. Fig. 6, Fig. 7, Fig. 8).

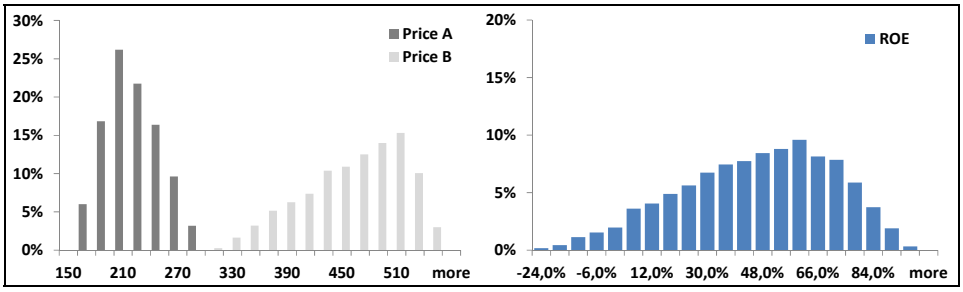

Fig. 6. Example 1, Price A: Triangular min = 150, mode = 200, max = 290; Price B: Triangular min = 300, mode = 500, max = 550; ρ = + 0,8

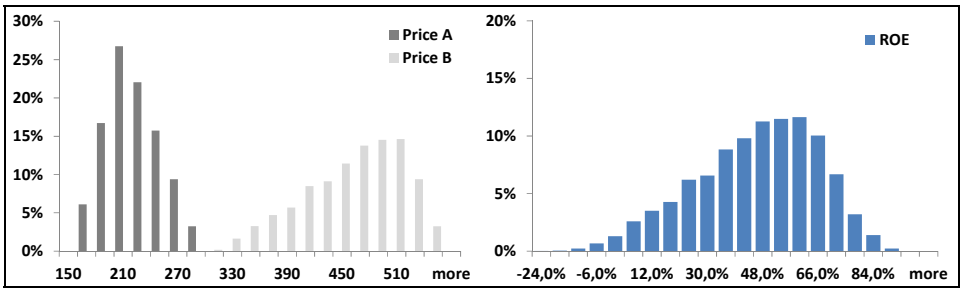

Fig. 7. Example 2, Price A: Triangular min = 150, mode = 200, max = 290; Price B: Triangular min = 300, mode = 500, max = 550; ρ = 0,0

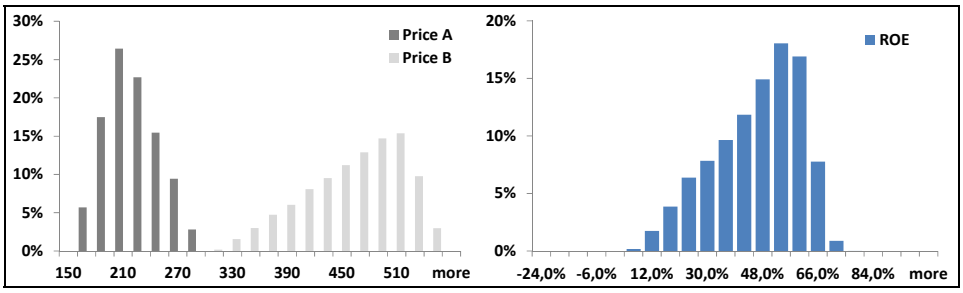

Fig. 8. Example 3, Price A: Triangular min = 150, mode = 200, max = 290; Price B: Triangular min = 300, mode = 500, max = 550; ρ = – 0,8

Alternatively, as has been stated so far, one is able to make subjective assumptions using beta distributions. In order to compare the beta distributions with the triangular ones, the same extreme values and modes were set. The main advantage benefited from the beta distribution is the ability to easily change the

shape. In following examples the shape's parameters were replaced, maintaining the others (Fig. 9, Fig. 10, Fig. 11).

