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Remarks on network public theory

1. Introduction

In the 80's Alvin Toffler [17, p. 44–45] advanced a thesis that mankind entered a new civilization development stage and that the old order will be replaced with a new one in a very dramatic way. Collision of the old order and the new one will force a transformation of all social relations, including authorities, policy and customs. Rise of the information era cannot be described by a particular turning point. All turning points are determined normatively and irrespective of the fact they are or not associated with Internet occurrence, economy networking, globalization or the occurrence of new social movements; moreover, their affection is different over time. In other words the changes are not revolutionary but they mean erosion of the old institutions and growing power of the new network based institutions. However, such processes may take place due to a catalyst (accelerating factor) or delaying factor, they penetrate each other, hence, they accumulate or compete with each other.

In this paper attention is paid to considerations regarding the public sphere from a traditional point of view – presented by Jürgen Habermas [4] – and in the context of the network society concept by Manuel Castells [2]. The goal of this paper is the identification of the factors affecting the transformation of the public sphere from the traditional one to the network one and consequences they stimulate in the field of relations between public actors. At the same time a hypothesis is advanced that the traditional public sphere has been the subject of the atrophy, however, the network public sphere has been the subject of the augmentation process. A thesis formed up in such a manner implicates other questions: (1) do the afore-mentioned processes take place simultaneously, in other words, do the same factors result in the atrophy and augmentation?; (2) did the medium, through which the dialog among public actors take place, change?

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2. Public sphere transformation

The 'public sphere' term has been explained and interpreted many times in the field of sociology. In its traditional meaning it regarded interactions between particular members of the society, characterized by open nature. J. Habermas [4, p. 56–57] defines a public sphere as a reality zone where the audience is a public opinion carrier. Hence, public sphere bodies are state authorities and mass media which are used to send messages inside the audience.

A tradition of participation in the public sphere origins from middle-class traditions dated in the seventeenth and eighteenth centuries. At the very beginning the audience (term) covered addressees, consumers and critics of pieces of art, which enabled to define civil & middle-class public sphere as a zone of private individuals who collectively compose an audience [4, p. 95–101]. The process, which consists in observing, taking particular positions and presenting own opinions publicly by audience has significantly evolved over the ages. Contemporarily it takes place with a share of the mass media and on the free market. As it is said by J. Habermas, who was quoted previously, a consequence of it is a growing tendency to penetrate the public sphere and private zone, arising from the nature of the economic system based on private property and making the private zone public, which may be summarized in the following way: „large-city human is a mass human and he/she cannot cultivate the private zone any longer” [4, p. 279–306].

Changes, which have taken place in the public sphere in the recent two decades, seem to be equally significant as those described previously. Commercialization of the media which consists in sale of information instead of a provision of issues to be discussed caused that the public discourse has been abandoned and it initiated the process called media *tabloidization*. This term means acquisition of a tabloid's attributes by newspapers and magazines and then, by other media. A consequence of this process is a change of priorities in a particular medium and growing advantage of the entertainment, consequently, exceeding of good taste boundaries in the field of different content forms [9]. Other illustrations of changes in media is the *infotainment* phenomenon. It is a neologism which combines the words „information” and „entertainment”, which means material emitted by electronic media and which is intended to inform and to entertain or, in other words, to present information in an interesting manner [6]. The changes caused the public sphere (in the contemporary form) atrophy.

Public sphere atrophy obviously does not mean that all social contacts disappear. It rather comes about a collapse of the bourgeois public sphere. A human being has a natural need to express his/her own opinions which are, at the same time, accordant and contrary to opinions of other public life participants and the

public sphere 'forms up' a measure to perform this tendency. Considering the hierarchy of needs of Abraham H. Maslow [8, p. 82–86], one may conclude that the needs of affiliation, respect and self-realization are seriously expressed by participation in the dialog with other members of the society. Hence, the public sphere *sui generis* does not disappear but its traditional form fades away and at the same time feeds the new one. In the network society it is logic that the public sphere has been moved to virtual space.

Basically, the network society is based on three main pillars: structure, technology and a driving force [2, p. 20–40; 14, p. 7–16]. Each of these elements is reflected by new social order institutions, including the public sphere. In M. Castells' opinion a driving force is social movements, which he deems (on the basis of his research approach) to be self-aware [14, p. 93]. Looking for one's identity and a role in the social order of social movements members make them an engine of restructuring accepted institutions. This process requires the use of technologies and more accurately, IT technologies which allow for a new efficiency of communication [7, p. 199–214]. They enable us to shape network relations instead of hierarchic ones, and of a global nature instead of local character. Consequently, collective consumption limits, which are characteristic for urban issues, are omitted [14, s. 23].

Network public sphere is a resultant of afore-mentioned factors and its 'size' depends on their specificity at the particular civilization development stage since – as they are categories – they are always present. In the contemporary society the social movements have relevant tools to move the dialogue between public actors into other platforms. Internet has become a platform as a communication medium, which is so popular that approx. 34% of global population has on-line access, the internet being the most significant information medium. However, as M. Castells pointed out [2, p. 21] – structuring of the dialogue on the network enabled a bipolar relation between the network (as the entireness) and the identity (as the individuality).

Bipolarity means, on the one hand, looking for a network of profiles, each correlated to individual identity, and on the other hand, forming the network up on the basis of its own preferences. Flexibility of the network structure enables such forming since the network is nothing else but a system of mutually connected nodes [2, p. 468], that is without limits imposed by agents (contrary to the hierarchy). In connection with the communication possibilities provided by the Internet, one has previously unknown possibilities to participate actively in the public sphere dialogue under one's own conditions.

Network public sphere, according to information paradigm, has its place in the virtual space. It enables participation of social actors in the public life irrespective of time, place [7, p. 223–227] and social status. Internet forums are

available for everyone and anytime. The extent of participation depends only on willingness, involvement, knowledge and skills of a person having access to the network. It means that the participation rate in the public sphere is not the same for the entire audience. It would be advisable to divide this heterogeneous group into two sub-groups. The first group comprises persons, who actively participate in the public life (they enter any content[1] into the public sphere) and which may be called 'public actors'. This expression responds to the bourgeois audience of the traditional public sphere. The second group comprises of extras, that is passive observers of events.

Extras of the public sphere became meaningful as a result of the digital revolution and the occurrence of a network society. Due to the technology they gained simple possibilities to express their preferences without the necessity to develop their own content or knowledge of observed events. One such tools are social portals which enable participation in the public sphere e.g. by the popular 'like it' button in case of Facebook[2]. Networking enabled abandoning the role of extra and becoming active actors in the network public sphere. It is a consequence of the bipolarity of relations between a community (collectivity) and individuals. Looking for one's own identity in the network public sphere, actors may become active and passive again and again, what was limited in the traditional public sphere. Tabloidization described above and monopolization of access to the information was replaced by variety and free access, through social media (mainly social portals and blogosphere).

3. Role of social media in the network public sphere

M. Castells observed, at the turn of 60's and 70's, that the essence of cities is collective consumption [14, p. 21–28]. Collective provision of goods and hence, mass production, is a characteristic attribute of the industrial era. Mass-scale, even if unquestionably it is a source of economic efficiency, covered also social life fields where it was not favorable. The public sphere belongs to such types of examples. The public sphere power is quality of dialogues between the actors. Through activity one may find a consensus between what the society wants and what is performed by groups having the power. Moreover, it comes about

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[1] No matter these are *de facto* texts, pictures, music, or any other content which can be recorded and copied in form of computer file. Generally, all of them are information goods and, as it is proved by Jeremy Riffkin [11, p. 146–148], they are cultural goods at the same time.

[2] This kind of mechanisms is a form of marking (*tagging*) and they are used by all of important social portals.

the authority arising from the legitimism of violence measures (state), economic authority (monopoly) and other types arising from keeping a kind of *status quo*. Since the dialogue taking place in the public sphere is nothing more but communication, that is information flow, the supervision over its medium is synonymous to the orientation of activity of public actors.

The role of supervisor or a moderator in the twentieth century was held by mass-media managers. Consequently, there took place a mass-consumption of information which means that crowds could become just extras or finally, they could just come into conflict in form of protests and strikes which is not a dialogue in the framework of public sphere but a fight. The power of media communication has been basically appreciated since the radio was invented. Both W. Churchill and A. Hitler appreciated mass communication and based their political activities on radio messages [7, p. 154–161].

J. Habermas mentions the integration of that the mass media and advertising services is one of factors of public sphere re-feudalization [4, s. 359]. It is connected to the fact that the exchange of information between public actors takes representative[3] form again (characteristic for the feudal period), where most of the citizens are passive observers. It seems that in the course of further mass-media development this idea did not find a justification but for sure the mass-scale contributes to the atrophy of traditional middle-class public sphere.

Network public sphere is characterized by reverse correctness. At first, the dialogues take place beyond the mass media. Blogosphere and other social media, even those slightly commercial, are of serious meaning. Secondly, it is a zone of large diversification of opinions and goals of public actors. Looking for one's identity makes that information flowing through the Internet is very varied. M. Castells [1, p. 65–66] mentions that variety of Internet content is seriously related to the fact that the social movements from beyond the main stream could be revealed here.

Paul Levinson [7, p. 223–227] proves that simplified access to the possibility of becoming an „*on-line*" author – that is development and distribution of own texts – resulted in a variety of points of view and ideas [7, p. 223–227]. Similarly, M. Castells [1, p. 65–68] says that for the variety of the content in the Internet virtual communitarians are responsible, whose ergonomic technology of computer interface enables expressing one's own ideas. Before the Internet era content development on the global market was reserved for large publishing houses which had relevantly accumulated financial capital as well as human resources. The information paradigm is connected to the reduction of final costs of reproduction

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[3] Acc. to J. Habermas' considerations it is a form where the society is represented by single actors of the public sphere [4, p. 60–71].

and information products distribution in digital form, which is reflected by the removal of entry barriers into the group of authors [13, p. 53; 12, p. 15, 36; 3, p. 9–20]. In turn, authors who present their ideas and opinions are active actors of a network public sphere.

According to a survey carried out by Technorati Inc., the authors of blogs take up subjects regarding politics, economy as well as entertainment or culture. Nearly 50% of subjects cannot be classified anywhere since they are focused on a very wide range of issues. To a large extent – 45% bloggers share their own ideas with their readers, not focused on a particular issue [15, Day 2, Page 2]. In figure 1 results of a questionnaire divided into subjects the blogosphere deals with, are presented.
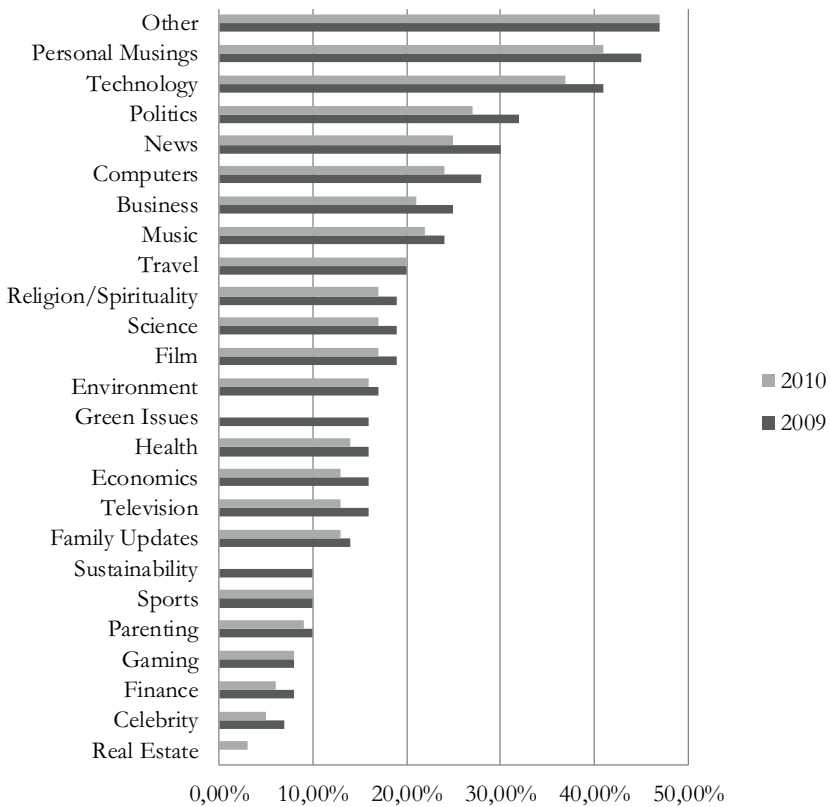
Figure 1. Blogs – subjects (data 2009)

Source: developed on the basis of data [15, Day 2, Page 2; 16, Day 2, Page 2]

The importance of the blogosphere in the exchange of social information, that is a dialogue between actors of the network public sphere, has been growing. Data made available by Technorati Inc. dated 2011 proves that bloggers think they are those who stimulate serious discussions in the blogosphere (22% of respondents approves this thesis). It means that the dialogue on blogs is very active. These are not just descriptions and comments of mass-media information but discussions started by the actors of the networked public sphere. Printing media to less extent (8%) and TV (approx. 3%). Even commercial media existing in the Internet (pages of media giants such as CNN or New York Times) have relatively poor impact (approx. 7%) [16, Part 2, Page 2].

Respondents polled by Technorati Inc. also indicate that blogs are more and more frequently deemed to be an information source (65% of them accepts this opinion). Approximately 50% of respondents state that these blogs are as significant media as the traditional mass media. More than half of them say that the mass media are trusted by a less number of respondents than 5 years ago and nearly 25% of them think that traditional media will not survive another 10 years [16, Part 2, Page 2–3].

This survey supports the hypothesis on the traditional public sphere which is subject of lower trust and on augmentation of the network public sphere. It also proves the fact that the dialogue between public actors takes place in social media to a large extent (among others blogosphere) and simultaneously the mass media meaning has been decreasing. Obviously, it is not possible to point out that the mass media have not meaning in the field of dialogue shaping but definitely they lose its hegemonic position in relation to the social media.

4. Miscellaneous

Summarizing the considerations contained in this paper one may state that the atrophy of the traditional public sphere is an unavoidable process. The weakening of activity of its actors is a consequence of both, factors beyond the networked public sphere and the other ones. An independent factor is significant (if not total) commercialization of the dialogue medium. Nowadays the public sphere medium is no longer direct performance e.g. like famous monologues at *Speakers' Corner* in London Hyde-Park, but printed and electronic media which, converting themselves into mass-media, have been commercialized. Their ubiquity made other forms of communication less meaningful. Hence, passive extras from beyond the media world converted into active actors.

In an industrial society the role of extra could be satisfying but in a network society, where looking for the identity is a bipolar process taking part between

the network and individual person, it has become insufficient. Considerations over oneself and internal need of finding oneself within social order are a factor causing a link between atrophy and augmentation. Traditional public sphere stops being an attractive institution for self-aware social movements – thus it is abandoned. In turn, the network social zone creates possibilities to occur in dialogues - and this is a desired situation.

In practice, this possibility is expressed by the Internet. In other words – by technological factors, assuring the effectiveness of replication and information distribution. Actors enclosed in the static role of traditional public sphere, in the network zone may freely start activity either, to less an extent – by support for expressed issues or by total commitment in a form of a particular position. The activity rate depends on themselves and not on an owner of a medium.

Social media have become medium of the networked public sphere (non-commercial) and they respond to mechanics of social movements. The tendency of private expression on the public forum has been growing. The middle-class citizen has no monopoly to cultivate the private zone but the network citizen hasn't got it as well. It also should not be forgotten that the Internet is no longer anonymous. Even if, in fact, it does not provide total impunity (there exist measures enabling the identification of each Internet user separately) at the stage of everyday expression it enables wearing masks, so called: avatars.

Finally, the traditional public sphere must be replaced by the network one since its shape does not respond to the valid needs of social actors. This fact is also observed by the representatives of mass media and their administers, who follow forms characteristic for social media – blogs of large publishing houses, politicians, famous persons, representatives of religion institutions. It does not change the fact that in order to participate in the dialogue via the social media they must proceed acc. to its principles, otherwise they shall be excluded [10, p. 153–178].

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The optimal portfolio in respect to Expected Shortfall: a comparative study

1. Introduction

Dependence structures in capital markets have recently attracted increasing attention among economists, empirical researchers, and practitioners. In order to control a portfolio for risks, portfolio managers and regulators have to take into account a degree of dependence between international equity markets when studying returns across international financial markets. Therefore, the topic of asymmetric dependence structures, such as high dependence in a bear period of the stock market is very important for both the risk control and the policy management. In addition, the benefits derived from an international diversification of asset allocation are often affected by asymmetric dependence structures.

It is well known and widely discussed in the literature that linkages among international capital markets are mostly asymmetric. From this asymmetry researchers draw a conclusion that in a bear phase, returns tend to be more interrelated than they are in a bull phase of capital markets. From this observation serious theoretical consequences for an international portfolio follow. The most important implication is a possible loss of diversification benefits in a bear time due to the rise in the dependence among capital markets. In other words, international portfolios become much more risky in bad times of stock markets that assumed in good times. The observed asymmetric dependence is an essential source of rise in the costs of a diversification with foreign equities.

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In this article we investigate how model selection affects the calculated risk of financial position. The two standard models are mean-variance Markowitz model and multivariate GARCH model. Both models assume symmetric and thin-tailed distributions of returns, in particular they assume the normal distribution. Recently developed models based on copula functions are both flexible and convenient to model anomalies in distributions, such as an asymmetry or fat-tails. In this article we focus on regime switching copula models. We consider two risk measures: Value at Risk and Expected Shortfall. The expected risk derived on the basis of the regime switching copula model is compared to the expect risks obtained by using the Markowitz model and the multidimensional GARCH model.

A model misspecification may cause a number of problems. Incorrect evaluation of the expected value of a financial position is one of the most serious drawbacks of the financial models. However, a risk underestimation may cause even worse consequences. Most of risk measures are strongly, or entirely, dependent on distributions of tails. Especially, the dependence of extreme assets' values substantially affects the distribution of the portfolio value. Therefore, an omission of an asymmetry or a high kurtosis of assets' distributions may be a reason for a miscalculation of risks.

The remainder of the contribution is organized in the following way: in section 2 we conduct the literature overview concerning the dependence concepts, including regime switching models and copulas and discuss the recent contributions to the subject; in section 3 the dependence measures and copulas are overviewed; in the following section the copula regime switching model is described; in the fifth section risk measures based on copula models are discussed; in the sixth section we present the data, report and discuss the results; section 7 concludes the paper.

2. Literature overview

Relations among international stock markets have been investigated in many papers, especially in the period of the financial crises. The topic under study is important for market participants, because, due to the globalization process, the global markets are becoming more and more dependent. This observation follows from the liberalization and deregulations in both money and capital markets. In addition, the globalization process diminishes opportunities for international diversification.

Numerous recent studies deal with an asymmetry in dependence structures in international stock markets. They reveal two interesting asymmetries. The dependence tends to be high in both highly volatile markets and bear markets.

While in some studies, the evidence of the first type of asymmetry is shown, several other studies found the second asymmetry. In one of the earliest contribution, Hamao, Masulis, and Ng [18] investigated the relations among equity markets across Japan, the U.K., and the U.S. using the daily data of stock indices. The authors estimated the GARCH-M model. Using this model the authors established volatility spillover effects from the U.S. and U.K. stock markets to the Japanese market. King and Wadhwani [23] developed a contagion mechanism model. They detected contagion effects. The contributors stressed that an increase in volatility by using a high frequency data from the stock markets in Japan, the U.K., and the U.S strengthened these effects. These findings were supported to some extent by Lin et al. [26] who analysed two international transmission mechanism models based on the daily returns of stock indices in Japan and the U.S. Erb et al. [14] found that monthly cross-equity correlations among the G7 countries were highest when any of two countries were in a recession. In addition, the contributors claimed that they are much higher in bear markets. In the paper by Longin and Solnik [27], the monthly data of stock indices for several industrial countries were analyzed. The contributors, using a multivariate GARCH model, found that the correlations between major stock markets raised in periods of a high volatility. On a basis of the multivariate SWARCH model, Ramchand and Susmel [36] found that monthly returns of stock markets in the U.K., Germany, and Canada tended to be essentially more correlated with the U.S. equity market during periods of a high U.S. market volatility. The similar results could be found in King, Sentana, and Wadhwani [22], Ball and Torous [5], Bekaert and Wu [6], Ang and Bekaert [2], and Das and Uppal [10].

Following Davison and Smith [11] and Ledford and Tawn [25], Longin and Solnik [28] derived a method to measure the extreme high correlation by the conditional tail correlation based on extreme value theory. The contributors established that the conditional correlation between the U.S. and other G5 countries strongly increases in bear markets. In contrary, the conditional correlation does not essentially increase in bull markets.

In more recent studies by Campbell et al. [7], Ang and Bekaert[2], Das and Uppal [10], Patton [34], and Poon et al. [35], the existence of two regimes in international equity markets was suggested: a high dependence regime with low and volatile returns and a low dependence regime with high and stable returns.

Based on this hypothesis, Ang and Bekaert [2] estimated a Markov switching multivariate normal (MSMVN) model using the U.S., the U.K., and German monthly stock indices. The contributors detected some evidence that a bear regime is characterized by low expected returns, high volatility, and high correlation, whereas a normal regime is characterized by high expected returns, low volatility, and low correlation. Their model was able to replicate Longin and

Solnik's [28] results. Referring to Ang and Chen [2], they demonstrated that an asymmetric bivariate GARCH model, widely used in the literature to analyze the international stock markets, cannot replicate them.

In recent times, copulas have become a major tool in the finance for modelling and analyzing dependence structures between financial variables. In contrast to the linear correlation, the copula reflects the complete dependence structure inherent in a random vector (see [13]). In finance, copulas have attracted much attention in the calculation of the Value-at-Risk (VaR) of market portfolios (see e.g. Junker and May, 2005; Kole et al., 2007 and Malevergne and Sornette, 2003) and the modelling of the credit default risk.

Ball and Torous [5] and Guidolin and Timmermann [17] investigated the economic significance of their empirical findings from a risk management point of view. Rodriguez [37] used copula model with Markov switching parameters. Okimoto [32] stressed that ignoring the asymmetry in bear markets could be costly when risk measures are evaluated. In his contribution, using a copula based regime switching Markov model, he concentrated on the value at risk (VaR) and expected shortfall (ES).

According to his calculation, ignoring such an asymmetry in bear markets significantly affects risk measures, i.e. the 99% VaR is undervalued by about 10%, while the expected shortfall is undervalued by about 5% to 10% consistently over the whole significance level between 90% to 99%. This is essential for the risk management.

The empirical literature on the optimal choice of the parametric copula family for the VaR-estimation can be clustered into three groups.

The first group of contributors claims that the elliptical copulas are optimal. The representative of this stream of papers is e.g. paper by Malevergne and Sornette [29]. This is one of the first empirical studies on the optimality of copula models for the modelling of dependence structures of linear assets. The authors, based on the dataset consisting of six FX futures, six commodity prices and 22 stocks listed on the NYSE, demonstrated that the dependence structures of the majority of bivariate portfolios built from these assets can be correctly reflected by a Gaussian copula. However, in the opinion of the contributors, their result can be biased. The reason is that Student's t copula can easily be mistaken for a Gaussian copula. In addition, Malevergne and Sornette [29] did not include the estimation of a risk measure or Goodness of Fit –tests (abbreviation GoF-tests). Kole et al. [24] found, on the basis of just one trivariate portfolio (one stock-, one bond- and one REITS-index), that the Student's t copula is the best for modelling the dependence structure of linear assets. DiClemente and Romano [12] using the 20-dimensional portfolio of Italian stocks, demonstrated that a model incorporating margins following an extreme value distribution and an elliptical copula

can yield much better VaR-estimates than the classical correlation-based model. However, they used neither Archimedean copulas nor copula-GoF- tests. In contribution by Fantazzini [15], it is shown that three bivariate portfolios built from stock indices can be well modelled by a constant or dynamic Gaussian copula in order to estimate VaR properly.

The second stream of studies justifies an optimality of Archimedean copulas. Junker and May [21] argued that a transformed Frank copula with GARCH margins can improve VaR- and ES-estimates in comparison to elliptical copula models. However, their conclusions are based solely on the single bivariate portfolio of German stocks. In addition, they only apply GoF-tests for general distributions. They were not adjusted to the characteristics of copulas. Similar results were presented by Palaro and Hotta [33] for the bivariate portfolio based on the S&P 500- and the NASDAQ- index. The authors showed that a symmetrised Joe-Clayton copula joint with GARCH margins performs significantly better than elliptical copula models.

Recent studies, belonging mostly to a third cluster of research, demonstrate that the optimal parametric copula as well as the strength and structure of the dependence between asset returns are not constant over the time. In order to allow the parametric form of the copula to change over time more recent studies like the ones addressed above Rodriguez [37], Okimoto [32], Chollette, Heinen, and Valdesogo [8] and Markwat, Kole, and van Dijk, [31], Weiss [38] apply the convex combinations of copulas. The contributors drew a conclusion that more flexible mixture copula models yield better VaR and ES estimates than unconditional copula models.

The contributors stressed that copula models perform better than correlation-based models with respect to the estimation of VaR. This was the case when the optimal parametric copula family was known ex ante.

The main aim of this contribution is a comparison of the expected shortfall for returns derived on the basis of the Markowitz model, the multidimensional GARCH model and the copula regime switching model.

3. Dependence measures based on copulas

The correct evaluation of the dependence between assets' interest rates is essential for an accurate assessment of an investment risk. In the case of risk management, the dependence between negative values, in particular between extreme negative values plays a key role. Especially, if such a dependence is substantial, then an investor can lower the risk by diversification of a portfolio to less than expected. In this section we present some functions measuring the dependence between

random variables and discuss their intuitive meaning. Moreover, we describe the presented dependence measures' relationship with copulas.

3.1. Exceedance correlation coefficient

The most traditional dependence measure is Pearson correlation. However, it measures only linear dependence and works only in the range of the spherical and elliptical distributions. The exceedance correlation is the generalized Pearson coefficient which measures asymmetric dependence. It is defined as the correlation between two variables, conditional on both variables being below or above some fixed levels. Exceedance correlation coefficients between random variables X and Y are defined as:

$$ecorr_{\theta_1 \theta_2}^{L}(X, Y) := corr(X, Y | X \leq \theta_1, Y \leq \theta_2), \tag{1}$$

$$ecorr_{\theta_1 \theta_2}^{U}(X, Y) := corr(X, Y | X \geq \theta_1, Y \geq \theta_2), \tag{2}$$

where $ecorr_{\theta_1 \theta_2}^{L}$ is lower exceedence correlation, $ecorr_{\theta_1 \theta_2}^{U}$ is upper exceedence correlation and θ_1, θ_2 are fixed thresholds.

Properly calculated exceedance correlation would be an efficient tool in risk management, where negative extreme values of an investment return are crucial. However, this coefficient has some drawbacks. For instance, it is computed only from observations which are below (above) the fixed limit. Therefore, as the limit is further out into the tail as exceedance correlation is computed less precisely. Another inconvenience with the exceedance correlation is that it is dependent on margins, thus it cannot be calculated only from the copula connecting variables.

3.2. Tail dependence

Another tail dependence measure is quantile dependence. For random variables X and Y with distribution functions F and G, respectively, the lower tail dependence at threshold α is defined as $P\left[Y < G^{-1}(\alpha) | X < F^{-1}(\alpha)\right]$. Analogously, the upper tail dependence at threshold α is defined as $P\left[Y > G^{-1}(\alpha) | X > F^{-1}(\alpha)\right]$. The dependence measure which is particularly interesting is the tail dependence obtained as the limit of a quantile dependence. We define lower tail dependence λ_L of X and Y as:

$$\lambda_L = \lim_{\alpha \to 0^+} P\left[Y < G^{-1}(\alpha) | X < F^{-1}(\alpha)\right], \tag{3}$$

and upper tail dependence Λ_u of X and Y as:

$$\lambda_U = \lim_{\alpha \to 1^-} P\left[Y > G^{-1}(\alpha) | X > F^{-1}(\alpha)\right]. \tag{4}$$

Variables X and Y are called asymptotically dependent if $\lambda_L \in (0,1]$ and asymptotically independent if $\lambda_L = 0$ For variables connected by the copula C, lower tail dependence λ_L and upper tail dependence λ_U can be computed as follows:

$$\lambda_L = \lim_{u \to 0^+} \frac{C(u,u)}{u}, \tag{5}$$

$$\lambda_U = \lim_{u \to 1^-} \frac{\overline{C}(u,u)}{1-u}, \tag{6}$$

where $\overline{C}$ is the survival copula defined by:

$$\overline{C}(u,v) = C(1-u, 1-v) - u - v + 1u, \text{ for } u,u \in (0,1] \tag{7}$$

Unlike exceedance correlations, tail dependence is independent of margins. In the most cases, for a given copula, one can simply calculate tail dependences using formulas (5) and (6). In Table 1, we present results for the copulas used in the paper.

Table 1

Tail dependencies for Gaussian, BB1, BB4, BB7 copulas

	λ_L	λ_U
C_ρ^{Gauss}	0	0
$C_{\theta,\delta}^{BB1}$	$2^{-\frac{1}{\delta\theta}}$	$2 - 2^{\frac{1}{\delta}}$
$C_{\theta,\delta}^{BB4}$	$\left(2 - 2^{-\frac{1}{\delta}}\right)^{-\frac{1}{\theta}}$	$2^{-\frac{1}{\delta}}$
$C_{\theta,\delta}^{BB7}$	$2^{-\frac{1}{\delta}}$	$2 - 2^{\frac{1}{\theta}}$

3.3. Kendall's τ

Another class of dependence measures is based on ranks of variables. The two most popular rank correlations coefficients are Kendall's τ and Spearman's ρ. Both rely on the notion of the concordance. Let (x_1, y_1) and (x_2, y_2) be two observations of the random vector (X, Y). We say that the pair is *concordant* whenever $(y_1 - y_2)(x_1 - x_2) > 0$, and *discordant* whenever $(y_1 - y_2)(x_1 - x_2) < 0$. Intuitively, a pair of random variables are concordant if large values of one variable occur more likely with large values of the other variable.

For random variables X and Y, Kendall's τ is defined as:

$$\tau = P\left[(y_1 - y_2)(x_1 - x_2) > 0\right] - P\left[(y_1 - y_2)(x_1 - x_2) < 0\right],$$

where (x_1, y_1) and (x_2, y_2) are independent observations of (X, Y). In terms of copulas, Kendall's τ has concise form. For the pair of random variables X and Y and its copula C, we have:

$$\tau_C = 4 \int_{[0,1]^2} C(u,v)\,dC(u,v) - 1.\tag{8}$$

Since copula is invariant with respect to any monotonic transformation, Kendall's τ has also this property. From the formula (8) we see that Kendall's τ does not depend on marginal distributions.

4. Compared models

In this section we present the regime switching copula model with GARCH margins and the estimation procedure. Other models used in this article are: the Markowitz model and *multivariate Generalized Autoregressive Conditional Heteroscedasticity* (mGARCH) model.

The Markowitz model is a standard model introduced by Markowitz. This model is based on a normal distribution assumption and does not include any dynamic changes. There are numerous papers stressing the inadequacy of this model. We believe that there are still individuals using this method. Thus, we decided to compare this method to other in the context of our study. Markowitz model's parameters can be equivalently estimated using the likelihood function maximization or the least square method.

Switching models were introduced by Hamilton [19] and widely analyzed by Hamilton [20]. Let $y_t = (y_{1t}, y_{2t})$ be a pair of interest rates of analyzed indices, and let $Y_t = (y_t, y_{t-1}, y_{t-2},...)$ be the series of observations available at the time t.

We denote the two-state Markov state process by s_t, which has two possible values, say 1 and 2, we call these states regimes. We choose the first regime copula from copulas with non-zero tail dependencies, namely BB1, BB4 and BB7 copulas. The second copula is the Gaussian copula, which corresponds to symmetry and tail independence of the investigated variables.

The conditional joint density function f for y_t is defined as:

$$f(y_t|Y_{t-1}, s_t = j) = c^{(j)}\big(F_1(y_{1t};\delta_1), F_2(y_{2t};\delta_2)\big) \cdot f_1(y_{1t};\delta_1) \cdot f_2(y_{2t};\delta_2),\tag{9}$$

where F_i and f_i, for $i = 1,2$, are the marginal distribution functions and density functions of corresponding variables, and δ_i is a parameter vector for the marginal distribution. The probability that the state i precedes the state j is denoted by $p_{ij} = P[s_t = j | s_{t-1} = i]$.

All four probabilities form transition matrix:

$$\boldsymbol{P} = \begin{bmatrix} p_{11} & p_{12} \\ p_{21} & p_{22} \end{bmatrix} = \begin{bmatrix} p_{11} & 1-p_{11} \\ 1-p_{22} & p_{22} \end{bmatrix}. \tag{10}$$

The estimation of the regime switching copula model is based on the maximum likelihood estimation. Unfortunately, the computing power needed to maximize likelihood function is enormous. To simplify the calculation, the decomposition of likelihood function to margins likelihood functions and the dependence likelihood function is performed. Formally, for a given sample $Y = (Y_1, Y_2, ..., Y_T)$, the log-likelihood function is defined by:

$$L(Y; \delta, \theta) = \sum_{t=1}^{T} \ln f(y_t \mid Y_{t-1}; \delta, \theta),$$

and it is decomposed to L_m and L_c such that:

$$L(Y; \delta, \theta) = L_m(Y; \delta) + L_c(Y; \delta, \theta),$$

where:

$$L_m(Y; \delta) = \sum_{t=1}^{T} \left[\ln f_1(y_{1t} \mid (Y_{1t-1}; \delta_1)) + \ln f_2(y_{2t} \mid (Y_{2t-1}; \delta_2)) \right], \tag{11}$$

$$L_c(Y; \delta, \theta) = \sum_{t=1}^{T} \ln c[F_1(y_{1t} \mid (Y_{1t-1}; \delta_1), F_2(y_{2t} \mid (Y_{2t-1}; \delta_2); \theta]. \tag{12}$$

The parameters of the model are estimated as follows. In the first step we estimate the parameters δ_1 and δ_2 of the marginal distribution. This step is performed by the maximization of the likelihood function defined by (11). In the second step we maximize the likelihood function defined by (12) to estimate parameters θ_1 and θ_2 of copulas $c^{(1)}$ and $c^{(2)}$, and transition matrix given by (10). Note that parameters $\delta_1, \delta_2, \theta$ are in fact collections of parameters.

A method of the estimation of marginal distributions depends on the model which is chosen to describe the specific marginal variable. To model the mean of a time series, we use the simple autoregressive model. As we mentioned before, usually for time series of returns hypotheses of normal distribution of residuals are rejected. In particular, investigated time series are fat-tailed, asymmetric and heteroscedastic. Therefore, for every analyzed time series r_t, we use the following AR(1)-GARCH(1,1) model:

$$r_t = \varphi_0 + \varphi_1 r_{t-1} + \varepsilon_t \tag{13}$$

$$b_t = \omega + \alpha \varepsilon_{t-1}^2 + \beta b_{t-1} \text{ for } \omega > 0, \ \alpha \geq 0, \ \beta \geq 0; \tag{14}$$

where $\varepsilon_t = b_t e_t$ and e_t is a white noise. Although, with respect to an asymmetry and a fat tail, e_t is described by the skewed Student-t distribution. The skewed

Student-*t* is a two parameter distribution. For v > 2 and $\lambda \in [-1,1]$, the skewed Student-*t* density function, denoted by *St*, is defined by:

$$St_{v,\lambda}(x) = \begin{cases} bc\left(1+\dfrac{1}{v-2}\left(\dfrac{bx+a}{1-\lambda}\right)^2\right)^{\frac{-(v+1)}{2}} & \text{dla } x < -\dfrac{a}{b} \\[4mm] bc\left(1+\dfrac{1}{v-2}\left(\dfrac{bx+a}{1+\lambda}\right)^2\right)^{\frac{-(v+1)}{2}} & \text{dla } x \geq -\dfrac{a}{b} \end{cases}, \tag{15}$$

where $a = 4\lambda c\left(\dfrac{v-2}{v-1}\right), b = \sqrt{1+3\lambda^2 - a^2}, c = \dfrac{\Gamma\left(\dfrac{v+1}{2}\right)}{\sqrt{\pi(v-2)}\Gamma\left(\dfrac{v}{2}\right)},$

The second step is the estimation of copulas parameters and transition probabilities. To do so, we use Hamilton filter. For the transition matrix $\boldsymbol{P}$ given by (10), we define:

$$\hat{\xi}_{t|t} = \frac{\hat{\xi}_{t|t-1} \odot \eta_t}{1^T(\hat{\xi}_{t|t-1} \odot \eta_t)}, \tag{16}$$

$$\hat{\xi}_{t+1|t} = \boldsymbol{P}^T \hat{\xi}_{t|t}, \tag{17}$$

where $\hat{\xi}_{t|t} = P[s_t = j \,|\, Y_t;\theta]$ and $\hat{\xi}_{t+1|t} = P[s_{t+1} = j \,|\, Y_t;\theta]$ the Hadamard's multiplication denoted by $\odot$ means the multiplication coordinate by coordinate. The vector of copulas' densities is denoted by η_t,

$$\eta_t = \begin{bmatrix} c^{(1)}\left(F_1(y_{1t};\delta_1), F_2(y_{2t};\delta_2);\theta_1\right) \\ c^{(2)}\left(F_1(y_{1t};\delta_1), F_2(y_{2t};\delta_2);\theta_2\right) \end{bmatrix}. \tag{18}$$

The log-likelihood function defined by (12) for the observed data can be written as:

$$L_c(\boldsymbol{Y};\delta,\theta) = \sum_{t=1}^{T} \ln\left(1^T\left(\hat{\xi}_{t|t-1} \odot \eta_t\right)\right), \tag{19}$$

where the initial value $\hat{\xi}_{1|0}$ is the limit probability vector:

$$\hat{\xi}_{1|0} = \begin{bmatrix} \dfrac{1-p_{22}}{2-p_{11}-p_{22}} \\[4mm] \dfrac{1-p_{11}}{2-p_{11}-p_{22}} \end{bmatrix} \tag{20}$$

Models based on mGARCH have been recently broadly used and modified. In this article, conditional mean dynamics is described by the VAR(1) model. For details of the recent study we refer to Croux and Joossens [9]. To model conditional correlation, we use the Dynamic Conditional Correlation (DCC) model with normal conditional distributions.

Under this model the conditional mean of the multidimensional time series y at the time t is computed as follows:

$$E[y_t \mid \Omega_{t-1}] = \mu + Ay_{t-1} + \varepsilon_t, \tag{21}$$

where μ is constant, Ω_t is the information set available at the time t and A is a vector autoregressive matrix. The error term ε_t at the time t is defined by:

$$\varepsilon_t = H_t^{(1/2)} z_t, \tag{22}$$

where z_t is a sequence of N- dimensional, in our case $N = 2$, i.i.d. random vector with the following characteristics: $E(z_t) = 0$ and $E\left(z_t z_t^T\right) = I_N$, therefore $z_t \sim N(0, I_N)$. The dynamic covariance matrix H_t is decomposed to:

$$H_t = D_t R_t D_t, \tag{23}$$

where D_t^2 is a dynamic variance matrix and R_t is a dynamic correlation matrix. In the two-dimensional case, $D_t = \mathrm{diag}\left(\sqrt{h_{11,t}}, \sqrt{h_{22,t}}\right)$, where

$$h_t = \omega + \alpha \varepsilon_{t-1} \odot \varepsilon_{t-1} + \beta h_{t-1}. \tag{24}$$

The correlation matrix R_t is decomposed as follows:

$$R_t = \left\{\mathrm{diag}(Q_t)\right\}^{-\frac{1}{2}} \cdot Q_t \cdot \left\{\mathrm{diag}(Q_t)\right\}^{-\frac{1}{2}}. \tag{25}$$

The correlation driving process Q_t is defined by:

$$Q_t = \left(1 - \alpha - \beta\right)\bar{Q} + \alpha P_{t-1}^* + \beta Q_{t-1}, \tag{26}$$

where $\bar{Q}$ denotes unconditional correlation matrix of the stantarized errors and

$$P_t^* = \left\{\mathrm{diag}(Q_t)\right\}^{-\frac{1}{2}} \cdot D_t^{-1} \cdot Q_t \cdot D_t^{-1} \cdot \left\{\mathrm{diag}(Q_t)\right\}^{-\frac{1}{2}}. \tag{27}$$

This particular specification of the DCC model has been proposed by Ailelli [1].

5. Portfolio optimization

The portfolio optimization problem is widely analyzed. There are two main goals to achieve in any portfolio optimization problem. The first aim is the maximization of the expected value of the portfolio. The most natural way is to maximize

the expected nominal value, a generalization of this approach is the maximization of an expected utility. In this article, we do not consider utility functions, for more details about a maximizing an expected utility see Föllmer and Schied [16]. The second aim in the portfolio optimization is to minimize a risk. There are numerous approaches to a concept of risk. The most standard understanding of a risk is an uncertainty. For any portfolio, its risk may be understood as the variance of the future value of the portfolio. This concept was firstly introduced in [30] and the corresponding portfolio optimization problem was solved in this paper.

In this article, we deal with the concept of risk proposed in [4]. We analyze the risks of the financial positions in the one period case. It means that the value of the financial position under study in the end of the period turns into a random variable.

The function $\rho \colon \mathcal{X} \to \mathbb{R}$, where $\mathcal{X}$ is the family of all attainable financial positions, is called *risk measure* if it satisfies the following properties for all financial positions X, Y:

1. *Monotonicity:*

   If $X \leq Y$, then $\rho(X) \geq \rho(Y)$. $\hspace{3cm}$ (28)

2. *Cash invariance:*

   If $m \in \mathbb{R}$, then $\rho(X + m) = \rho(X) - m$. $\hspace{2cm}$ (29)

The interpretation of monotonicity is clear: The increase of a financial position's payoff profile do not increase its risk. The cash invariance is motivated by the interpretation of $\rho(X)$ as a capital requirement. If the amount m is added to the position and invested in a risk-free manner, the capital requirement is reduced by the same amount.

It is usually assumed that the portfolio diversification should not increase the risk. *Convex risk measures* has this property, the risk measure ρ is called *convex risk measure* if it satisfies the following convexity property for all financial positions X, Y:

$$\rho\big(\lambda X + (1-\lambda)Y\big) \leq \lambda\rho\big(X\big) + (1-\lambda)\rho(Y),\text{, for all } 0 \leq \lambda \leq 1. \qquad (30)$$

Moreover the convex risk measure ρ is called *coherent risk measure* if it satisfies the following positive homogeneous property:

$$\rho\big(\lambda X\big) \leq \lambda\rho\big(X\big),\text{, for all } 0 \leq \lambda \text{ and } X \in \mathcal{X}. \qquad (31)$$

Value at Risk (VaR) is an approach to the problem of measuring the risk of a financial position X based on specifying a quantile of the distribution of X under the given probability measure. Value at Risk is the smallest amount of capital which, if added to X and invested in the risk-free asset, keeps the probability of a negative outcome below some fixed level.

For $X \in \mathcal{X}$ and $\lambda \in (0,1)$ we define *Value at Risk at level* λ as:

$$VaR_\lambda (X) := \inf \left\{ m \,|\, P[X + m < 0] \le \lambda \right\}. \tag{32}$$

In the other words, $VaR_\lambda (X)$ is $(1 - \lambda)$-quantile of the variable $(-X)$. Clearly, *VaR* is a positively homogeneous risk measure. Generally, Value at Risk is not a convex risk measure. However, it is convex if it measures a risk of financial positions come from some particular classes. For instance, *VaR* is convex risk measure if X consists of only normally distributed financial positions.

This risk measure has a clear interpretation and is recommended by numerous financial institutions and presented in documents such as the Basel Accords. However, the absence of the convexity is a substantial objection. This disadvantage of *VaR* led researchers to convex risk measures which have similar interpretation as Value at Risk. It appears that, so called *Expected Shortfall* (ES), is a convex risk measure.

For $X \in \mathcal{X}$ and $\lambda \in (0,1)$ we define *Expected Shortfall at level* λ as:

$$ES_\lambda (X) := E[VaR_\alpha \,|\, \alpha \le \lambda] \tag{33}$$

This convex risk measure is also called *Conditional Value at Risk* (*CVaR*), *Average Value at Risk (AVaR), Tail Value at Risk (TVaR), Mean Excess Loss or Mean Shortfall*. However, there are other risk measures defined in some papers under these names. In this article, the risk measure defined by (33) is called an Expected Shortfall. Clearly, $ES_\lambda(X) \ge VaR_\alpha$, for any $\lambda \in (0,1)$.

In general case it is difficult or impossible to find an analytical form of *ES*. One can notice that there does not exist an analytical form of *VaR* for normally distributed financial positions. We estimate *VaR* using the Monte Carlo method. For every analyzed model, we simulate 1,000,000 observations. It is usually recommended to simulate 100,000 observations. However, we are mostly interested in extreme observations, namely those which are below VaR_λ-level. In the formula (33), one can see that ES_λ is determined by a conditional distribution, in particular by the financial position's distribution in the lower λ-tail.

6. The data and the estimation results

The database consists of prices of three stock market indices. Namely, the American DJIA, the German DAX and the Austrian ATX. In order to avoid introducing an artificial dependence due to the difference in closing times of stock exchanges around the globe, we work with Wednesday to Wednesday returns. Comparing to daily returns, weekly return processes have lower autocorrelation

and avoid the missing data problem. This gives us a sample of 689 weekly returns from January 2000 to March 2013. We apply continuous (logarithmic) returns:

$$r_t = 100 \cdot \log \frac{p_t}{p_{t-1}}, \tag{34}$$

where p_t is the price index at the time t.

Firstly, we present some descriptive statistics in Table 2.

Table 2

Logarithmic rates of return time series summary statistics

	ATX	DAX	DJIA
Mean	0.1036	0.0248	0.0335
Median	0.4157	0.3984	0.2140
Std. dev.	3.4646	3.4630	2.5782
Kurtosis	16.7931	5.1127	7.7125
Skewness	−1.9245	−0.6643	−0.9464

In the period under study we observe an insignificant positive means in all the three indices. A relatively large absolute value of median suggest asymmetries in the examined time series. Negative skewnesses confirm this conjecture. These asymmetries suggest that normal distribution should not be used to model these time series, and high kurtosis in all the three time series confirms that.

Table 3 presents empirical dependence measures for analyzed pairs of price indices.

Table 3

Empirical dependences between price indices' time series

	ATX/DAX	ATX/DJIA	DAX/DJIA
$\boldsymbol{\rho}$	0,6439	0.6056	0,7863
Kendall's τ	0.4135	0.3704	0.5848
$\boldsymbol{\lambda_L}$	0.6421	0.5072	0.5797
$\boldsymbol{\lambda_U}$	0.4638	0.3623	0.5652
$\boldsymbol{ecorr^L_{Q_1^1, Q_1^2}}$	0.7179	0.6441	0.6781
$\boldsymbol{ecorr^U_{Q_5^1, Q_5^2}}$	0.3798	0.5302	0.7183

Here ρ is Pearson's correlation, Q_α^1 and Q_α^2 are α-quartiles of a realized volatility series and a daily volume series, respectively. Tail dependencies λ_L and λ_U are approximated by $P\left[Y < G^{-1}(0.1)|X < F^{-1}(0.1)\right]$ and $P\left[Y > G^{-1}(0.9)|X > F^{-1}(0.9)\right]$, respectively.

One can observe the strong and significant linear correlation between the indices under consideration. As expected, the strongest dependence is observed for the DAX/DJIA pair. Despite the many drawbacks of linear correlation, it is worth to mention that a portfolio construction is very sensitive to the degree of dependence.

Asymmetries in tails are observed for the ATX/DAX and ATX/DJIA pair. For the DAX/DJIA pair, the lower and the upper estimated tail dependence are at similar levels. The same result is observed for exceedence correlations.
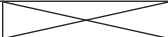
A multidimensional GARCH(1,1) model with conditional mean described by the VAR(1) is supposed to eliminate the incorrect assessments of the foregoing model. Table 4 presents *A* matrices and constants μ from equation (21) for the three pairs of analysed time series:

Table 4

Vector autoregressive parameters

	ATX	DAX		ATX	DJIA		DAX	DJIA
ATX	−0.0738	0.0855	**ATX**	−0.1274	0.2409	**DAX**	−0.0937	0.0880
DAX	−0.0640	−0.0009	**DJIA**	−0.0006	−0.0754	**DJIA**	−0.0265	−0.0479
μ	0.1118	0.0235	**μ**	0.1117	0.0334	**μ**	0.0160	0.0333

Estimated parameters of GARCH(1.1) model. described by (24) and (26). are presented in Table 5:

Table 5

Multidimensional GARCH model parameters

	ω	α	β
ATX	0.4952	0,2281	0,7467
DAX	1,2810	0,3028	0,6133
DCC		0,0363	0.9513
	ω	α	β
ATX	0.5308	0.2278	0.7411
DJIA	0.5657	0.2451	0.6830
DCC		0.0315	0.9607

Table 5 cont.

	ω	α	β
DAX	1.2065	0.2986	0.6239
DJIA	0.5601	0.2505	0.6802
DCC		0.0495	0.8987

Using methods described in section 3 we conducted the estimation of parameters of models for margins and regime-switching copulas. Table 6 contains the estimation results of AR(1)-GARCH(1.1) models along with Skeweed-*t* distributions.

Table 6

Estimation results of models for margins

parameter	φ_0	φ_1	ω	α	β	v	λ
ATX	0.2868	–0.0267	0.4007	0.126	0.8315	–0.2211	7.5306
DAX	0.2616	–0.1133	0.5833	0.1871	0.7703	–0.3183	9.4504
DJIA	0.172	–0.1215	0.2738	0.1455	0.8127	–0.2332	7.7701

The estimated results confirm the stylized facts about log-returns: the skewness and the fat-tailedness. All of the estimated parameters are significant (5% level) with one exception (the AR(1) term in the ATX model).

We tested the correctness of the specification using the Ljung-Box and Engle tests applied to standardized residuals which are transformed to the uniform using the estimated Skewed-t distributions. Through goodness of fit tests along with the BDS test (Brock-Dechert-Scheinkman) we were able to check the uniform distribution of standardized residuals.

In the next step we estimated the regime switching copulas. To describe a dependence asymmetry we use two-parameter Archimedean copulas (BB1, BB4 and BB7) and Gaussian copula to model symmetric dependence with tail-independence patterns. In Table 7 we present the estimation results.

Table 7

Estimation results of regime switching copulas

pair of indices	first regime copula	$\theta_1^{(1)}$	$\theta_1^{(2)}$	θ_2	p_{11}	p_{22}
ATX/DAX	BB7	1.5723	1.5644	0.3430	0.9983	0.9978
DAX/DJIA	BB1	0.6434	1.8649	0.4356	0.9916	0.9246
ATX/DJIA	BB1	0.7751	1.3501	0.3561	0.9984	0.9983

All of the estimated parameters are significant. The copulas that fit the best are chosen using AIC and BIC information criterions. The correctness of the copula specification are validated by an Anderson-Darling test applied to the first derivative of copulas: $C(u|v) = \dfrac{dC}{du}$ and $C(v|u) = \dfrac{dC}{dv}$.

In addition, based on estimated parameters of the transition matrix we computed the mean time of return to regimes. In all cases this value is lower for the asymmetric regime with a dependence in tails. For all pairs, the dependence between extremely low returns is stronger than between extremely high returns. The strength of dependence measured by weighted Kendall coefficients is the strongest for the DAX/DJIA pair (with value 0.564) and the weakest for the ATX/DJIA pair (value 0.352).

The standard method of visualization of measure of risk under the assumed model is drawing of the efficient frontier line. An efficient frontier for a given measure of risk is the curve showing the minimal risk of portfolio which exhibit the calculated expected returns.

For all three indices' pairs and the two risk measures, Figures 1–6 illustrate similar relationships.
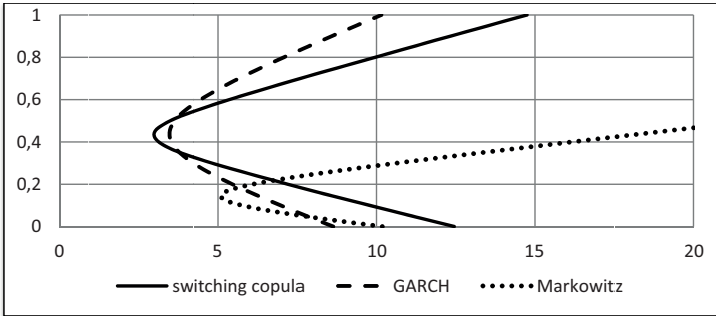
Figure 1. Efficient frontiers of Value at Risk for ATX/DAX pair
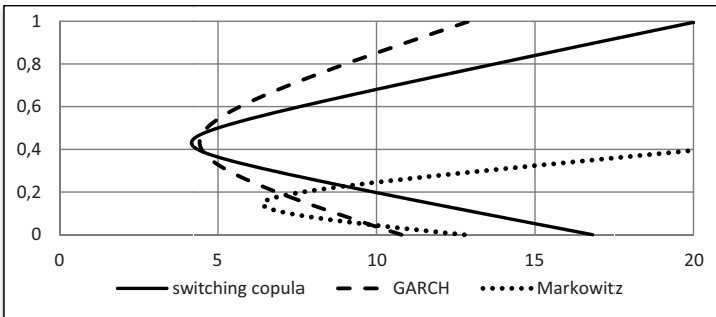
Figure 2. Efficient frontiers of Expected Shortfall for ATX/DAX pair
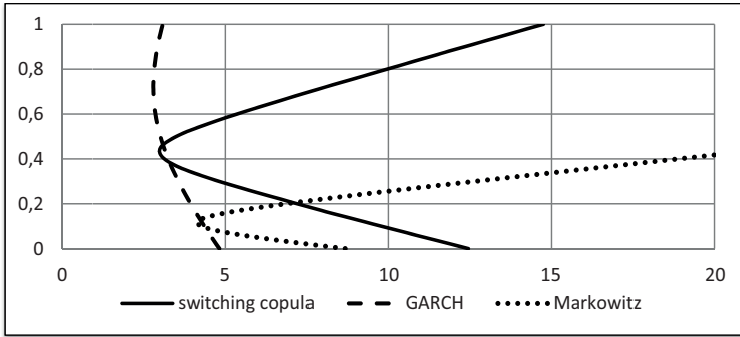
Figure 3. Efficient frontiers of Value at Risk for ATX/DJIA pair
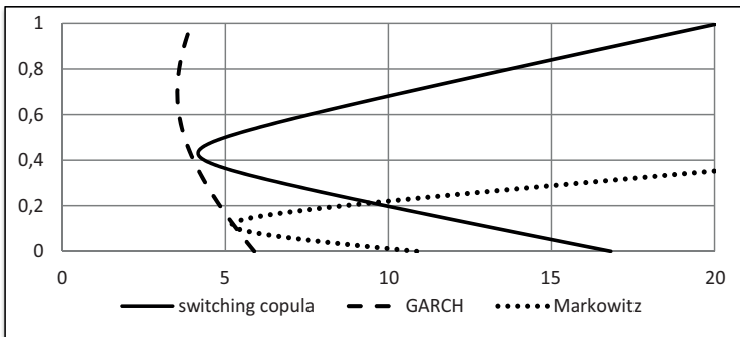
Figure 4. Efficient frontiers of Expected Shortfall for ATX/DJIA pair
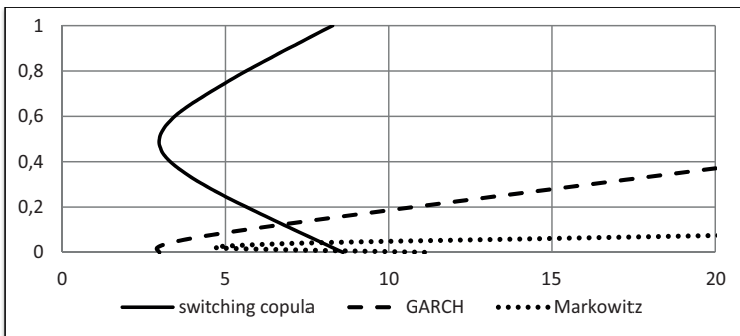
Figure 5. Efficient frontiers of Value at Risk for DAX/DJIA pair
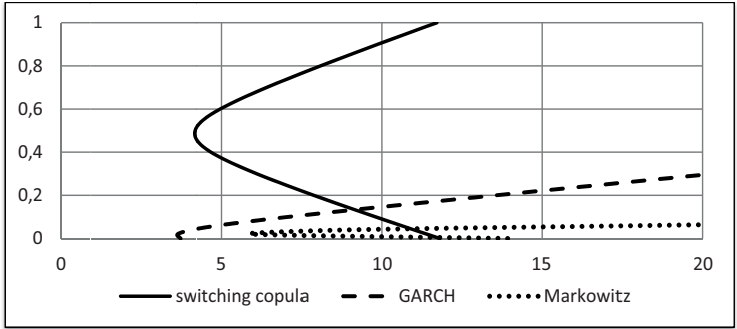
Figure 6. Efficient frontiers of Expected Shortfall for DAX/DJIA pair

Relatively small means of returns, presented in Table 2 cause a rapid increase of risk with increasing an expected portfolio return for the Markowitz model. Clearly, by definition, for every pair and every model ES is higher than VaR, see formula (33). Since negative expected returns are not interesting from a practical point of view, the included figures outline only the risks for positive expected returns.

For low expected returns (lower than 0.2 for ATX/DAX and ATX/DJIA pairs and lower than 0.05 for DAX/DJIA pair), the mean-variance model underestimates risks and after reaching some level overestimates them. The similar relation is observed for the GARCH model applied for the DAX/DJIA pair, but for the higher level. For ATX/DAX and ATX/DJIA pairs, the multivariate GARCH model underestimates risks for almost every level.

The level of an expected return, for which the minimum of a risk is attained, is determined by the forecast's multidimensional mean. At this particular time, means of all the three indices are the lowest for the Markowitz model, means of ATX/DAX and ATX/DJIA pairs are at similar levels for the switching copula model and the GARCH model.

With increasing of the expected return, VaR and ES increase with the similar speed for models based on a normal distribution. However, for all three pairs, ES increases essentially faster than VaR in the case of copula based model. A positive tail dependence in switching copula models and relatively fat tails of marginal distributions, such as a skewed t distribution, are reasons for this observation.

7. Conclusions

Recent contributions suggest non-normal distributions of multivariate asset's returns. Evidences for an asymmetry in univariate distributions and in dependences have been found. Furthermore, the kurtosis of an univariate distribution and

extreme dependences are found to be greater than under the assumption of normal distribution. In the three analysed pairs of assets, all of these anomalies have been detected. Any model in which the conditional distribution is assumed to be normal does not fit since statistical tests reject hypothesis of normal distributions.

For the three pairs under study a switching copula models fit well. This model includes asymmetries and fat tails for both margins and for dependences. Conducted statistical tests confirmed goodness of fit for the switching copula models. Comparing results of a risk calculation, for the GARCH model and the Markowitz model to the switching copula model, we observed discrepancies.

A mean-variance model does not assume a dynamic structure of series, the expected mean of the series is significantly different for a dynamic model. Thus, a multivariate GARCH and a switching copula models forecast the mean at the similar level, while the estimated mean, using Markowitz model, stands out.

Misspecifications may cause both, an underestimation and an overestimation of a risk. Slopes of efficient frontiers describe the speed of increase of a risk with increasing expected return. It is observed that slopes for models which neglect anomalies, such as asymmetries and fat tails, are biased. In particular, a change of slope with the increasing expected return is underestimated.

Evaluations differ particularly for the Expected Shortfall risk. A tail's dependences and fat tails are ignored in models based on a normal distribution. Expected Shortfall measures not only a frequency of a loss, but also its size. The supposition that observed anomalies of the multivariate distribution of an assets' returns vector affects the size of an extreme return is confirmed.

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The structure of contemporaneous price-volume relationships in financial markets

1. Introduction

The learning of price-volume dependencies is important, because it enables to get an insight into the structure of financial markets, and into the information arrival process. In addition, one can learn how information is disseminated among market participants.

There are two competitive hypotheses: the Mixture of Distribution Hypothesis (MDH hereafter) [1, 5, 8, 26] and the Sequential Information Arrival Hypothesis [6, 13]. While MDH implies contemporaneous price-volume relationships the Sequential Information Arrival Hypothesis assumes dynamic, causal dependence price-trading volume.

Under the Mixture of Distributions Hypothesis the time series of the volatility of stock returns and trading volume are positively correlated, but the time series of stock returns and trading volume do not show correlation. Most contributions involving price-volume dependencies were based upon the Pearson linear correlation coefficient, which does not allow the testing of extreme value dependencies. Fleming and Kirby [9] found a strong correlation between innovations and trading volume and volatility in the case of 20 firms on the Major Market Index (MMI). The results suggest that trading volume can be used to obtain more precise estimates of daily volatility for cases in which high-frequency returns are unavailable. Balduzzi et al. [1] using linear regression (with trading

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volume as a dependent variable) arrived at a low correlation between extremely low (below –4.09%) stock returns and trading volume for the American Index. Marsh and Wagner [15] tested tail relationships (the indexes under study were the AEX, CAC, DAX, HSI, FTSE, S&P500 and TPX) using extreme value theory. The authors found a lower degree of dependence in the left tail than in the right tail in the pair stock returns-trading volume.

In one of more recent studies Gurgul et al. [12] modeled the dependence structure of log-volume and volatility (calculated as absolute values of stock returns) for eight stocks from the DAX. The results indicate a significant dependence between high values of variables and a lack of dependence for low values.

Rossi and de Magistris [24] using mixtures of copulas and survival copulas (Gumbel and Clayton) found that volatility and volume are more dependent for high values than for low. The volatility was computed using high-frequency data and realized volatility estimators. Ning and Wirjanto [18] using Archimedean copulas tested the degree of dependence of stock returns and trading volume for some Asian indexes. The presented results indicate that there is no dependence between low stock returns and high (low) trading volume.

A special kind of dependence is known as long-memory. (Robinson and Yajima [3] , Phillips and Shimotsu [20, 21, 22], Shimotsu [25]). If a time series possesses long memory, there is a persistent temporal dependence between observations even considerably separated in time. The long memory property of volatility has been widely documented in empirical research. This topic was discussed in Bollerslev and Mikkelsen [4] and Ding and al. [7], among others. On the other hand, Lobato and Velasco [14], Bollerslev and Jubinski [3], Fleming and Kirby [9], Rossi and de Magistris [19] found that trading volume also exhibits long-run dependence (long memory). The interesting question is the link between long memory in volatility and in trading volume.

The central question of our paper is the examination of dependence stuctures of stock returns, volatility and trading volumes of companies included in CAC40 and FTSE100. Moreover, we aim to test the MDH hypothesis in version with long memory. We will check the equality of the long memory parameters of volatility and trading volume and fractional cointegration of these time series.

In particular we will examine the existence of essential dependence between high volatility and high trading volume. The important goal of this study is the choice of proper copulas necessary to capture contemporaneous dependence structures of returns and trading volume. In addition, we will also compare the dependence structure of times series under study based on companies included in CAC40 and FTSE100.

The structure of the paper is as follows. The methodology and main notions applied are outlined in the following section. Third section is concerned with a description of the dataset. Empirical results and their discussion are provided in

fourth section. Finally, in the last section we summarize major conclusions and suggest directions for future research.

2. Methodology

2.1. Long memory

The autocorrelation function (ACF) of time series with long memory tails off hyperbolically. The short-memory property is easy to detect by the low order correlation structure of a series. This type of time series is characterized by exponentially declining autocorrelations and, in the spectral domain, demonstrates high-frequency distribution. The standard ARMA-processes do not show long memory. They can only exhibit short run (high-frequency) properties.

The presence of long memory in financial data is a source of both theoretical and empirical problems. The long memory property arises from nonlinearities in economic data. The well-known martingale models of stock prices cannot follow from arbitrage, because new information cannot be entirely arbitraged away. A second problem caused by long memory is pricing derivative securities with the martingale method. This method is usually false if the accompanying stochastic (continuous) processes exhibit long memory. The process X_t has a degree of fractional integration d (we write $I(d)$), when:

$$(1 - L)^d X_t = u_t, \tag{1}$$

where L is a lag operator ($LX_t = X_{t-1}$) and u_t is a process with a short memory. The expression $1(-L)^d$ is presented in the form of the infinite series:

$$(1 - L)^d = \sum_{k=0}^{\infty} \frac{\Gamma(k-d)}{\Gamma(d)\Gamma(k+1)} L^k,$$

where $\Gamma(x)$ is the Gamma function. The process $ARMA$ ($p.q$) is defined as:

$$\Phi(L)(u_t - \mu) = \Theta(L)\varepsilon_t, \tag{2}$$

where $\Theta(z) = 1 - \sum_{i=1}^{p} \phi_i z^i$ and $\Theta(L) = 1 + \sum_{j=1}^{q} \theta_j z^j$ are lag polynomials of degree p and q, respecively. The process is stationary and invertible if the roots of $\Phi(z)$ and $\Theta(L)$ lie outside the unit circle. If u_t is described by (2.2), and ε_t is white noise then the process is the Autoregressive Fractionally Integrated Moving Average process $ARFIMA(p, d, q)$.

If the parameter $0 < |d| < 0,5$ then the process is stationary and invertible and the autocorrelation function exhibits hyperbolic decay, because for the lag k it is proportional to $\dfrac{\Gamma(1-d)}{\Gamma(d)} k^{2d-1}$ when $k \rightarrow \infty$. If $d \in (0; 0,5)$, we say that the process has a long memory and if $d \in (-0,5; 0)$ the process is antipersistent and has intermediate memory. For $d \in [0,5; 1]$ the variance of X_t is infinite, so the process is covariance nonstationary but mean-reverting.

There are many different estimators of long memory parameter d (Phillips and Shimotsu [21]). We use the exact local Whittle estimator (Phillips and Shimotsu [20, 22], Shimotsu [25]). Following (2.1) we get:

$$X_t = \left(1 - L\right)^{-d} u_t = \sum_{k=0}^{t-1} \frac{\Gamma(d+k)}{\Gamma(d)k!} u_{t-k}, \quad t = 0, \pm 1, \pm 2 \ldots$$

Discrete Fourier transformations and periodogram of α_t are defined as:

$$w_a\left(\lambda_j\right) = (2\pi n)^{-1/2} \sum_{t=1}^{n} a_t e^{it\lambda_j}, \text{ where } \lambda_j = \frac{2\pi j}{n}, j = 1, \ldots, n,$$

$$I_a\left(\lambda_j\right) = \left|w_a(\lambda_j)\right|^2.$$

Supposing that process X_t is covariance stationary and spectral density function $f(\lambda)$ fulfills the condition $f(\lambda) \sim G\lambda^{-2d}$, if $\lambda \rightarrow 0_+$, Phillips and Shimotsu [20] minimize the function:

$$Q_m\left(G, d\right) = \frac{1}{m} \sum_{j=1}^{m} \left[\log\left(G\lambda_j^{-2d}\right) + \frac{1}{G} I_{\Delta^d x}(\lambda_j) \right]$$

The ELW estimator of long memory parameter d is then:

$$\hat{d}_{ELW} = \arg \min_{d \in [\Delta_1, \Delta_2]} R(d),$$

and

$$R(d) = \log\hat{G}(d) - 2d \frac{1}{m} \sum_{j=1}^{m} \log\lambda_j, \, \hat{G}(d) = \frac{1}{m} \sum_{j=1}^{m} I_{\Delta^d x}(\lambda_j).$$

If d_0 is value of the true parameter of long memory parameter d then if $\Delta_2 - \Delta_1 \le \dfrac{9}{2}$ and the assumed m is such that $\dfrac{m}{n} + \dfrac{1}{m} \rightarrow 0$, if $n \rightarrow \infty$, then the ELW estimator is consistent and it holds true that:

$$\sqrt{m}(\hat{d}_{ELW} - d_0) \xrightarrow{d} N\left(0, \frac{1}{4}\right).$$

2.2. Fractional cointegration

Stationarity is a crucial precondition for standard linear Granger causality tests. Nonstationarity of the time series under study may lead to false conclusions by a traditional linear causality test. This phenomenon has been investigated in previous empirical (Granger and Newbold [11]) and theoretical (Phillips [19]) deliberations which led to a cointegration analysis.

A cointegration analysis (based on the estimation of a VEC model) may be performed for variables which are integrated in the same order. As shown by Granger the existence of cointegration implies long run Granger causality in at least one direction (Granger [11]). To establish the direction of this causal link one should estimate a suitable VEC model and check (using a t–test) the statistical significance of the error correction terms. Testing the joint significance (using an F–test) of lagged differences provides a basis for short run causality investigations.

The classical definition of cointegration can be generalized as for any d and d_e two $I(d)$ processes are fractionally cointegrated, if there exists a linear combination of these processes that is $I(d_e)$ with $d_e < d$. In this case there exists long-run dependence and a common stochastic trend. Assume that $z_t = (x_t, y_t)$ with $x_t \in I(d)$ and $y_t \in I(d)$. If there exists $\beta \neq 0$ such that there is the linear combination $y_t - \beta x_t \in I(d_e)$, where $0 \leq d_e < d$, then x_t and y_t are fractionally cointegrated. We write $z_t \in CI(d, b)$, for $b = d - d_e$. Robinson i Yajima [23] consider the case of stationary variables, whereas Nielsen and Shimotsu [17] analyse the case of covariance nonstationary variables too. The model under consideration is given by (Shimotsu [25]):

$$\begin{cases} (1-L)^{d_e}\left(y_t - \beta x_t\right) = u_{1t} \\ (1-L)^{d} x_t = u_{2t} \end{cases} \tag{3}$$

where $u_t = (u_{1t}\, u_{2t})' = C(L)\varepsilon_t$ is a bidimensional stationary vector with spectral density $f_u(\lambda)$. In matrix notations (2.3) has the form:

$$Bz_t = \begin{pmatrix} (1-L)^{-d_e} & 0 \\ 0 & (1-L)^{-d} \end{pmatrix} u_t, \ B = \begin{pmatrix} 1 & -\beta \\ 0 & 1 \end{pmatrix}, \ z_t = \begin{pmatrix} y_t \\ x_t \end{pmatrix}.$$

The rank of the matrix $C(1)$ determines whether the processes y_t and x_t are cointegrated. Denoting as r the number of cointegration vectors, the rank of $C(1)$ is equal to $2 - r \leq 2$. If the variables are cointegrated, then $C(1)$ does not have full rank.

The fractional cointegration can be tested as follows. Firstly using Whittle estimators long memory parameters are estimated, and then a test of their equality

is performed. Let d_* be the common value of the long memory parameters of series x_t and y_t (with parameters d_1 and d_2, respectively). When testing:

$$H_0 : d_i = d_*, i = 1, 2,$$

test statistics of Robinson and Yajima [23] has the form:

$$\hat{T}_0 = m(S\hat{d})' \left(S \frac{1}{4} \hat{D}^{-1} \left(\hat{G} \odot \hat{G} \right) \hat{D}^{-1} S' + h(n)^2 \right)^{-1} (S\hat{d}),$$

where $S = (1 - 1)'$, $h(n)$ is the function which is convergent to 0, $D = diag\,(G_{11}, G_{22})$, whereas $\hat{G}|$ is expressed as:

$$\hat{G}\left(\hat{d}\right) = \frac{1}{m} \sum_{j=1}^{m} Re[I_{\Delta(\mathrm{L};d_*)[x,y]}(\lambda_j)],$$

where $I_{\Delta(\mathrm{L};d_*)[x,y]}$ is the periodogram of $\left((1 - L)^{d_1} x_t, (1 - L)^{d_2} y_t \right)'$. If the variables under study are not cointegrated (cointegration rank $r = 0$ then $\hat{T}_0 \to^d \chi_1^2$. Otherwise $\hat{T}_0 \to 0$, which means that $r = 1$. If $H_0 : d_i = d_*, i = 1, 2$ cannot be rejected then one can estimate the cointegration rank using the eigenvalues of matrix $\hat{G}|$. If $\hat{\delta}_i$ is $i - th$ eigenvalue, then the rank of cointegration is equal to

$$\hat{r} = \underset{u=0,1}{\operatorname{argmin}} L(u),$$

where

$$L(u) = v(n)(2 - u) - \sum_{i=1}^{2-u} \hat{\delta}_i,$$

and $v(n)$ is a function with $(n) + \dfrac{1}{\sqrt{m_1} v(n)} \to 0$, for $n \to \infty$. The value $\hat{G}(d_4)$ is estimated as:

$$\hat{G}\left(d_*\right) = \frac{1}{m_1} \sum_{j=1}^{m_1} Re[I_{\Delta(\mathrm{L};d_*)[x,y]}(\lambda_j)],$$

where $I_{\Delta(\mathrm{L};d_*)[x,y]}$ is the periodogram of $\left((1 - L)^{d_*} x_t, (1 - L)^{d_*} y_t \right)'$ whereas m_1 is the function of n. The value of d_* is unknown, so it is computed as the mean of the estimated long memory parameter values of x_t and y_t. Finally $\hat{G}\left(\overline{d_*}\right)$ is computed.

2.3. Dependence between volatility and trading volume

In this subsection the methods of the dependence structure analysis of volatility and trading volume is described. Using copulas we can model the degree of dependence in the tails. i.e. for extreme values.

Having estimated long memory parameters to filter the time series we can use FIVAR models (Rossi and de Magistris [24]). We should transform the series using formulas:

$$(1-L)^{d_{R_t^2}} R_t^2 = \widetilde{R_t^2},$$

$$(1-L)^{d_{\ln V_t}} \ln V_t = \widetilde{\ln V_t}.$$

As a result we obtain stationary time series I(0). Then, we apply a *VAR* (*k*) model to capture linear dependencies. This model for vector $P_t = (X_t\, Y_t)'$ can be described as :

$$P_t = \Phi_0 + \sum_{i=1}^{k} \Phi_i P_{t-i} + \varepsilon_t,$$

where Φ_0 is the vector of intercepts. $\Phi_i = \begin{pmatrix} \phi_{11.i} & \phi_{12.i} \\ \phi_{21.i} & \phi_{22.i} \end{pmatrix}$ is the matrix of parameters (for $i = 1... k$) and ε_t is the vector of error terms. Optimal lags k are chosen using information criteria and likelihood ratio tests. For vector $P_t = \left(\widetilde{R_t^2}\ \widetilde{\ln V_t} \right)'$ in most cases $k <= 3$. We estimate the variance-covariance matrix of parameters with heteroscedasticity correction. In most cases this correction is enough to get homoscedastic errors. If not, ARCH-type models are used. We standardize the residuals and fit different distribution functions: NIG (abbreviated from normal inverse Gaussian), hyperbolic, *t* location-scale.
Probability density functions are given by:
  – NIG:

$$f_{NIG}\left(x;\alpha;\beta;\delta;\mu\right) = \frac{\alpha\delta}{\pi} \exp\left(\delta\gamma + \beta\left(x-\mu\right)\right) \frac{K_1\left(\alpha\sqrt{\delta^2 + \left(x-\mu\right)^2}\right)}{\sqrt{\delta^2 + \left(x-\mu\right)^2}}.$$

where $x \in \mathbf{R}, \alpha \in (0.\infty), \beta \in (-\alpha.\alpha), \delta \in (0.\infty), \gamma = \sqrt{\alpha^2 - \beta^2}$ and $K_1(\cdot)$ is a modified Bessel function of the third kind with an index one of the form:

$$K_1\left(z\right) = \frac{1}{2}\int_0^\infty exp\left(-\frac{1}{2}\left(z\left(t+t^{-1}\right)\right)\right) dt;$$

  – hyperbolic:

$$f_{HYP}\left(x;\alpha;\beta;\delta;\mu\right) = \frac{\gamma}{2\alpha\delta K_1\left(\delta\gamma\right)} \exp\left(-\alpha\sqrt{\delta^2 + \left(x-\mu\right)^2}\right) + \beta\left(x-\mu\right);$$

$$f_{Skal-t}\left(x;\mu;\sigma;\nu\right)=\frac{\Gamma\left(\dfrac{\nu+1}{2}\right)}{\sigma\sqrt{\nu\pi}\,\Gamma\left(\dfrac{\nu}{2}\right)}\left(\frac{\nu+\left(\dfrac{x-\mu}{\sigma}\right)^2}{\nu}\right)^{-(\nu+1)/2}.$$

All of the distribution functions presented above are special cases of generalized hyperbolic distributions.

2.4. Copulas

Copulas reflect the dependence structures among financial variables. We use in empirical part Gaussian copula, Archimedean (Clayton and Gumbel) copulas, survival copulas and their convex combination (Nelsen, 1999).

The Gaussian copula (or normal copula) is given by:

$$C_\rho^{Ga}\left(u_1,u_2\right)=\Phi_\rho\left(\Phi^{-1}\left(u_1\right)\Phi^{-1}\left(u_2\right)\right)=$$

$$=\int_{-\infty}^{\Phi^{-1}(u_1)}\int_{-\infty}^{\Phi^{-1}(u_2)}\frac{1}{2\pi(1-\rho^2)^{1/2}}exp\left(\frac{-\left(s_1^2-2\rho s_1 s_2+s_2^2\right)}{2(1-\rho^2)}\right)ds_1 ds_2,$$

where Φ_ρ is bivariate normal distribution with correlation coefficient $|\rho|<1$ and Φ denotes standard univariate normal distribution function.