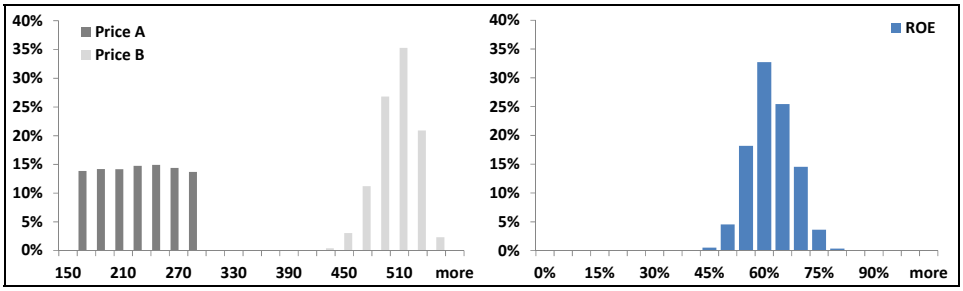

Fig. 9. Example 4, Price A: Beta min = 150, mode = 200, max = 290, shape = 0; Price B: Beta min = 300, mode = 500, max = 550, shape = 20; ρ = -0,8

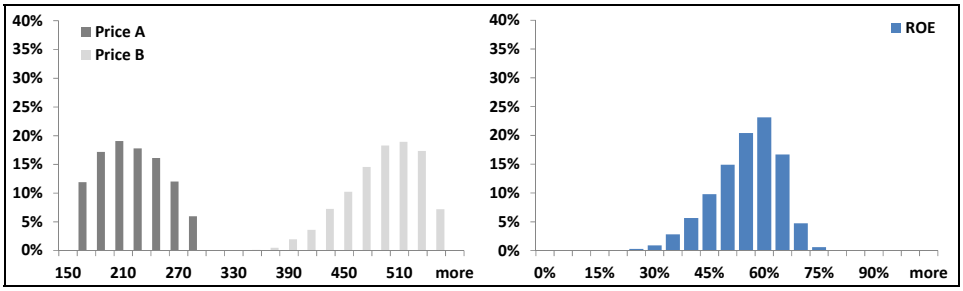

Fig. 10. Example 4, Price A: Beta min = 150, mode = 200, max = 290, shape = 1; Price B: Beta min = 300, mode = 500, max = 550, shape = 5; ρ = -0,8

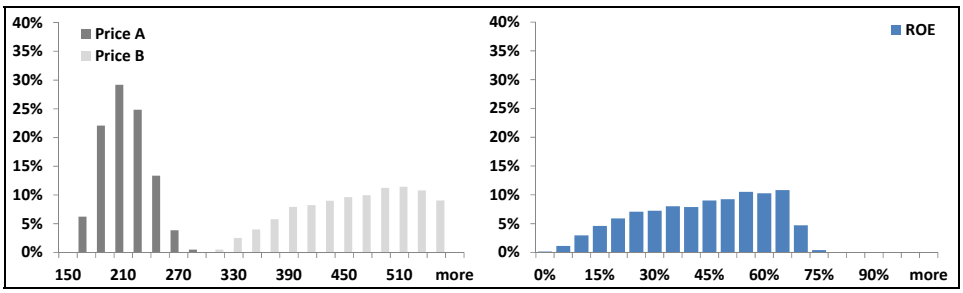

Fig. 11. Example 4, Price A: Beta min = 150, mode = 200, max = 290, shape = 5; Price B: Beta min = 300, mode = 500, max = 550, shape = 1; ρ = -0,8

Furthermore, the FDFs endorse their ability to present the probability as simple as possible. The CDFs with cumulative information could heavily blur probability images. The presented model assumes Product B to bring much higher profit margin than Product A. One is able to possess the same information, while looking at the prices' and the ROE's FDFs – the ROE significantly tends to maintain the shape of much more profitable Product B.

Summary

Whenever risk analysis is important, one has to consider using simulation techniques. Having historical data in hand may be both useful and dangerous as well. Even historical information has to be transformed in some way to truly reflect future nature of an economical process. It is suggested that companies shouldn't cross simulation, when the subjective way, is the only way on the horizon. Even subjectively chosen distribution can bring much more detailed picture of the company's risk. Triangular and beta distributions seem to be really helpful when it comes to picture risk factors without historical data. Empowering the analysis with subjectively chosen distributions with interdependencies' assumptions eliminates some illogical scenarios from simulation process and can't be put aside. The only hurdle is the convenient software. Using spreadsheets is suggested but involves two approaches. First, one can possess license for using some professional add-ons (like @Risk, Crystal Ball etc.). Second, one may develop a model oneself. First approach is rather expensive, whereas second necessitates proper IT experience.