The Clayton copula is given by:

$$C\left(u_1,u_2;\theta\right)=\max(\left[u_1^{-\theta}+u_2^{-\theta}-1\right]^{-\frac{1}{\theta}},0).$$

with $\theta\in\left[-1.\infty\right)\setminus\{0\}$. If parameter θ is positive then

$$C\left(u_1,u_2;\theta\right)=(u_1^{-\theta}+u_2^{-\theta}-1)^{-\frac{1}{\theta}}.$$

The Gumbel copula is given by:

$$C\left(u_1,u_2;\theta\right)=\exp(-\left[\left(-lnu_1\right)^\theta+\left(-lnu_2\right)^\theta\right]^{\frac{1}{\theta}}),$$

for $\theta\in\left[-1.\infty\right)$.

The Gumbel and survival Clayton copulas describe asymptotic dependence in the right tail, and Clayton and survival Gumbel in the left tail. To model the dependence in both tails simultaneously one can use mixtures of copulas.

We consider the following copulas:

1. $\omega C_{Gum} + (1 - \omega) C_{sGum}$;
2. $\omega C_{Gum} + (1 - \omega) C_{Cl}$;
3. $\omega C_{sCl} + (1 - \omega) C_{sGum}$;
4. $\omega C_{sCl} + (1 - \omega) C_{Cl}$;
5. $\omega C_{Gum} + (1 - \omega) C_{Gauss}$;
6. $\omega C_{sCl} + (1 - \omega) C_{Gauss}$;

and one-parameter copulas:

7. ωC_{sCl}
8. ωC_{Gum}

The copulas that fit the best are chosen using information criterion. The correctness of the copula specification are validated by an Anderson-Darling test applied to the first derivative of copulas: $C(u|v) = \dfrac{dC}{du}$ and $C(v|u) = \dfrac{dC}{dv}$.

The classical Archimedean copulas (and survival copulas) defined above (volatility-trading volume pair) can be applied only to modeling dependence in the top-right corner (high returns-high volume). To model relationships in the top-left corner we can use rotated (anticlockwise) copulas by 90° degrees (Gumbel copula) and 270°(Clayton copula). For any copula C it holds true that:

$$C^{(90)}(u_1, u_2) = u_2 - C(1 - u_1, u_2),$$

$$C^{(180)}(u_1, u_2) = u_1 + u_2 - 1 + C(1 - u_1, 1 - u_2),$$

$$C^{(270)}(u_1, u_2) = u_1 - C(u_1, 1 - u_2),$$

The copula $C^{(180)}$ is of course the survival copula for C. The domain of copula parameters ($C^{(90)}$ and $C^{(270)}$) are symmetrical in respect to zero so the parameters are negative. As formerly, mixtures of copulas can be used to model dependence in both top corners simultaneously.

- $\omega C_{Gum} + (1 - \omega) C_{Gum}^{(90)}$;
- $\omega C_{Gum} + (1 - \omega) C_{Cl}^{(270)}$;
- $\omega C_{Cl}^{(180)} + (1 - \omega) C_{Cl}^{(270)}$;
- $\omega C_{Cl}^{(180)} + (1 - \omega) C_{Gum}^{(90)}$.

Using the reviewed methods we will check in different aspects links between returns and trading volume. In the next section we will show the dataset.

3. Data description

We consider the prices and trading volumes of stocks from the French (CAC40) and the English (FTSE100) indexes from 1 October 2002 to 1 October 2012. The dataset comes from Thomson Reuters data services and covers a period of 2610 trading days. Throughout the paper stock returns were approximated by log-returns.

3.1. Descriptive statistics

Using daily prices at close we computed logarithmic stock returns and multiplied them by 100. The series of trading volumes are mostly leptokurtic and positively skeweed so we apply a logarithmic transformation. As a result, the returned series are close to normal. The Tables 1 and 2 present the descriptive statistics of the log-returns, volatilities (square of log- returns) and log-volumes.

Table 1
Descriptive statistics of companies listed on CAC40

log-returns				
statistics	mean	standard dev.	skewness	kurtosis
minimum	−0.050	1.434	−2.039	5.418
1st quartile	−0.014	1.862	−0.122	7.285
median	0.012	2.183	0.084	8.750
3rd quartile	0.032	2.574	0.267	10.527
maximum	0.074	3.730	0.970	53.052
log–volume				
statistics	mean	standard dev.	skewness	kurtosis
minimum	5.150	0.438	−1.003	2.737
1st quartile	6.746	0.486	−0.317	4.077
median	7.361	0.531	−0.188	4.391
3rd quartile	8.111	0.618	0.058	4.830
maximum	9.763	1.155	0.356	7.642
volatility				
statistics	mean	standard dev.	skewness	kurtosis
minimum	2.057	5.438	5.760	51.531
1st quartile	3.467	9.342	7.292	78.266
median	4.763	12.646	9.168	127.220
3rd quartile	6.624	19.192	12.896	270.836
maximum	13.910	100.382	42.043	1991.226

Source: own elaboration based on Reuters data basis

Table 2

Descriptive statistics of companies listed on FTSE100

log-returns				
statistics	mean	standard dev.	skewness	kurtosis
minimum	–0.126	0.990	–10.355	3.620
1st quartile	0.012	1.699	–0.282	7.524
median	0.032	1.963	–0.077	9.248
3rd quartile	0.057	2.516	0.081	13.482
maximum	0.113	4.179	1.409	316.662
log-volume				
statistics	mean	standard dev.	skewness	kurtosis
minimum	5.100	0.489	–1.877	2.868
1st quartile	7.434	0.604	–0.353	3.643
median	8.162	0.667	–0.192	4.121
3rd quartile	9.144	0.745	–0.048	4.830
maximum	12.124	1.690	0.612	10.228
volatility				
statistics	mean	standard dev.	skewness	kurtosis
minimum	0.981	4.139	3.185	15.753
1st quartile	2.885	8.240	8.002	97.386
median	3.857	11.588	10.329	156.916
3rd quartile	6.330	19.931	15.339	358.252
maximum	17.456	243.561	50.070	2539.289

Source: own elaboration based on Reuters data basis

For all stocks under consideration we observe significant skewness and excess kurtosis in stock returns. The null hypothesis about normality by the Jarque-Bera test is rejected in all cases. Some of the log-volume series have a kurtosis close to 3, but the non-zero skewness causes a departure from normality in the series. The null hypothesis about lack of autocorrelation by the Ljung-Box test is also rejected. Using regression we may remove, if necessary, any deterministic trend from the series of log-volumes to achieve trend-stationary time series. Additionally, we use dummy variables in order to describe calendar effects i.e. the effect of the month in the year and the day in the week in the log-volume series. The time series of volatility are far from normal because of high values of the kurtosis and skewness (positive in all cases).

4. Empirical results

4.1. Results of long memory and fractional cointegration estimation

Based upon the methodology presented above we computed the long memory parameters of the time series (Robinson and Yajima [23], Phillips and Shimotsu [20, 21, 22], Shimotsu [25]). The long memory parameters of return volatility and log-volume are denoted by $d_{R_t^2}$ and $d_{\ln V_t}$, respectively. To test the equality of long memory parameters we use (Robinson and Yajima [23]):

$$b_1(n) = 1/\ln n,$$
$$b_2(n) = 1/\ln^2 n,$$
$$m = n^{0,6}.$$

In the Tables 3 and 4 we present the results of the estimation of long memory parameters:

Table 3

Long memory parameters

statistics	CAC40		FTSE100	
	$d_{R_t^2}$	$d_{\ln V_t}$	$d_{R_t^2}$	$d_{\ln V_t}$
minimum	0.189	0.154	-0.054	-0.005
1st quartile	0.354	0.262	0.280	0.174
median	0.417	0.300	0.390	0.244
3rd quartile	0.456	0.348	0.488	0.285
maximum	0.679	0.495	0.717	0.427

Source: own elaboration based on Reuters data basis

All parameters of long memory are significant for French stocks. In eight cases the long memory parameters of R_t^2 are less than of lnV_t. The long memory parameters of R_t^2 are greater than 0.5 in seven cases. This indicates that the time series are covariance non-stationary. Taking into account that critical values are $\chi_1^2 = 2.706$, $\chi_1^2 = 3.841$, $\chi_1^2 = 6.635$, at significance levels of 10%, 5% and 1%, respectively, in twelve cases there is no reason to reject the null hypothesis of the equality of estimated long memory parameters.

In the case of English stocks $d_{R_t^2} > d_{\ln V_t}$ for 69 stocks. 96 long memory parameters of volatility are significant (at 0.1 significance level). The same

conclusion is valid for 83 parameters for log-volumes. Some of the parameters are negative and close to zero. There is no reason to reject the null that they equal to zero. The null hypothesis of parameter equality is rejected for about 70% of stocks. Based upon the results above we analyzed the problem of the fractional cointegration of volatility and trading volume. We estimated the eigenvalues δ_1 and δ_2 (multiplied by 10000) of matrix $\hat{G}$ and computed the values of function $L(u)$ for $m_1 = n^{0,55}$ and $v(n) = m_1^{-0,45}$. In the tables below we present the results of the estimation of long memory parameters in detail and the fractional cointegration tests.

The descriptions of the columns of Tables 4 and 5 below refers to notations described in the section Methodology (Fractional Cointegration).

Table 4

Fractional cointegration (CAC40)

Company	$d_{R_t^2}$	$d_{\ln V_t}$	$T_0(b_1)$	$T_0(b_2)$	δ_1	δ_2	$L(0)$	$L(1)$
ACCOR	0.425	0.350	0.953	1.198	5.243	0.020	−1.713	−1.267
BNP PARIBAS	0.319	0.288	0.130	0.168	30.514	0.030	−1.713	−1.394
CARREFOUR	0.351	0.285	0.934	1.194	5.341	0.030	−1.713	−1.340
CREDIT AGRICOLE	0.373	0.320	0.308	0.386	22.102	0.036	−1.713	−1.251
EADS	0.305	0.375	0.816	1.016	25.224	0.027	−1.713	−1.208
ESSILOR INTL.	0.354	0.337	0.173	0.217	2.095	0.023	−1.713	−1.247
SAFRAN	0.353	0.386	0.363	0.449	5.975	0.029	−1.713	−1.171
SANOFI	0.299	0.348	0.443	0.563	4.471	0.021	−1.713	−1.319
SOCIETE GENERALE	0.357	0.353	0.008	0.010	32.197	0.026	−1.713	−1.348
SOLVAY	0.358	0.331	0.029	0.037	2.798	0.028	−1.713	−1.303
TECHNIP	0.448	0.365	1.535	1.941	11.138	0.026	−1.713	−1.295
VEOLIA ENVIRONNEMENT	0.274	0.306	0.280	0.355	30.874	0.026	−1.713	−1.307

Source: own elaboration based on Reuters data basis

The estimated rank of cointegration is equal to 0 for all stocks under consideration. Despite the equality of long memory parameters fractional cointegration does not exist. The same is observed when using $v(n) = m_1^{-0,35}$ and $v(n) = m_1^{-0,25}$. It is worth mentioning that for parameters $m_1 = n^{0,55}$ and $m_1 = n^{0,45}$ the conclusions are analogous.

Table 5

Fractional cointegration (FTSE100)

Company	$d_{R_t^2}$	$d_{\ln V_t}$	$T_0(b_1)$	$T_0(b_2)$	δ_1	δ_2	$L(0)$	$L(1)$
ABERDEEN ASSET MAN.	0.403	0.411	0.035	0.043	72.322	0.072	−1.713	−1.165
AGGREKO	0.348	0.304	0.882	1.096	9.377	0.058	−1.713	−1.200
ASTRAZENECA	0.252	0.250	0.002	0.002	4.978	0.028	−1.713	−1.350
BABCOCK INTL.	0.210	0.152	0.453	0.557	11.075	0.221	−1.713	−1.116
BAE SYSTEMS	0.172	0.109	0.896	1.122	44.409	0.072	−1.713	−1.250
BARCLAYS	0.237	0.231	0.001	0.001	557.495	0.056	−1.713	−1.148
BRITISH SKY BCAST. GROUP	0.262	0.203	0.676	0.842	12.532	0.078	−1.713	−1.211
BURBERRY GROUP	0.326	0.313	0.020	0.025	14.540	0.068	−1.713	−1.239
CAPITAL SHOPCTS. GROUP	0.426	0.320	1.894	2.329	3.703	0.037	−1.713	−1.116
COMPASS GROUP	0.192	0.198	0.006	0.008	30.611	0.082	−1.713	−1.199
CRODA INTERNATIONAL	0.395	0.303	1.210	1.482	2.475	0.083	−1.713	−1.071
G4S	0.154	0.113	0.255	0.316	34.623	0.150	−1.713	−1.181
GLAXOSMITHKLINE	0.261	0.244	0.109	0.137	2.425	0.038	−1.713	−1.271
HARGREAVES LANSDOWN	0.277	0.305	0.057	0.073	9.415	0.078	−1.665	−1.263
INTL.CONS.AIRL.GP.(CDI)	0.277	0.123	1.064	1.376	10.683	0.037	−1.554	−1.118
LLOYDS BANKING GROUP	0.340	0.266	0.948	1.160	323.025	0.061	−1.713	−1.047
MORRISON(WM)SPMKTS.	0.237	0.264	0.054	0.068	6.362	0.053	−1.713	−1.257
NATIONAL GRID	0.218	0.267	0.505	0.626	8.365	0.049	−1.713	−1.184
PENNON GROUP	0.321	0.261	0.688	0.853	2.148	0.061	−1.713	−1.180
RANDGOLD RESOURCES	0.438	0.427	0.065	0.079	8.820	0.042	−1.708	−1.019
RIO TINTO	0.321	0.269	0.495	0.624	119.727	0.040	−1.713	−1.288
SAINSBURY (J)	0.202	0.261	0.769	0.963	17.965	0.060	−1.713	−1.249
SCHRODERS	0.284	0.342	0.655	0.796	59.326	0.044	−1.713	−0.897
SEVERN TRENT	0.221	0.173	0.369	0.461	5.346	0.068	−1.713	−1.233
SHIRE	0.207	0.241	0.187	0.239	8.458	0.045	−1.713	−1.330
SMITHS GROUP	0.314	0.285	0.143	0.177	5.677	0.051	−1.713	−1.167
SSE	0.317	0.218	1.752	2.153	3.693	0.055	−1.713	−1.105
TESCO	0.278	0.222	0.643	0.807	4.407	0.044	−1.713	−1.262
TULLOW OIL	0.391	0.343	0.376	0.467	16.349	0.053	−1.713	−1.197
UNITED UTILITIES GROUP	0.218	0.269	0.554	0.683	5.164	0.044	−1.713	−1.130
WOLSELEY	0.244	0.227	0.030	0.037	71.620	0.069	−1.713	−1.242

Source: own elaboration based on Reuters data basis

4.2. Results of estimation of dependence between volatility and trading volume

The best fitted distributions are chosen using goodness of fit tests and information criteria. In most cases the distributions that fit best are NIG and *t*-location-scale distributions (hyperbolic distribution was fitted for only a few log-volume series of English stocks). Next, using selected distributions we transform the series to get uniformly distributed variables (comp. Fig. 1).
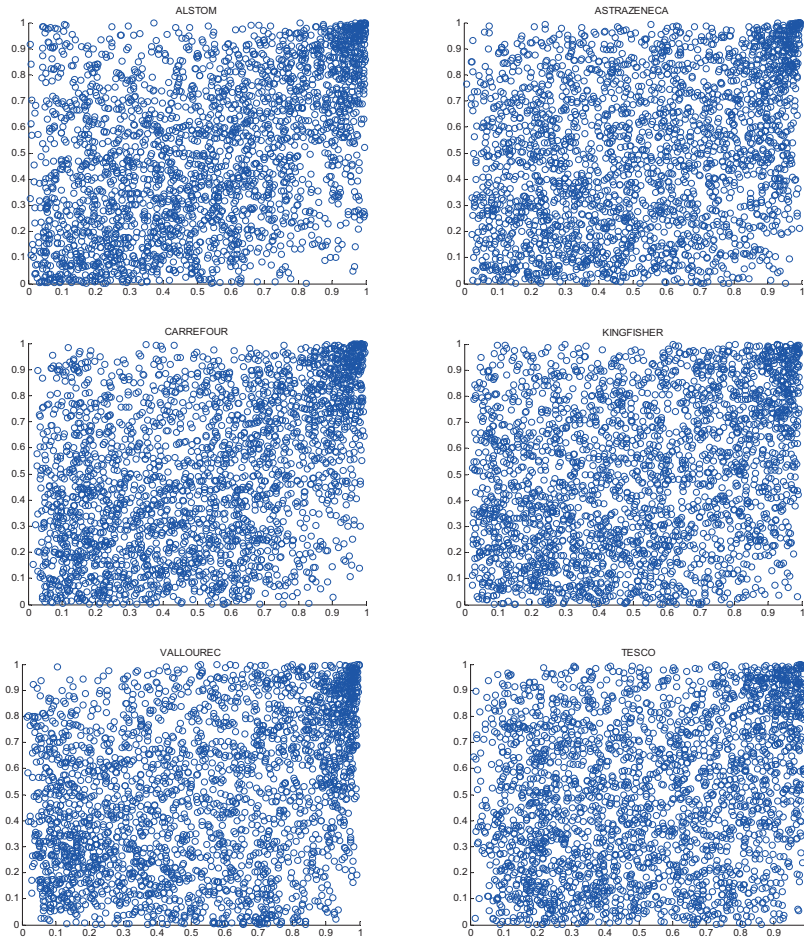
Figure 1. Dependence structure of volatility and trading volume

Source: own elaboration based on Reuters data basis

Because of the large number of companies under investigation, the figure below presents only chosen (but typical) examples of dependence structures of volatility and trading volume that are modeled using copulas. The left column contains examples of stocks from the CAC40 (ALSTOM, CARREFOUR, VINCI), the right from the FTSE100 (ASTRAZENECA, KINGFISHER, TESCO).

There are concentrations of points in the bottom-left and top-right corners i.e. extremely low and extremely high values of volatility and trading volume occur together. To describe these patterns we apply a Gaussian copula, Archimedean copulas, survival copulas and their convex combination describe above.

The Tables 6 and 7 contain the results of the estimation and dependence measures. α_1 and α_2 are the parameters of copulas used in mixtures, first and second, respectively. We compute the Kendall correlation coefficient τ using convex combinations of copulas. Tail dependence coefficients, denoted by λ_U (upper) and λ_L (lower) are scaled with a mixture parameter ω. The symbols of copulas used refers to these from section Methodology (Copulas).

Table 6

Estimation results of dependence for pair $\widetilde{R_t^2} - \widetilde{\ln V_t}$

CAC40							
company	copula	α_1	α_2	ω	τ	λ_U	λ_L
ALSTOM	5	1.31	0.66	0.73	0.30	0.22	0.00
CARREFOUR	6	0.73	1.50	0.96	0.27	0.37	0.02
VINCI	7	0.60	—	—	0.23	0.31	0.00
FTSE100							
company	copula	α_1	α_2	ω	τ	λ_U	λ_L
ASTRAZENECA	7	0.53	—	—	0.21	0.27	0.00
KINGFISHER	5	0.50	0.26	0.80	0.19	0.20	0.00
TESCO	7	0.43	—	—	0.18	0.20	0.00

Source: own elaboration based on Reuters data basis

For the most part the mixture $\omega C_{sCl} + (1 - \omega) C_{Gauss}$ fits the data best for stocks traded on the CAC40. In some mixtures the estimated parameters were on a boundary, so these copulas were simplified and one-parameter copulas were used instead. On the whole, for English stocks the survival Clayton copula best fits the dataset. In the table below we present the statistics of the dependence measure of all stocks under consideration.

Table 7

Dependence measures for pair $\widetilde{R_t^2} - \widetilde{\ln V_t}$ (CAC40)

CAC40			
statistics	**τ**	**λ_U**	**λ_L**
minimum	0.16	0.12	0.00
1st quartile	0.21	0.22	0.00
median	0.23	0.27	0.00
3rd quartile	0.25	0.31	0.00
maximum	0.30	0.38	0.08
FTSE100			
statistics	**τ**	**λ_U**	**λ_L**
minimum	0.08	0.01	0.00
1st quartile	0.12	0.08	0.00
median	0.15	0.12	0.00
3rd quartile	0.17	0.16	0.00
maximum	0.21	0.27	0.04

Source: own elaboration based on Reuters data basis

The dependence in the right tail (for extremely high values) is stronger than in the left tail (extremely low values). This is because of the high values of mixture parameter omega. So dependence in the right tail is dominant. The conclusions drawn for English stocks are analogous. Dependence in the right tail is stronger.

4.3. Analysis of dependence between stock returns and trading volume

We use VAR models applied to stock returns r_t and trading volumes $\widetilde{logV_t}$ (long memory was removed from the series). To describe the heteroscedasticity observed we use a GARCH type model. As in the previous section we fitted some distributions for the residuals of the VAR models. Additionally, we considered GED and skewed t distributions. For the residuals of the equation for stock returns GED and skewed t distributions were generally. As with the results of the VAR models, for the pair volatility-volume, generally NIG distributions and the t-location scale were fitted for trading volumes.

Figure 2 presents typical examples of dependence structures of stock returns and trading volumes.
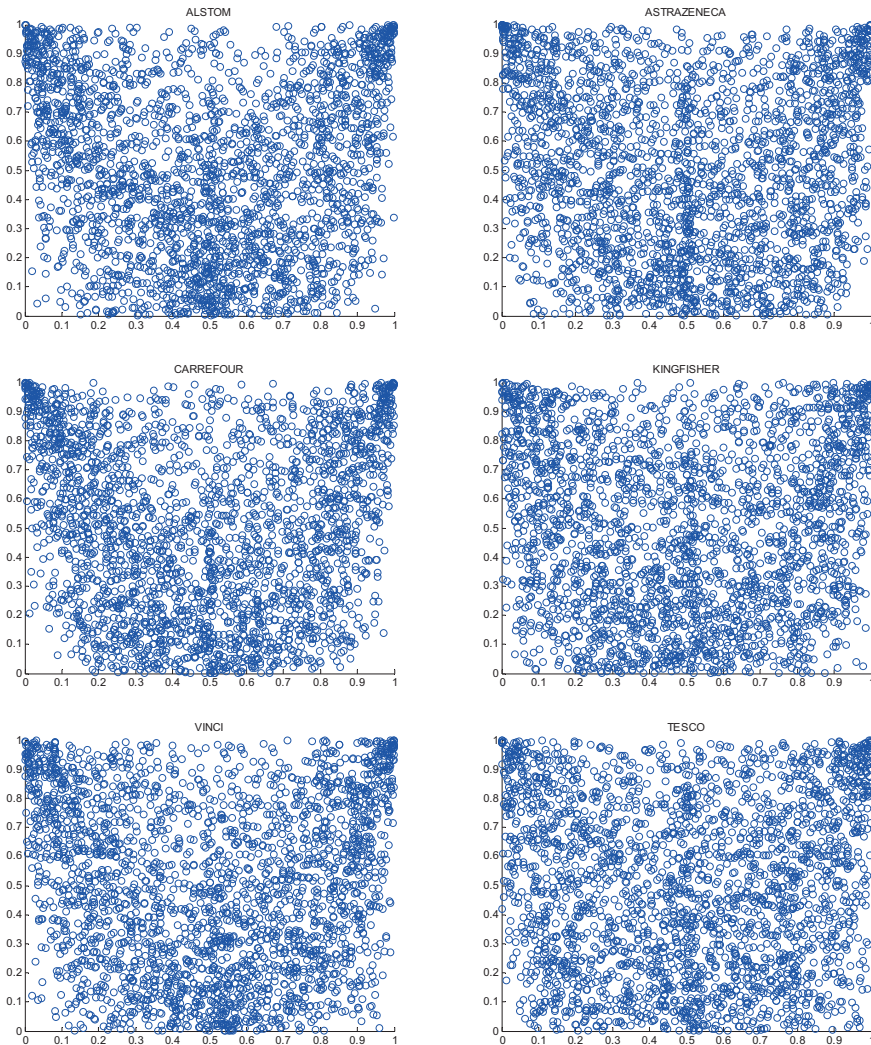
Figure 2. Dependence structure of stock returns and trading volume

Source: own elaboration based on Reuters data basis

There is a clustering of points in the top corners, which means that extremely a high trading volume is interrelated with high stock returns (positive and negative). The concentration of points for $u_1 \approx 0.5$ and $u_2 < 0.5$ is a sign of low trading volume linked with low volatility (stock returns close to zero).

The computation results corroborate the observation made above. We computed Kendall correlation coefficients for the whole sample and in all corners (for quantiles 0.01 and 0.99). When using whole samples, the correlation between stock returns and trading volumes of companies are close to zero. For some companies, in spite of their significance the computed values are small. For all companies under study, there is no correlation for the pairs low stock returns-low trading volumes and high stock returns-low trading volumes. The correlation coefficients $\tau_{u_1>0.99,u_2>0.99}$ and $\tau_{u_1<0.01,u_2>0.99}$ are significant for the majority of the sample and greater than 0.1 To sum up, even using rank correlation coefficients it is impossible to model dependence structures. One can model relationships for negative and positive returns separately but it is not then obvious what is the ratio of the correlations. Moreover, the correlations presented above are not equivalent to tail dependence coefficients.

The Tables 8 and 9 contain the results of the estimation of the parameters of the mixtures (absolute values of parameters are given) along with dependence measures upon copulas.

The coefficient λ_{HH} describes the asymptotic dependence between extremely high positive stock returns and extremely high volume, whereas λ_{LH} is related to extremely low stock returns. These coefficients are computed using mixing parameters. As in the previous section, α_1 and α_2 are the parameters of copulas used in mixtures, τ is the Kendall correlation coefficient and ω is the mixture parameter.

Table 8

Estimation results and dependence measures for pair $\tilde{r}_t - \widetilde{\ln V}_t$

company	α_1	α_2	ω	τ	λ_{HH}	λ_{LH}
ALSTOM	0.74	0.72	0.49	0.27	0.19	0.20
CARREFOUR	0.74	0.71	0.51	0.27	0.20	0.19
VINCI	0.52	0.68	0.51	0.23	0.13	0.18
company	α_1	α_2	ω	τ	λ_{HH}	λ_{LH}
ASTRAZENECA	0.68	0.69	0.45	0.26	0.16	0.20
KINGFISHER	0.50	0.58	0.55	0.21	0.14	0.14
TESCO	0.57	0.60	0.55	0.23	0.16	0.14

Source: own elaboration based on Reuters data basis

In almost all cases the mixture $\omega C_{Cl}^{(180)} + (1-\omega) C_{Cl}^{(270)}$ fits the dataset best. The only exception is the English stock Evraz (mixture of $\omega C_{Gum} + (1-\omega) C_{Cl}^{(270)}$). The table below presents the rank statistics of dependence measures for all stocks under study.

Table 9

Dependence measures for pair $\tilde{r}_t - \widetilde{\ln V_t}$

statistics	CAC40			FTSE100		
	τ	λ_{HH}	λ_{LH}	τ	λ_{HH}	λ_{LH}
minimum	0.13	0.05	0.05	0.10	0.03	0.00
1st quartile	0.21	0.13	0.16	0.15	0.08	0.07
median	0.23	0.15	0.17	0.18	0.10	0.10
3rd quartile	0.25	0.18	0.19	0.20	0.13	0.14
maximum	0.29	0.22	0.22	0.26	0.18	0.21

Source: own elaboration based on Reuters data basis

The dependence structures in the analyzed corners are not unique. For 15 out of CAC40 companies the dependence between the pair high returns-high trading volume is stronger than that between low returns-high volume. English stocks are characterized mostly (in 59 cases) by the strongest high returns-high volume dependence.

5. Conclusions

We analyzed the dependence stuctures of stock returns, volatility and trading volumes of companies listed on the CAC40 and FTSE100. Additionally, we tested the MDH with long memory i.e. the equality of the long memory parameters of volatility and trading volume and fractional cointegration of these series. With some exceptions the estimation results of long memory parameters show that the series under study are stationary.

Moreover, taking into account the lack of fractional cointegration, the extended hypothesis is rejected in all cases. This means that a common long-run dependence does not exist. In other words, the series are not driven by a common information arrival process with long memory.

The correlation between volatility and trading volume is present for almost all stocks of companies under investigation. There exists a significant dependence between high volatility and high trading volume. In general dependence is stronger for the French than for the English stocks.

It was noted that the classical correlation coefficient (even rank correlation) does not allow the capture of the specific dependence structures of returns and trading volume. Using mixtures of rotated copulas and a Kendall correlation

coefficient based upon them, extreme return-volume dependence was investigated. In the case of CAC40 companies we can conclude that high trading volume is not correlated as frequently with high stock returns as with low stock returns. For companies listed on the FTSE100 high stock returns are mostly related with high trading volume.

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Financial institutions as an example of institutions of public trust

1. Introduction

Nowadays, in a complicated world of multilateral and various relationships and also affluence of information, the reliability of which is hard to verify, there occurs a risk of fallacious assessment of processes and phenomena that occur. This results in an increase in uncertainty and risk in an making economic and extra-economic decisions. This gives great significance to the issue of confidence in relationships between the entities. Special importance is attributed to reliance on relationships that, from their nature, are burdened with asymmetry, and their effects determine the future of the weaker side of the relationships. Such relationships include the contacts between a patient and a doctor, an aggrieved person and law enforcement and judicial bodies, customers and financial institutions, customers and insurers, etc. The functions of institution of public trust are attributed to the entities offering the aforementioned services. This situation is usually controlled in a better or worse way by appropriate legal regulations.

1.1. Institution – the essence of the notion

In order to speak about institutions of public trust, the essence of the notion of institution should be understood[1]. In the literature of the subject we can find two different definitions of this notion. Institution can be understood among others, as:
 – a group of people organised according to certain rules for the purpose of satisfaction of a need [1, p. 73],

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[1] Latin. Institutio – habit, instruction

- an element of social life that serves the satisfaction of the needs of individuals and that also constitutes an element of social control maintaining coherence and functionality of a social system [7, p. 66],
- an organisation composed of people and things they need to act [22, pp. 355–356; 8, p. 126],
- formal principles, rules (such as legal regulations) and / or informal structures (such as conventions, standards of behaviour, imposed codes of conduct) [14, p.6],
- common activity controlled by an action of an individual is both unstructured form of relationship between individuals that it is created by (e.g. family) and an organised form of activity, i.e. an enterprise [12, p. 1178],
- durable social group, understood as every association of people, which in the awareness of those people constitutes some kind of separate entirety. The function of the institution is to execute the tasks set by a broader group. To perform these tasks they are equipped with tangible and intangible goods and with some system of regulations that control the group activity [11, p. 700, 18, p. 16],
- „institutions are the rules of the game in a society, the structure of which influences interpersonal interactions (interpersonal exchange) and influences the condition of the economy in a particular period of time" [13, p. 3].

Analysing the definitions presented above we can distinguish some elements that make an institutions:

- groups of people that form an institution, performing particular roles in it, and with attributed scopes of duties and responsibilities,
- standards and rules determining the cooperation of individuals within a particular institution, that are formally accepted principles of acting and / or informal standards of behaviour, yet generally operating in particular institutions,
- tasks and goals that a particular institution performs or should perform,
- resources that an institution has at its disposal, that serve the achievement of goals and the satisfaction of the needs of individuals (both tangible and intangible ones such as reliance or image).

Institutions can be classified through the identification of their structure, activities performed in them and repetitions in these actions. Because of the criterion of formality and the rules or principles of the economic game, they can be divided into formal and informal institutions. The group of the first ones includes the system of property rights, government regulations and laws. On the other hand, informal institutions include culture, values, level of trust and thinking models, tradition and religion [16, pp. 5–6; 20, p. 596]. Institutions can also be analysed in a narrow and broad approach. Speaking about groups of

people forming an institution and resources as the elements of institutions, we can speak about the institution as a narrowly perceived (organisation). It is worth observing that a part of representatives of institutionalism consider organisations (and thus narrowly perceived institutions) to be something distinct from institutions themselves, while writing that „organisations are some kind of emanation of institution". And then, we talk about institutions in a broad approach when we perform their division into formal and informal institutions (just as Douglass Cecil North perceived them).

1.2. Trust towards financial institutions

Trust is a complex notion and it has no simple definition in literature. Therefore, profound literature studies that might allow for the arrangement of this knowledge and adoption of some methodological assumptions are necessary. Francis Fukuyama's definition is one of major definitions of trust: "trust is expectation that arises in a community on the subject of regular, honest and co-operating behaviour of other community members on the grounds of commonly accepted standards" [4, pp. 26–27]. According to Nan Lin „trust is a conviction or expectation that a partner will consider the interests of the other partner in the course of exchange" [9, p. 147], Barbara Misztal, in turn, says that „trusting is to believe that results of somebody else's intentional actions will be appropriate from our point of view" [10, pp. 9–10]. Trust can be analysed in terms of many scientific disciplines. From the economic point of view, trust can be discussed in the perception of transactional costs. The bigger the trust between economic entities that enter various relationships, the smaller the transactional costs, which may not occur at all.

Trust is also an indispensable element of social capital. Robert Putnam, writes that „Social capital refers to features of social organization, such as networks, norms, and trust, which facilitate coordination and cooperation for mutual benefit (…) [17, p. 258]". Then, he also states that „… the higher the level of trust within community, the larger the probability of cooperation" [17, pp. 264–265]. It is important to distinguish the two notions, the notion of trust and of public trust. Definitions that have been quoted refer to generally comprehended notions of trust and public trust refers to various types of institutions or organisations understood as a collection of structural rules within which some actions and interactions occur [19, pp. 103–149]. What is more, public trust is in general an enforced consequence of natural or / and created information asymmetry, frequently also of market asymmetry, associated with the provision of services, that social and economic order often depends on.

Trust is essential in the activity of all institutions, however, there are also such institutions that, because of their role in community, must be equipped with this quality. Financial institutions are generally considered to be such institutions. They have to fulfil both a social and economic role in the economy. The social role of financial institutions is manifested in ensuring the security and stability of all entities that deposit or lend financial resources. On the other hand, the economic role of financial institutions consists in the provision of financial supplies that enable full use of economic resources that are available, and also in the investment of financial resources that households possess and in the transforming these resources into active money capital.

Financial institutions manage the capital that is deposited by clients (that is other people's capital), they are institutions in which trust comes into particular prominence. While depositing their financial resources, the customers have to place confidence in it, believing in getting their money back or multiplying the capital that was deposited, thus apart from economic reasons the customers are guided by trust towards institutions while making decisions [3, p. 19]. An attempt is also made to determine some characteristic features that distinguish institutions of public trust from others:

– subordination of their activity to broadly understood social interest,
– existence of legal solutions ensuring protection of the right or name of such an entity,
– observance, by the institution, of principles of professional ethics adopted in practice,
– specific character of relationships between the entity of public trust and the consumer of its benefits or service, that finds its expression in some amount of trust and secrecy, and obligation to observe professional secrets,
– subjection of institutions of public trust to stricter principles of responsibility for mistakes and omissions while executing operations [21, p. 54],

Employees of institutions of public trust also have to meet some requirements, for example:

– high requirements as for professional qualifications of people employed in them, both with respect to theoretical as well as practical background,
– the right of exclusiveness to do a particular job (a particular activity) [21, p. 54].

A lot of aforementioned qualities that characterise institutions of public trust find their reflection in articles, acts and legal regulations of financial institutions. Of course, there occurs a question whether it is enough to call institutions distinguished, against others by the qualities mentioned above, the institutions of public trust. What are the relationships between financial institutions and shareholders and how does information and market asymmetry influence these relationships and public trust?

Various types of relationships occur between financial institutions and other entities (especially between external entities). Here we can speak about some kind of symmetry or asymmetry between them. With respect to this we can distinguish the model of asymmetric relationship and the model of asymmetric relationships. The first model is a situation in which a financial institution and its shareholders remain in partnership relationships, cooperate with each other and communicate with each other. A privileged position of any entity is out of the question here. Then, in the other model a financial institution occupies a privileged position and its shareholders conform to it. Models of information asymmetry and symmetry are also associated with these models. In the case of such institutions as financial institutions, we can certainly speak about information asymmetry that consists in the fact that the scope of information that parties that execute transactions have at their disposal or remain in some relationships with each other is different [compare 15].

Everyone will probably agree with the statement that financial institutions as institutions of public trust should not take advantage of their priviliged situation in relationships with other entities. However, in reality we often face both information asymmetry and asymmetry in relationships for the benefit of just financial institutions. They are just the ones that impose conditions to other entities that remain in various relationships with them. So, in such a situation can we speak about aware trust of entities towards financial institutions or rather about some generally accepted principle of trust towards these institutions? What does actually prove the fact that financial institutions are institutions of public trust?

It is generally believed that banks are the pillar for financial institutions because they are the ones that mostly constitute the major source of capital for other market entities. Banks (and also other financial institutions) have been undergoing changes for years. Passing the law on NBP [*National Bank of Poland*] and banking Law in 1989 was of fundamental significance for the banking sector. The following years brought further changes in the banking system that contributed to formation of diversifed organisational structures. Changes of economic, political, legal, social or technological character had enormous impact on these transformations. There occurred institutions and regulations ensuring security for the new banking system. Within the framework of Narodowy Bank Polski [*National Bank of Poland*] banking supervision system has been established that, while being equipped with appropriate tools of control, has been supervising banking institutions. Also, various types of tools that serve the accomplishment of various goals have been implemented. And so, for example refinance loans and loans on securities occurred for the purpose of stimulating the loan activity of commercial banks, the system of special deposits was established to ensure the stability of the banking system, and an instrument of open market operations occurred for the

purpose of balancing the demand and supply of financial resources kept by commercial banks in the Central Bank. In fact banks have always been considered institutions of public trust (although not always justifiably) and aforementioned changes and new tools only contributed to the strengthening of such an image of banks in community awareness. However, it should be stated that even in banking law, a bank is not directly called an institution of public trust. However, it is also important that the Polish Constitutional Tribunal applied this doctrine while giving reasons for its judgement [2]. It „stated that bank priviledges are justified because of specific social and economic significance of banks as entities of public trust. Judges of the Polish Tribunal also indicated the fact that banks while defending their interests as individual legal entities, act at the same time for the benefit of their customers that deposited their money in them" [more in 6]. Therefore why is the notion of bank as an institution of public trust so frequently used? Magdalena Dąbrowska claims that „it is not about literally understood trust, but about perceiving banks as institutions under special supervision of the state in which legal system determines the framework of cooperation for them in a much more detailed way than for other economic entities" [more in 2]. It is also rightly noticed by Andrzej Janiak, that the public trust, banks among others are endowed with, should be associated with higher demands towards entities of public trust such as: higher requirements towards professionalism of actions or more severe responsibility of those entities [5, p. 26]. He also postulates the abolition of the so-called bank priviledges such as the right to security of a debt, bank deduction, reduction and exemption from court fees, official power of banking documents, bank mortgage, bank enforceable titles and general terms and conditions of agreements and regulations [5, p. 26]. It seems legitimate to claim that less privileged situation of banks and also equal access and understanding of information, might reduce asymmetry of relationships and information between banks and other entities in these relationships.