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PODEJŚCIE SUBIEKTYWNE W MODELOWANIU RYZYKA Z WYKORZYSTANIEM TECHNIK SYMULACYJNYCH

Streszczenie

Zastosowanie technik symulacyjnych powinno być brane pod uwagę zawsze w sytuacji, gdy konieczne jest przeprowadzenie analizy ryzyka. Dostępność danych historycznych nie powinna być ostatecznym kryterium wyboru technik symulacyjnych. Subiektywny dobór rozkładów czynników ryzyka oraz współzależności pomiędzy nimi

może stanowić wyjątkowo atrakcyjne i skuteczne rozwiązanie. Zaletą wykorzystania technik symulacyjnych jest możliwość rozważenia ogromnej liczby wariantów, szczególnie w zestawieniu z tradycyjną metodą scenariuszy. Uwzględnienie współzależności eliminuje ponadto nierealne scenariusze. Część teoretycznych rozkładów prawdopodobieństwa w szczególny sposób ułatwia subiektywne założenia w analizie ryzyka, w sytuacji gdy opinia eksperta jest jedynym źródłem informacji o ryzyku. Prezentowany jest pogląd, iż przedsiębiorstwa powinny rozważyć wykorzystanie technik symulacyjnych w procesie zarządzania ryzykiem, podobnie jak czynią to instytucje finansowe.

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University of Economics in Katowice

THE PROBLEM OF RISK PERCEPTION IN THE INNOVATIVE CORPORATE FINANCIAL STRATEGY

Introduction

Modern companies operating in the changing environment are exposed to new challenges. In order to face these challenges, to develop themselves and to increase their value, modern companies are forced to create and implement new ideas, solutions and instruments in every field of their activity. These new developments can be also applied in the financial strategy changing its character from the traditional approach into the innovative one. Financial innovations that can be applied by the companies can have different forms and fulfill various functions. Their effects for the company's situation can be also ambiguous. Thus, this conceptual paper, based on the literature studies, aims at presenting the way in which the financial innovations can be applied in the corporate financial strategy, regarding its three basic elements: financing, investment and risk management strategy. The analysis of the financial innovations consequences both positive and negative is also provided, focusing on the potential changes in the level of the corporate risk.

The paper is structured as follows. Section 1 presents the definition of the corporate financial strategy and discusses its main types and elements. Also, it introduces the term "innovative corporate financial strategy". Section 2 analysis various definitions of the "financial innovations" and presents the classification of the financial innovations types and functions. Section 3 presents the potential application of the financial innovations in the particular elements of the corporate financial strategy. It also focuses on the consequences of the financial innovations for the company's situation regarding the potential changes in the level of risk.

1. Corporate financial strategy – types and elements

Modern theory of corporate finance assumes that the main objective of the company is to maximize its shareholders' wealth by increasing the market value of the company (Damodaran, 2001, p. 11-15; Ehrhardt, Brigham, 2009, p. 9). To

realize this main goal, the company is required to have consistent long-term global strategy of development. It is difficult to find one, universal definition of the corporate strategy. However, taking different approaches into account, it can be defined as a model concept of company's functioning and development aiming at achieving its main objective with a set of tools and methods that help to realize this goal. This global, long-term strategy should be adjusted to the internal conditions of the company (i.e. its resources, organizational structure, stage of development or ownership structure) and its external conditions defined by its changing macro- and micro-environment. Thus, the global strategy of development is limited only by three elements: (1) the company's goals, (2) its particular characteristics and (3) external conditions.

The global financial strategy is constructed for the whole company and it defines the company's type of activity and the direction of development. It also coordinates all functional strategies that are devoted to the particular fields of company's activity, e.g.: production, R&D, human resources, marketing, finance, communication, sales. Financial strategy is one of the most important, as it is not only one of the functional strategies, but it also determines the effectiveness of the other strategies (by providing them required sources of funds) and the company's general ability to achieve its main goal (Karpuś, 2004, p. 111, Griffin, 2002, p. 140-141). In addition, the inappropriate financial strategy can have significant consequences, as it may lead even to the company's financial distress and bankruptcy.

Financial strategy can be defined as the set of methods, tools and criteria applied in the decision making process in the field of raising corporate funds (financing strategy) and allocating these funds (investment strategy) (Wypych, 2000, p. 33; Zadora, 2004, p. 26-27). It is important to stress, that the decisions taken in these fields should consider the opportunities and threats for the company and its connections with the business environment in order to enhance the realization of the main company's objective. Thus, the traditional approach to the financial strategy distinguished two substrategies: financing strategy and investment strategy. However, taking into account the challenges that the modern company is forced to face, it would be advisable to distinguish one more important aspect of the financial strategy concerning the risk management (see Figure 1).