1.3. Trust in financial institutions in the light of public opinion

For many years the studies concerning the trust of society towards various institutions, including financial institutions among others, have been performed. The latest research performed by TNS Polska as requested by Związek Bnaków Polskich [*Polish Banks Association*][3] concerning the image of the

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[2] Decision of Polish Constitutional Tribunal of 16th May 1995 (k 12/93) OTK 1995, part I section 14.

[3] More on the subject of research on the webpage of Związek Banków Polskich [*Polish Banks Association*] at www.zbp.pl (as of 20.05.2013), further information will be presented on the grounds of this research.

banking sector proves that banks, despite the economic situation in the country and all over the world, enjoy the trust of Polish people and in these rankings, they come before other entities of the financial sector. In 2013 as compared to the previous year, the reputation of Polish banks increased by 7 points and at present it amounts to 28 points[4]. Among the respondents 73% assess banks well and very well. Nearly 40% express a similar view while answering the question about the general assessment of the banking sector. Banks provide the feeling of security for 48% of respondents, 37% Polish people believe that banking sector is resistant to economic crises and 54% believe that they have good prospects for development. The fall of Amber Gold was presented by 15% respondents as the reason for the decrease in trust towards banks and security of deposits. In general, 48% respondents trust banks, and 57% respondents trust the bank the services of which they use. A bank was indicated as an institution of public trust by 59% respondents and 27% think that banks are not institutions of public trust. There is also a question of customer satisfaction with banking services, where in 2012 the level of satisfaction reached 77%.

We should wonder how the aforementioned results of research really show whether banks (or financial institutions) are institutions of public trust. We speak about a positive image of banks, satisfaction with services or security of deposits. It is stated that a bank is an institution of public trust but we do not ask the respondents why they think so. Maybe it is just a proof of the fact that bank as an institution is a notion that is deeply-rooted in awareness of the people. It has already been mentioned that more is demanded from institutions of public trust. The requirements as for professionalism and responsibility are for example larger. Thus, every institution of public trust should observe some rules such as the principle of professionalism, reliability, business-like character, exactitude or the principle of best knowledge[5]. These principles ought to be observed in relationships between financial institutions (institutions of public trust) and other entities. Financial institutions ought to treat their shareholders with reasonable care and skill, reliability and in a partnership way. Financial institutions should not apply their knowledge and possibilities in the way that might violate the interests of entities with which they remain in various relationships and information transferred by financial institutions should be reliable and transparent.

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[4] Reputation of banking sector in our country as measured by aggregated TRI*M index (Indeks TRI*M – a synthetic single-number *index,* that is the measure of the level of satisfaction of the customer with services, based on a set of standardised questions).

[5] See chapter 1 section 2 "The Principles of Good Banking Practice" at www.zbp.pl see also section 2 of general provisions of SKOK code of ethics.

2. Conclusions

Without any doubts there is a conviction in people's awareness that financial institutions (and first of all banks) are institutions of public trust. However, even in banking law, a bank (or a financial institution) is not directly called an institution of public trust. Trust is also undoubtedly associated with security, therefore the security of banks and the whole banking sector is the people's own interest. The awareness of this is certainly translated into trust towards these institutions. Information and relationship symmetry and also less privileged position of financial institutions favour the trust of entities towards just those institutions that are generally called institutions of public trust. Financial institutions receive an enormous capital in the form of social trust which favours winning a strong market position by them. However, it is important that these institutions should not use this advantage but should fulfill worthily the role of institutions of public trust that is attributed to them.

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Methodology of optimisation of local energy infrastructure development

1. Introduction

For many years economists believed that the best tool to optimize allocation of resources is the market itself. In the 20th century however, along with progressing devastation of the natural environment, scientists discovered that in some cases the market alone does not lead us to socially optimal solutions. One of the fields where the free market may and should be rectified is the energy market. Among basic reasons of this state is the existence in energy sector of the problem of external costs and natural monopolies. In Poland in accordance with the "Energy law" the bodies responsible for the creation and enforcement of energy policy are: the government, Energy Regulation Office and local (municipal) authorities. One of the basic means of fulfilling this obligation by municipalities are "Plans of supplying local consumers in heat, electricity and gas" [7]. Those plans (to update at least every 3 years) should draw the main axes of local energy systems development in the way which is coherent with socially optimal solutions. Their importance results from the fact that they should influence other social actors i.e. energy companies and energy consumers, which peruse their own interests. The reality is that the majority of municipalities do not prepare such strategic plans [22], and that these plans that exist are too general to influence the market actor's behavior [28]. One of the basic reasons of this situation is not applying by local authorities models optimizing local energy systems development. To fulfill such task model should have the following features:

– municipality oriented and comprehensible by local administration,
– consider various forms of final energy,

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- consider consumers, both connected and not connected to energy networks (electricity, heat, gas), including for example consumers of heat with individual boilers,
- ignore details which may locally exist but are out of local authorities control (for example technologies and fuels applied in a big condensing power plants, locally existing but owned by large corporations),
- represent in a detailed way local reality (incl. existing infrastructure, variety of local energy resources, etc.),
- concentrate on social (not private) optimum,
- represent typical behaviors of consumers, parameters of technologies, environmental conditions and existing energy networks features.

This paper presents a methodology of construction of a mathematical model which seems to fulfill all these requirements. The model may be a good starting point to create a software tool which can be used by local authorities in practice.

2. Optimization models of local energy systems

In the last three decades a big number of energy models appeared. A fraction of them may be to some degree useful for local authorities although most of them have serious limitations and disadvantages which reduce their capacity to create strategic plans of municipal energy infrastructure development. In this chapter some examples of existing models of local energy systems are presented.

One of the most popular energy models which may be used in the local scale (although it's geographical scope is universal - including region and country) is *Perseus* [5, 11, 14, 27]. It is a dynamic, linear, optimization model which selects the best technologies and fuels to meet the given demand for various energy forms. It represents all phases of energy transformation (extraction and transportation of fuels, energy production, energy transmission and distribution). The objective function of the model is the sum of discounted, yearly costs of the following factors: fuel (extraction, transport), technologies (variable and fixed), investments, transmission and distribution. Constraints of the model may be divided into three groups: technical, environmental and socio-political. The model may be particularly useful in optimizing technologies and fuels of power and heating plants thus seems more useful to energy companies than to local authorities - less interested in technologies of big energy producers and less conscious of them.

A well-known tool for support of local energy systems development, with many application is *Homer* [13, 19]. It has been built by the National Energy Laboratory (USA) and commercial companies. The model (recommended by the World Bank) shows the various effects of the application of different combinations

of fuels and technologies. The main assumption of the model is the balance between energy production and energy demand in each of the 8760 hours of the year. Package is free and accessible in the internet (www.nrel.gov/homer).

The tools which may support municipal authorities in elaborating or updating long-term plans of meeting local energy needs are *CAPLEP* [14] (Laboratory of Energy Models of Polytechnic University of Torino) and *MARTES* (Goeteborg – Sweeden). The main limitation of both models is concentrating exclusively on district heating while neglecting other forms of final energy and residents not connected to the heat network).

Another model which may be helpful to local administration is *MODEST (Model for Optimization of Dynamic Energy System with Time-dependent* components [11, 12]. *MODEST* is a linear programming model that minimizes the costs of supplying heat and electricity during the analyzed period. It was used to optimize local energy systems development in several municipalities.

Long-run local energy systems designing may also be supported by *MARKAL or its successor – TIMES.* These well-known and frequently applied energy models have a universal geographical range (country, region, local) [21]. Both tools (although useful for energy companies) have some disadvantages from the point of view of local authorities and of the creation of municipal strategic energy plans which are: concentration on network infrastructure (neglecting for example heat for individual-dispersed housing) and considering issues which are out of control of local authorities (big power plants, electricity distribution technical problems, etc.).

An interesting tool which may also be used to plan the development of local energy systems was created in 2008 by Ritsumeikan Global Innovation Research Organisation, Ritsumeikan University (Kioto, Japan) and Faculty of Environmental Engineering of Kitayushu University [24, 25, 26]. It has a MILP form (*Mixed Integer Linear Programming*) and is static (one year period).

The objective function is the sum of the following factors:
– fuel costs,
– investments costs,
– fixed exploitation costs,
– variable exploitation costs.

Restrictions of the model are technological and demand side aspects. The tool considers local climate, tariffs for energy (heat and electricity), technological and economic data of technologies and the demand for energy (divided into seasons and hours). The model selects (for the given local energy system) the cheapest set of technologies and the best way of their use. It has been applied to optimize energy supply to Kitakyushu University Campus. The tool can be applied in case of smaller (then municipality) areas.

Beside the optimization models, also multi-criteria analysis are applied to support the planning of local energy systems development. Although it do not show one best solution for the formulated problem, the multi-criteria approach allows us to see many aspects (of both quality and quantity character) of potential decisions. This methodology leads us to a set of Pareto optimal states. An example of the application of this approach in the process of designing of local energy systems is created in 2006 (by the Electrotechnic Faculty of Rzeszów Polytechnic School) a software tool dedicated to a small municipal client (a house, a block of apartments or a housing district) [2, 3]. The software package considers the costs of supplying energy, emission level, the comfort of the user and the reliability of the system. The tool, although very useful in the case of planning of energy infrastructure development of a district, covers too small an area to be applied in the process of a complex, long-term energy strategy formulation for the whole municipality.

In the recent years many interesting models of local energy systems have also been created in the developing countries. One of them is a linear, optimization model *IRES* (*Integrated Renewable Energy System*) [1, 6]. It has been created and used in India. The objective function in the model is the cost of meeting local demand for energy (electricity, space heating, heat for preparing meals). *IRES* is dedicated to a village or a group of villages not connected to the power grid or the gas network areas of the third world countries. The model assumes only local, renewable fuels. Although it is a useful tool in the case of peripheral areas of developing countries, *IRES's* algorithms are not adequate to the Central European reality. Another model to optimize development of local energy systems is DGEP (*Distributed Generation Expansion Planning*) [29]. This, created in Iran, tool has a multi-criteria character (a few objective functions – including maximization of costs and minimization of CO_2 emissions). Modeling of local energy systems has also recently become a focus of scientists from China. One of a few examples of this interest may be *ICS-EM* (*Inexact Community Scale Energy Model*) [4], created by the School of Environment of Beijing Normal University in co-operation with two Canadian Universities (Regina and Waterloo). The tool is a *MIP* (*mixed integer programming*) optimization model with objective function equal to costs of supplying amounts of energy given in all sub-periods of the given period. The model's advantage is its dynamic character and considering the existing local technologies. However it does not reflect central European user's behavior.

The short review of examples of models of energy systems shows that there are available tools which may support local authorities in the process of strategic planning of local energy infrastructure development. Still, there is a need of creation of an optimizing tool without the following limitations and disadvantages

– limiting the range of the modeled system to the network infrastructure (neglecting for example heat boilers of individual houses),

– considering only one type of final energy,
– universal range of the tool (not only local but also region or a country), which results in not enough detailed representation of local specificity and considering the issue of control and comprehension of local administration (for example locally existing power plants),
– the lack of increasing marginal costs impact of local – renewable fuel, which affects increasing quantities of energy produced,
– cost-benefit analysis seen from private (not social) perspective,
– algorithms not adequate to Central European reality and the Central European user's behavior.

3. A general concept and assumptions of the model

The following part of this article presents a methodology and mathematical representation of an optimization model of local energy system development which is dedicated to local administration and may be used to formulate plans of supplying local residents in electricity, heat and gas. This non-linear, dynamic model allows us to find the cheapest (socially) way of supplying local residents in the given amount of final energy. The objective function (minimized) is the sum of discounted yearly costs of energy supply, each consisting of the following factors:
– fuel costs,
– variable exploitation costs (beside fuel),
– investment costs,
– fixed exploitation costs (beside depreciation and investments),
– external environmental costs.

Key decision variables are: installed powers of chosen technologies (in each year of the examined period), quantities of energy produced by these technologies to supply the demand of all customer segments and quantities of fuel received from each source. These are the most critical and determining factors of long term strategic energy plans for municipalities so their calculation will make these plans concrete and precise.

Social costs (benefits) differ significantly from private costs (considered usually in energy companies oriented models). While in the case of private perspective we consider costs and benefits of energy supplier, social perspective concentrates on costs and benefits of the whole society, neglecting transfers between different market actors (for instance income from various "green" certificates and subsidies) and in the same time considering all external costs (at present only partially internalized and suffered by energy companies). Such a methodological

approach – so called socio-economic perspective [12] (which is an alternative to a business economic perspective) results in the three following features of the described in the article model:

– considering the external costs of energy production and transmission to the full extent (regardless current regulations),
– neglecting the effects of all (current or future) intervention tools aiming at rectifying market actors behavior (transfers between different actors, neutral from the point of view of the whole society – for instance revenues from the sale of green certificates),
– neglecting profit margins (super normal profits) of local fuel suppliers [15].

Inclusion of the full external costs in the objective function is a very important feature of the proposed model. This approach allows us to find solutions improving social welfare [18]. When external costs are not considered it may lead to sub-optimal (from socio-economic prospective) solutions [12].

Exogenic (given) data which are introduced to the model by the user are the following:

– existing energy infrastructure (capacity of each technology and the expected depreciation of each technology in every year of the examined period),
– demand for electricity and thermal energy (total demand needed for heating, hot-water production, technology purposes and cooking) – expected for all years and all sub-periods of each year,
– potential and costs of local energy resources,
– costs of global energy carriers (electricity from the power grid, coal, etc.),
– technical and economic data of considered technologies,
– compatibility of some fuels with some technologies and of some technologies with some demand sectors.

The existing infrastructure and expected demand for final energy are introduced separately for all sectors of the municipality (declared by the user). Sectors are defined in such a way that:

– each sector is homogenic with respect to the set of technologies which may be used to meet the demand for energy (two customers with the same set of compatible technologies belong to the same sector, two customers with different sets of compatible technologies belong to different sectors),
– sectors are separate and complementary (each customer belongs to one and only one sector).

A very important advantage of the model is the variability of marginal costs of local-renewable fuels. The more local-renewable fuel we use the less attractive sources of this fuel we must exploit. In the traditional approach the user decides which sources are still attractive and which are already unattractive to exploit. Then the total potential of all attractive resources (in the user's opinion) is exogenously given to the model. Also, the unit price (or cost) of the fuel (which actu-

ally increases with the increase of the scale of the local fuel usage) is exogenously given by the user and usually equal to the average price of considered resources. In the presented model we introduce the whole function linking the unit fuel cost (dependent variable) and the fuel quantity (independent variable).

This relation consists of a set of pairs of figures $\{p_i, k_i\}$, i = 1,2,..., n, where:

i – number of the resource,

p_i – potential of the resource „i",

k_i – unit cost of the fuel from the resource „i",

n – number of locations.

Then the model decides to what point existing renewable fuels should be utilized – not the user in an arbitrary way.

The following assumptions and simplifications have been made:

– unit external costs of energy production and distribution are fixed (not dependent on the quantity of energy produced neither on the technology – for example not related to the height of the stack);

– the quantity of global fuels used by the municipality (for instance gas, coal) is small and does not change unit prices on the global (or national) market;

– new capacity is introduced to the system on the first hour of every year (capacity of each technology during the chosen year is constant);

– investment costs of already installed technologies are neglected (*sunk costs*);

– unit investment costs and unit exploitation costs do not depend on the capacity nor the quantity of energy produced (in reality they usually decrease with the scale);

– economic and technical parameters of each technology are constant during the whole examined period;

– there are two types of sectors:
  • one user – one installation (for example small boilers in individual houses),
  • many energy installations whose outputs are added together – many users profiting from the same distribution network (where outputs of different installations are added together);

– in case of the one installation – one user sector the quantity of energy produced in each technology is proportional to the capacity of this technology; inexistence of this assumption would lead us to the impossible state i.e. meeting the demand of the sector (beside peak hours) only by those technologies whose variable costs are low (impossible because houses equipped in energy technologies with higher variable costs cannot import energy produced elsewhere);

– the whole year is divided into sub-periods reflecting both seasonal and daily variations of demand; for instance four seasons (spring, summer, autumn, and winter) and two daily periods (peak, out of peak) gives us eight sub-periods of the year;

- capacity (installed power) of energy production technologies should be high enough in every year to supply local clients with demanded quantities of energy (in every sub-period of every year);
- in case of houses equipped in boilers supplied with solid fuels (for example wood, coal, etc.) heat for hot water in summer periods may only be produced from electricity or sun energy (assumption reflecting Central European customer behavior – closing solid fuel installations in summer period);
- costs and prices are constant during the whole examined period and equal to prices existing in the first year.

4. Mathematical formulation

Symbols used in the model are presented in the Table 1.

Table 1

Symbols used in the model

symbol	type of represented value	description
s	index	sectors of demand
f	index	sources of fuel
t	index	years
i	index	sub-period of the year
g	index	technologies considered
z	index	pollution type
S	set	set of all demand sectors
F	set	set of all fuel sources
T	set	set of all years
I	set	set of all sub-periods of the year
I_{summer}	set	sub-set of set I assembling all those and only those sub-periods of the year when heat is produced only for hot water
I_{winter}	set	sub-set of set I assembling all those and only those sub-periods of the year when heat is produced both for hot water and for space heating
G	set	set of all technologies considered (potentially proper for some sectors of the municipality)

Table 1 cont.

G1E	set	one element sub-set of set *G* – hot water electric boilers
G1S	set	one element sub-set of set *G* – hot water solar panels
G2	set	sub-set of set *G*, including gas or solid fuel fired boilers
G3	set	sub-set of set *G*, including solid fuel boilers
Z	set	set of all polutants
F×G	set of pairs	set of all pairs of fuel source – technology
A $A \subset F{\times}G$	sub-set	sub-set of set $F \times G$, including all those and only those pairs of fuel sources and technologies which are compatible
G×S	set of pairs	set of all pairs technology - sector of demand
$B \subset G{\times}S$	sub-set	sub-set of $G \times S$, including all those and only those pairs of technologies and sectors which are compatible
E_g	parameter	efficiency of transforming chemical energy stored in fuel into final energy (given for technology *g*)
$COGEN_g$	parameter	co-generation coefficient – ratio equal to electrical energy divided by total energy produced (given for technology *g*)
$MAX\_WORK_{g,i}$	parameter	maximal number of working hours in sub-period *i* of the year (given for technology *g*)
$POWER\_RES_{g,s,t}$	parameter	residual power of technology *g*, in sector *s*, in year *t*
C_INV_g	parameter	unit investment costs (for technology *g*)
$C\_FIX\_EL_g$	parameter	unit fixed costs of producing electrical energy (given for technology *g*)
$C\_VAR\_EL_g$	parameter	unit variable costs of producing electrical energy (given for technology *g*)
$C\_FIX\_H_g$	parameter	unit fixed costs of producing heat (given for technology *g*)
$C\_VAR\_H_g$	parameter	unit variable costs of producing heat (given for technology *g*)
$UNIT\_EMI_{z,g}$	parameter	unit emission of pollution z by technology g
$UNIT\_EXT_z$	parameter	unit external cost of pollution *z*

Table 1 cont.

symbol	type of represented value	description
$D\_EN\_EL_{t,i}$	parameter	demand of the municipality for electrical energy in year t, in sub-period i (beside electricity for hot water production which is calculated by the model)
$D\_EN\_TH_{s,t,i}$	parameter	demand for thermal energy (sector s, year t, sub-period i)
$DYSK_t$	parameter	discounting factor in the year t
R_t	parameter	discounting rate in the year t
CRF_g	parameter	capital recovery factor for technology g
LT_g	parameter	life period of technology g (expressed in years)
$PRICE_{f,t}$	parameter	unit price of fuel from source f in the year t
$POT_{f,t}$	parameter	yearly potential (capacity) of source of fuel f in the year t
$PRICE\_IMP_t$	parameter	unit cost of electrical energy from power grid (including T&D fees)
$PRICE\_EXP_t$	parameter	unit price received for supplying power grid in electrical energy surplus
$COEF\_SOL\_WIN\_SUM$	parameter	coefficient of the fall of solar panels capacity in winter (ratio equal to capacity in winter / capacity in summer)
EN_POWER_s	parameter	ratio equal to energy produced / power installed (received from historic data)
$cost$	objective function	total social cost of supplying municipality in final energy
$cost\_prod_t$	variable	cost of production of electricity and heat in the year t
$cost\_ext_t$	variable	external cost of energy production in the year t
$cost\_inv_t$	variable	investment cost in the year t
$cost\_fix_t$	variable	fixed costs of energy production in the year t
$cost\_fix\_el_t$	variable	fixed costs of electrical energy production in the year t
$cost\_fix\_th_t$	variable	fixed costs of thermal energy production in the year t

Table 1 cont.

$cost\_var_t$	variable	variable costs in the year t
$cost\_var\_el_t$	variable	variable costs of electrical energy production in the year t
$cost\_var\_th_t$	variable	variable costs of thermal energy production in year the t
$cost\_fuel_t$	variable	fuel costs in the year t
$expo_{t,i}$	variable	surplus of electrical energy produced in the municipality in the sub-period i of the year t (transferred to the power grid)
$impo_{t,i}$	variable	electrical energy deficit - covered by the power grid in the sub-period i of the year t
b_exp_t	variable	benefits from supplying power grid in surplus of energy in the year t
c_imp_t	variable	costs of using electrical energy from the power grid in the year t
$pow_{g,s,t}$	variable	power (capacity) of technology g, in the sector s, in the year t
$new\_pow_{g,s,t}$	variable	power of technology g in the sector s, built between the year 1 and the last year (including those years)
$produ\_en\_el_{g,s,t,i}$	variable	electrical energy produced by technology g, in the sector s, in the year t, in the sub-period i
$produ\_en\_th_{g,s,t,i}$	variable	thermal energy produced by technology g, in the sector s, in the year t, in the sub-period i
$produ\_tot\_en\_cie_{s,t,i}$	variable	total thermal energy produced in in the sector s, in the year t, in the sub-period i (all technologies)
$q\_fuel_{f,g,t}$	variable	quantity of fuel from the source f to technology g in the year t
$emi_{z,g,t}$	variable	emission of pollution z, by technology g in the year t
$tot\_power\_th\_g2_{s,t}$	variable	total power of all technologies of gas or solid fuels, in the sector s, in the year t
$produ\_g2\_en\_th_{s,t,i}$	variable	production of heat by all technologies of gas or solid fuels, in the sector s, in the year t, in the sub-period i
$sol\_tot\_summer_{s,t}$	variable	quantity of heat produced by solar panels in the sector s, in the year t

Objective function (minimization) has the following form:

$$cost = \sum\nolimits_{t \in T} DYSK_t \times (cost\_prod_t + c\_imp_t - b\_exp_t + cost\_ext_t)$$

Yearly costs of production of energy are defined as the sum of investment costs, fixed costs, variable costs and fuel costs, which can be described in the following manner:

$$\forall_{t \in T} \quad cost\_prod_t = cost\_inv_t + cost\_var_t + cost\_fix_t + cost\_fuel_t$$

Yearly costs of investment

Yearly costs of investment are calculated in the following way:

$$\forall_{t \in T} \quad cost\_inv_t = \sum\nolimits_{s \in S} \sum\nolimits_{g \in G} CRF_{g,t} \times C\_INV_g \times new\_pow_{g,s,t}$$

where:

$$\forall_{g \in G, s \in S, t \in T} \quad new\_pow_{g,s,t} = pow_{g,s,t} - POWER\_RES_{g,s,t}$$

and:

$$\forall_{g \in G, t \in T} \quad CRF_{g,t} = \frac{R_t}{1 - (1 + R_t)^{-LTg}}$$

Yearly variable costs

Yearly variable costs are the sum of yearly, variable electricity production costs and yearly, variable heat production costs. This can be written as follows:

$$\forall_{t \in T} \quad cost\_var_t = cost\_var\_el_t + cost\_var\_th_t$$

Yearly, variable costs of electricity production and yearly, variable costs of heat production are given by the following equations:

$$\forall_{t \in T} \quad cost\_var\_el_t = \sum\nolimits_{g \in G} \sum\nolimits_{s \in S} \sum\nolimits_{s \in I} prod\_en\_el_{g,s,t,i} \times C\_VAR\_EL_g$$

oraz:

$$\forall_{t \in T} \quad cost\_var\_th_t = \sum\nolimits_{g \in G} \sum\nolimits_{s \in S} \sum\nolimits_{s \in I} prod\_en\_th_{g,s,t,i} \times C\_VAR\_TH_g$$

Yearly fixed costs

Yearly fixed costs are the sum of yearly, fixed electricity production costs and yearly, fixed heat production costs. This can be written as follows:

$$\forall_{t \in T} \quad cost\_fix_t = cost\_fix\_el_t + cost\_fix\_th_t$$

In the same time yearly, fixed costs of electricity production and yearly, fixed costs of heat production are given by the following equations:

$$\forall_{t \in T} \quad cost\_fix\_th_t = \sum_{g \in G} \sum_{s \in S} C\_FIX\_TH_g \times pow_{g,s,t}$$

oraz:

$$\forall_{t \in T} \quad cost\_fix\_el_t = \sum_{g \in G} \sum_{s \in S} C\_FIX\_EL_g \times pow_{g,s,t}$$

Yearly fuel costs

Yearly fuel costs are equal to the sum of products of prices and yearly quantities of each fuel. This can be written as follows:

$$\forall_{t \in T} \quad cost\_fuel_t = \sum_{g \in G} \sum_{f \in F} q\_fuel_{f,g,t} \times PRICE_{d,t}$$

Yearly external costs

Yearly external costs are defined in the model as a sum of products of quantities of pollutants which are emitted during the production of energy and unit external costs.

This can be submitted in the following way:

$$\forall_{t \in T} \quad cost\_ext_t = \sum_{z \in Z} \sum_{g \in G} emi_{z,g,t} \times C\_EXT_z$$

where:

$$\forall_{z \in Z} \forall_{g \in G} \forall_{t \in T} \quad emi_{z,g,t} = \sum_{f \in F} q\_fuel_{f,g,t} \times UNIT\_EMI_{z,g}$$

Costs of consuming electrical energy

Costs of consuming electrical energy produced outside the municipality and supplied by the power grid, as well as benefits from supplying power grid in electrical energy surpluses (produced in the municipality and nor consumed by municipal consumers) can be calculated in the following way:

$$\forall_{t \in T} \quad c\_imp_t = \sum_{i \in I} imp_{t,i} \times PRICE\_IMP_t$$

$$\forall_{t \in T} \quad b\_exp_t = \sum_{i \in I} exp_{t,i} \times PRICE\_EXP_t$$

Constraints of the model are the following:
– yearly production of a fuel – not higher than the potential of the source;
– balances between primary and final energy fluxes;
– balance of flows of electrical energy (production, consumption, transmission to or from the power grid);
– meeting the demand for heat;
– balance between capacities of technologies and energy production by these technologies;
– constant ratio between electrical and thermal energy for each technology (constant co-generation co-efficient);

– zero output in summer, in the case of solid fuel technologies, used by individual, dispersed residents (individual consumers equipped in small solid fuel boilers turn these boilers off in summer period and produce hot water only from the sun energy or electricity);
– zero output in spring, autumn and winter in the case of electrical boilers producing hot water;
– seasonal variation of power of solar panels (for the rest of the technologies installed power is constant throughout the year);
– compatibility of some technologies and some sources of fuel while incompatibility of others;
– compatibility of some technologies and some sectors, while not compatibility of others;
– equality of the two following variables (in the case of sectors with individual, dispersed boilers):
  • share of thermal energy produced by a technology in the total thermal energy production of the sector,
  • share of the installed thermal power of this technology in the total installed power of all technologies installed in the sector.

The equation representing the relation between capacity of fuel sources and fuel production is the following:

$$\forall_{f \in F} \ \forall_{t \in T} \ \sum_{g \in G} q\_fuel_{f,g,t} \leq POT_{d,t}$$

The balance between primary energy of fuels consumed and the energy produced is the following:

$$\forall_{g \in G} \ \forall_{t \in T} \ E_g \times \sum_f q\_fuel_{f,g,t} = \sum_{s \in S} \sum_{i \in I} \left(prod\_el_{g,s,t,i} + prod\_tb_{g,s,t,i} \right)$$

The balance of electrical energy is described by the following formula:

$$\forall_{g \in G} \ \forall_{s \in S} \ \forall_{t \in T} \ \forall_{i \in I} \ \ D\_EN\_EL_{g,s,t,i} = prod\_el_{g,s,t,i} + imp_{g,s,t,i} - exp_{g,s,t,i}$$

The condition of satisfying the demand for heat is the following:

$$\forall_{g \in G} \ \forall_{s \in} \ \forall_{t \in T} \ \forall_{i \in I} \ \sum_{g \in G} prod\_en\_tb_{g,s,t,i} \geq D\_EN\_TH_{s,t,i}$$

The balance of power installed is the following:

$$\forall_{g \in G} \ \forall_{s \in} \ \forall_{t \in T} \ \forall_{i \in I}$$

$$prod\_en\_el_{g,s,t,i} \leq pow_{g,s,t} \times MAX\_WORK_{g,i} \times COGEN_g,$$

$$prod\_en\_tb_{g,s,t,i} \leq pow_{g,s,t} \times MAX\_WORK_{g,i} \times (1 - COGEN_g)$$

and

$$\forall_{s\in S} \ \forall_{t\in T} \ \left(\sum_g pow_{g,s,t} \times (1 - COGEN_g)\right) \times EN\_POWER_s \leq \sum_i D\_EN\_TH_{s,t,i}$$

The constraint resulting from constant quotient - electrical energy / thermal energy produced by each technology in every period of every year is as follows:

$$\forall_{g\in G} \ \forall_{s\in} \ \forall_{t\in T} \ \forall_{i\in I}$$
$$produ\_en\_el_{g,s,t,i} \times (1 - COGEN_g) = produ\_en\_th_{g,s,t,i} \times COGEN_g$$

Production of hot water by small, individual boilers supplied with solid fuels in summer is as follows:

$$\forall_{g\in G3} \ \forall_{s\in S} \ \forall_{t\in T} \ \forall_{i\in Isummer} \ \ produ\_en\_th_{g,s,t,i} = 0$$

Production of hot water by electric boilers in autumn, spring and winter is the following:

$$\forall_{g\in G1E} \ \forall_{s\in S} \ \forall_{t\in T} \ \forall_{i\in Iwinter} \ \ produ\_en\_th_{g,s,t,i} = 0$$

Decreasing power of solar panels in the winter period is as follows:

$$\forall_{g\in G1S} \ \forall_{s\in S} \ \forall_{t\in T} \ \forall_{i\in Iwinter}$$
$$produ\_en\_th_{g,s,t,i} = COEF\_SOL\_WIN\_SUM \times MAX\_WORK_{g,i}$$
$$\times \frac{\sum_{i\in Isummer} produ\_en\_th_{g,s,t,i}}{\sum_{i\in Isummer} MAX\_WORK_{g,i}}$$

Each fuel source in the model is related to some technologies. This relation (compatibility of some fuel sources with some technologies) can be represented by logic or arithmetic relations. In the model arithmetic way is used. The constraint is represented by declaring fuel transfers between these fuel sources and these technologies which are not compatible as equal to zero. It is written as follows:

$$\forall_{t\in T} \ \forall_{(f,g)\in\{F\times G\}\setminus A} \ \ q\_fuel_{f,g,t} = 0$$

Each technology in the model is related to some demand sectors. This relation can be represented by logic or arithmetic relations. In the model arithmetic way is used. The constraint is represented by declaring the power of some technologies in some sectors as equal to zero (when they are not compatible). It is written as follows:

$$\forall_{t\in T} \ \forall_{(g,s)\in\{G\times S\}\setminus B} \ \ power_{g,s,t} = 0$$

Proportionality of thermal energy produced by a technology to the contribution of the power of this technology to the total installed power of the sector is described below. It concerns sectors of consumers with individual boilers and only those periods when thermal energy is used both for heating and for hot water production (not summer). The constraint has the following form:

$$\forall_{g \in G2} \ \forall_{s \in S} \ \forall_{t \in T} \ \forall_{i \in Iwinter}$$

$$\frac{produ\_en\_tb_{g,s,t,i}}{\sum_g produ\_en\_tb_{g,s,t,i}} = \frac{pow_{g,s,t}}{\sum_g pow_{g,s,t}} \times (1 - COGEN_g)$$

5. Conclusions

Existing models for the optimization of development of local energy systems have numerous disadvantages which limit their usefulness in the process of designing a strategy of meeting local energy needs by local administration (which is required by Polish Energy Law). In this paper a methodology of construction of a dynamic, non-linear model for optimization of local energy system is presented. The methodology leads us to the construction of a mathematical model which may be a good starting point to develop a simple software package well suited for local authorities. The model is a tool which combines various types of final energy and consumers - both connected and not connected to the power grid or the district heating system). The model considers local conditions in a very detailed way (local resources, residual infrastructure, local – sectorial demand for energy). The decision variables reflect only those factors which may be influenced by local administration, while all factors beyond the local authorities are given (exogenic). The model reflects both private and external costs and is designed to find socially (not privately) optimal technologies and fuels (for each sector of the given municipality). It corresponds with the Central European environment (customer behavior, grid infrastructure, etc.). The tool, when combined with a proper software (for example *General Algebraic Modeling System*), may constitute a simple and user-friendly package dedicated to municipal administration and can be helpful in the process of preparing plans for supplying a local community in final energy. It will be able to find and show exactly the optimal evolution of the existing (residual) energy infrastructure. The results of the calculations executed by such a mathematical software tool will include the power and energy production of all considered technologies (year by year), optimal fuels and yearly emissions of pollutants.

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Using case study for tertiary education in the field of economics

1. Introduction

A case study is a popular method adopted by academic teachers and an effective instrument for sharing their knowledge and experience with students. It enables not only to observe particular stages of a single process taking place in a given organization, but also to understand analogical or similar processes occurring in other market entities [4]. Furthermore, case studies allows both students and teachers to think critically and analytically. It has a profound effect on their creativity, effectiveness in noticing market opportunities and threats to their solutions, as well as motivation to accomplish their goals. It shows them how to present and defend their ideas, enables them to acquire confidence in their abilities and skills, develop their ability to take decisions and help them integrate theoretical and practical knowledge.

Keeping in mind the above characteristics, it is relevant to analyse ways in which the case study method is used for tertiary education in the field of economics. The problem will be verified on the basis of results of a questionnaire survey addressed to students of economics and related fields of study

2. Case study vs. the educational process

Literature on the subject distinguishes a number of practical uses of case studies as a tool supporting the didactic process. Królikowska mentions the following stages in employing case studies for educational purposes:
– establishing a diagnosis based on a problem suggested by the teacher or chosen by students themselves;

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– seeking solutions in line with the already established criteria for solving the problem;
– discussing possible solutions in order to enable students not only to present their opinions on feasible solutions to the problem, but also to take a common position;
– transferring conclusions into a real-life situation thanks to which students may verify the usefulness of knowledge acquired during classes and confront it with real problems arising from resource management [4].

A completely different approach is held by Werd who proposes the following stages in using case studies as a teaching method:
– identifying the problem;
– defining the aim of the case study;
– formulating the question, thesis or hypothesis;
– answering the question posed or verifying the thesis/hypothesis;
– determining the data collection method;
– determining the time devoted to the case study;
– defining the sources of information useful for getting to know issues under consideration;
– collecting data;
– analysing data and drawing conclusions to be used in further studies [8].

Another useful approach is held by Labov. He is inclined to believe that case studies for educational purposes should include the following stages:
– summary of a problem – should illustrate the problem described by means of a given case;
– focus on the problem – one should answer the following questions: who? (who is dealing with the problem), when? (moment in time when the problem is being faced), what? (description of the root of the problem), where? (place of the problem occurrence);
– consequences following from the problem – one should describe the consequences following from the problem under study;
– assessment – one should perform a synthetic analysis of the effect that the problem has on environment;
– final result – presenting solution to the problem;
– conclusion – verification of problem solutions based on the analysis in stages no 3 and 4 [5].

Having in mind the aforementioned methodological remarks, it seems reasonable and universal to adopt the model proposed by Greenhalg, which is shown in Figure 1. Subsequently, the model will be supplemented by practical remarks made by the author of the present paper.
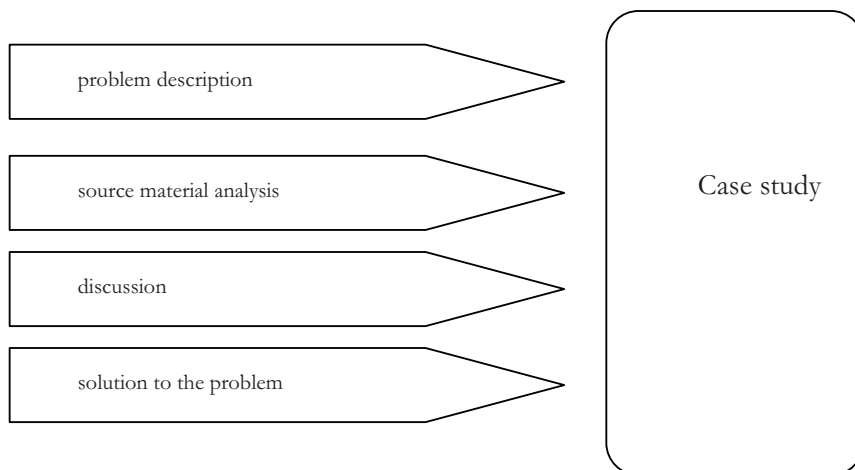
Figure 1. Model presenting the implementation of case studies for educational purposes

Source: own elaboration based on [1 , pp. 181–194]

The above model consists of four stages. The first stage, i.e. description of the problem, involves a comprehensive analysis of the issue under discussion. Here attention should be paid to the fact that while describing the problem, it is crucial to use plain and understandable language. In case of using specialist terminology, a glossary of terms should be included at the end of case study. Furthermore, the problem under analysis ought to refer to a real-life situation which, in turn, finds reflection in the curriculum followed during classes. In fact, only understandable problems that bear resemblance to reality may interest students and make them involved in creative solution-seeking. As a result, goals set by the teacher can be accomplished. At this stage of the study, a pedagogue ought to select a thematic area to which the problem will refer and organize (if possible) meeting between students and specialists, i.e. people experienced in certain area. Such a meeting is to prepare students for solving a given problem. If it is not possible for both groups to meet, the teacher should make use of practical materials, namely reports, articles, TV programmes and radio broadcasts. Furthermore, it is essential for the material to be relevant and appropriate to the essence and form of a given case.