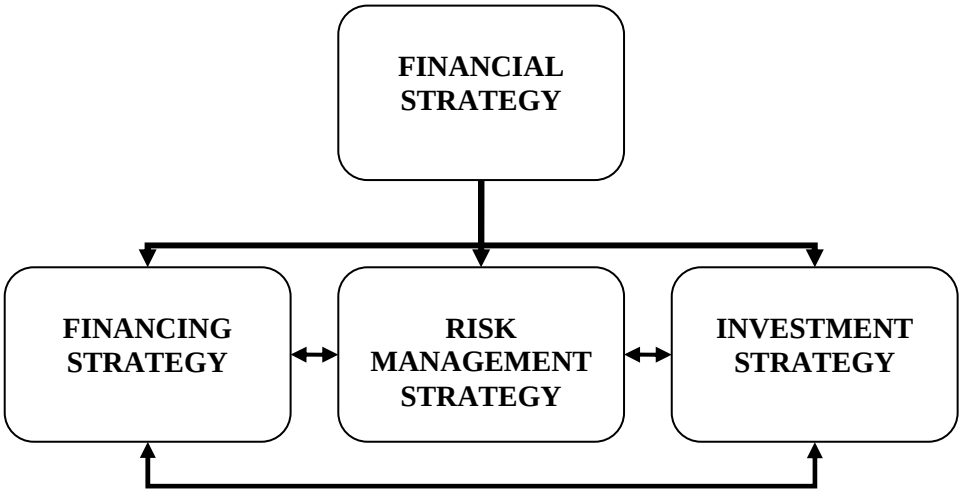

Fig. 1. Elements of the corporate financial strategy

Source: Own study.

All elements of the financial strategy are connected with each other and influence the company's financial decisions. Investment projects require proper sources of funds, as by matching liabilities to assets, the company can maintain its financial balance and long-term solvency. The results of the investment projects determines the level of the generated profit, that has influence on the company's needs for external funding and its ability to attract investors. The investment decisions are based on the investment principle stating that company should invest in assets only when they are expected to earn a return greater than a minimum acceptable rate named hurdle rate. While the financing decisions are based on the financing principle positing that the company should choose the mix of debt and equity in order to maximize the value of investment and to minimize the cost of capital (Damodaran, 2001, p. 4). Both investment and financing decisions can be sources of the company's risk (investment, financing, operating or liquidity risk). The main aim of the risk management in this aspect is to reduce the volatility of the generated cash flows.

Corporate financial strategy based on the company's attitude towards risk can be classified as: (1) aggressive or (2) conservative (Łukasik, 2004, p. 117-121). Aggressive financial strategy is focused on the dynamic development of the company that can be realized either by internal growth or by mergers & acquisitions. It is constructed to use the company's strength and the opportunities generated by its environment. It requires taking up different types of risk, including investment and financial risk, in order to increase the company's value. Aggressive strategy applies variety of tools and instruments to increase the potential growth of the company. While conservative strategy focuses on the main-

tenance of the current situation of the company with the acceptable slow rate of development. All undertaken actions aim at company's protection against the potential threats arising from its environment. Thus, the main objective of the conservative strategy is to reduce the company's risk by using well known and safe tools and instruments.

The types of the instruments applied in the particular financial strategy decide about its character. Thus, traditional financial strategy is based on the classical financial instruments such as: ordinary shares, straight debt instruments, traditional investment opportunities. However, as the financial system and financial markets are developing themselves, the new solutions appeared that can be applied in the corporate financial strategy, enhancing its effectiveness and increasing its value. Therefore, the new type of the financial strategy can be distinguished--innovative financial strategy based on the financial innovations (see Figure 2).

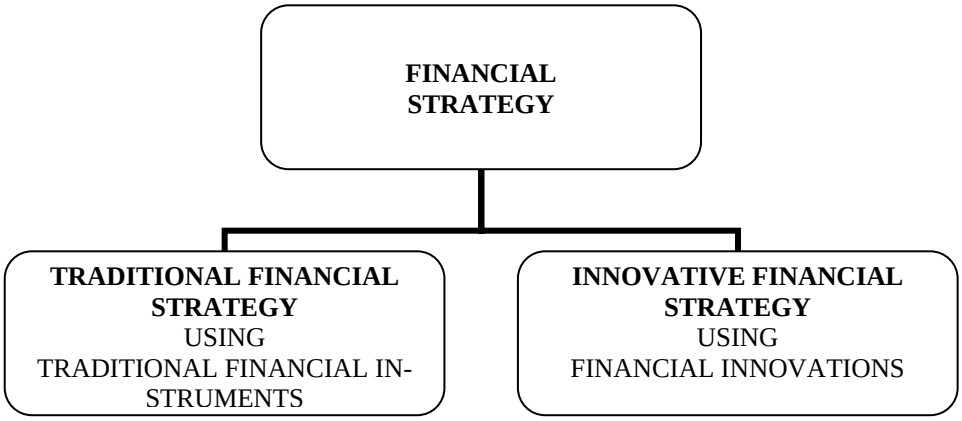

Fig. 2. Types of corporate financial strategy

Source: Own study.

2. Financial innovations – types and functions

The sustainable development and new challenges that face the modern company, require inventing and implementing innovations. The general definition describes innovations as new ideas, solutions and instruments implemented to the business entity in order to improve its situation, to increase its competitiveness and to create value for its owners (compare: Dabic, Cvijanovic and Gonzalez-Loureiro, 2011, p. 196).

Originally, the term "innovation" was used to describe the changes in the technological solutions, creating new combinations of productive means, generating enormous rates of return and thus, enhancing the dynamic development of the overall economy (Targalski, 2006, p. 7). The traditional classification of the

innovations, developed by J. Schumpeter includes four different groups of new solutions: (1) new product, (2) new methods of production, (3) new markets, (4) new sources of raw materials, (5) new organization forms and business structures and (6) new methods of management (Dabic, Cvijanovic and Gonzalez-Loureiro, 2011, p. 196). Based on this approach, the OECD methodology was developed focusing on four groups of innovations: (1) product, (2) process, (3) marketing and (4) business organization (OECD, 2005, p. 48). However, as the growing importance of the financial system in the economy has been observed, the classification of innovations required modification aiming at introducing the new category – financial innovations.

There is no single, universal definition of the financial innovations. Most of the works apply the narrow meaning of the financial innovations defining them as any new developments in financial instruments and they are regarded as financial innovations sensu stricto. These new developments may include: entirely new instruments, combination of traditional instruments, modification of traditional instruments, new application of existing instruments, etc.

However, the broad definition of the financial innovations can be also applied. In this broad meaning (financial innovations sensu largo), financial innovations are explained as any new developments in any elements of the financial system: (1) financial markets, (2) financial institutions, (3) financial instruments and (4) regulations determining their functioning. The distinguished groups of innovations are connected with each other and their relationship is multidimensional, so they are often described as the spiral of innovations (Gubler, 2010, p. 1-49). This means that the new financial institutions create the new financial instruments (products & services) that are traded in the new financial markets and these new solutions require shortly the new regulations. On the other hand, changes in the market conditions together with the changes in the legal environment lead to the formation of new instruments and then foundation of the new markets and institutions specializing in these new developments (see Figure 3).

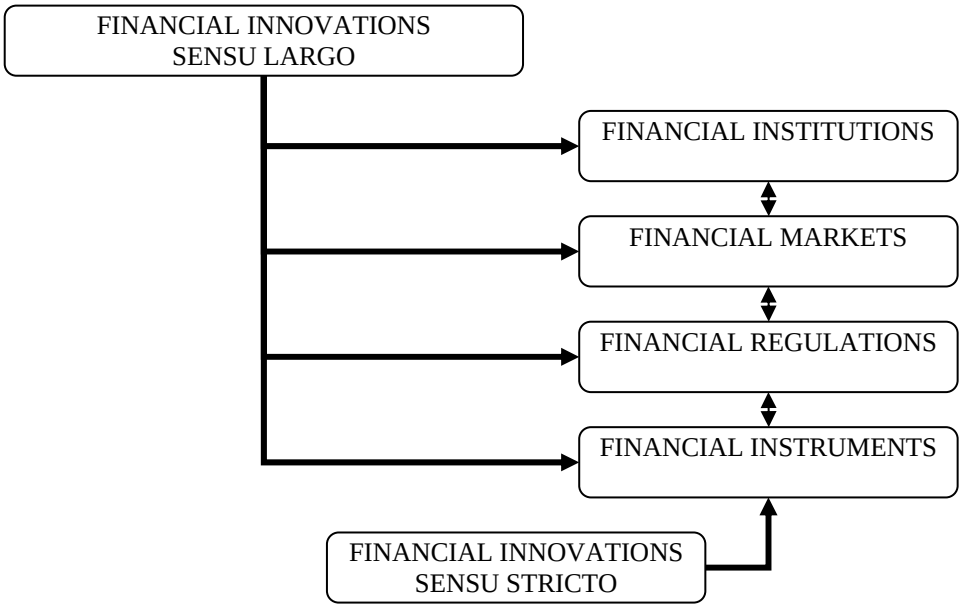

Fig. 3. Broad and narrow definition of the financial innovations

Source: Own study.