The second stage involves the analysis of source material. The verification of material may consist in reading the excerpt of case study description or watching relevant audio-visual recordings. The teacher's main objectives are as follows: creating an atmosphere favourable to reading or watching film material,

answering every question asked by students, and determining the span of time during which they should get to know the material presented.

The third stage is a discussion held between students and the teacher. It is aimed mainly at exchanging their views on the case. What is of major importance here is the way in which the teacher leads the discussion.

To be more specific, three types of discussion can be distinguished, namely group discussion, subgroup discussion and face-to-face discussion:

– Group discussion – once a given case has been introduced, discussion is held and moderated by the teacher in order to select an optimum solution. At this stage, it is extremely useful to write down opinions expressed by discussion participants (i.e. students), e.g. on a blackboard, flipchart, etc. This is aimed at presenting both students and the teacher with possible alternatives. Furthermore, such a discussion enables its participants to avoid repeating possible solutions. Everyone is free to present their ideas and thus has a chance to be appreciated. Last but not least, group discussion facilitates the selection of optimum solution through eliminating the least effective alternatives.

– Subgroup discussion – involves dividing the group into subgroups whose members confront their views and eventually adopt a common position. Subsequently, the group leader presents the remaining groups with conclusions that his/her group has drawn. Just as in the case of group discussion, it is helpful if the teacher (moderator) or leaders of particular groups write down opinions expressed by each group, e.g. on a blackboard, flipchart, etc. Once all the views have been presented, discussion is held again by the entire group of students and moderated by the teacher in order to select optimum solution.

– Face-to-face discussion – this form enables discussion participants to share their views with another person (as the name suggests – it is held between two people). Subsequently, the teacher moderates the exchange of views among all the students [2].

The teacher performs a fundamental role in the discussion. He/she encourages students to voice their opinions.

The last stage of the process entails problem solving. In the course of analysis and discussion, the group should select the optimum solution. Depending on the issues under consideration, several alternatives may be agreed upon. Nonetheless, numerous studies [6; 7; 3] have confirmed that choosing one solution is the most effective from the perspective of didactic process. Therefore, the teacher ought to summarize all the opinions expressed by the discussion participants, establish (together with the group) criteria for selecting certain solutions and discuss the strengths and weaknesses of particular alternatives in order to eliminate the least valuable solutions.

Bearing the above in mind, it is relevant to analyse the effect of the case study method on tertiary education in the field of economics.

3. The results of questionnaire survey

In order to accomplish the main goal of the present paper, questionnaire survey was conducted and addressed to students of economics and related fields at the University of Szczecin. The survey was undertaken as part of the project entitled "Using case study method for improving the quality and effectiveness of tertiary education in the field of economics" carried out in the framework of Scientific cooperation between Eastern Europe and Switzerland (SCOPES). The main tool was a structuralised questionnaire addressed to 150 students. All in all, 134 correctly filled in questionnaires were returned. The survey was carried out between November 2011 and January 2012.

As far as the characteristic of respondents is concerned, it should be stated that female students represented 57% of survey participants, whereas male students constituted 43%. The majority (84%) attended first cycle studies (BSc), while 14% of those surveyed attended second cycle studies (MSc). With reference to the fields of study, most respondents studied finance and banking (35%) as well as management (30%). On the contrary, the lowest percentage of those surveyed studied economics (16%) as well as information science and econometrics (9%).

Once the criteria for population division are known, the subject matter may be analysed comprehensively. To begin with, the respondents were asked to enumerate teaching methods adopted by academic teachers during lectures and classes. Figure 2 below presents detailed results.
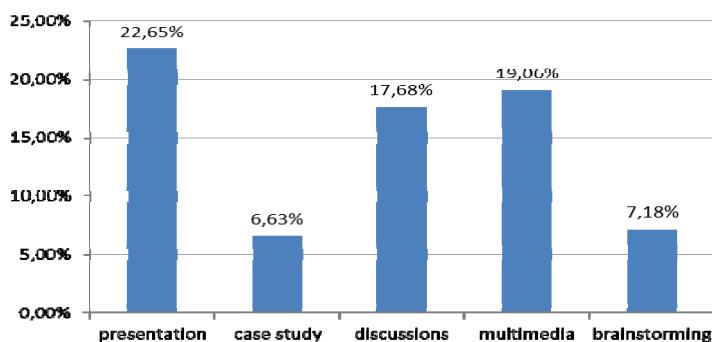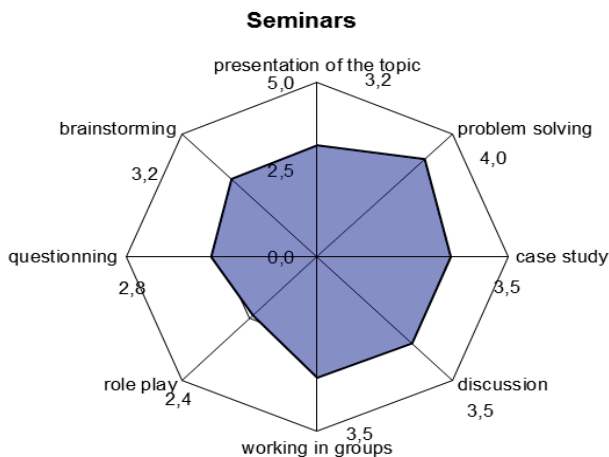

Figure 2. Presents methods employed during lectures

Source: own elaboration based on the questionnaire survey

According to the respondents, the most popular teaching method employed during lectures was power point presentation (22.65%). Other options selected by considerably high percentage of students were multimedia (19.06%) and discus-

sions (17.68%). Case study (6.63%) and brainstorming (7.18%) were variants chosen by the lowest proportion of respondents. As for teaching methods adopted by academic teachers during classes, it could be noticed that every third respondent mentioned presentations (34%), whereas every fourth (24%) – multimedia. Furthermore, 21% of students selected discussion, 17% – brainstorming, and 4% – case study. It is interesting to look at the structure of answers divided by the level of studies. With respect to methods employed during lectures, 42% of respondents attending first cycle studies (BSc) considered presentations as the most popular teaching method, whereas 29% of students attending second cycle studies (MSc) regarded discussion as a method willingly employed by their teachers. A similar tendency is observed as far as methods adopted during classes are concerned. **The former mentioned presentations (38%), whereas the latter indicated case study (28%).**

The above structure of answers will be supplemented by opinions expressed by the students on effective teaching methods in the field of economics. **In order** to present the results in a transparent way, average weights were adopted on a scale from 1 to 5 (where 1 indicates extremely low effectiveness and 5 implies extremely high effectiveness). At first the respondents were asked to select effective methods to be employed during lectures. The majority of respondents mentioned presentation (average weight 4.32), case study (average weight 4.18), discussion (average weight 2.9), working in groups (average weight 2.6) and brainstorming (average weight 2.3). Furthermore, the respondents were asked to choose the effective methods to be followed during classes. Figure 3 presents detailed results.

Figures 3. Effective teaching methods to be employed during classes

Source: own elaboration based on the questionnaire survey

The majority of students regarded problem solving (average weight 4.0), case study, discussion and working in groups (average weight 3.5) as effective teaching methods adopted during classes. Role play was the least popular among the students participating in the survey (average weight 2.4). Analysing the results by the fields of study, it can be stated that respondents studying management as well as finance and banking considered case study and discussion the most preferred methods to be followed during lectures and classes. On the contrary, respondents studying information science, econometrics and economics mentioned presentation. **This certainly stems from differences in curricula followed in the case of particular specializations.**

The survey results presented so far indicate that the respondents appreciate methods that provide them with access to practical knowledge. Nevertheless, they claim that methods employed most willingly by their teachers are the least effective. At the same time, they call for a practical dimension to classes, among other things discussing case studies more often. Therefore, for the sake of the present analysis it is of great use to get to know arguments „for" and „against" employing case studies for tertiary education in the field of economics (Tab. 1)

Table 1

Arguments for and against using case studies for educational purposes

For	Against
Comes in a number of forms and requires using various techniques	Not every curriculum can be implemented in the form of case study
Makes students more active during classes	
Enables students to develop the ability to analyse cases critically	Teacher may lose control over students during the discussion
Enables students to become involved in teamwork and to be more precise: resolve conflicts, negotiate, communicate, seek new solutions	Lack of time to discuss case study during classes
Enables students to solve real problems with the functioning of certain organizations	Unwillingness to prepare for classes

Source: own elaboration based on the questionnaire survey

According to the students participating in the survey, case studies allows to adopt various forms and techniques of knowledge transfer and hence can be a universal tool to be employed during classes with different groups of students. Not every group will be able to **become involved in effective brainstorming.** However, there are a number of alternative instruments such as teamwork,

metaplan, simulation game, etc. thanks to which the teacher may analyse a given case study. Furthermore, according to the respondents, case studies used in teaching process encourage students to show greater interest and activity during classes. What is more important, while preparing for case study analysis, students have to gain adequate knowledge and hence become more self-reliant and responsible for the results of their work. Another argument for using case studies to teach curriculum content (mentioned by the respondents) refers to teamwork which enables students to develop number of skills, namely to present their ideas, communicate, negotiate, seek compromise. **Furthermore, it should be emphasized** that while solving case study students learn how to perform a critical analysis and take decisions.

It is also worth mentioning that case studies offers a chance to deal with real problems. Students highlight the fact that they are emotionally involved and identify with a given situation, which enables them to get to know their attitudes and behavioural patterns. Furthermore, one should bear in mind that students learn from one another via observation and gain knowledge thanks to learning by doing principle. The last-mentioned aspect is particularly crucial as the teacher may immediately prove the usefulness of a proposed solution.

Apart from arguments for adopting the case study method, the respondents also offered arguments against it. First of all, not every curriculum subject and content can be taught with the use of case study. Statistics and econometrics are very often quoted as examples. Nevertheless, one should keep in mind that case studies do not always have to refer absolutely to the aforementioned content. Sometimes the case under discussion may be connected indirectly with issues presented during classes. The main aim is to guide **students toward proper think**ing pattern. According to the respondents, another argument against is the fact that the teacher may lose control over the group during the discussion. Such a risk is always present during classes regardless of the fact if a case study is being discussed or not. In this context, the risk is the more serious, the less the teacher's ability to cooperate with the group. Needless to say, this ability depends on his/her experience and personality.

 A high percentage of students suggest that the curriculum does not allow to use case study for every subject and hence during every class. The lack of time for accomplishing such tasks is another problem. This is a debatable argument since, as it has already been proven, adequate preparation of case study (the formulation of questions, aim of case study, selection of source material, or form of presentation) allows to follow curriculum content practically and not theoretically. At the same time, learning units can be adjusted to the official curriculum.

The last argument advanced by the respondents is students' unwillingness to prepare properly for discussing and thus solving case study. And again it is

beyond any doubt that this argument is not very convincing since nowadays people are expected to improve and develop their skills and abilities. Therefore, while preparing for case studies students acquire knowledge and experience, and thereby develop their ability to think analytically and synthetically.

4. Conclusion

Summing up, it should be stated that the respondents consider case studies an effective tool, yet rarely used for knowledge transmission. Students are unanimous as to the fact that case study method not only enables them to acquire theoretical knowledge but – what is more important – to develop a number of skills they will certainly need in the future. The most essential skills include: critical analysis of information received, communication, presentation of one's own ideas, negotiation, teamwork. Furthermore, the respondents are inclined to believe that thanks to the method under discussion they can confront theory with practice, which only underlines the sense of education.

Nevertheless, in order to attain their goals with the use of case method, teachers need special preparation and training. They are the heart of every case study discussed during classes. They set standards and framework for solving the case. Therefore, it is strongly recommended that teachers adopted methodical suggestions presented in the article. These suggestions may certainly be subject to modification. All things considered, they are a set of rules to be followed by teachers and a foundation for solving every case study.

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Commercial hospitality as a business model in the independent hotel company

1. Introduction

Research and studies clearly show that commercial hospitality is one of the world's oldest businesses.

It is considered as a fact that, although hospitality is rooted in culture as the social behaviour and the cultural form, it also has its social and economic attachment. Therefore, it is assumed that aspects which shape the expected standards in relationships based on hospitality (hospitality relationships) are the most important in the commercial hospitality services.

Until recently hospitality professionals have had a good reputation in the society. Nowadays, the platform of knowledge and vocational education of hospitality professionals is being built from the beginning in Poland as well as abroad. It is also under debate how to create the importance of hospitality professions to the other service professions.

The quality and the value of the hospitality service both in Polish and international hospitality business is being more and more carefully considered by its buyers (clients and guests) who booked, purchased and consumed such service.

Hospitality services are offered by hotels and restaurants, categorized and non-categorized facilities, functioning as the independent enterprises or in groups as chain facilities. On the other hand, for the last twelve years we have been observing the process of blurring the differences between service and marketing functioning of individual and chain hotels.

The hospitality business is currently also creating the way of benchmarking and integrative functioning, which means that similar hotels of the same category

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or service specialization (e.g. city hotels, conference hotels or wellness hotels) are entering into some marketing or pricing alliances.

In this article, the author does not undertake the comparison and identification of the differences of business models between the independent and chain hotels based on commercial hospitality standards. There is also no presentation of a model and operational value chains offered in the different types and kinds of hospitality facilities such as wellness hotels, business hotels, design hotels, conference hotels or hotel condominiums.

What seems to be important for the author at this stage of his research in the matter of commercial hospitality is the attempt of defining the meaning and the proper understanding of the difference between the commercial and non-commercial hospitality in order to determine its proper application in the economic management of the independent hotel company. The importance of this matter and its practical application result from the author's experience (over 40 years) in the operational positions (including 30 years in managerial positions) in Polish and foreign hospitality business.

Statistically, independent hotels (categorized and non-categorized facilities) make 88% of the hospitality market in Poland (according to the research conducted by the company K&P Consulting in 2012 and the Polish Academy of Hospitality in 2011). The author's own research (as a academic teacher and hospitality coach) shows clearly that the commercial hospitality in managing the hotel company is not identical for the hotel managers with the hotel management based on their own concept of the commercial hospitality. The survey conducted in 2011 among 240 hotel managers from the hotels located in four Polish host cities of UEFA EURO 2012 showed that 96% of pollees had not undertaken to create their own business model based on the commercial hospitality management.

When properly profiled and implemented in the hotel or restaurant company, commercial hospitality can become an innovative business model for this particular hotel or restaurant. Moreover, the implementation of such a model results in more effective marketing management.

Establishing a broader context is an important part of the debate on the application of commercial hospitality as the innovative business model. It should define the conditions resulting from the type of activity and the specificity of the industry, where commercial hospitality is provided, that is the hospitality business and the hospitality industry.

Hospitality business is a specific type of economic activity focused on profit, in which an entrepreneur earns income from reception of guests and guest service at the hotel or restaurant. The hospitality business can be performed all year-long, seasonally or occasionally on land, water or in the air. The subject in hospitality business is a tourist – traveler, who goes on a journey outside his

usual environment for any main purpose (business, leisure or recreation etc.) and uses the services of the hotel or restaurant, becoming a major participant of the hospitality business – guest (in case of a hotel) or consumer (in the case of a restaurant). In other words, hospitality business is oriented to the supplying of the paid hospitality services.

Meanwhile, hospitality industry is the term broader than hospitality business. It refers to the structure, potential and types of entrepreneurs engaged in the hospitality business in a specific area with all kinds of cooperations and connections, which enable the correct economic and organizational operation of a single company – the hotel or restaurant investment. In this context, one can speak of hospitality industry of a country, city or region as its potential with the certain level of organization and the diverse structure of hotel and restaurant units.

It should be noted that hospitality business regionally enters a phase of "competitive integration", which means that the promotion policy of the touristic areas will support the development of service quality in the independent hotel or restaurant companies for the domestic and / or international client (guest or customer).

A low or high level of organization in the hospitality industry results, among others, from the type and quality of cooperations operating for the hospitality business in the specific area (on many levels – local, regional or national level). This is accompanied by the quality of the hospitality services in the strict sense provided by hotels and restaurants as well as their value which is more accurately assessed by the clients and guests who paid for it. This assessment is carried out at each stage of hospitality service provision – at the time of booking, purchasing and its consumption. More and better-educated clients (guests or consumers) seeking and expecting from the service provider the higher quality and standard of services, even "forces" on the hotel or restaurant entrepreneurs such level of organization of their services (resulting from the implementation of the appropriate model of commercial hospitality), which let the host focus his attention on the correct and reliable guest service.

In the current market situation and in this strongly competitive environment, not gaining or losing a client becomes too expensive, which is why more and more importance is given to the quality and standard of services. They are influenced by the way of offer and personnel management, establishing the proper relations with suppliers and – moreover – by the model of commercial hospitality and how it is managed (this model should be profiled individually for each hotel or restaurant business, with regard to its offer individuality and the needs of its base or alternative client).

While hotel chains will still care for their standardized, brand image, whereas the independent hotel companies will create and emphasize the uniqueness and

value of their individually profiled commercial hospitality. In this case, the implementation of commercial hospitality as the innovative business model becomes for independent hotel companies the way to strengthen their market position.

2. The concept of hospitality in services

The starting point for discussion whether commercial hospitality can become the innovative business model in the hotel or restaurant companies, should be the clarification of the essence of this type of hospitality as well as the answer to the question about the differences between the proposed by the the author's definition of hospitality and the previous research in this matter.

Previous studies on the issue of hospitality show the rather variable and fluid use of the terms "hospitality", "commercial hospitality" and "hospitality management". The term "hospitality" is defined and used by most of the researchers in a quite indistinct and unsatisfactory manner and the concept of hospitality seen in the context of its structural or behavioural characteristics is a relatively young research topic. What is the subject of the scientific debate of the researchers from the various university centers (mainly in the English-speaking countries) is the question whether hospitality should be conceived as a product, a process, an experience, or all three(!).

The example of a relatively general definition of hospitality is one by Ewout H. Cassee, who defined it as "a harmonious mixture of tangible and intangible components – food, beverages, beds, ambience and environment, and behaviour of staff" [3, p. XIV].

On the other hand, there is also a tendency to narrow the field of research when it comes to the hospitality and focus only on the commercial or economic dimensions of hospitality to look at the hospitality through the prism of a product or a service process. For example, Mauritis C. Tideman defined hospitality as "the method of production by which the needs of the proposed guest are satisfied to the utmost and that means a supply of goods and services in a quantity and quality desired by the guest and at a price that is acceptable to him so that he feels the product is worth the price" [9, p. 1]. In turn, Yann Pfeifer, from a strongly supply-side economic perspective, said that "Hospitality consists of offering food, beverage and lodging, or, in other words, of offering the basic needs for the person away from home" [6, p. 191]. Going forward, Peter Jones came to the conclusion that "the term 'hospitality' has emerged as the way hoteliers and caterers would like their industry to be perceived ... In essence hospitality is made up of two distinct services – the provision of overnight accommodation

for people staying away from home, and the provision of sustenance for people eating away from home" [5, p. 1].

Relatively the most widely recognized (though not undisputed) definition is one by Bob Brotherton, who said that hospitality is "a contemporaneous human exchange, which is voluntarily entered into, and designed to enhance the mutual wellbeing of the parties concerned through the provision of accommodation and food or drink" [2, p. 168].

The lack of widely recognized and accepted by most of the researchers uniform definition of hospitality, which would define the true essence of this concept, makes it difficult to construct the theory of knowledge on hospitality. The analysis of the previous studies shows that the idea of hospitality research exists more in form than in substance. What is common in all the above mentioned definitions of hospitality is that the place, where the professional commercial hospitality management – due to the host-guest relationship – is held, is not clearly enough emphasized. And that is essential for the presented issue, because the process innovation requires a strict defining of the place where it is implemented.

The starting point for giving the author's definition of commercial hospitality was to define non-commercial hospitality in the broad sense as a set of natural, direct, genuine and kind behaviours and actions of hosts and their representatives towards guests arriving and staying in known and unknown for them place, who expect from them (hosts and their representatives) such behaviours. This definition refers to the people's private sphere in general and can be also used for describing their social or institutional, non-commercial relations.

One of the important features of hospitality is that guests can use it on a non-commercial or commercial basis and that is the reason for defining hospitality with reference to services provided on the commercial basis in the hospitality business. According to the author, commercial hospitality is a set of conventional and unconventional behaviours and actions put into practice on a commercial basis by the professional service providers and realized through preparation to and process of guest service at the hotel or restaurant. Those actions act positively on guests' mood and behaviour during their staying at the hotel or eating in the restaurant. Commercial hospitality begins with the professional ability of inviting the clients and ends with just professional ability of bidding the guests farewell.

What distinguishes commercial hospitality management from non-commercial hospitality is that non-commercial hospitality may be given both by amateurs and professionals but commercial hospitality management can be performed only by commercial hospitality professionals. For this reason, defining the hospitality management combines not only the management and hospitality, but also indicates the existence of a profession related to the commercial hospitality management and all the related issues.

3. Non-commercial hospitality vs. commercial hospitality

In order to analyze the possibility of using commercial hospitality as an innovative business model in the operation of hotel or restaurant companies, it is crucial to define the features differentiating hospitality provided on the commercial basis from the non-commercial hospitality (Tab. 1):

Table 1

The comparison of features of non-commercial and commercial hospitality according to the behavioural criterion

NON-COMMERCIAL HOSPITALITY	vs.	COMMERCIAL HOSPITALITY
Cordiality	replaced by	kindness
Honesty	replaced by	openness
Politeness	replaced by	courtesy
Forbearance	replaced by	tolerance
Familiarity	replaced by	distance
Confidentiality	replaced by	discretion
Personal thoughtfulness	replaced by	professional responsibility for: – interpersonal safety – servicing safety – material safety
Personal uprightness: – information uprightness – commitment uprightness – material uprightness	replaced by	personal reliability: – service reliability – report and accounts reliability – information reliability
Natural uncessantness	replaced by	committed consistency
Casual behaviour	replaced by	procedural action
Emotional behaviour	replaced by	motivated action
Natural and personal engagement	replaced by	aware and professional engagement
Provided free of charge	replaced by	provided for a payment
Non-commercial hospitality is extended disobligingly – individually and collectively – as a reflection of one rule: people for and towards people	vs.	Commercial hospitality is created and extended – individually and collectively – by professional service providers towards hotel & restaurant guest

Non-commercial hospitality is rooted in culture and the commercial hospitality is rooted in economics.

3.1. The structure of commercial hospitality

Commercial hospitality begins with the professional ability of inviting guests (or clients) and ends with just the professional ability of bidding them farewell. Between the process of inviting and bidding guests farewell, there is the whole sphere of tangible and intangible service elements, which make the commercial hospitality gain acceptable and satisfying to the client value.

The structure of commercial hospitality is based on four pillars:
– inviting hospitality,
– welcoming hospitality,
– service hospitality,
– farewelling hospitality.

Those four above mentioned pillars are tightly integrated with each other and that is why none of them can work separately. The infirmity or weakness of one of them affects the quality and durability of the construction of commercial hospitality as a whole (the commercial hospitality is the means for building an individual business model for the hotel or restaurant company) (Fig. 1).

WELCOMING

INVITING — COMMERCIAL HOSPITALITY — SERVICE

FAREWELLING

Figure 1. The structure of commercial hospitality – the process model

Source: own elaboration

Inviting hospitality – used at the stage of communicating the offer with the market – is the whole of marketing activities undertaken to persuade the client and guest as a customer to take a decision about choosing and ordering the offer of a specific hotel or restaurant. The inviting hospitality is, among others, comprised of: PR and branding activities, internet marketing, loyalty programmes designed for guests (clients) who repeat buying the services of a the same hotel or restaurant as well as the communication system which is used to maintain the relationship with guests who

don't take part in loyalty programs (especially those satisfied with the proper high quality service, so they are willing to return or promote this specific hotel or restaurant by providing the positive feedback on the specific hotel or restaurant).

Welcoming hospitality is comprised of all activities and behaviours of service personnel and managerial team of the specific hotel or restaurant, which are related to the service of a guest's arrival and reception at the hotel or restaurant starting from the arrival and the checking-in as well as on his way to the hotel room or other areas where the hospitality service is provided. They will also be all the activities undertaken prior to the client's arrival, who has already made the booking, which consist in giving him all the additional information and the provision of service known as a "personal concierge".

Service hospitality is understood as a complete and consistent with all standards and procedures of guest service staying in the hotel or eating in the restaurant; it is received by him in the place where the service is consumed (purchased), e.g. in a hotel room, restaurant, bar, conference room or in wellness & spa area.

Farewelling hospitality is comprised of all activities and behaviours of service personnel and managerial team that close the process of guest service leaving the hotel or restaurant. Those activities are also a smooth transition to re-inviting guest to return to this specific hotel or restaurant. This set of activities plays an important role in guest service; it may become the opportunity of "forgiving" minor mistakes that may have occurred during one's stay and sometimes to settle the client's claim. That is why it is crucial that the managers are present during the process of inviting and bidding guests farewell.

At each stage of performing the hospitality service there are different procedures and standards, which all are necessary to achieve guest satisfaction and to build the proper relationship with him. Commercial hospitality which is properly applied and managed affects the whole service process at the hotel and the restaurant. It mustn't be perceived as the added value as it is the integral element of the full value of the service expressed in the price and paid by the client or guest.

What never changes in the hospitality services, is that: the staff expresses and provides the commercial hospitality and guests experience, feels and pays the host (as entrepreneur) for the commercial hospitality.

4. Key elements of the business model based on commercial hospitality

The positive relationship and emotions between the host and guest are the economic advantage and a value in itself. Therefore, commercial hospitality management requires a process approach as the economic success of the hospitality

business is also or primarily based on the quality of the staff who is aware, understands and is engaged in the service performance. The quality of staff, standards and procedures can be included in the individual model of commercial hospitality, which may secure the conditions for better, undisturbed and economically effective management of the hotel or restaurant company.

The implementation of commercial hospitality as the individual business model results in effective distinguishing the company from the competition as the business model is by which a firm builds and uses its resources to offer its customers better value than its competitors to produce a sustainable competitive advantage. In this view, a business model can be conceptualized as a system made up of components, link between the components and dynamics [1, p. 19].

The model of commercial hospitality developed and prepared to implement in the independent hotel company should be based on ten fundamental elements: 1) customer segments, 2) value proposition, 3) communication, distribution and sales channels, 4) the customer's relationship, 5) revenue streams, 6) key resources, 7) key activities, 8) key partnerships, 9) the cost structure and 10) ways of preserving the model.

Customer segments: in a modern, highly diversified hospitality business considering the different categories and types of hotels, the key to the customer segmentation is the classification of client which distinguishes two general customer segments – the base client and the alternative client. The base client through a continuous, repetitive use of the paid hotel services should secure the profitability of the hotel company. Whereas the alternative client is a type of client which will be „reached" by the hotel marketing in the periods of lower activity of the base client in order to secure the projected occupancy level as well as the sales of the other services provided by the hotel or restaurant. Customer segmentation according to the key of base and alternative client depends on the specificity and the service individuality of the hotel or restaurant; the economic existence will be differently protected by the city business hotel and differently by the wellness & spa hotel located in a tourist or health resort, etc. Prior to the development of customer market analysis for the specific hotel, one must know and understand the scope of the basic needs which should be met to satisfy the base and an alternative client.

Value proposition: a hospitality company as a business organization tries to solve customer problems and satisfy their needs using the value proposition which is expressed in the price and service offer of specific independent hotel company. In hospitality business equally important for the entrepreneur values are: 1) a guest who arrives and purchases the hospitality service for the first time, 2) a satisfied guest who – more or less frequently – returns to the specific hotel and purchases its services (prosumer 1), 3) a satisfied guest who

doesn't return to the specific hotel but promotes on his own the services of this hotel (prosumer 2). In other words, gaining in the expected number the guests arriving for the first time as well as returning guests will be the value for the hospitality business.

Communication, distribution and sales channels: communication, distribution, and sales channels comprise a company's interface with customers. Through them hotel service offer (with proposition and value accents) reaches the appropriate customer segment and gets directly to the client. While building the right mix of communication and sales channels, it is important to remember that they should allow to reach directly the appropriate segment of the base client. Often, there are too many distribution channels used as the managers trying to protect themselves widely "spread" information on their hotel offer. Meanwhile, it is important to establish the appropriate distribution channels to each segment of the base client to get through to the chosen client with the offer. Besides spreading the information on the hotel offer on the customer market, the communication channels serve several functions, e.g. they help providing post-purchase customer relationship management.

Customer relationship: this element of the business model should describe: the relations at the stage of gaining clients and guests, relations at the stage of maintaining the relationship with guests and clients who used the services of the specific hotel or restaurant as well as the occasional relations with the segment of base and alternative client using to secure the additional sale of the services provided by the hotel or restaurant. Nowadays, as the number of offers and their diversity begins to "overwhelm" the customers and maintaining the direct relationship with them becomes more and more difficult, the way of preserving this specific element of the model starts playing the important role.

Revenue streams: in case of the hotel company, it is important to select and combine such revenue streams from the chosen market segments of base and alternative client in order to achieve the projected gross operating profit (GOP), which is the basis for calculating the profitability of the specific hotel company. „If customers comprise the heart of a business model, revenue streams are its arteries" [7, p. 34]. Moreover, it is possible that with a very good direct communication and relationship with the base client, each revenue stream will be based on a different price mechanism (fixed, seasonal, occasional, promotional, loyalty, etc.).

Key resources: when building the business model of the hotel company, it is important to establish (for the newly opened hotels) or reconstruct (in running hotels) the key resources required for the proper functioning of the model as the process innovation. In the hospitality business very important are the material (tangible) resources, but particularly important are intangible assets – both

human and intellectual. The commercial hospitality will not work without people, regardless of whether it is the professional hospitality but used intuitively or the commercial hospitality applied and implemented as the innovative model in the management of the hospitality company.

Key activities: key activities are those defined as a priority according to the schedule which should be taken by the manager to ensure the efficient operating of the implemented model of commercial hospitality. Key activities in the hospitality business are:

1. to create the systematic work of the general manager as the of strategic element of this model.
2. to preserve the model by its modification, improvement or elimination of unnecessary and outdated assumptions established at the model construction phase,
3. to verify the results of the model operation; in particular those referring to the declared to the guest values and efficiency of revenue streams.

Key partnerships: key partnership is the network of suppliers and partners that make the business model work efficiently. Key partners should be aware whether the hotel company has its own individual model of commercial hospitality and what the key segments of the base client of this specific hotel facility are. E.g. the family hotel providing its services for families with young children (as the base client) requires from its key partner (e.g. food supplier) putting the special attention to the quality and best-before date of the offered products, their freshness and environmentally-friendly features.

In collaboration with key partners one should remember about eliminating all risks resulting from the cooperation agreements.

Cost structure: cost structure should not be confused with the direct costs associated with the operation and maintenance of the hotel property. In this case, the cost structure includes all expenses of the hotel owner referring to the implemented business model which is based on the commercial hospitality. It is obvious that every entrepreneur will accept the business model with low cost structure. On the other hand, there is also the tendency, which may be more appropriate for creating the business model of commercial hospitality, based on cost concentration and expenditures for the value generation and its maintenance. In this case, we can talk about the premium value propositions and a high degree of personalized service which is especially important in today's highly diversified hospitality business [8, p. 45].

Ways of preserving the model: while in many business areas this element of the business model is not essential, in the case of the business model based on the commercial hospitality it is the key issue. Unfortunately, hospitality business is affected by permanent staff fluctuation, even at the managerial level (as

the average duration of employment of a hotel manager in the same company is in Poland not longer than 2.5 years), but the positive result of the proper implementation of commercial hospitality model is building of the strong and permanent team, which will be able to manage the applied model. This way the commercial hospitality can affect not only the improvement of profitability and key indicators used to assess the profitability of the hotel business, but as a business model should also support reducing outflow of the personnel from the properly and well-run hotel company.

The process of implementing commercial hospitality as the business model should be based on the 7-I approach to the hospitality innovation. The seven steps involved in the 7-I process are: 1) inspiration, 2) insight, 3) ideation, 4) initiative, 5) implementation, 6) invigilation and 7) investigation [4, p. 113]. Those steps should be realized one by one as every step depends in part on the preceding one.

Inspiration initiates and guides the change process and the insight helps turn it into results. The level of understanding of the elements and processes of the intended change affects the depth of employee engagement in the change process. It is obvious that the idea must be grounded in reality and that is why all hotel employees (both management and service personnel) should become part of the idea-generating process and its modification according to local needs and conditions, because idea which is not supported by all engaged parts is unlikely to last. The next step of the 7-I process is initiative, which should work as a catalyst between an idea and the implementation stage of the innovation cycle. The implementation of an idea should be based on the assumption that the idea which tests well in one hotel business (e.g. wellness & spa hotel) might fare worse when introduced in the hotel of a different type (e.g. city or conference hotel). Invigilation is the sixth step in the process of hospitality innovation implementing. It helps ensure if the process is running as intended and, if not, it can support modification as needed. The last step of the 7-I process is the investigation of various cause-and-effect relationships and unexpected outcomes that have occurred in the change process.

The assumption and main goal of taking the process of innovation based on implementation of the commercial hospitality and its management in the hotel operation is to achieve better results and higher profitability indicators of the hotel business as well as to implement the simple quality standards and simplified service procedures that distinguish the hotel from its competition. Every time the analytical results should be very clear so that they could be used to refine the process. Implementing an innovation, one should remember that it is a process and that innovations should be modified and adapted to individual needs event at the stage of their implementation until the intended goal is achieved.

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Krystian Nowakowski*

The institutional matrices theory as the basis of explanation of real estate bubble

1. Introduction

Real estate bubbles have occurred in many countries over the last few years. Therefore it is still a very popular and widely explained topic. A lot of authors in their researche try to implement the way of explanation based on the wide range of outlooks often beyond the economy, linking different sciences such as a law, a psychology or biology. Multiplicity of perspectives during the explanation process is the best evidence of complexity of the real estate bubble. The purpose of the article is the explanation of the real estate bubbles which were observed in the United States, Spain and Poland and were disastrous for their economies. The cognitive clarification of such complex process was done on the ground of new institutional economy. This article explains the factors which create the increase beyond the fundamentals using Novosibirsk School of Economic Sociology and Svietlana Kirdina's institutional matrices theory. The research has been performed on the set of institutions conductive to the formation of bubbles. The combination of dominant and complementary institutional matrix crucial for the creation of enormous price growth has been identified and described. The following hypothesis has been formulated: the creation of a real estate bubble is the effect of lack of optimal combination of the dominant and complementary matrices institutions. In the research part of the article there were presented the institutions which influence the balanced structure and create the conditions for the blow of the bubble. Two main areas were examined. First, unintended effects of intervention in the market economy mechanism in the form of establishment of housing finance organizations, social housing policy, and tax and

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subsidies systems. Second, wrongly understood full "liberalization" of market and deregulation of all market processes was examined from the perspective of the creation of debt for the customers and financing banks themselves. Therefore the research was performed on the securitization process, capital requirements for banks, in the area of lending standards and new banking products.

2. Literature review

2.1. Definitions

At the beginning it is worth to define the institution. To find the appropriate definition and elements of institution it is important to underline several significant elements of institutions indicated by authors of the old and new institutional economics.

Thorstein Veblen one of the "founding fathers" of institutionalism formulates the following definition: social institutions are in essence the dominant ways of thinking, taking into account the different social conditions and certain functions of the individual and the society. […] Each community can be seen as economic mechanism consisting of what we call economic institutions. These institutions are usual ways of life processes' regulation in the society with regard to the material environment in which it exists [38]. In this definition author divided institutions into two types: social and economic. The first are the ways of thinking, attitudes or method of recognition of social phenomenon. The second group creates economic mechanism and is the basis for the action of people in the material environment. For better understanding of economic and social order it is crucial to refer to the historically shaped institutional framework forming the specific context of human activity [5].

The second of the "founding fathers" John Rogers Commons introduced, in the place of the impersonal market exchange, characteristic for the orthodox economics, the concept of a transaction. It led to the creation of the conception which allows understanding the activities of individuals, their economic and social life with the accompanying problems. Transactions are the meeting places of economics, physics, psychology, ethics, jurisprudence and politics. They are the two or more wills giving, taking, persuading, coercing, defrauding, commanding, obeying, competing, governing, in the word of scarcity, mechanism of rules of conduct [5]. J. R. Commons stressed the importance of the regulations, state legislation and well-developed process of constituting the law. He underlined the fact that good legislation creates appropriate incentives for individuals or groups of individuals to act wisely and worthy. The law however, limits activities that are harmful [7].

In the new institutional economics the work of Ronald Harry Coase Noble Prize winner in 1991 should be described as the background and milestone in the direction of the transaction costs economics. R.H. Coase observation of the market shows that the transactions are not made in emptiness, but within the institutions that organized the market [6]. His approach to institutions is very broad starting from patterns of human behaviour and on the formal regulations at the various levels of social life ending. Rational individuals achieving their aims act always in the institutional environment. They need to take it into account, and even in their way of achieve goals they could try to change the rules for their benefit and also break them. This fact is the evidence that the famous institutional balance of the market structure could not guarantee perfect competition [5].

For Oliver Williamson institutions are primarily the principles and rules governing transactions which relate to the conception of the "contracting human" characterized by limited rationality and opportunism behaviour [31]. Douglass North proposed the definition of institutions as rules of the game or more formally human made constraints that shape human interaction and cooperation. As a result, build the structure of incentives in the area of exchange between people, whether political, social or economic. Institutional changes shape the way of society evolution and are therefore the key in understanding of historical changes [34]. Marshall Hodgson offered conception of institutions as a system of established and widely recognized rules in society that shape social interactions. Language, money, law, system of weights and measures, rules of behaviour at the table, companies and other organizations are within the scope of the definition of institution [17].

The presented overview of the definition does not cover probably all of the approaches to the institution. The multiplicity of definition attempts made by the wide range of authors shows the difficulty in finding single universal definition corresponding to the representatives of both the old and the new institutionalism. For the purpose of this paper presented set of definitions should be sufficient, as it highlights the main elements of the institutions that will be used in the further analysis of real estate bubble. These elements are the rules of the game in the real estate market. The first group of rules is connected with the intervention in the market economy through the establishment of housing finance organization and tax relief and subsidies for real estate purchases. The second one wrongly understood "liberalization" consists of rules at both levels: the creation of debt for the customers, but also at the stage of financing banks themselves. "Liberalization" means transferring risks through securitization process, lower capital requirements, lowering lending standards of banks such as loan-to-value ratio, long maturity period, or lack of verification of clients.