It is important to stress, that these new developments, either technological or financial, can be regarded as innovative ones, only if they are perceived as new for the entity implementing them, which means that these solutions can be already known and applied in other entities or organizations (Anderloni and Bongini, 2009, p. 41). Another important fact worth remembering is the connection between the financial and technical innovations, as they are bound together and they evolve together over a time (Michalopoulos, Leaven and Levine, 2009, p. 2-5). Firstly, financial innovations provide mechanism to finance innovative technological projects, when traditional sources of funds are unavailable due to the high level of investment risk. On the other hand, the technological and economic progress resulting in the higher complexity of business processes and new types of risk, forces the financial system and financial markets to adopt to the changes, to be modernized according to the new requirements of the business entities and to the challenges of the modern world. Thus, the technological and economic development would constrained without financial innovations. And at the same time, the application of the financial innovations would be limited without the increasing demand arising from the technical progress.

Financial innovations can classified according to different criteria. Some of them could be useful to analyze their application in the corporate financial strategy. One of the most popular classification of the financial innovations is based on their sources including demand-driven and supply-driven innovations. The

demand-driven innovations are created as the response to the needs of the business entities to meet their individual goals. As the modern financial market is characterized by many imperfections (mainly: asymmetric information, agency costs and transaction cost), many business entities search for new solutions to reduce their negative consequences. Also, unfavorable tax regulations and increasing volatility of the market parameters can create demand for new solutions enabling business entities to avoid paying high income tax or to reduce the level of market risk. While, the supply-driven innovations are created by the financial institutions to enhance their competitive advantage. New developments are offered to the business entities in various fields of their activity, including: investment, savings, financing and payment instruments, tools and techniques. These financial innovations are also created and implemented to improve the results of the financial institutions or to protect their market situation.

Another classification of the financial innovations regarding their functions has been elaborated by the Bank for International Settlements. According to it, financial innovations are divided into five groups: (1) price-risk transferring, (2) credit-risk transferring, (3) liquidity-generating, (4) credit-generating and (5) equity-generating instruments (Fabozzi and Modigliani, 2003, p. 27). The first group of financial innovations provide business entities with more efficient means for dealing with price or exchange rate risk. Credit-risk instruments are used to reallocate the risk of default. Liquidity generating instruments can have three different consequences: they increase the liquidity of the market, they enable deficit units to look for additional sources of funds and they allow market participants to avoid unfavorable law regulations. Credit-generating instruments increase the amount of debt funds available to the deficit units. And equity-generating instruments provide the access to the additional sources of equity capital.

The presented classification of the financial innovations functions can be modified to be better adjusted to the corporate financial strategy perspective. Thus, taking into account the assumptions that the financial innovations should enhance the efficiency of the business entities in fulfilling their objectives, the functions of the financial innovations can be described as follows: (1) payment function (increasing the liquidity of the financial system and business entities), (2) investment function (increasing the variety of investment opportunities better adjusted to the risk-return profile of the investor), (3) financing function (increasing the availability to the sources of funds – either equity or debt capital, both for longer and shorter periods), (4) pricing function (improving the process of assets valuation and risk pricing by the elaborated statistical methods) and (5) risk management function (increasing the possibilities of transferring risk between system participants).

Despite any differences in the approaches towards financial innovations functions, the most important are consequences for the company implementing them, including changes in its financial situation and the level of risk.

3. Financial innovations and their consequences for the corporate risk perception

The implementation of the financial innovations in the corporate financial strategy can be determined either by the internal or external factors. In case of the internal factors, the decision to use financial innovations is based on the company's needs and goals, its particular situation, attitude towards risk and new developments connected with the management style. Regarding external factors, the application of the financial innovations in the corporate financial strategy can be determined by the situation on the financial market, changes in its business environment or unfavorable law regulations. It is often that a combination of different factors influences the decision to implement financial innovations.

There are two situation in which the financial innovations application in the corporate financial strategy is justified. Firstly, when the traditional financial solutions are no longer available. And secondly – when the costs connected with the introduction of the financial developments are lower than the costs connected with the usage of the old, traditional solutions (Pantalone and Welch, 1987, p. 33-35).

Thus, the effect of the financial innovations implementation is the major problem of the innovative financial strategy. As financial innovations can have both positive and negative consequences for the company and its performance. The sustainable innovations help company to fulfill its functions and realize its goals at lower costs and higher efficiency and thus improve its situation. In case of the harmful innovations, unexpected and undesirable side-effects lead to instability of the company and to increased level of the financial risk.

The problem of the financial innovations impact on the company's situation should be particularly assessed in terms of the corporate risk and its perception. As some financial innovations can be used to reduce the level of company's risk. While, at the same time others can be regarded as the sources of the additional corporate risk. Thus, the consequences of the financial innovations applications in the corporate financial strategy should be carefully analyzed and controlled (see Table 1). To make this analysis more efficient, it would be advisable to look for these potential consequences in each of the distinguished elements of the financial strategy, i.e.: financing decisions, investment decisions and risk management decisions.

In case of the financing strategy, financial innovations are applied to increase the access to the external sources of capital (both debt and equity), to decre-

ase the cost of capital or to improve the flexibility of the capital structure (financing function of the financial innovations). They can be also applied to improve the capital structure by replacing part of the company's debt by the equity capital or off-balance sheet liabilities, increasing its financial stability. Also, financial innovations enable the company to adjust the cash flows generated by the issued instruments to the cash flows generated by its operating activity and in this way reduce the financial risk (including financing risk and liquidity risk). On the other hand, financial innovations issued by the company to acquire additional capital are usually complex solutions that can be difficult to understand for the potential investors. Thus, the company's offer should be prepared, first of all to attract new investors providing funds, also to win the competition between other issuers (companies and financial institutions) that are searching for capital. The complexity of financing innovations, together with insufficient knowledge about their mechanisms, may lead to the increased risk of unsuccessful issue. Recently developed financing innovations include: mezzanine finance, private equity finance, hybrid finance, structured finance or swap contracts.

Financial innovations can be applied in the investment strategy to increase or stabilize the expected rate of return on the realized investment projects. In addition, they can enable the company to avoid or postpone the income tax payments. Financial innovations can be also applied to improve the assets structure increasing the liquidity and flexibility of the company, decreasing the level of operating risk. Some financial innovations are implemented to reduce the transaction costs and to limit the investment risk as the result of the portfolio diversification. Complex financial instruments can be also applied to get access to the markets and instruments that are not available in the direct investments (investment function of the financial innovations). They can be also implemented to get the opportunity to earn return on the falling market. Tailor-made investment instruments can be better adjusted to the risk-return profile of the company. However, investment innovations can also increase the company's exposure to risk. This increased risk can have several sources: (1) low liquidity of instruments (in case of "buy-and-hold" investments), (2) low transparency of the market for some instruments (when they are traded on less regulated markets) or (3) high complexity of the mechanism of investment instruments (which makes it difficult to forecast their performance and return for investors). The most popular investment innovations include: hedge funds, Exchange Traded Funds, Real Estate Investment Trust, structured products, Residential Mortgage Backed Securities, Commercial Mortgage Backed Securities or Collateralized Debt Obligations.

Financial innovations applied in the risk management process limit the level of the financial risk, stabilizing cash flows and improving financial planning (risk management and pricing functions of the financial innovations). Risk-

transfer innovations can be applied to hedge against the unfavorable changes in the market parameter such as: stock prices, interest rates, foreign exchange rates or commodity prices. However, other risks can be also hedged, e.g.: credit default risk or catastrophic risk. The most popular hedging instruments are derivatives (plain vanilla and exotic ones), such as: options, futures, forwards and swaps and their combinations (second generation innovations) created by the financial engineering. The main motive of the risk-transfer innovations application is not only the reduction of risk, but also the reduction of transaction costs due to the standardization process. On the other hand, tailor-made innovations can be perfectly adjusted to the company's individual needs. Obviously, entering derivative contracts creates additional risk for the company, that is connected with the unfavorable changes in the value of the underlying assets. The situation called "perfect hedge" is the most advisable, as the loss incurred on the spot market can be covered by the profit generated by the derivative contract and in the opposite situation, the loss on derivatives can be balanced by the profit on the spot market. However, besides hedging, derivatives are often used for speculative purposes, in such situation, they give potential to generate high profits but simultaneously the expose company to additional risk. Thus, the effective usage of derivatives, particularly these characterized by higher complexity, requires professional knowledge about their construction and potential performance.