Similarly to institution also economic bubbles are not formally defined in the economics with a single universal definition which could help to identify them.

It is mainly due to the fact that this process is very complex and occurring over several hundreds of years. Multiplicity of markets, geographic spread and variety of items influenced by bubble makes this area still poorly understood. For the purpose of this article some repetitive and generally accepted definitions and characteristics of economic bubble are discussed.

The definition of bubble most often used in economic researches is: part of asset price movement that could not be explained on the basis of fundamentals. Fundamentals are a group of variables which determine asset prices. In the situation of a specific model of asset price determination, if there are serious problems with forecasting asset prices there could be a symptom of a bubble [14].

Whenever perceived or psychological value of assets exceeds its real economic value the bubble exists. Economic value could be defined as value based on rational economic parameters, such as growth of population, growing company earnings, increased personal income, or some other fundamental economic factors directly linked with the asset's rise in value. Alternatively, if the asset is sold for a lot more than its economic value, and the price increases for two or more times by growing psychological or perceived value then it is a bubble. [40]

In the above definition the great importance of value was stressed. Value is the concept from the area of metaphysics on the ground of neoclassical economics. In mainstream of the institutional economics, value is determined institutionally and culturally. Therefore, certain behaviours and choices are fixed in the institutions and culture. Despite they do not make the value they give it or receive it [37].

The last element which will be used in explanation of real estate bubble is the idea of soft budget constraint. It was introduced by Janos Kornai in his book *Economics of Shortage* [28] and in his expository paper [29] briefing the theory of chronic shortage in socialist economies. The term "budget constraint" was taken from the theory of the household. The statement that the decision-maker has a budget constraint is equivalent to the Say's principle. The budget constraint is not technical relation nor book-keeping identity, but postulate of a rational planning. Two important things must be emphasized. First, the budget constraint is connected with a behavioural characteristic of the decision-maker. It is used during the decision about covering expenses from the income generated from various sources. As a result, the decision-maker adjusts his expenses to his financial resources. Second, the budget constraint is a constraint on ex ante variables and firstly on demand. It is determined by expectation concerning future financial position when the actual spending will occur [30].

The budget constraint is "softened" when the severe relationship between expenditure and earnings is relaxed, as excess expenditures over earnings will be covered by some other organization, usually by the State. An additional factor of 'softening' is that the decision-maker expects such external financial support with

high likelihood and this likelihood is firmly built into his behaviour. J. Kornai presented for socialist firms different ways and means of softening the budget constraint. There were divided into four groups: soft subsidies granted by national or local governments, soft taxation, soft credit and soft administrative prices [30].

Subsidy granted by the governments (national or local) is soft if it is negotiable, subject to lobbing or bargaining. The subsidy is adjusted to cost overruns (past, present or future). The attribute soft in the taxation does not refer to the rate of taxation. Taxation system can be hard even with the low tax rate, if rules in the system are uniform, fixed for the long period and the payment of tax is enforced rigorously. In the system of soft taxation tax rates are not uniform, but almost tailor-made according to the financial situation of different sectors or regions or forms of ownership. Soft credit is also not connected with the level of interest rate. Credit system can be hard event in the situation of low interest rates, when the fulfilment of credit contracts is severely enforced. In opposition the soft credit system means tolerance of unreliable debt service, postponement and rescheduling of credit payments. Soft administrative prices could be applied in the situation, when the price is not set by a free contract between seller and buyer, but by some bureaucratic organization. The administrative price is hard if, once set, it restricts expenditure and does not automatically adjust to cost rises [30].

2.2. The institutional matrices theory

On the ground of the system paradigm which deals not just with the individual details of economy but with the system as a whole has been developed by Svietlana Kirdina the institutional matrices theory. Institutional matrices theory follows traditional Russian economic way of thinking and stands apart from western theories [24]. The most significant reason of a new theoretical framework construction was driven by the insufficiency of actual structures for understanding and predicting social processes [25].

Theory of institutional matrices is founded on two key postulates playing the role of axioms. The first is a vision of society as an integral, indivisible object. The economic process should not be clarified only on the basis of data which characterize economy in its substantive meaning. Economic processes explanation requires also reference to political (organizational) and value (motivational) aspects. The second theory postulate is assumption about basic institutions. Basic institutions are described by as historically stationary, very deeply rooted, and perennially reconstructed social forms. They were called as historical invariants allowing the society to survive and advance during historical evolution without losing its self-sufficiency and integrity. Basic institutions are independent of concrete social actors' desire and will. The basic institutions category (distinct from

a broader category of "institution") abstracts from social relations only histori-
cally stationary and internally unchangeable. Their function is regulation of social
subsystems and the maintenance integrity of societies of different types [24].
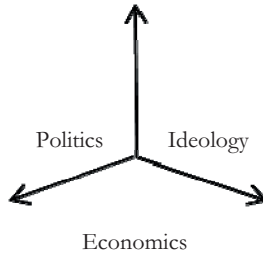
Figure 1. The main projections of the society
Source: [23]

On the basis of stated assumptions the model of human society as a social
system structured along three axes: economy, politics and ideology could be now
elaborated on (see Figure 1). These three spheres are strongly interrelated mor-
phologically as sides, parts or elements of an indivisible whole [23]. The system
approach to society makes it possible to identify economy, politics and ideology
as the subsystems [24].

The economic sphere of society relates to the receipt of resources used for
the reproduction of social entities. The political sphere is connected with interre-
lations for regular and organized civil and public society actions which purpose is
to achieve defined local, regional or national aims. Finally, the ideological sphere
is connected with the interrelations embodying significant cultural and social
ideas and values of a nation of people [22].
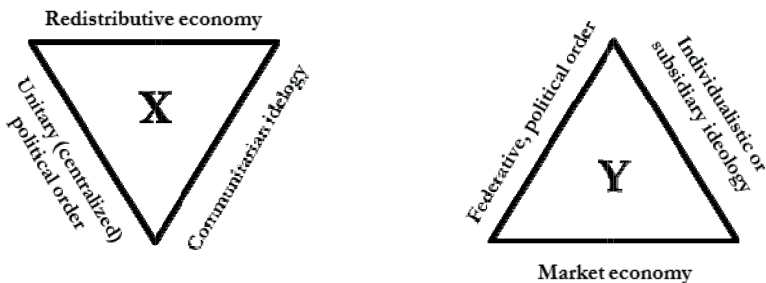
Figure 2. Institutional X- and Y-matrix
Source: [23]

The corresponding set of basic institutions regulates each of described spheres. Empirical studies and historical observation as well as mathematical modelling and a wide philosophical approach constitute a ground for the following hypothesis: two specific interdependent types of institutional matrices exist around the world. They are called X- and Y-matrix and are presented in Figure 2 with their unique identities of each one in relation to the other. The matrices are different in function of the set of basing institutions creating them [23].

The X-matrix can be described by the following set of basic institutions. In the economic sphere institutions of the redistributive economy which is characterized by the existence of centre (on the top). The centre controls the movement of goods and services and also regulates the rights for their production and use. The political sphere consists of institutions of a unitary (unitary-centralized) political order). The ideology projection is created by the institutions of communitarian ideology, whose essence is described by the idea of domination of collective, shared, public values over individual, sovereign, private ones. The priority of "We" over "I". [9]
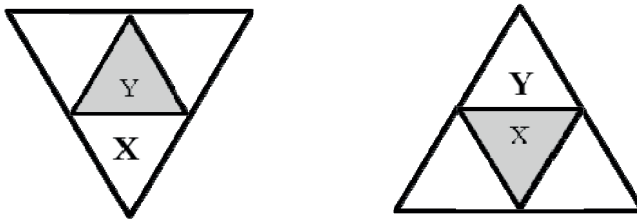
Figure 3. Combination of dominant and complementary institutional matrices
Source: [23]

In the Y-matrix the basic institutions in the economic sphere are the institutions of a market economy. Political institutions are connected with the federative (federative-subsidiary) political order. Finally, the ideological institutions consist of an individualistic (or subsidiary) ideology, proclaiming the supremacy of individual values over the values of larger communities, bearing a subordinate character to groups and the personality. The priority of "I" over "We"[23].

In modern societies and nations, X- and Y-matrices interact, with one of them permanently predominating. Nevertheless, the matrices are not exclusive entirely of each other. Both X and Y-matrices co-exist simultaneously in any given case. In other words, the society social structure can be described as a dynamic binary-conjugate structure of these two interrelating, yet alternative institutional complexes. The supremacy of one matrix over the other is usually constant in the course of history. The dominant institutions of the prevailing matrices therefore play a role of a performance framework for complementary institutions from the other matrix as it is presented on the figure 3 [23].

X-matrix	Y-matrix
Economics	
Supreme conditional ownership	Private ownership
Redistribution (accumulation-coordination-distribution)	Exchange (buying-selling)
Cooperation	Competition
Employment (unlimited term) labour	Hired (short and medium term) labour
Cost limitation (X-efficiency)	Profit maximization (Y-efficiency)
Politics	
Administrative system (unitary)	Federative structure (federation)
Vertical hierarchical authority with Centre on the top	Self-government and subsidiary
General assembly with the rule of unanimity	Multi-party system with the rule of democratic majority
Appointment	Election
Appeals to higher levels of hierarchical authority	Election
Ideology	
Collectivism	Individualism
Egalitarianism	Stratification
Order	Freedom
Well-being-oriented	Pecuniary-oriented
Generalization-Integralism/Holism	Specialisation-Atomization/Mereism

Figure 4. Institutions of X- and Y-matrix and their functions

Source: [23]

The X-matrix institutions are predominant in China, Russia, and India along with most Latin American and Asian countries. In these cases Y-matrix institutions are "a must" but they have additional and complementary functions. Conversely, Y-matrix institutions prevail in most European countries and in North America, whereas X-matrix institutions are supportive. On the Figure 4 the structures and functions of basic institutions in X- and Y-matrices through each of three spheres are presented [23].

3. Institutional analysis of real estate bubble – empirical research

In the research about real estate bubble the institutional basis could not be ignored. It is crucial to take into consideration institutional factors, due to the fact that in the early stages of formation of economic bubble, prices are raising

as a result of logical and economically justified reasons. For example, the cause of increase in the prices of houses can be a growing population. When the number of people reporting the demand for houses is increasing and the supply is relatively stable or growing at a slower rate, increase in prices appears to be economically justified. Prices may also rise due to increased income and in the situation of limited supply. In this situation the price is again the result of demand and supply. Therefore, irrespective of how expensive the houses are, as long as economic justification for higher prices could be found in reference to the fundamentals, the price increase is not a bubble. However this mechanism is often disturbed when there is a crisis of institutions in the area of factors influencing the price increase.

In order to explain the real estate bubble process it is important to identify the prevailing combination of institutional matrices on the ground of the presented institutional matrices theory. It is obvious that without institutions of a market economy in the economic sphere, the institutions of federalism in the political area and ideology of individualism, there would not be the real estate bubble. Clearly, as it has been already mentioned, it has never been the pure X- or Y-matrix. Therefore, the environment for real estate bubble is the combination of two matrices with the domination of Y-matrix with its set of basic institutions. The basic institutions of Y-matrix are some kind of underlying (necessary) conditions in creation of the growth beyond the fundamentals. However they could not be seen as the only cause of their formation. Referring to the previously described definition of economic bubble it should be noted that basic institutions of Y-matrix allow the creation of sustainable growth of prices which could be distorted and turned into speculation with the end in disastrous bubble economy. The examples of such kind of distortion are presented in the research part of article in two groups: unintended effects of intervention in the market mechanism and wrongly understood full "liberalization" of market and deregulation of all market processes.

3.1. Unintended effects of intervention in the market mechanism

One of the key factors contributing to the formation of real estate bubble is intervention in the market mechanism affecting the balanced proportion of basic institutions of a dominant and complementary matrix in the economic system. There are many examples of intervention in terms of real estate market. The most significant in terms of repercussion in the economy have been examined in this article.

The first and foremost example of intervention was the establishment in the United States of America two sources of housing finance: The Federal National Mortgage Association (Fannie Mae) and The Federal Home Mortgage Corporation (Freddie Mac). The organizations were chartered by Congress of the United States

to create a secondary market for residential mortgage loans. President Franklin Delano Roosevelt created Fannie Mae in 1938 as part of New Deal program. The main purpose was to help jump start the national housing market after the Great Depression. Freddie Mac could be characterized by the much shorter history, due to the fact that it was founded in 1970 [15]. Mission of both organizations was to help working families access to long-term mortgage or providing to them quality rental housing. The objective of organizations was to create a system for stabilization the home mortgage market, increasing the possibility of buying and rental for the less wealthy Americans [13]. In addition, they were involved in supporting families who have problems with self-payment of the mortgages. Thus secure many people from losing their homes. At the time when the loan was not repaid they took the obligation to sell the property on their own at the price close to market value [35].

Assets hold by them – through mortgage securitizations and direct portfolio holdings – have increased from approximately 7% of total residential mortgage market originations in 1980 (about 78 billion dollars) to about 47% in the year 2003 (3.6 trillion dollars). By the year 2010, Fannie Mae and Freddie Mac owned or guaranteed about half of all outstanding mortgages in the United States, including a considerable share of sub-prime mortgages. They financed 63% of new mortgages originated that year. Other federal agencies, such as the Federal Housing Administration and the U.S. Department of Veterans Affairs, insured another 23% of home loans. Therefore it means that federal taxpayers guaranteed approximately 86% of all new mortgage originations in 2010 [32].

The involvement of the organizations equity-related with the government of the United States was an important factor of creation the housing bubble. Guarantee of mortgages for the insolvent individuals without creditworthiness was some kind of J. Kornai's softening budget constraint. The overall objective of Fannie Mae and Freddie Mac has not been achieved.

The evidence of this is an analysis performed on the basis of data about sales prices of new homes sold in the United States [1]. As presented on the figure 4 between the years 1969 and 1970 it was observed the decline of the median sales prices of new homes from 25 600 to 23 400 dollars in the year of establishment of Freddie Mac. In the period of first ten years of activity of this organization there was a significant increase of sales prices median for about 176% in comparison to the year 1970. For better understanding of this trend the growth of prices between 1963 and 1970 amounted to only 30%. It must be underlined that the first few years after the establishment of the organization, annual increases ranged from a few to several per cent reaching the peak between 1972 and 1973 at the level of 18%. In light of these trends the overall aim of Freddie Mac and Fannie Mae has not been achieved and the huge increases since 1970 were the unintended effects of intervention in the market mechanism.

Moreover, during the first five years of the twenty-first century, growth in median sales price of new houses has reached enormous proportions. During this period the median increased for about 43% from 169 000 dollars in 2000 to 240 900 dollars in 2005. This trend, however, has not been maintained for a long time and in the next two years there were seen growths for only 1–2%. These increases preceded the collapse of the property market in 2008 and 2009 with the decreases reaching the levels of 6 and 7%.
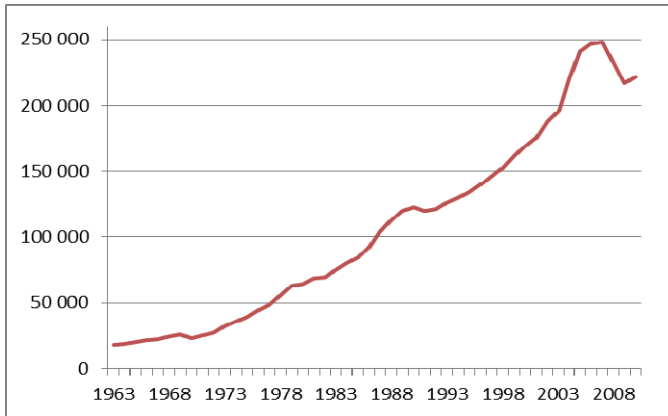
Figure 5. Median sales prices of new homes sold in the United States between 1963 and 2010

Source: own elaboration based on [1]

The culmination point of a very long-lasting period of boom in the property market was the increase of involvement of Fannie Mae and Freddie Mac into the support of insolvent borrowers. In the first period of the 90s the maximum amount of debt, which was granted to the American family with an average income amounted to about 90 thousand dollars. Ten years later the amount of granted debt increased to 200 thousand dollars. Taking into account a growth of house prices in the decade of 90s of approximately 31% the increase in granted debt had no economic explanation [35].

In connection to the subject of this paper organizations established in order to stabilize market mechanism in the area of mortgage loans could be seen as the framed within basic institutions characteristic for the X-matrix. Due to the lack of strict rules based rather on economic factors such as creditworthiness they become a tool of speculation and led to the blow of enormous real estate bubble. The idea of founding this kind of stabilization organizations in the intention

was not bad. However, Fannie Mae and Freddie Mac guarantees and secure the mortgage without taking into consideration the strict, healthy criteria. Taking over more and more debt and engagement in the huge credit actions, without expectation of discipline in debt service and a hope of repayment of debt was a departure from the basic institutions of Y-matrices. Ideological basis of activities of these organizations involving the support for less wealthy part of community was closer to the principles of collectivism and well-being-orientation rather than individualistic thinking directed for the maximisation of profits. In effect, subsidizing such activities under the motto of stabilization of real estate market had to failure because it has become a field for fraud and moral hazard in situation where everyone could borrow money in the hope that the debt will be taken over by the government supporting organizations.

The examination of Polish and Spanish mortgage market does not provide the evidence of intervention in the market mechanism in the scale similar to the United States. However the performed examination of these markets shows important institutions characteristic for the X-matrix as a part of social housing policy of these countries. The first observed in Poland is connected with the National Strategy for Social Policy for the years 2007–2013 (as a part of the National Development Plan). The aim of this policy was prevention against social exclusion in the context of access to housing. It was done through improvement of the financial framework of affordable rental housing program and development of affordable rental dwelling co-financed by preferential loan granted from National Housing Fund resources (located in National Economy Bank – BGK). The preferential loans were granted for Social Building Association (TBS) and housing cooperatives for building and adaptation for rental. The flats financed with the participation of National Housing Fund were rented to families who do not own the legal title to another flat, as well as those who have a moderate income per head in the family.[10] Spanish Ministry of Housing has created a National Plan for housing and renovation with the perspective of 2009–2012. The purpose of the plan was the elimination of barriers of access to houses by Spanish households connected mainly with the difference between the market price of house and economic capacity of households. It was done on the ground of social aim stated by the Spanish Constitution: creation of necessary conditions for a decent and suitable home to live for everyone, which is the right especially for those citizens with economic difficulties and lower-income groups [11]. This aim is strictly connected with the mentioned collectivism as an X-matrix basic institution in ideology sphere.

Another form of intervention in the market mechanism in Poland was the system of subsidies which was available till the end of the year 2012. The 50% of mortgage interest payments (calculated on a reference rate basis) could be

subsidies for a period of 8 years according to the "Act for the Finance Assistance of Families in the Purchase of Their Own Flat". The scope of the subsidies was restricted to the flats and single-family dwellings with the certain disposable area. In addition, the mortgage loans under this program must be denominated in polish zloty and there were also restrictions in connection with the price of the dwelling [10]. This kind of subsidies in connection with the real estate market significantly influenced the decision about purchase of new flats and was an additional factor of enormous price increase.

Another form of intervention in the real estate market mechanism which was observed in was a tax deductions and subsidies system. Amendments to the Law on Personal Income Tax, which entered into force on January 2007 in Poland led to the liquidation of interest relief, and thus limited the intervention in this area. However, all tax payers who took out mortgages to the end of 2006 may still benefit from the deduction of interest on these loans. Tax deduction mechanism is the ability to deduct from the tax base actually incurred paid interests on debt granted for the housing needs. The relief was intended as kind of intervention in the housing market as a possible deduction increased, in fact, real borrower's ability to pay the mortgage debt. It was an incentive for the decision about buying new house.

In the Spain in the period of real estate bubble the mechanism of mortgage tax relief made mortgage repayments tax deductible. Mortgage tax relief was available for loans on primary residences. The tax deduction amounted to 15% of the mortgage payments up to an annual limit of 9.015 euros, giving the maximum amount of annual savings of 1.352 euros [21].

The mechanism of tax credit was used in a much larger scale in the United States. It has found its source in the approved by President Herbert Hoover Federal Home Loan Bank Act of 1932 with the aim of providing liquidity to mortgage lenders. Designed relief has been a repeatable subjected to criticism, but as a part of incentive and stimulation system in the real estate market has not been reformed for a very long time. The main reason was that it was an essential part of real estate market development and incentive to achieve "American Dream". Interest deduction was a very expensive way to support the property market because it costs annually more than 20 billion dollars in the period between the year 2000 and 2007 [16].

In connection to the research carried out in the article [8] available at HousingEconomics.com about beneficiaries of tax deductions in the property market in America it must be emphasized that the main recipients of these incentives were in 2008 the middle class taxpayers with the income in the range of 50 000 to 200 000 dollars. This could be the confirmation of emerging criticism on this kind of intervention. The tool that was intended to promote the purchase

of real estate assets by less wealthy part of society, in fact, has become support-ing tool of speculation. It was the primary contributing factor in the creation of American housing bubble. It has awarded the highest subsidies, in the form of tax deductions of up to a million dollars to the richest one third of Americans willing to buy the biggest and most expensive houses, while rejecting subsidies to the two thirds of American income earners who cannot buy a house at all or who cannot take advantage of the housing deduction due to the fact that it does not exceed their standard deduction granted to all taxpayers [16].

The average size of houses bought by Americans has grown from 949 square feet in 1900 to 2436 in 2005 [16]. With reference to the theory of institutional matrices an intervention through tax deductions reflect activities characteristic for the basic institutions of X-matrix. There were intended to be a help in achiev-ing the general welfare and availability of house for everyone even less wealthy citizens of the United States. However, the inappropriate design of the deduc-tion works for the one third of wealthiest Americans and again support rather speculative activities conducted by them. As the support of these it is worth to see into the Table 1 which shows the comparison of home ownership between various developed countries which introduced or not the tax deduction system. The analysis of the data shows that such developed countries like the United Kingdom or France have reached high home ownership rate in 2001 equal or even higher than the United States, without the expensive system of tax deduc-tion. The aim of higher home ownership rate could be achieved also by other, less expensive ways.

Table 1

Comparison of home ownership between developed countries

Country	Tax deduction for housing	Home ownership rate in 2001 [%]
United States	Yes	69,0
United Kingdom	No	71,1
Germany	No	43,6
France	No	63,1

Source: [4]

The tax deductions system and subsidies in the real estate sector as the tool of stimulation is the soft budget constraint in the J. Kornai meaning which influ-ences the balanced combination of institutional matrices.

3.2. Wrongly understood full "liberalization" of market and deregulation

In the last part of this paper the real estate bubbles are explained taking into consideration wrongly understood full "liberalization" and deregulation of all market processes. As an element of this process, especially connected with credit system, soft budget constraint is described on the basis of available evidence in the examined countries. There are identified and described most visible and important aspects of soft budget constraint. In connection to the institutional matrices theory there are presented cases in which there were attempts to eliminate, from the combination of matrices, the complementary matrix. It was performed in order to create a system of domination of Y-matrix. It is in opposite to the discussed intervention in the market mechanism when the prevailing matrix attempted to be dominate was the X-matrix. Aspiration for absolute deregulation was the source of many deformations in healthy functioning market system such as lowering lending standards, an increase in lending on a large scale in many countries, securitization process and other things leading to the creation of moral hazard.

Following behind Grzegorz Kolodko the reasons of such negative events as financial crisis and economic bubble could be found in the isolation of the financial sphere from the real economy [26]. The financial sphere was out of control, as a consequence of liberalisation of financial markets. On the way to the ideological freedom and in the process of embedding of freedom in the market economy, at both the creation of debt for the customers, but also at the stage of financing banks themselves, was a high deformation of market system, and unbalanced structure of the combination of basic institutions. As the result of this process there has been a very dynamic development of financial instruments, including the securitization process.

Securitization is the process which allows banks to turn traditionally illiquid financial assets (bank loans) into the marketable securities. The most popular method of conversion of loan into tradable security was mortgage backed securities (MBS) and collaterized debt obligation (CDO). Securitization allows funding lenders to transfer the risk connected with loan and increase their liquidity by selling it in the secondary market as a parcel of loans [16]. The consequences of securitization were several. First, the symbiotic relationship between lender and borrower has been broken. Banks historically keep the mortgages on the books and service the loan directly (keeping a relationship with the borrower). Securitization allows to separate mortgage origination from mortgage servicing. Therefore originators of loans had no longer a vested interest in the viability of a borrower in a long-term. It led to definitely lower lending standards. Moreover,

it allowed banks to issue more loans than their balance sheet might otherwise. Secondly, securitization made very difficult dealing with problem loans. It was due to the fact that mortgages were in pools with cash flows allocated according to a prearranged dynamic. As a result no one party were in charge of a particular mortgage. Previously borrower was able to negotiate directly with the bank holding mortgage, securitization made potential loan modifications through negotiation almost impossible [33].

Table 2

Securitized subprime loans

Year	Total mortgages that were subprime [%]	Subprime mortgage that were securitized [%]
2001	7,8	54,1
2002	7,4	62,9
2003	8,4	61,1
2004	13,5	75,7
2005	21,3	76,3
2006	20,1	74,8

Source: [16]

The significance of the securitization process in the creation of the real estate bubble was visible in the United States and Spain. The increasing level of securitization in the United States is shown in the Table 2. In 2006 20% of mortgages were subprime and 75% of them were securitized. In 2006 value of the subprime mortgages amounted to about billion dollars which was about 8% of Gross Domestic Product on the peak of economic growth of the United States [36]. Spanish Mortgage-Backed Securities (SMBS) regulated in 1992 were very popular and after the ten years Spain was the third issuer of MBS in Europe [2]. In 2010 value of all securities (mortgage-backed and assets-backed) was so high that the Spain reached the second place in Europe as an issuer [3].

The development of the securitization process in Poland has been strictly connected with the progress of law regulations in this matter which was significantly delayed in comparison the changes in the Polish financial market. The Polish banking sector has not been interested in the process of securitization for a very long time mainly due to the lack of formal definition of the process, regulations in the banking law or limitation in transactions conducted by the

securitization fund [39]. According to the report from 2013 the market of securitization does not practically exist in Poland. In the last several years there have been realized by banks only two important transactions which have not been connected with the mortgage loans [19].

The main problem with the new financial instruments and securitization process especially visible in the United States was involvement of banks which activity were deregulated mainly in the area of connecting the lending (commercial) and investing banking (abrogation of the Glass-Steagall Act). What more, in the process were also engaged the organizations which have never been regulated. The system called by Paul Krugman as the system of "shadow banking" exaggerated the conventional banking system [31]. Lack of regulations in this part of economy led to an unbalanced combination dominated by Y-matrix institutions with the aim of maximisation of profits, especially by lenders and Wall Street financial institutions such as hedge funds and money funds. It was a mechanism of transferring risk connected with bad debt and softening budget constraint by banks and similar institutions. This process accelerated the financing of the real estate bubble and also supports the speculative activity.

The next evidence of softening budget constraint from the perspective of commercial banks was connected with the capital requirements. Loosening standards and aggressive lending led in the United States to decreasing capital requirements. In 1990 the capital requirements amounted to 10% whereas in the year 2005 it was only 2,5% (minimum capital requirement for Freddie Mac and Fannie Mae). Comparing capital requirements of the United States with the United Kingdom and BASEL we can see that the difference was considerable. They set the requirements at the level of 8% [16]. As a result another accelerating mechanism has been launched under the deregulation trend. The decline in capital requirements exposes banks on the high level of unjustifiable risk.

Further signs of softening budget constraint in the United States could be found in the commercial banks operations growth. Through acquisition at the end of 2002, there were 7887 government-insured commercial banks in comparison to 12 347 in 1990. The level of acquisition sprees in the commercial and investment banking sector in the late 90s led to creation of lending behemoths seriously dependent on economies of scale. During the last real estate boom in the United States the mortgage industry was heavily relied on human capital and expensive technology. The loan origination process was based on the high-technology platforms connected with millions of dollars investments. Due to the high level of fixed costs, the profit of originators depended more on volume than quality [16].

From the borrowers' perspective soft budget constraint (soft credit) is visible when lenders began relaxing lending standards and loan approval guideline.

One of the primary lending standards is the level of loan-to-value ratio (LTV). Higher level of ratio means higher risk exposure of a bank. Each bank has its own limits of this ratio and in the situation of exceeding this ratio higher down payment is required. Safe level of this ratio is when it is below 80%. During the boom on the real estate market in Spain the LTV amounted to about 64% [12], however there are still available sources of offers of banks from 2010 with the ratio 100% [18]. The average value of LTV in the United States increased from 88% in the middle of 90s to 94% in 2005 [9]. In Poland in the period of boom most of credits were granted with the ratio between 75 to 100%. In 2010 there were situations when the credit was granted for the 120% of the value of property. In the Alior Bank S.A. proposal there were credits with LTV at this level [20]. However, the Polish Financial Supervisory Authority implemented several recommendations regarding mortgages such as the calculation of creditworthiness, the limitation of credits in foreign currencies etc. [27]. These recommendations had a significant influence on the creation of mortgages. They protected Poland against the blow of speculative real estate bubble.

The second important credit standard is the maturity of the credit. The research performed in each of the examined countries shows that in the period of boom on the real estate market the maturity period was extended and there were credits with the maturity period above 30 years (with the maximum maturity of 50 years). Margins and other charges connected with mortgage loans (low down payment etc.) were in the period of enormous real estate price increase on the risky low level. The main reason of that fact was a wish of further acceleration of credit action by banks and desire of joining to the group of beneficiaries of rising market.

The signs of relaxing approval guidance are visible in the United States in the form of the stated-income loan. This loan was traditionally extended to borrowers who could not confirm their income due to the fact that they were self-employed or did not want to generate income tax returns for personal reason. It was used by lenders as a standard also for the borrowers with easily verified income (including fixed income) [16].

Other products with the feature of soft budget constraint and avoidance of regulations were stated asset loans, no-ratio loans and no-documentation loans. Generally a prime loan has the requirement of verification of assets to cover 2, 5 or 12 months' worth of mortgage payments which should be available to the borrower. In the state asset loan, the borrower was obliged only to state the amount of assets, not verifying them. In a non-ratio loan, the income of the borrower was not disclosed; the underwriter decided whether the person's business, position and tenure suggest they can repay the loan. No-documentation loans were probably the softest products. The borrower did not even state his occupation and the underwriting decision was based entirely on his credit history and collateral [16].

All above factors led to the unbalanced structure with the dominant Y-matrix with the wrongly understood freedom in terms of banking practices and standards. This unbalanced institutional combination was the field for the moral hazard and accelerator in blowing the enormous increase in properties prices.

4. Conclusion

The creation of a balanced institutional structure with the optimal combination of the dominant and complementary institutions positively influencing economic growth and preventing against deformations such as an economic bubble is very challenging and hard work. The combination completely dominated by one of the matrix leads to crisis and stagnation. When the market does not work effectively it is supplemented by the institutions on the ground of monetary and fiscal policy. On the other hand, the efficient market means the private ownership, exchange, competition, freedom and ideological individualism.

Results of the research discussed in this paper show that real estate bubble was created in the environment of combination of two matrices with the domination of Y-matrix. Basic institutions of that matrix were necessary conditions for development and growth in the real estate market. The study shows that in the examined cases the development and market growth was repeatedly distorted and turned into situation when the perceived and psychological value of houses exceeds their economic value. The identified institutions which influenced balanced structure and supported the blow of the bubble were divided into two main groups.

First group, unintended effects of intervention in the market economy mechanism, was against the dominant matrix and was planned as the response for the needs of less wealthy part of society or the way of stabilization and/or stimulation of real estate market. The overall objectives of interventions in the examined cases have not been achieved. The best evidence of that fact was an enormous increase in houses prices in the first years after establishment of Freddie Mac. The efficiency of tax deductions and subsidies as the way of stimulation of real estate market was also questioned due to the fact that higher ownership rate was achieved in several countries without such expensive system reliefs. Besides, this mechanism was used mainly by wealthiest part of society which was in conflict with the basic assumptions of the program. In all the presented cases of intervention in the market mechanism, established with good intentions, the result of the intervention was the creation of mechanism finally supporting the speculation and blowing the bubble. The main reason of that fact was connected with the inappropriate design of the institutions of complementary matrix. In the case of

organisations Fannie Mae and Freddie Mac the problem was that they guaranteed and secured the mortgage without taking into consideration the strict, healthy criteria. As a result their activities become a field of fraud and moral hazard, creating situation where everyone could borrow money in the hope that the debt will be taken over by someone else. The conclusion for this group of institution based on the research is that it is crucial in the case of dominance of Y-matrix to create the safe system of complementary institutions which are protected against such speculation and moral hazard.

The second group wrongly understood full "liberalization" and deregulation of all market processes through softening the budget constraint, was in line with the dominant matrix institutions and was planned as a tool for stimulation of the real estate market. This group was called as wrongly understood full "liberalization" with reason. It shows that liberalization in each of examined cases was a desire to eliminate of the complementary matrix from balanced institutional structure. "Wrongly" means that liberalization is possible in the healthy economy however it does not mean that market mechanism could work without any institutions. Therefore, deregulation in each of examined cases led to isolation of financial sphere from the real economy. It was done at the level of lenders (banks) through softening budget constraint in the process of securitization or decrease of capital requirements and also at the level of borrowers through softening budget constraint by lowering lending standards such as loan-to-value ratio, maturity period or fees and charges connected with credit or relaxing the loans' approval guidance by banks in the no-ratio and no-documentation loans.

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Industrial meaning of university basic research in modern economies

1. Introduction

The meaning of scientific knowledge in creating innovation and improving economies' growth potential is unquestioned. Universities play a vital role in national innovation systems, they are a source of both skilled labour and valuable scientific knowledge embodied in the R&D output. The role of basic research in modern economies seems to change. Previously, in the linear model of innovation, basic research has been the first stage of innovation process, followed by the applied research and experimental development. Nowadays, basic research seem to be a sterling product itself, ready to achieve the full market value. Basic research, nowadays conducted mainly at universities have some important advantages. First of all, they are publicly funded, as a basic universities' activity aimed at reducing the uncertainty of expanding the body of pure knowledge and creating potentially useful solutions. Secondly – thanks to the institutional change within modern universities, which is the emergence of the universities' "third mission" , there appeared the possibility of selling the basic research output thanks to the commercializing procedures adopted widely by research universities. Those procedures enable shortening the distance form the pure science to market-valuable solution.

The goal of the article is to show the changes in the approach to the university basic research as a part of the innovation process.

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2. Innovation models

Nowadays, as economic systems evolve in the direction of knowledge-oriented ones, the knowledge (and especially the scientific knowledge) is a factor of great importance for the economic development. Post industrial economies, according to Bell, differ from industrial ones, and the distinguishing factor is the attitude to the technological innovations. Formerly innovations resulted from business practice, nowadays they are the result of theoretical research [12]. According to Bell, the technological progress is dependent on the development of science . The development of technology is getting more and more similar to the scientific research because of the utilizing of typically scientific methods and research results. Naturally, knowledge has always been important for the economies, but post-industrial society is involved in research programs in order to broaden the theoretical knowledge which is useful in economies' problems solving. Post-industrial economy needs both highly qualified employees and advanced scientific research. Universities became the main institutions in modern economies. Bell said [1]: "if an enterprise has been the main institution through the past 100 years, according to its role in organizing production and economies of scale, the university is supposed to be the most important institution through the next 100 years, because of the innovation and knowledge it creates.

For decades after World War II the generally accepted model of innovation was the 'linear model of innovation'. This model explicitly and implicitly dominated much of the theoretical debates and science and technology policy formulations. In the model, basic research produces theories and findings that are redefined in applied research, tested in development processes and after that commercialized as industrial innovations. Each level in the linear model produces outputs that are transferred to the next level as inputs. The flow of knowledge is also unidirectional, i.e., later stages do not provide inputs for earlier stages[3].

This linear model of innovation and the idea of "public good " character of science laid the basis for academic autonomy. The fact, that they are mostly funded with public funds caused their greater autonomy in shaping both the scientific problems to solve and the methods to be used in problem solving. As the innovations were seen resulting automatically from basic research, they became a flagship activity of universities, which, from now on, got the autonomy of creation of the future.

The great change in the innovation process took place in the period of decade (mid 1970s – mid 1980s). In that time the attitude to the nature of knowledge changed. Polanyi (1966) demonstrated first that any knowledge was a combination of "tacit" and "explicit" dimensions [18]. The impact on fundamental

research was demonstrated by Collins (1974), and his findings were, that the nearer to the discovery the most difficult it is to take-up knowledge and make it circulate – only those, who participate in a project can fully understand its nature [4]. The implication was that in high technology sectors, it was important for firms to develop strong connections with academic labs if they wished to be in a position to master new knowledge. The notion of "absorptive capacity" [9] translated this new understanding of the circulation of knowledge. This explains the exponential growth observed from the beginning of the 1980s in so-called "industry-university collaborations" (or said more precisely in joint research projects between public and private research actors) [10].

Also the understanding of the innovation process changed. The idea of a linear model of innovation was found as the oversimplified one. As an alternative to the linear model, Kline and Rosenberg [9] (presented a model they called 'the chain-linked model'). In this model, science exists alongside development processes, as it is used in any stage of such process when needed. Furthermore, science can be divided into two components: known, existing scientific knowledge and scientific research. If a problem is confronted in innovation, the existing knowledge is consulted first. Only if this consultation is not producing results, scientific research is needed. In this view, scientific research is not the initiating step, but a factor that is utilized at all the points in the innovation processes.

Of course the chain linked model is not the only alternative here. The newest attitudes to the innovation process are network model of innovation or open innovation [16].

Innovation process – no matter what model we adopt, can be translated as a process of knowledge transformation – from purely scientific to practical one. Since the postwar period until now the most valuable type of knowledge is a scientific knowledge. Thanks to this knowledge dimension scientists have a vital impact on economies development direction. The institutions that are devoted to the research activity are universities. Universities also educate, and in some cases this is their dominant activity, but in case of research universities – their scientific, innovation-oriented output is the greatest value.

3. Scientific background of innovation

The role of science in creating the useful knowledge is unquestioned. On the theoretical background, the idea of science as a public good was forwarded by seminal analytical work by Nelson (1958) and Arrow (1962), who introduced the idea of 'market failure' in the behaviour of firms investing in scientific research [6].

The traditional 'market failure' approach to the economics of publicly funded research centers on the important role of information in economic activity. Drawing on the work of Arrow (1962), it underlines the informational properties of scientific knowledge, arguing that this knowledge is non-rival and non-excludable. Non-rival means that others can use the knowledge without detracting from the knowledge of the producers, and non-excludable means that other firms cannot be stopped from using the information. The main product from government-funded research is thus seen to be economically useful information, freely available to all firms. By increasing the funds for basic research, government can expand the pool of economically useful information. This information is also assumed to be durable and costless to use. Government funding overcomes the reluctance of firms to fund their own research (to a socially optimal extent) because of their inability to appropriate all the benefits. With government funding, new economically useful information is created and the distribution of this information is enhanced through the tradition of public disclosure in science [20].