Table 1

Financial innovations impact on the corporate risk

Innovative financial strategy	
Factors increasing the level of corporate risk	Factors decreasing the level of corporate risk
– High complexity of innovations – Low liquidity of the market – Low transparency of the market – Increased market risk – Increased credit-default risk – Increased unsuccessful issue risk – Underestimation of the potential risk	– Better access to sources of funds – Lower financing cost – Lower transaction cost – Better access to investment opportunities – Higher rate of return on investment projects – Better adjustment to the company's needs and environmental conditions – Higher flexibility of the company's decisions

Source: Own study.

The financial innovations applied in the particular elements of the corporate financial strategy are bound together, similar to the connection that exists between its parts. Their specific construction makes it possible to use one innovative financial instrument in several fields of the corporate financial strategy, achieving simultaneously several results. This connection is visibly observed in

case of the financial innovations combining investment and risk management instruments or financing and risk management instruments (e.g. structured instruments). As a result of such solutions, the company can combine investment or financing decisions with the risk-transfer process, obtaining the effect of scale or reduced transaction costs.

Conclusion

The implementation of the financial innovations to the corporate financial strategy can have both positive and negative consequences, also for the level of the company's risk. The most important opportunities given by the financial innovations as compared to the traditional instruments, can be listed as follows: (1) lower financing costs, (2) better access to external sources of funds, (3) higher rate of return on investment projects, (4) increased flexibility of the company's decisions, (5) better adjustment to the company's needs and the environmental conditions.

Regarding the problem of risk, financial innovations give opportunity to decrease the level of the financial risk (liquidity and insolvency), business (operating) and investment risk. These positive results should improve the situation of the company and increase its value enhancing its long-term development better than in case of the traditional financial strategy.

However, to complete the picture of the financial innovations, their negative consequences should be also considered. The main problems connected with the financial innovations observed during the last financial crisis, occurred due to the underestimation of their risk. The most significant consequences were observed in case of the investment and risk-shifting instruments, as in many companies their inappropriate application resulted in the deterioration of their financial situation and in some cases even lead to the bankruptcy. The potential threats connected with the application of the financial innovations are mainly in the form of the increased risk: market risk, liquidity risk, credit-default risk or unsuccessful issue risk. These problems indicate the necessity of the thorough analysis of the financial innovations and their implications for the company's exposure to risk. Thus, the effectiveness of the innovative financial strategy is determined mainly by the professional knowledge of the company's managers about the construction and performance of the chosen instruments. Also, the financial institutions creating financial innovations should inform their clients about the potential consequences, both positive and negative. The problem of the reliable valuation of these instruments and improved transparency of the market is also important.

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PROBLEM PERCEPCJI RYZYKA W INNOWACYJNEJ STRATEGII FINANSOWEJ PRZEDSIĘBIORSTWA

Streszczenie

Cechą charakterystyczną współczesnych przedsiębiorstw jest funkcjonowanie w dynamicznie zmieniającym się otoczeniu oraz konieczność sprostania ciągle pojawiającym się nowym wyzwaniom. Rozwój przedsiębiorstwa i zwiększanie jego wartości nie są możliwe bez kreacji i implementacji różnorodnych rozwiązań innowacyjnych. Nowe

pomysły, instrumenty, techniki, procesy i metody są stosowane we wszystkich obszarach działalności przedsiębiorstwa, także w strategii finansowej. Innowacje finansowe mogą mieć różne formy, w związku z tym pełnione przez nie funkcje również mogą być różnorodne, a konsekwencje ich zastosowania dla sytuacji przedsiębiorstwa nie zawsze są pozytywne.

Celem artykułu jest prezentacja podstawowych możliwości i sposobów zastosowania innowacji finansowych w strategii finansowej przedsiębiorstwa z uwzględnieniem jej trzech głównych obszarów: strategii finansowania, strategii inwestowania oraz strategii zarządzania ryzykiem. W artykule przedstawiono także analizę skutków zastosowania innowacji finansowych dla sytuacji przedsiębiorstwa, ze szczególnym uwzględnieniem potencjalnych zmian w poziomie jego ryzyka. Problem ten jest szczególnie istotny ze względu na fakt, iż innowacje finansowe mogą być zarówno sposobem i narzędziem redukcji ryzyka, jak i źródłem dodatkowego ryzyka w działalności przedsiębiorstwa. Oznacza to konieczność przeprowadzania każdorazowej, szczegółowej analizy potencjalnych konsekwencji wykorzystania innowacji finansowych przed podjęciem decyzji o ich zastosowaniu w strategii finansowej przedsiębiorstwa.