The idea of proprietary science appeared with the advent of the neoliberal era, which influenced modern, western economies[17]. The development of the neoliberal attitude to universities brought into the existence the academic capitalism, where the profitability became a key-word for many spheres of economy, also for universities. Universities started to take part in different business-like activities. This goes far beyond nonacademic consumption items (such as logos, tee shirts, etc.). Today, higher education institutions are seeking to generate revenue from their core educational, research and service functions, ranging from the production of knowledge (such as research leading to patents) created by the faculty to the faculty's curriculum and instruction (teaching materials that can be copyrighted and marketed) [19]. The idea of engagement between universities and society - the "third mission" of universities (after teaching and research), which puts them close to the society and industry, became a source of knowledge production and introduced changes to the innovation process.

4. The new dimension of scientific research

Scientific knowledge, e.g. knowledge created by scientists, usually at universities evolves. The academic science model, which has separated academic from industrial science and basic research from technological application does not any longer fit to the requirements of modern economies. Changes in the

model of knowledge creation entail a change in the approach to the ethos of science.

The academic science has been researched by Merton [14], who constructed four norms or "institutional imperatives" defining its ethos. These are universalism, communism, disinterestedness, and organized skepticism.

The great dimension in the attitude to the scientific knowledge is discovering its market values. The possibility of using scientific research outputs as a commodity was possible thanks to emergence of knowledge transfer institutions, eg. intellectual property rights. Since that time one can easily say that knowledge creation has been replaced by the knowledge production.

The first important knowledge production model which can be found in the literature is the New Production of Knowledge [7]. The main proposition here is the emergence of a knowledge production system that is "socially distributed". While knowledge production used to be located primarily at scientific institutions (universities, government institutes and industrial research laboratories) and structured by scientific disciplines, its new locations, practices and principles are much more heterogeneous. To clarify this assertion the authors introduce a distinction between Mode 1 knowledge production, which has always existed, and Mode 2 knowledge production, a new mode that is emerging next to it and is becoming more and more dominant. The five main attributes of Mode 2 summarize how it differs from Mode 1 (which can be a synonym of the academic science).

Mode 2 knowledge is generated in a context of application. Of course, Mode 1 knowledge can also result in practical applications, but these are always separated from the actual knowledge production in space and time. This gap requires a so-called knowledge transfer. In Mode 2, such a distinction does not exist. A second characteristic of Mode 2 is transdisciplinarity, which refers to the mobilization of a range of theoretical perspectives and practical methodologies to solve problems [8]. Transdisciplinarity goes beyond interdisciplinarity in the sense that the interaction of scientific disciplines is much more dynamic. In addition, research results diffuse (to problem contexts and practitioners) already during the process of knowledge production. Thirdly, Mode 2 knowledge is produced in a diverse variety of organizations, resulting in a very heterogeneous practice. The range of potential places for knowledge generation includes not only universities and colleges, but also research centers, government agencies, industrial laboratories, think-tanks and consultancies. These sites are linked through networks of communication and research is conducted in mutual interaction. The fourth attribute is reflexivity. Compared to Mode 1, Mode 2 is based on an instant dialogue of knowledge-producing actors, and has the capacity to incorporate multiple views.

The more advanced concept of knowledge production is Ziman's concept of post-academic science and its more orthodox variation: industrial science [22]. In Ziman's notion of post-academic science, he incorporates elements from several other approaches. Ziman intends to describe and explain a set of developments in scientific knowledge production. To summarize, post-academic science refers to a "radical, irreversible, worldwide transformation in the way science is organized, managed and performed"[22]. Industrial science can be characterized by the following five (strongly connected) designations. First, science has become a collective activity: researchers share instruments and co-write articles. Moreover, both the practical and fundamental problems that scientists are concerned with are transdisciplinary in nature, calling for a collective effort. Second, the growth of scientific activities needs capital support. The resources available for research seem not to increase much more, creating a need for accountability and efficiency. Thirdly, but strongly related, there is a greater stress on the utility of knowledge being produced. Successful application of scientific knowledge in the creation of new products and practical solutions in certain types of business activity has caused "impatient expectations" of industry, government and the public. The expectancy refers to the scientific knowledge diffusion rate and its impact on the company's profits and the state's welfare. There is an increased pressure on scientists to deliver more expected and desired value that can provide long-term gains. Moreover policy-making in science and technology has intensified the competition for resources. In such a situation competing for a lucrative contract may diminish the significance of the researcher's scientific credibility. Research teams can be conceived as small business enterprises, their staff as "technical consultants". Finally, science has become "industrialized": the links between academia and industry have become close and the relationship has a financial dimension. This phenomenon is in contradiction to the Mertonian norms of academic science. Due to the industrial orientation a new set of norms can be discerned, which Ziman labels as PLACE: *Proprietary, Local, Authoritarian, Commissioned,* and *Expert*.

The concept of post-academic science is quite similar to that of Mode 2 knowledge production. While New Production of Knowledge explicitly states that Mode 2 emerges "next to" Mode 1 research (which means that academic science still exists) and suggests a future in which both develop in co-evolution.

As the short literature review shows, the change in the attitude to knowledge creation is evolving, and the direction of this evolution is to treat knowledge as a commodity. Universities as the sources scientific knowledge and of course well-educated scientific personnel are the significant chain of the

knowledge creation. But using its potential in purpose of creating innovations faces several problems. First of all the problem of transmitting the results of scientific research into the market. This matter concerns mainly the process of commercialization, e.g. the subject of commercialization, the IPRs and commercialization process organization. Besides the industry is willing to achieve valuable knowledge from universities (embodied in the outcomes of university research and development (R&D) activity). The problem of knowledge commercialization affects the science- industry relations and results in different forms of fruitful cooperation.

5. Basic research in use – new growth areas

Basic research may be considered as the first step in the knowledge generation or in the innovation process. Since the basic research is conduced mainly at publicly funded universities, nowadays the new phenomena in knowledge creation (Mode 2 or industrial science described in previous sections) can be easily adopted. It is worth to underline here that basic research financed publicly can be attractive especially for new-potentially profitable science areas. Indubitably, the growth of economies in industrialized countries has been driven mainly by the pursuit of scientific research, the implementation of innovative engineering solutions and a constant flow of technological innovation. Basic research is basically conduced at the universities and public research institutions. Its role is mainly to advance the knowledge and scientific discoveries. Scientists often endeavor to solve purely scholar problems, where there are no direct expectations (or even interest) to utility implication. As a consequence of such an activity basic research may produce results of vast scientific value, but not necessarily with plausible economic significance [11]. It is worth to underline here, that the increased importance of basic research is strictly connected with the emergence of new technologies and knowledge, that have the ability to change the direction or accelerate the economies development. The scientific fields of such an importance undoubtedly are information technology, health innovations (like biotechnology), energy-saving and environmental innovation. They depend on and require very basic research that might eventually materialize to marketable assets.

After information technology, biotechnology is increasingly recognized as the next wave in the knowledge-based economy. A recent estimate of the European Commission suggests that by the end of the decade the global biotechnology market could amount to over 2,000 billion Euro. Despite the capital

intensity of the industry, the growth rate of the biotechnology industry during the 1990s, and to a lesser extent, the beginning of the 21st century has been impressive. Biotechnology has been at the core of a number of important developments in the pharmaceutical, agrochemical, energy and environmental sectors. In particular, progress in the field of molecular biology, biotechnology and molecular medicine has highlighted the potential of biotechnology for the pharmaceutical industry [2].

The literature shows there is a dispute on the importance to drug discovery of basic research conducted at Public Sector Research Institutions. Zycher et al [21] found that at least 80% of 35 major drugs were based on scientific discoveries made by public institutions. Toole found a quantifiable correlation between investment in publicly funded basic research and corporately funded applied research: 1% increase in the funding in public basic research led to increase of 1,8% in the number of successful applications for new molecular entities in the lag of 17 years. The research conducted by Zycher et al shows also that, public research institutions have contributed to the discovery of 9,3% to 21,2% of all drugs involved in new-drugs applications approved during the period from 1990–2007. These proportions are higher than those identified before [21]. The examined data also suggest that public research institutions in USA tend to discover drugs that are expected to have a disproportionately important clinical effect.

The strong growth of the biotechnology industry in the recent years has been mirrored by the stronger than average growth rate for patent applications and patent grants that relate to biotechnology inventions. According to the OECD data, a number of patents granted in biotechnology rose 15% a year at the USPTO during the period 1990–2000, and 10,5% at the EPO (it is worth to notice, that the overall increase in patents reached 5% in the requested period). Patenting and licensing from universities and public research centers are a particularly important phenomena in health-sciences. in the USA licensing revenues reached 1.6 billion $ in 2005 [15].

It should be noted here, that patent is very often just a beginning of a very costly process of developing a marketable commodity [12]. The biotechnology industry exemplifies this problem. It is a common knowledge that the development of medical innovations (and especially new drugs) requires massive long-term investments in R&D, expertise in pharmaceuticals development, obtaining regulatory approval, production and marketing capacities [12]. On average – developing a new drug takes about 12 years. A recent estimate of the average cost of developing an innovative new drug is over $800 million, including expenditures on failed projects and the value of forgone alternative investments. That is probably why pharmaceutical companies find viable innovation to be much

more accomplish internally – within firm's capacities. The challenges encourage large pharmaceutical firms to pursue collaborative alliances. As the Table 1 shows majority of these alliances materialize through licensing transactions with university scientists, which is the pure industrial science example. The publicly funded academic research serves both the industry and the society.

Table 1

List of patented new drugs from universities in Israel

Product	Indication	Licensee	Sales in 2011 (in milions)	Licensor
Copaxone	Multiple Sclerosis	Teva	$ 3,570	Weizmann Institute
Rebif	Multiple Sclerosis	Merck-Serono	Eur 1,691	Weizmann Institute
Exelon	Alzheimer	Novartis	$1,067	Hebrew University
Doxil/Caelyx	Cancer	Scheering--Plough	$ 320	Hebrew University and Hadassah Hospital
Aziltec	Parkinson	Teva	$290	Technion Medical Scholl
Erbitux	Cancer	Merck-Serono	EUR 855	Weizmann Institut

Source: [12]

The data presented in the chapter 5 show that there is a great correlation between university R&D in the field of biotechnology and biotechnology development. Moreover, one can easily see that universities tend to attract biotechnological companies as competent research partners. Thanks to the development of economic institutions enabling knowledge transfer form public universities to private corporations, the scientific output originating at universities can achieve marketable properties and be the source of income.

The changes in the attitude to the role of academic science in modern economies can be easily noticed on examples of new, innovative, economic growth generating areas of industry. Chemical industry, information technology, life sciences – all those industry branches derive from the university laboratory. Consequent shortening of the distance between science and industry causes the change both in the shape of modern scientific research and the innovation process. The academic R&D is nowadays more the output of industrial science than of academic one. Proprietary, local, authoritary, commissioned and expert are adjectives describing the attributes of modern scientific research model.

Research conducted at universities has also a great advantage in comparison to the corporate ones. It is financed by the state. The issue of knowledge commercialization still causes heated controversies among scientists, managers and technology transfer practitioners. Violation of the rules of open, public science,

especially in the field of life sciences, can be harmful especially for the cumulative innovations and for developing countries [20]. The basic economic justification for university patenting is based on the idea that it facilitates the commercialization of the discoveries produced by scientific research. Thanks to well defined IPRs, firms or individuals have the incentives to invest additional R&D in product development because imitation is deterred and they can appropriate the related monopoly rents. Without a patent, the non-rival and non-excludable nature of knowledge would dissipate the expected profits and, therefore, the incentives to have extra R&D to bring such a product into the market [15].

The possibility of using publicly funded research for private (corporate) purposes gives rise to a new phenomena. The idea of industrial science which caused more direct and close relations between scientists and businessmen primarily could be understood as a trial of privatizing scientists instead of their scientific research output. The industrial science attitude often meant that those were people – scientists who took up work at huge laboratories financed by large corporations, loosing scientific independence but gaining good work conditions and money. The commercialization process affected more people and their peculiarities (like the tacit dimension of knowledge they are part of) than research results they were authors of.

Modern economies' economic policy puts an emphasis on the knowledge-directed development and growth. It means that a lot of public money is addressed to research institutions in order to provoke better economic performance. In the years of economic crisis corporations, which in the years of economic growth spent a lot of money on R&D activity, do savings using the possibility of market interplay with public research institutions like universities. And the biotech- and, in a wider prospect, health-sciences as the flagships of the economic- and social-quality change scientific disciplines, do realize such a crisis scenario.

In-licensing is understood as the licences bought by pharmaceutical industry from universities and public R&D laboratories. Out-licensing means licenses sold by pharmaceutical corporations to other entities. As the Figure 1 shows, the number of licenses bought from the universities grows in the two consecutive years with the stable number of licenses sold by the pharmaceutical corporations to other entities.

As the Figure 1 shows, pharmaceutical companies limit their research activity and in return they concentrate on buying licenses from public research entities like universities etc. The example of Sanosfi-Aventis shows that this company switched to the external sources of R&D. The numbers representative for this company prove that the internal R&D practically does not exist (minimal focus on out-licensing). The very similar data one can easily see on the example of Roche or Abbott, but with smaller engagement in in-licensing.
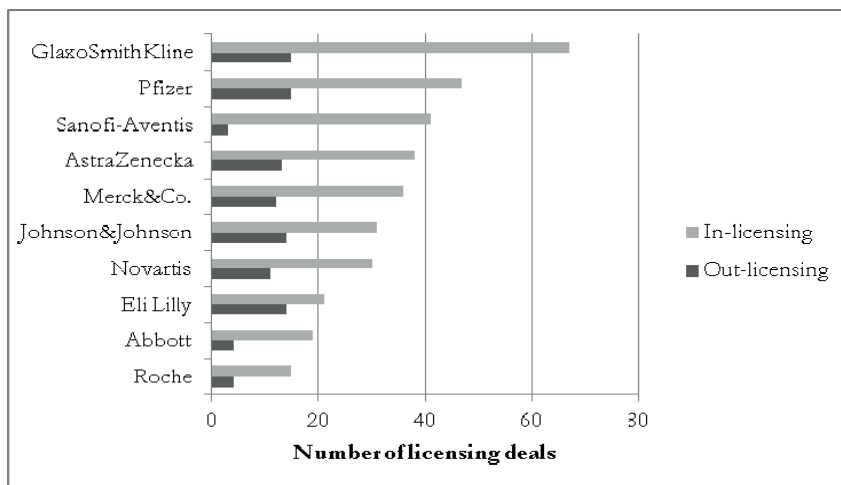
Figure 1. Licensing agreements in the pharmaceutical industry in 2008 and 2009, by the company name

Source: [5]

University basic research are nowadays the key point in fostering of development of new, innovative industries. Publicly funded university research became the very important part of the innovation process in pharmaceutical industry. Undoubtedly those are symptoms of the reversed trend in the knowledge privatization. As described above, primarily scientific research outputs privatization was associated with the personal dimension of knowledge – scientists. Nowadays the situation looks diverse – scientists sell their research output using the university technology transfer channels, but do not lose their relationship with the university. For the company university affiliation of a scientist is the guarantee of cost saving.

6. Conclusions

University basic research are the research of key importance for innovative industries. Primarily presumed as the first part of the innovation process, nowadays constitute a quite new phenomenon on the innovation scene.

Thanks to the introduction of economic institutions like IPR's the market exchange of basic research output is possible. It is a factor of a great importance because basic research conducted at the publicly funded universities are a source of public knowledge, which aim is enlarging the existing knowledge pool, not giving

private profits. Thanks to the IPRs one can say, that the academic science (or even post-academic one) changed to the industrial science. Industrial science primarily described the situation when scientists decided to loose their research autonomy in return of the great research conditions in corporations' lab followed by satisfactory salary. Nowadays one can easily notice, that in the matter of innovative industries like biotechnology, information technology etc. the process of knowledge privatizing is reversed. At present pharmaceutical companies more and more often look for savings outsourcing R&D to the university laboratories. It means, that universities do license the rights to inventions the university scientists are authors of. Scientists earn royalties. It means that the product – a research output is privatized, with no additional personal costs connected with scientists employment.

As the research show – new drugs are produced mainly thanks to university basic research. Thanks to public funds and laboratories. It makes university research an attractive source of potentially useful innovation, and public funds devoted to them rise their attractiveness even more.

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European enterprises in crisis time

1. Introduction

The economic crisis it is rapid economic downturn. It is accompanied by a sharp drop in production, the decline in real income, a slowdown in consumer spending and a decline in capital expenditures as well as an increase in unemployment [5, 26–27]. The a origins of the recent crisis date back to mid-2007 in the United States. However, in 2009 it was perceived as a global economic crisis. The crisis of the U.S. financial system quickly transmitted the negative effects to the European countries. Falling demand in the wealthy economies associated by declining level of investments resulted in a significant decline in international trade and in foreign direct investments. The sharp decline in confidence in the financial markets resulted in further reduction of access to private capital. As a result, some countries were facing the risk of bankruptcy and had to be helped with emergency loans offered by international institutions [19, 40].

National economies are increasingly intertwined through trade and capital. So now the transmission of the crisis to other countries happens much faster than it did during previous crises. These negative phenomena spread by reducing the volume of international trade and the level of direct investment, the instability of national financial markets resulting from excessive dependence on foreign capital inflows and excessive indebtedness of companies and households, as well as by the deterioration of the macroeconomic situation as a result of weakening rates, rising unemployment, the problems of the financial sector, fiscal deterioration and worsening business sentiment and consumer [16, 25].

Crisis phenomena do not necessarily occur simultaneously and uniformly in all countries of the world [5, 26]. They spill with different intensity and have different impact on the functioning of national economies. The crisis results mainly

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in the rapid decline in demand, what entails a drop in prices of consumer goods and a reduction in production, and consequently the deteriorating financial situation of enterprises. Unfortunately, a phenomenon of business bankruptcies intensifies in industry, construction and services. As a result of these negative phenomena in the sphere of enterprises is an increase in unemployment, which contributes to a further deterioration in consumer confidence and reducing purchases. At the same time the crisis was reflected in the financial markets, including most of all recorded declines in the stock markets, which had a negative effect on the valuation of the assets held by firms and households [19, 40].

Under such an unstable macroeconomic environment functioned European companies, which were forced to review their strategies and maintain a high flexibility for the reactions to changes in the environment. The promotion of competitiveness of European enterprises has become the priority of public regional, national and supranational (EU institutions). Any initiative outside support had and still have a great role in building a sustainable and permanent competitive position of the European companies.

The purpose of the undertaken analysis is to present the influence of the last economic crisis on company activities and an indication of the EU support to combat the negative effects of the crisis and to enhance the competitiveness of European businesses.

2. Enterprises in the time of crisis

### 2.1. Business and the consequences of the economic crisis

The economy has a great impact on conditions of companies. Changes in the economy due to the crisis generally lead to the transformation of the business environment for most companies. This is reflected in [2, 28–29]:
- change in the availability of loans – there is a shift towards greater usage of own equity as a main capital source;
- transformation of the labour market – a change in the relationship between employers and employees;
- increased competition between companies operating in the same branch.

The crisis is reflected in the emergence of a number of negative effects for enterprises (especially SMEs). Due to problems with keeping regularity in the processes of production, a decline in sales while increase in costs, there is the problem of maintaining an adequate level of turnover for an adequate profit to survive in the long term. In addition, the deterioration of the financial situation of enterprises and at the same time limiting access to external sources of capital results in

a decrease of the scale of investments and make enterprises to focus on current operations. Negative effects also strengthen the social cost. High costs and the forced reduction in prices of goods and services are the factors that lead companies to reduce the level of remuneration and to dismissal of employees (Fig.1).
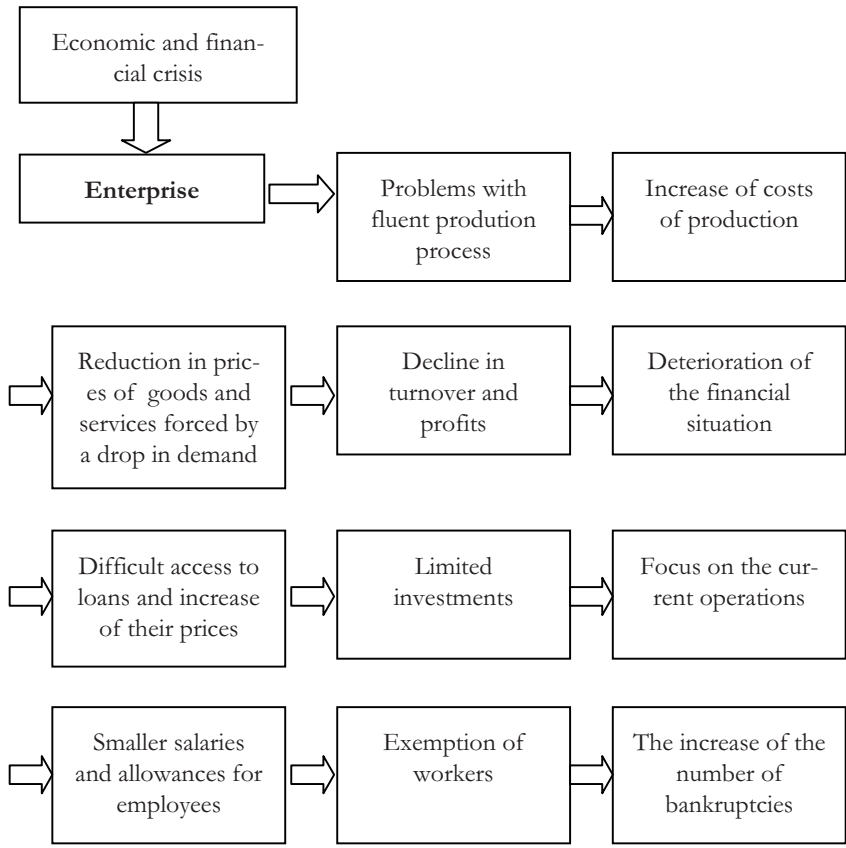
Figure 1. Effects of the economic crisis on enterprises

Source: Own analysis based on [3, 20–21; 19, 40; 5, 29–30]

There are also negative practices that contribute to the deterioration of the economic and financial situation of companies. These include: significant delays in payments, exerting downward pressure on prices and favourable conditions of supply, lowering prices below the cost of production, reduction of working time, conclusion of illegal collusion cartels, creating oligopolies, hostile takeovers,

forcing conclusions unfavourable to contractors, failing to provide loans by banks [3, 21; 5, 29].

The economic and financial crisis of 2007–2010 affected enterprises significantly. The economic environment where a company operated so far has been deteriorated, especially there was a great slump in demand for many types of goods and services. In a situation of economic collapse, shock reduction in demand often occurs and, consequently, a real decline in production, trade and international exchange of goods and services occur. This is especially true for goods and services which are luxury ones, so those ones which are dropped in the first place when a significant loss of revenue occur. In this economic environment to maintain companies on the market specific skills are required from their management, especially those which can help to anticipate changes in the economy and to adapt business operation strategy to changing conditions.

European companies, as well as companies in most regions of the world, had to adapt their behaviour (strategies) to changing market conditions. Strategies in time of crisis can be either passive (passive isolation, a reactive attitude) or active (proactive adaptation, a proactive attitude) [12, 68; 18, 232]. In the first case, companies are focused only on the survival during recession time and no major changes are made in the way the company operates. In strategies aimed primarily at survival recession focuses mainly on reduction of costs of material resources (such as cheaper substitutes, worse quality) and human capital (staff cuts) as well as on the reduction or suspension of investments.

In the second case, companies respond to external stimuli and implement new strategies to stay on the market, but also make efforts to extrude the most out of this situation for the further development of the company. The proactive measures may include [16, 45; 18, 239]:
– development of new markets, and an increase in advertising;
– investing in new technologies;
– restructuring;
– usage of market knowledge and the ability to read the general macroeconomic situation and use this knowledge for the more effective management of the firm.

Given the time horizon as a criteria, those strategies aimed at the struggle for survival in the market are focused on short-term goals, including above all maintenance of the level of revenue and profits. On the other hand, strategies aimed at long-term measures, in addition to activities that enable a smooth running operation, focus on the development of the company in spite of the unfavourable macroeconomic situation, creating a better market offer and building lasting relationships with customers, partners, employees and business and the social environment [16, 45].

2.2. Proposed activities of enterprises
in order to weaken the negative effects of the crisis

Managers in times of crisis should pay attention to those elements that enable the company to both: stay in business and further develop. The main factors influencing the company's resistance to the crisis are risk dispersion and increase in flexibility of the company [17, 12–13]. In order to spread the risk, efforts to diversify activities, geographic business operations, suppliers, buyers, and investment sources should be undertaken. Increasing the flexibility of the company means to prepare it to act in good and bad environmental conditions, including the implementation of anticipatory mechanisms for rapid response to changes.

In a crisis, but not limited to, companies should first of all be actively carry out market-oriented activities [11, 6]. In this regard, information should be intensively collected and disseminated, especially in large enterprises, enabling them to rapidly respond to market changes. Moreover, the key element for maintaining and improving the efficiency of a well-functioning internal communication allows you to respond in a timely manner to the situation in the company environment, which may be critical to its operation, especially under adverse market conditions. Another element to survive in economic recession times is searching for niche markets and diversification of goods and services offered.

The greatest problem faced by the company during the crisis is a decline in demand. Normally, financial problems are associated with it as the reduction in demand affects the amount of revenue. On top of that there are also often difficulties in obtaining payments from existing customers for transactions already carried out. Hence the importance of access to external sources of financing might be crucial to insure the survival of some companies [4, 390]. Obtaining external funding during the economic recession might be a great problem, as companies struggling with the effects of the crisis reduce their creditworthiness, which greatly limits their ability to raise capital from external sources.

One of the key elements to reduce the negative effects of the crisis on a company is innovation. This was pointed out in studies by Vikash Naidoo [14] and Angela Hausman and Wesley Johnston [8]. Managers should look for innovation in products and processes. The simultaneous introduction of both types of innovation can bring benefits to companies in all aspects of the business. As results of their implementation production costs might be reduced or the level of sales increased and changes in the functioning of the company realized.

In addition, in order to survive the period of economic slowdown and continue effective business, a set of activities should be undertaken aimed at usage of the economic situation in order to remodel the strategy of the company, improve its financial standing. It is also important to make an analysis of leadership by

managers, introduce new organizational and sales techniques (e.g., loyalty systems, strategies challenge), search for strategic partners and to analyse consumer behaviour [1, 15–20; 15, 21].

The regulatory environment in which businesses operate is also important. State actions aimed at supporting businesses through the development of appropriate regulations and safeguards against improper competition or negative behaviour on the part of the principals may be critical to the survival of many businesses [10, 3]. Relevant regulations in this area and support from the state could prevent many unfavourable phenomena in the market. Of course, these activities should be carried out in the extend that it is allowed by the Community legislation. Also, very beneficial for entrepreneurs, and definitely needed for the SME sector, support by the state and the business environment in the form of strategic consulting and expansion of educational programs [16, 109].
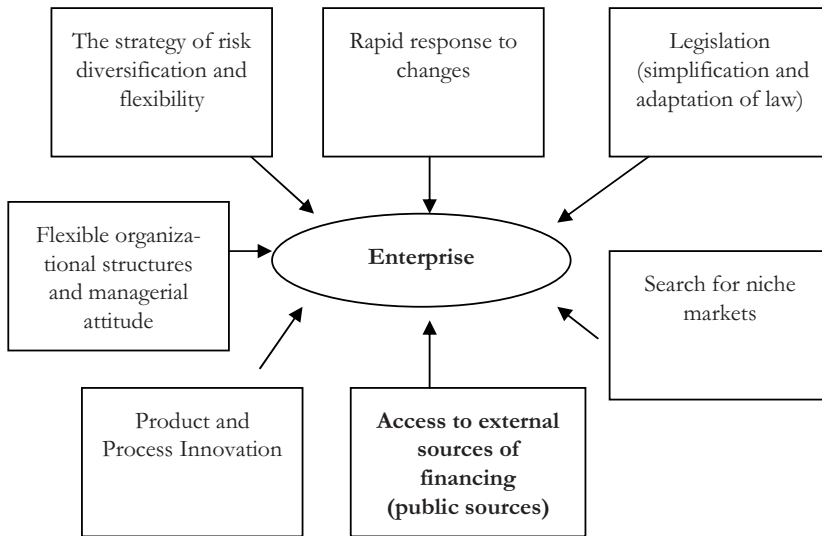
Figure 2. Activities of enterprises and their business and social partners to combat negative effects of crisis

Source: own study

Enterprises in order to fight the negative effects of the crisis are forced to rapid and flexible response to changing conditions and turbulent macro-environment. However, their efforts should be reinforced by external partners, especially

by public institutions: European, national and regional. Their role is the creation of a favourable business environment as well as to provide additional financial support (Fig. 2).

3. The EU actions towards enterprises

Companies operating in the European Union are in a unique situation, as national regulations forming the regulatory environment of enterprises must comply with rules imposed by the whole community. However, functioning within the larger integrated group may have a positive effect, because actions can be taken at the Community level in order to mitigate the impact of the crisis on the European entities and create the conditions for a faster exit from the economic recession.

In the European Union we can talk about the activities at Community level, which indirectly affect functioning of business (eg through legislation or policy) and direct support for business and entrepreneurship generally understood.

3.1. Legislative Framework

For enterprises operating in the EU it is important the smooth and effective functioning of the internal market providing the opportunity to exercise fundamental freedoms: free movement of goods, persons, services and capital. The concept of full implementation of the internal market freedoms became more important during the crisis and has been included as one of strategic objectives of "The policy guidelines for the European Commission" in 2009. There was a report published in 2010 in which the following recommendations have been presented to improve the efficiency of the internal market in order to provide direct, positive effects for companies [9] :
  – free circulation of documents and the mutual recognition of their official functions;
  – mutual recognition of civil law transactions and the adoption of common legislation on collective redress;
  – ensuring an effective debt collection process (European Small Claims Procedure);
  – increasing the transparency of bank fees, standardization and comparability of information on financial products;
  – speeding up adaptation measures for small businesses (Small Business Act);
  – the adoption of the Statute of the European Private Company;

- evaluation of the implementation of the Goods Package 2008 – certification and standardization of goods, promotion of new approaches;
- further review of certification and standardization;
- the adoption of a single EU patent and patent litigation as a matter of urgency;
- full legal regulation of areas not covered by the Services Directive;
- coordination of taxes with respect to the sovereignty of Member States taxes;
- amendments to the law on public procurement.

In response to the proposals of the report, the European Commission presented two documents: "Action for the Single Market I" in 2011 and "Action for the Single Market II" in 2012. The twelve priority actions were set there, the so-called "Leverages of the Internal Market" . Five of them directly concerns enterprises and their environment, i.e.:

- Access to finance for SMEs – legislation designed to make it easier for venture capital funds to invest freely in any other Member State, without obstacles or additional requirements; boost long-term investment in the real economy by facilitating access to long-term investment funds;
- Intellectual property rights– unitary patent protection and a unified patent litigation system; combating piracy and counterfeiting more effectively (cost European businesses EUR 250 billion each year) and the European trademark system;
- Taxation – common consolidated corporate tax base for businesses (CCCTB) – harmonising the methods for computing the tax base, so that the businesses so choosing can be subject to the same set of rules, irrespective of the Member State in which they are taxed;
- Business environment – Simplification of the Accounting Directives as regards to financial information obligations and reduction of the administrative burden, particularly for SMEs; adoption of a Small Business Act to facilitate the activities of SMEs – Think Small First rule; adoption of a European Private Company Statute (EPC); optional European contract law instrument – simplification of the cross-border recovery of debt, modernization of bankruptcy legislation – the so-called the right to a second chance;
- Public procurement – Revised and modernised public procurement legislative framework;

and two indirectly:

- Social entrepreneurship – legislation setting up a European framework facilitating the development of social investment funds;
- Social cohesion – improving and reinforcing the transposition, implementation and enforcement in the practice of the Posting of Workers Directive; legislation aimed at clarifying the exercise of freedom of establishment and the freedom to provide services alongside fundamental social rights.

In the European Union there is also enterprises policy conducted. The aim of this policy is to create adequate conditions for investment in sectors of strategic importance, as well as in traditional industries. The focus is also put on small and medium enterprises, which account for 92% of all enterprises in the EU [7]. In this regard, policy for enterprises aims at promoting entrepreneurship and skills, improving SMEs' access to markets and to enable them to develop the capacity for research and innovation.

3.2. Business support

The EU actively supports businesses directly. It takes the form of free, personalised assistance through a series of pan-European networks and services, as well as a financial support [6]. The main aim of networks and services is to offer information about different issues concerning enterprises or to provide advisory help. Enterprises through participation in certain of the proposed action or European societies can also give advice and opinions to the policy makers.

Individual help is offered by The Enterprise Europe Network. It offers a one-stop shop to meet the needs of businesses in the EU and provides information and assistance on a wide range of issues, including cross-border activities, innovation and technology, access to finance and programmes and business cooperation as well as helping companies understand the EU laws directly related to their activities. The network also provides information through awareness-raising activities (trade fairs, seminars, lectures and workshops) and a range of publications in local languages (guides, newsletters, and websites).

Other networks are SOLVIT and EURES. SOLVIT helps businesses solve concrete cross-border problems arising from the misapplication of EU rules by public authorities, including market access for products, provision of services, going self-employed, public contracts, tax or VAT reimbursements and border controls. While European Employment Services (EURES) offer employers and jobseekers information and support on recruitment and job opportunities throughout the EU. In border regions, EURES provides information on cross-border commuting and helps workers and employers with any problems they may encounter.

In cases of in business-to-consumer problems, an entity or a client can use the assistance of the European Consumer Centres Network (ECC-Net), which was set up jointly by the European Union and its Member States, to provide assistance when consumers make cross-border purchases in person or through distance selling (especially online shopping). This network also provides information on EU and national legislation on consumer protection.

Moreover, enterprises can lodge complaints with the European Ombudsman about maladministration by EU institutions and bodies, such as late payments,

contractual disputes, problems with calls for tender or refusal of access to documents. Companies often have dealings with EU institutions when taking part in EU-backed projects and may therefore come across problems that the Ombudsman can solve.

Companies can express their opinions, needs and expectations through a system of Interactive Policy Making (IPM). By using interactive online questionnaires companies can participate in the consultation process and to assist in the development of European policies. The EU institutions ensure companies can access all information relevant to their activities. They also hold ongoing dialogue with businesses and involve them in the decision-making process – both through associations and individually. For that purpose, the following networking sites were established:

– The European Small Business Portal – it is a single portal packed with links to information on EU policies, programmes, projects, tools and services aimed at small companies, and is provided by the European Commission;
– The Communication and Information Resource Centre for Administrations, Businesses and Citizens (CIRCABC) – it is an open-source, web-based application used to create collaborative workspaces. It makes public administration documents more accessible and harmonised for businesses and private associations.
– European Business Test Panel (EBTP) – a panel of individual companies regularly consulted on European Commission policy initiatives. It enables companies registered in the panel to influence EU policies that could affect day-to-day business.

Companies can also receive support through participation in European associations such as EUROCHAMBRES, BUSINESSEUROPE and the European Association of Craft, Small and Medium-sized Enterprises (UEAPME). The first of them it is the Association of European Chambers of Commerce and Industry – EUROCHAMBRES. It represents national chambers of commerce and industry from across Europe and its mission is to give them a stronger voice and position on all major economic issues, ensuring their involvement in projects of value to business, delivering services to its members, and developing a European support network for enterprises. The activity of BUSINESSEUROPE focuses on the support of enterprises in order to strengthen their competitiveness, and at the same time the competitiveness of the whole European economy. Finally, The European Association of Craft, Small and Medium-sized Enterprises (UEAPME) represents the interests of European crafts, trades and small businesses in the EU institutions and provides its members with support and information on EU policy. It is also directly involved in all EU legislation affecting small businesses. It is an employers' organisation recognised as a European social partner.

An important area of business support offered by the European Union is the financial support. Companies may seek this type of support through participation in programs organized at the Community level (The Framework Programmes) or at the national/regional level by obtaining financial support from the European Structural Funds. However, managers need to be aware that the financial support offered from the European sources, in principle, cannot be used for the current operations of the enterprise and help maintain the company in the market during the economic recession. Financial support according to the adopted by the Union and the Member States priorities are focused on improving competitiveness, enhancing innovation, usage of new technologies, usage of renewable energy or implementing in the company other forms of natural environment protection.

4. Conclusions

In mid-2013, the global economy is still in the shadow of the economic crisis of 2007–2009, which had an impact on the economic condition of companies. This situation requires to redefine management styles. The crisis forces to take on challenges, reorganization, and to find new markets and new customers. It also results in forcing focus on activities that increase company efficiency and competitiveness. Determining the specific context of the environment in which enterprises operate, the crisis brings to some companies a threat to their existence, while for others it can become an opportunity for development [13, 176].

The companies of the Member States of the European Union are offered a wide range of support. This help is either of the informative or consultative nature, as well as promoting cooperation between European companies by facilitating the establishment of new business contacts. Companies can also receive financial support. However, the sourcing and use of funds from Community sources is a subject to particular conditions defining the objectives and principles of this support.

Time of economic recession and the period immediately thereafter provide a test for each company. Companies can prepare for the possibility of economic slowdown, but they are unable to protect themselves completely from the effects of economic fluctuations. Therefore, it is important to use the appropriate proactive attitude in business management and to use the available forms of support offered at the Community level, which both in combination create opportunities for the effective functioning of the company and the improvement of its competitiveness in a difficult period of economic crisis and beyond.

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Milena Suliga*, Tomasz Wójtowicz*

The reaction of the WSE to U.S. employment news announcements

1. Introduction

From the financial and economic literature it follows that macroeconomic news plays important role in asset pricing as it carries information about conditions of the economy and possible future government actions. Previous studies show that not only domestic news is significant for investors. Sometimes information about other economies is even more important, particularly when it is the U.S. economy. Such conclusion is obtained by e.g. Nikkinen and Sahlström [12], Będowska-Sójka [3], Harju and Hussain [11] and Gurgul et al. [10]. Their studies are performed on the basis of daily data as well as intraday data.

Using daily data Nikkinen and Sahlström [12] study the impact of macroeconomic announcements on German and Finnish equity markets. The data set considered in the paper consist of monthly reports from Germany, Finland and the U.S. involving three prominent macroeconomic indicators, namely Consumer Price Index, Producer Price Index and Unemployment Rate. Results of the study show that in the period from January 1996 to December 1999 neither the German nor the Finnish market is sensitive to domestic macroeconomic news but both of them react to U.S. announcements. UR and PPI influence the implied volatility on both stock markets while CPI reports have an impact on uncertainty on the Finnish market only.

The issue whether the U.S. economy is an important source of information to European investors is also studied by Harju and Hussain [11]. They use a wide set of U.S. macroeconomic releases from September 2000 to March 2006. Harju

and Hussain study their impact on high-frequency returns of four European indices: CAC40, DAX30, FTSE100 and SMI. For all of these stock markets Harju and Hussain find that intraday returns as well as volatilities react immediately to U.S. macroeconomic surprises.

In the similar manner Będowska-Sójka [3] studies the reaction of WIG20, DAX and CAC40 indices to announcements of eight types of US macroeconomic indicators, published between November 2007 and May 2009. She analyzes the impact of individual types of announcements as well as market reaction to "good" and "bad" news. Będowska-Sójka shows that U.S. macroeconomic news changes both returns and volatilities. Unemployment Rate announcements, on the average, decrease returns and increase volatilities of all three European indices under study.

The impact of announcements about CPI, UR and Industrial Production in the U.S. on the Polish stock market is also studied by Gurgul et al. [10]. The authors consider daily returns of WIG20 from February 2004 to December 2011. Using the event study analysis Gurgul et.al. show that investors significantly respond to CPI and IP announcements while UR releases seem to have no impact on the Warsaw Stock Exchange.

The abovementioned papers prove that releases of U.S. macroeconomic indicators do really impact developed as well as emerging European equity markets. This point of view is reinforced by Andersen et al. [2] who investigate the impact of U.S. fundamentals releases on stock, bond and exchange markets in the U.S., the UK and Germany. Their data set consists of 22 U.S. macroeconomic indicators and 5-minute returns from July 1, 1998 to December 31, 2002. Andersen et al. not only confirm the significant impact of U.S. announcements on the conditional means of European stock markets but also show that the strength and direction of the impact depends on the state of the U.S. economy i.e. traditionally bad information have a negative impact on European markets during contractions but the effect is positive while expansions. This is in line with the previous results of Boyd et al. [4] who study the impact of the U.S. Unemployment Rate announcements on S&P500 stock index in the period from February 1948 to December 2000. Boyd et al. discover that during contractions average stock returns are positive on the day when "good" news is announced and negative on the day of "bad" news. On the other hand, during expansions the situation is quite different – averages are positive on the day of the announcement regardless of the information contained in the release. Moreover, the market reaction to an unexpected rise in unemployment is positive in expansions and negative in contractions. Following Campbell and Mei [5] Boyd et al. explain that during contractions UR releases carry important information about interest rates, while during contractions in UR

announcements dominates information about equity risk premium and future corporate dividends.

From the abovementioned papers it follows that the state of the labor market is one of the most frequently examined macroeconomic issue. In fact, the Employment Report published monthly by the U.S. Bureau of Labor Statistics is one of the most significant U.S. macroeconomic announcements ([1],[2],[6]). However, in the majority of papers the state of the U.S. labor market is characterized by the Unemployment Rate which is only one of the indicators in the Report. Other important indicators are e.g. Average Hourly Earnings, Average Workweek, Nonfarm Payrolls, Manufacturing Payrolls Change and Private Payrolls Change. All of these indicators are released simultaneously and jointly affect price formation processes. Thus, the reaction of the stock markets on the Employment Report depends on the level of each of these indicators. Studies that focus only on the value of the Unemployment Rate ignore the fact that it describes one side of the employment situation in the U.S. and other indicators provide additional information. In particular, there could be an indicator that is more informative and have greater impact on investor behavior than UR.

In this paper we analyze the impact of four indicators published in the Employment Report on the Warsaw Stock Exchange. On the basis of high-frequency WIG returns from January 2004 to November 2012 we evaluate the significance of each of these indicators in price formation processes on the WSE. To indicate the most important indicator we also study the joint impact of some pairs of indicators from the Employment Report. The analysis in the paper estimates the duration and direction of the impact of U.S. employment news on the Polish stock market.

The structure of the paper is as follows. Data and methodology applied in the study are described in detail in the next section. Empirical results of the event study analysis are presented in Section 3. The final section concludes the paper.

2. Data and methodology

From the group of indicators that are published monthly in Employment Reports of the Bureau of Labor Statistics we choose four, that are commonly provided by information agencies and business and financial services. These are Unemployment Rate, Nonfarm Payrolls, Average Hourly Earnings and Average Workweek. Each of them describes various aspects of the employment situation and its changes can lead to different investor reaction. Decrease in the

Unemployment Rate is usually good news. However, too low UR can be interpreted as a symptom of labor shortage leading to wage growth. The level of the economic activity is reflected by changes in Nonfarm Payrolls, which measure monthly changes in the number of employed outside the farming industry. The more workplaces, the faster economic growth. Nevertheless, for the economy in the mature phase of expansion rapid growth of the employment can lead to inflationary pressures. Average Workweek expresses the weekly amount of working hours. Rising Average Workweek causes the increase in employment and supports production gains while decreasing Average Workweek could lead to a decline in employment. Wage pressure is represented by increase in Average Hourly Earnings. It is commonly believed that the upward tendency of this indicator can yield higher inflation. On the other hand, product prices do not increase if the wage growth are caused by the growth of productivity because the unit labor costs are unchanged.

In this paper we examine the reaction of stock prices on the WSE to unexpected news about each of the abovementioned indicators. Dates and hours of announcements as well as released values and their forecasts come from www.bloomberg.com and cover the period from January 2004 to November 2012.

Employment Reports are released on the first Friday of the month at 8:30 EST (Eastern Standard Time) i.e. usually at 14:30 CET (Central European Time). Due to differences in introducing the Daylight Saving Time in the U.S. and Europe one announcement (November 2, 2012) arrived the WSE at 13.30 CET. From the data sample we exclude 5 events when there was no trading on the WSE in the day of the announcement. It gives the total number of 102 report releases.

For each indicator under study we compared the announced value with its previous forecast and thus we divided all announcements into three clusters: "below consensus", "in line with consensus" and "above consensus". Unexpected news are connected with events in the first and third clusters. To analyze the impact of these unexpected news on the WSE we applied the event study. More precisely, we applied nonparametric rank test proposed by Corrado and Zivney [9] to test the significance of abnormal 5-minute returns of WIG.

It is well established in financial literature that intraday volatility of high-frequency returns is higher at the beginning and at the end of a trading session. In this study we consider the pre-event window of the length 48 returns (four hours) and the event window of the length of 35 minutes. The event window consists of seven 5-minute returns: two returns before the announcement, the event return and four returns after the release. The Employment Report is usually released at 14.30 CET, thus the earliest return in pre-event window is from

10.25 CET and the latest return in event window is from 14.55 CET. When the employment report is released at 13.30 CET then we use 5-minute returns from 9.25 to 13.55 CET i.e. 25 minutes after opening of the trading session and more than three hours before closing. Such pre-event and event windows do not include returns from the beginning nor the end of the trading session when increased volatility is observed.

If we denote the moment of the news release by $t = 0$ then the pre-event window are $t = -51, ..., -3$ while $t = -2, ..., 4$ are event window. Abnormal returns AR_{it} for i-th event are defined as differences between actual returns and the mean from the pre-event window. For each event abnormal returns are standardized:

$$SAR_{it} = AR_{it} / S(AR_i),$$

where

$$S(AR_i) = \sqrt{\frac{1}{47} \sum_{t=-51}^{-3} AR_{it}^2}.$$

is abnormal returns standard deviation in the pre-event window. Increased volatility of abnormal returns is frequently observed in the event window ([7], [8]). It is also visible in the case of the Employment Report announcements.

Figure 1 presents cross-sectional standard deviations of abnormal returns around the time of the announcement, i.e. at the end of the pre-event window ($t = -9, ..., -3$) and in the event window ($t = -2, ..., 4$). It shows that just after the event, for $t > 3$, cross-sectional volatility of abnormal returns increases. To control for this event-induced shift in the cross-sectional variance we adjust standardized abnormal returns:

$$SAR_{it}' = \begin{cases} SAR_{it} & t = -51,...,0 \\ SAR_{it} / S(SAR_t) & t = 1,...,4, \end{cases}$$

where

$$S(SAR_t) = \sqrt{\frac{1}{N-1} \sum_{i=1}^{N} \left(SAR_{it} - \overline{SAR_t}\right)^2}$$

is cross-sectional standard deviation and N is the number of events in a cluster. We tested the significance of abnormal returns for each t in the event window separately thus for each $t_0 = -2, ...,4$ Corrado-Zivney T_{cz} statistics is defined as ([7]):

$$T_{CZ}(t_0) = \frac{1}{\sqrt{N}} \sum_{i=1}^{N} \frac{\left(rank\left(SAR_{it_0}'\right) - \frac{n+1}{2}\right)}{\sqrt{n(n+1)/12}},$$

where n is the length of the pre-event window and $rank(SAR'_{it0})$ denotes the rank of SAR'_{it0} within the vector consisting of standardized abnormal returns from the pre-event window and SAR'_{it0}. T_{cz} statistics is asymptotically normally distributed. The advantage of the nonparametric Corrado-Zivney test is that is does not need any assumption of abnormal returns normality.
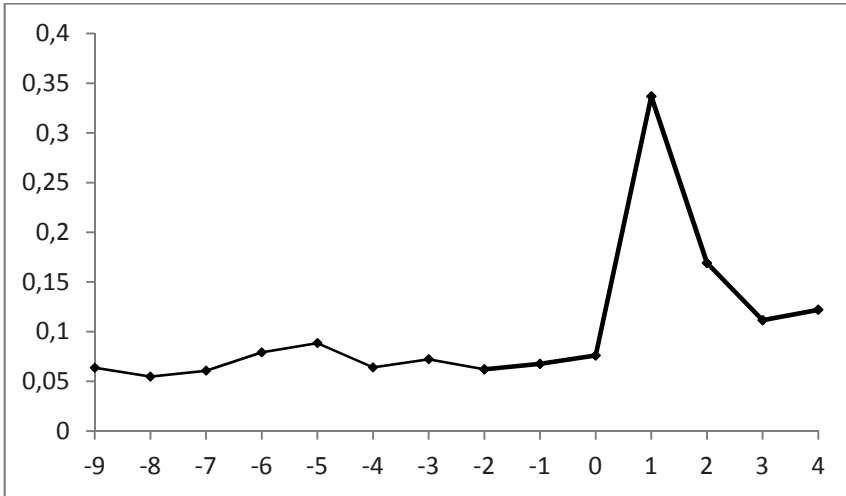
Figure 1. Cross-sectional standard deviations of abnormal returns AR_{it} of WIG in the part of the pre-event window ($t = -9, ..., -3$) and in the event window ($t = -2, ..., 4$).

3. Empirical results

In the first step we examined the impact of each indicator separately ignoring interrelations between them as if the Employment Report contained information only about this one indicator. It means that for each indicator and for the same set of abnormal returns data computed for all Employment Report announcements we define different events according to the value of this indicator. Detailed results of the event study analysis for Unemployment Rate, Average Hourly Earnings and Average Workweek i.e. average abnormal returns in the event window and Corrado-Zinvey statistics T_{cz} are presented in Table 1 for all clusters. Nonfarm Payrolls equals consensus only in one case so only the impact of unexpected news about NP is examined and results of the event study for NP are presented separately in Table 2. For each indicator the number of events in each cluster are also reported in Tables 1 and 2.

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Table 1
Reaction of intraday WIG returns to unexpected news in the Employment Report of the U.S. Bureau of Labor Statistics in the period from January 2004 to November 2012

	Below consensus		In line with consensus		Above consensus	
	$\overline{AR}$(%)	T_{cz}	$\overline{AR}$(%)	T_{cz}	$\overline{AR}$(%)	T_{cz}
Unemployment Rate						
t	44 events		30 events		28 events	
−2	0.007	0.24	−0.010	−0.68	0.012	1.40
−1	−0.004	−0.10	0.000	0.81	−0.004	−0.18
0	0.012	1.11	0.017	1.64	0.009	0.84
1	−0.016	−0.72	0.042	1.04	−0.091	−1.08
2	0.005	0.38	−0.016	−0.60	−0.018	−0.69
3	0.017	0.81	0.021	1.59	0.019	0.99
4	−0.012	−0.26	0.005	−0.09	−0.025	−0.35
Average Hourly Earnings						
	41 events		29 events		32 events	
−2	0.006	0.42	−0.004	0.02	0.006	0.44
−1	−0.015	−1.19	−0.006	0.44	0.015	1.43
0	−0.008	0.43	0.031	2.58*	0.022	0.97
1	0.013	0.34	−0.047	−0.70	−0.037	−1.00
2	−0.032	−0.98	−0.020	−0.97	0.035	1.29
3	0.020	2.06**	−0.001	0.19	0.036	0.63
4	−0.010	−0.57	−0.005	−0.02	−0.016	−0.09
Average Workweek						
	35 events		45 events		22 events	
−2	0.013	0.89	−0.001	−0.23	−0.003	0.34
−1	−0.007	−0.02	−0.016	−1.07	0.031	2.16**
0	−0.003	0.26	0.027	2.80*	0.009	0.43
1	−0.035	−0.60	−0.046	−0.87	0.057	0.43
2	−0.049	−1.47	0.035	1.40	−0.028	−0.94
3	0.041	1.68***	−0.012	−0.32	0.046	1.95***
4	−0.001	0.38	−0.017	−0.57	−0.013	−0.88

*, **, *** - significant at 1%, 5% and 10% level respectively

In should be noted here, that new information released at $t = 0$ can be reflected in stock prices only for t greater than 0. Thus, the most important in the analysis of the reaction of WIG to the Employment Report is the value and significance of $\overline{AR}_1$.

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When the announced value of the Unemployment Rate is different from expectations stock prices decrease in the first five minutes after the announcement in both clusters "below consensus" and "above consensus". On the other hand, when the unemployment rate is in line with expectations stock prices increase about 0.042%. It indicates that any unexpected information about unemployment is regarded by investors as bad news while UR in line with expectations is seen as good news. However, changes in abnormal returns induced by UR announcements are small when compared with returns standard deviation and hence become insignificant. These results confirm that in general the value of the unemployment rate in the U.S. does not impact stock prices. Similarly to UR, there is no visible impact of the announced value of the Average Hourly Earnings. The absolute value of T_{cz} statistics in each cluster for $t = 1$ is smaller than any reasonable critical value. Opposite to UR, investors react differently depending on the value of AHE. The announcement below consensus is followed by positive average abnormal returns (0.013%) while AHE greater than forecast implies negative $\overline{AR}$ (–0.037%). It suggests that when AHE is smaller than expected it is seen as good news while AHE greater than expected is bad news. Corrado-Zivney test statistics is significant at least at 5% level only in two cases: when the announcement is below consensus ($t = 3$) and when the announcement is in line with consensus ($t = 0$). The significantly positive change in abnormal returns just before the announcement in line with forecasts is also observed when the Average Workweek is taken into account. AW shorter than expected is accompanied by negative average abnormal returns up to 10 minutes after the release. Then highly positive $\overline{AR}_3$ is observed and its significance is confirmed by Corrado-Zivney test. The reaction of returns to AW below consensus in the first 10 minutes after publication of the Employment Report means that the reduction of working time in the U.S. is bad news for investors. The opposite reaction is visible for AW above consensus when at first investors react positively. In this cluster increase in stock prices is confirmed by significant T_{cz} statistics for $t = 3$ It means that 15 minutes after unexpected news about Average Workweek highly positive investor reaction is observed on the WSE irrespective of the value of news.

The reaction of WIG returns to Nonfarm Payrolls is different from the reaction of any other indicator analyzed in this paper. When all the data are divided according to unexpected news about NP, then the strongest reaction to the Employment Report is observed. Moreover, the impact of news about NP is the easiest to interpret. When NP is below consensus stock prices on the WSE decrease in average about –0.144% in the first five minutes after information release. This change is significant at the 1% level ($T_{cz} = -3.96$). After then there is no other significant changes. It means that NP smaller than expected is bad news to investors and their reaction is very strong, very fast and disappears after five minutes. The opposite reaction just after news release is observed when the announced value of NP is greater than

consensus ($\overline{AR}_1 \cong 0.198\%$). Hence, NP above consensus is admittedly good news to the stock market as evidenced also by significantly positive $\overline{AR}_3$ and by positive average abnormal returns in almost the entire event window.

Table 2

Reaction of intraday WIG returns to unexpected news about Nonfarm Payrolls in the period from January 2004 to November 2012

t	Below consensus (64 events)		Above consensus (37 events)	
	$\overline{AR}$(%)	T_{cz}	$\overline{AR}$(%)	T_{cz}
-2	0.009	1.06	–0.006	–0.42
-1	–0.004	0.29	0.001	0.18
0	0.007	1.41	0.023	1.96***
1	–0.144	–3.96*	0.198	4.07*
2	–0.010	–0.42	–0.008	–0.11
3	0.010	0.38	0.035	2.23**
4	–0.020	–0.80	0.010	0.77

*, **, *** - significant at 1%, 5% and 10% level respectively

Results in Table 1 and 2 indicate that unexpected changes in Nonfarm Payrolls are the major determinant of investor reaction to news about the U.S. labor market included in the Employment Report. A significant reaction of WIG returns just after the Employment Report release is observed only when announcements are divided according to the value of NP. Table 1 and 2, however, describe the reaction of WIG returns to information contained separately in each of the indicators. To verify that stock prices change mainly according to news about Nonfarm Payrolls we repeat the above computations taking into account unexpected news about NP together with unexpected news about each of the other indicators. This allows us to determine the joint impact of pairs of the indicators. Because we examine the impact of unexpected news, hence for each pair of the indicators we divide data into four clusters: both indicators are above consensus, both are below consensus and one indicator is above consensus while the other is below (there are two such clusters). Detailed results of this event study are reported in Table 3 where we present mean abnormal returns $\overline{AR}_t$ in the event window together with T_{cz} statistics. The small number of events in some clusters could result in the low power of the preformed tests. However, results in Table 3 clearly indicate the importance of Nonfarm Payrolls. In each cluster the mean abnormal return for $t = 1$ is significant at least at 10% level and, what is even more important, the sign of $\overline{AR}_1$ depends only on the value of unexpected news about NP. $\overline{AR}_1$ is negative when NP is below

consensus and $\overline{AR}_1$ is positive when NP is above consensus irrespective of the value of the other indicator. It confirms results from Table 1 and 2 that investors on the WSE react mainly to information contained in Nonfram Payrolls and the values of other indicators in the Employment Report are significantly less important.

Table 3

Reaction of intraday WIG returns to unexpected news about pairs of indicators published in the Employment Report in the period from January 2004 to November 2012

	Nonfarm Payrolls below consensus				Nonfarm Payrolls above consensus			
	$\overline{AR}$(%)	T_{cz}	$\overline{AR}$(%)	T_{cz}	$\overline{AR}$(%)	T_{cz}	$\overline{AR}$(%)	T_{cz}
t	UR below consensus (31 events)		UR above consensus (17 events)		UR below consensus (17 events)		UR above consensus (11 events)	
−2	0.009	0.55	0.021	1.50	0.004	−0.19	−0.001	0.38
−1	−0.004	−0.08	−0.007	−0.15	−0.003	0.11	0.001	−0.10
0	0.009	1.33	0.003	0.20	0.021	0.33	0.019	1.20
1	−0.176	−3.93*	−0.227	−2.57**	0.338	3.10*	0.119	2.08**
2	−0.008	0.12	−0.024	−0.82	0.046	0.94	−0.008	−0.18
3	0.003	−0.09	0.017	0.72	0.040	1.10	0.022	0.61
4	−0.020	−0.17	−0.045	−1.07	0.006	−0.27	0.007	1.52
t	AHE below consensus (25 events)		AHE above consensus (21 events)		AHE below consensus (17 events)		AHE above consensus (11 events)	
−2	0.010	0.38	0.012	0.88	0.003	0.39	−0.006	−0.46
−1	−0.022	−1.14	0.018	1.33	−0.004	−0.36	0.009	0.59
0	−0.024	−0.45	0.022	0.97	0.016	1.75***	0.023	0.31
1	−0.105	−1.92***	−0.163	−2.47**	0.181	2.70*	0.205	1.65***
2	−0.035	−0.77	0.022	0.48	−0.021	−0.29	0.060	2.10**
3	0.035	2.00**	0.025	−0.26	−0.011	0.48	0.056	1.35
4	−0.024	−1.08	−0.037	−0.72	0.011	0.16	0.023	1.63
t	AW below consensus (26 events)		AW above consensus (13 events)		AW below consensus (8 events)		AW above consensus (12 events)	
−2	0.008	0.45	−0.002	0.43	0.035	1.31	−0.003	0.02
−1	−0.013	−0.25	0.041	1.73***	0.014	0.63	0.018	1.31
0	−0.004	0.59	0.011	0.54	0.001	−0.23	0.006	0.05
1	−0.120	−2.12**	−0.155	−2.72*	0.219	3.11*	0.312	3.03*
2	−0.072	−2.03**	0.004	0.02	0.033	1.41	−0.066	−1.63
3	0.029	1.02	0.039	0.82	0.066	1.24	0.055	1.87***
4	0.000	0.35	−0.027	−0.58	−0.002	0.15	0.004	−0.66

*, **, *** - significant at 1%, 5% and 10% level respectively

4. Conclusions

The Employment Report published monthly by the U.S. Bureau of Labor Statistics is one of the most significant U.S. macroeconomic announcements. In this paper we examined the impact of four macroeconomic indicators included in the Report (Unemployment Rate, Nonfarm Payrolls, Average Hourly Earnings and Average Workweek) on stock prices on the Warsaw Stock Exchange in the period from January 2004 to November 2012. To analyze the impact of unexpected information on 5-minute returns of WIG we apply the event study. The analysis shows that generally investors react to announcements about the U.S. labor market in the first five minutes after information release. An unexpected increase in Average Hourly Earnings is seen by investors as bad news while increase is Average Workweek or Nonfarm Payrolls is good news. Reaction to unexpected information about the Unemployment Rate is negative. The comparison of investor reaction to indicators under study shows that Nonfarm Payrolls is the most important indicator i.e. changes in stock prices on WSE are in line with the value of Nonfarm Payrolls irrespective to the value of other indicators in the Employment Report.

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SUMMARIES

Marcin Brol, Sławomir Czetwertyński: **Remarks on network public theory** ▪ Managerial Economics 2013, No. 14

This paper is a trial of capturing of a relation between traditional public sphere atrophy and the augmentation of a network public sphere. A thesis is advanced that the traditional public sphere is subject of the atrophy, however, the entire network public sphere is subject of the augmentation process. Such a formulated thesis forces a choice between two following issues. The first of them regards a relation between factors, which stimulate the atrophy and the augmentation. The second issue regards a role played by social media in the network public sphere. Considerations included in the paper are based on the public sphere theory of J. Habermas and on the M. Castells' network society theory.

Henryk Gurgul, Artur Machno, Robert Syrek: **The optimal portfolio in respect to Expected Shortfall: a comparative study** ▪ Managerial Economics 2013, No. 14

Value at Risk plays a crucial role in the risk management. However, this risk measure has some drawbacks. The alternative risk measure is Expected Shortfall, which is rarely used, but exhibits desirable properties. In the paper, the estimation of both risk measures has been conducted, for pairs of index returns (DJIA, DAX, ATX), based on Markowitz model, the regime switching copula model and the multivariate GARCH model. The results suggest that a misspecification can cause many errors. Incorrect models cause bias of mean, especially models which do not assume dynamic structure of the market Both an underestimation and an overestimation of a risk has been observed. In the paper, it is shown that the measure of change in Expected Shortfall as a function of the expected return is strongly underestimated under the normal distribution assumption.

Henryk Gurgul, Robert Syrek: **The structure of contemporaneous price-volume relationships in financial markets** ▪ Managerial Economics 2013, No. 14

The main goal of this paper is an examination of the interdependence stuctures of stock returns, volatility and trading volumes of companies listed on the CAC40 and FTSE100. The

authors establish that the mean values of respective measures are different on the markets under study. In general, they are larger for equities from CAC40 than from FTSE100. The Mixture of Distributions Hypothesis with long memory is rejected for about 70 % of stocks from both markets. Additionally fractional cointegration was tested. The lack of fractional cointegration, suggests a rejection of the last variant of MDH in all cases, i.e. the time series under study do not exhibit common long-run dependence. The analyzed time series are not driven by a common information arrival process with long memory. Correlation between volatility and trading volume is present for all the stocks of companies from these markets. The mixtures of rotated copulas and Kendall correlation coefficient allowed the checking of extreme return-volume dependence structures. The empirical results reflect significant dependencies between high volatility and high trading volume. In general, the dependence structures of stock returns and trading volume are different. In the case of CAC40 companies high trading volume is not correlated as frequently with high stock returns as with low stock returns. For companies listed on the FTSE100 high stock returns are mostly related with high trading volume.

Agata Jakubowska: **Financial institutions as an example of institutions of public trust** ▪ Managerial Economics 2013, No. 14

JEL Classification: G2, G21, G23

Keywords: *trust, institutions of public trust, financial institutions*

Financial institutions are commonly known as institutions of public trust and they are fundamental for activities of other economic entities. The level of trust determines the competitive position of financial institutions. That is why care about the best standards is the most important task for these institutions. Financial institutions are called institutions of public trust and thus high professionalism and more responsibility is demanded from them. This article presents basic problems concerning trust and institutions of public trust. The article is also an attempt to verify the statement that financial institutions are institutions of public trust.

Zbigniew Juroszek, Mariusz Kudełko: **Methodology of optimisation of local energy infrastructure development** ▪ Managerial Economics 2013, No. 14

Keywords: *modeling of energy systems, local energy infrastructure, local energy systems, planning of development of local energy systems*

One of the most important issues concerning the national energy policy in Poland is planning of development of municipal energy infrastructure by local authorities. However, many municipalities do not have strategic plans for supplying local residents and businesses in energy. In addition, those plans that exist are usually very simplified, vague and imprecise. It is mainly due to not applying by local authorities optimizing tools during the planning process (intuition or following of others is the base instead). In this context, research on the possibility of modeling and optimization of local energy systems development seems an interesting and important issue. In this paper the authors present a mathematical optimization model which seems to suit well the needs of local authorities with respect to the strategic plans of local energy infrastructure development. The concept of the model may be a good starting point to create a complex, user friendly, easy to learn and municipality oriented software tool for the optimization of local energy infrastructure development.

Jarosław Korpysa: **Using case study for tertiary education in the field of economics** ▪ Managerial Economics 2013, No. 14

JEL Classification: I21, J24, DO1

Keywords: *case study, teaching, education, students*

The article has a theoretical and empirical character. It analyses ways in which the case study method is used for tertiary education in the field of economics. The problem is verified on the basis of literature and the results of a questionnaire survey addressed to students of economics and related fields of study

Zbigniew Kowalski: **Commercial hospitality as a business model in the independent hotel company** ▪ Managerial Economics 2013, No. 14

JEL Classification: O31

Keywords: *commercial hospitality, non-commercial hospitality, commercial hospitality management, business model in hospitality business, independent hotel company*

The hospitality business, not only in Poland, especially the independent hotel companies, require a greater commitment from theorists and practitioners in industry and others, who can inspire them with their knowledge, competence and experience. The presented for the first time in Poland example of using the commercial hospitality for more effective and profitable hotel operation is the process innovation itself becoming a new way of organizing the service activity of the hotel. One need to keep in mind that this is "a continuous process, consisting of a series of incremental changes in products and processes [and] this may occasionally complicate the identification of innovations in services in terms of single events" [7, s. 38], e.g. the individual implementations. Commercial hospitality as a business model could be an innovative tool in the hands of the hotel manager of the independent hotel company, because it allows him more effective control over the process of service provision and the creation of the value chain starting from inviting guest until bidding them farewell. Commercial hospitality mustn't be perceived as the added value as it is the integral element of the full value of the service expressed in the price and paid by the client or guest.

The phenomenon of commercial hospitality, not only in Poland, is a relatively young research issue and that is why it is the subject to constant assessment, analysis and constructive criticism. However, it is important that this publication enables a greater understanding of and commitment to the commercial hospitality. Goodwill for commercial hospitality and the innovative approach to the commercial hospitality management are the vector indicated by author in improving hotel's resistance to competition and in the process of development of the independent hotel companies of the XXI century.

Krystian Nowakowski: **The institutional matrices theory as the basis of explanation of real estate bubble** ▪ Managerial Economics 2013, No. 14

JEL Classification: R21, G12, E02

Keywords: *economic bubble, real estate bubble, institutions, institutional matrices theory, soft budget constraint*

The increase of prices that could not be explained on the basis of fundamentals is still a very complex process. The economic bubbles have occurred over hundreds of years. Multiplicity of markets, geographical spread and variety of items influenced by bubble makes them still poorly understood. Insufficiency of actual structures for understanding and predicting the economic

bubble was the reason for explanation based on the ground of new institutional economy. In the article factors creating the real estate bubble are examined using the institutional matrices theory. The research is performed through the analysis of data and identification of factors conductive in formation of enormous price increase in the United States, Spain and Poland. The study confirms that the lack of balanced combination of dominant and complementary matrices institutions leads to the creation of real estate bubbles. Besides, it was confirmed that the combination of dominant Y-matrix with their basic institutions is the necessary condition of the growth beyond the fundamentals. The examined institutions distorting the market growth and turning it into the bubble have been divided into two groups. First, unintended effects of intervention in market mechanism, has been examined by the identification of housing finance organization in the United States and analysis of the effects of their activity, analysis of social housing policy in Spain and Poland, and finally by the analysis of tax and subsidies systems. Second group, wrongly understood full "liberalization" and deregulation of all market processes, has been examined at two levels: creation of debt for the customers and financing banks themselves. Research was performed in this group in the area of bank lending standards, securitization process and capital requirements for banks. The activities of intervention in the market mechanism were against the dominant matrix and were planned for stabilization and stimulation of real estate market. But in fact supports the speculation and blow of the bubble due to the inappropriate design of institutions of complementary matrix. The activities of wrongly understood full „liberalization" were intended for absolute deregulation by elimination of institutions of complementary matrix. Research confirms that liberalization is possible in the healthy economy however it does not mean for sure that market mechanism could work without any institutions.

Elżbieta Pohulak-Żołędowska: **Industrial meaning of university basic research in modern economies** ▪ Managerial Economics 2013, No. 14

JEL Classification: O12, O31, O32, D83

Keywords: *academic basic research, intellectual property rights, industrial science*

Basic research conducted in the public research institutions are the ones of great importance for both novelty of conduced research and the possibility of their commercial exploiting. Thanks to the institutions which gave the property rights to the publicly produced innovations, it is possible to treat the academic research output as market commodities. It is the next step in the direction of industrial science development. The goal of the article is to show the changes in the approach to the university basic research as a part of the innovation process.

Joanna Stefaniak-Kopoboru, Joanna Kuczewska: **European enterprises in crisis time** ▪ Managerial Economics 2013, No. 14

JEL Classification: D21, F15, L21

Keywords: *European enterprises, crisis, enterprises policy, support*

The economic crisis it is a rapid economic downturn. National economies are increasingly intertwined through trade and capital what results in fast transmission of the crisis between countries. The crisis results mainly in the deteriorating financial situation of enterprises and in the increase of unemployment, the deterioration in consumer confidence and the reduction of purchases. Under such an unstable macroeconomic environment European companies were forced to review their strategies and maintain a high flexibility for their reactions to changes in the environment. The promotion of competitiveness of European enterprises has become the priority of public regional, national and supranational authorities. Any initiatives hads and still have a great

role in building a sustainable and permanent competitive position of the European companies. Companies operating in the European Union are in a unique situation, because they might receive a direct and indirect support to combat the negative effects of the crisis and to enhance their competitiveness on both the national and Community levels. The European companies are offered a wide range of support in the form of the pan-European networks and services, as well as the financial programmes. This results in new opportunities for the effective functioning of European companies and in the improvement of their competitiveness in a difficult period of economic crisis and beyond.

Milena Suliga, Tomasz Wójtowicz: **The reaction of the WSE to U.S. employment news announcements** ▪ Managerial Economics 2013, No. 14

JEL Classification: *G14*

Keywords: *event study, macroeconomic announcements, unemployment, nonfarm payrolls*

Stock markets react to various information. One of the most important information concerns macroeconomic data because it describes the state of the economy. The U.S. is the world's largest economy and thus American macroeconomic news announcements strongly affects European stock markets. In this paper we investigate the reaction of stock prices on the Warsaw Stock Exchange to values of macroeconomic indicators published in the Employment Report by the U.S. Bureau of Labor Statistics. We study the impact of macroeconomic indicators separately as well as interrelations between them. It allows us to specify which of the indicators under study is the most informative. We analyze the impact of information about the state of the labor market in the U.S. in the period from January 2004 to November 2012. In order to describe duration, direction and significance of the impact we apply the event study analysis to intraday returns of WIG – the main index of WSE.

STRESZCZENIA

Marcin Brol, Sławomir Czetwertyński: **Teoria sieciowej sfery publicznej** ▪ Managerial Economics 2013, No. 14

Klasyfikacja JEL: D85

Słowa kluczowe: *sfera publiczna, teoria sieci, media społeczne*

W niniejszym artykule podjęto próbę uchwycenia relacji między atrofią tradycyjnej sfery publicznej a augmentacją sieciowej sfery publicznej. Przedstawiono tu tezę, że o ile tradycyjna sfera publiczna ulega atrofii, o tyle jednocześnie augmentacji podlega sieciowa sfera publiczna. Tak sformułowany problem badawczy wymaga rozstrzygnięcia dwóch następujących kwestii. Po pierwsze, czy istnieje związek między czynnikami wpływającymi na atrofię i augmentację sfery publicznej. Po drugie, jaką rolę w tym procesie odgrywają media społeczne. Analizę przedstawioną w artykule oparto na teorii sfery społecznej autorstwa J. Habermasa oraz teorii społeczeństwa sieci M. Castellsa.

Henryk Gurgul, Artur Machno, Robert Syrek: **Optymalny portfel na podstawie Expected Shortfall: badania porównawcze** ▪ Managerial Economics 2013, No. 14

Klasyfikacja JEL: C58, G17

Słowa kluczowe: *Value at Risk, Expected Shortfall, interdependency, model przełącznikowy, kopula, zarządzanie ryzykiem*

Value at Risk jest kluczową wielkością w zarządzaniu ryzykiem. Jako miara ryzyka nie ma ona jednak pożądanych własności. Alternatywną miarą jest *Expected Shorfall*, która jest mniej używana w praktyce, za to ma własności, które są oczekiwane przez użytkowników modeli. W artykule zostały oszacowane obie miary, dla par stóp zwrotu z indeksów DJIA, DAX i ATX, w na podstawie modeli Markowitza, kopuli przełącznikowych oraz wielowymiarowego GARCH. Otrzymane wyniki pokazują, iż zły dobór modelu może powodować wiele błędów. Modele, które nie uwzględniają dynamicznego charakteru badanych szeregów czasowych błędnie oceniają średnią. Obie badane miary ryzyka mogą być przeszacowane oraz niedoszacowane. Szczególnie błędne okazało się oszacowanie zmiany *Expected Shortfall* wraz ze wzrostem oczekiwanej stopy zwrotu przy założeniu rozkładu normalnego.

Henryk Gurgul, Robert Syrek: **Struktura zależności równoczesnych cena – wielkość obrotów na rynkach finansowych** ▪ Managerial Economics 2013, No. 14

Klasyfikacja JEL: G15, C32, C58

Słowa kluczowe: *stopy zwrotu, zmienność stóp zwrotu, wielkość obrotów długa pamięć, kopule*

Głównym celem artykułu jest znalezienie zależności pomiędzy stopami zwrotu, ich zmiennością oraz wielkością obrotów dla spółek należących do indeksów CAC40 i FTSE100.

Autorzy ustalili, że średnie miary zależności na obu badanych rynkach różnią się istotnie. Przeważnie są one większe w przypadku spółek notowanych w indeksie CAC40 aniżeli w przypadku spółek z indeksu FTSE100. Badania empiryczne dają podstawę do odrzucenia ok. 70% akcji z obu rynków hipotezy o mieszance rozkładów (MDH) w przypadku dla wszystkich szeregów czasowych w wersji z długą pamięcią. Dodatkowo przetestowano istnienie kointegracji ułamkowej pomiędzy badanymi chrakterystykami akcji. Stwierdzono brak istotnej statystycznie kointegracji ułamkowej, co sugeruje konieczność odrzucenia ostatniego wariantu MDH odnośnie do badanych szeregów czasowych we wszystkich przypadkach. Świadczy to o tym, że nie wykazują one wzajemnej zależności długoterminowej. Tak więc analizowane szeregi czasowe nie są generowane przez wspólny proces napływu informacji z długą pamięcią. Występuje korelacja pomiędzy zmiennością stóp zwrotu a wielkością obrotów akcji wszystkich spółek z rozważanych rynków. Badania pozwoliły na ustalenie, że mieszanka obróconych kopul oraz współczynnik korelacji Kendalla umożliwiły sprawdzenie zależności pomiędzy ekstremalnymi stopami zwrotu i ekstremalną wielkością obrotów. Wyniki empiryczne odzwierciedlają istotne zależności pomiędzy wysoką zmiennością stop zwrotu i wysoką wielkością obrotów. Jednak struktury zależności w przypadku poszczególnych spółek różnią się istotnie. W przypadku spółek z CAC40 wysokie wielkości obrotów akcjami nie są tak często skorelowane z wysokimi stopami zwrotu jak z niskimi. Natomiast w przypadku FTSE100 wysokie stopy zwrotu są przeważnie skorelowane z wysokimi wielkościami obrotów.

Agata Jakubowska: **Instytucje finansowe jako przykład instytucji zaufania publicznego** ▪ Managerial Economics 2013, No. 14

Instytucje finansowe powszechnie uznawane za instytucje zaufania publicznego są ważnymi instytucjami wspierającymi działalność pozostałych uczestników rynku. Poziom zaufania z pewnością decyduje o pozycji konkurencyjnej instytucji finansowej. W związku z tym dbałość o jak najwyższe standardy jakości jest w przypadku tych instytucji pierwszoplanowym zadaniem. Nazywanie instytucji finansowych instytucjami zaufania publicznego skutkuje tym, że instytucjom tym stawiane są podwyższone wymagania odnośnie do ich profesjonalizmu czy odpowiedzialności. W artykule przedstawione zostały podstawowe zagadnienia związane z zaufaniem i instytucjami zaufania publicznego. Podjęto także próbę zweryfikowania powszechnie panującego przeświadczenia o tym, że instytucje finansowe są instytucjami zaufania publicznego.

Zbigniew Juroszek, Mariusz Kudełko: **Metodyka optymalizacji rozwoju lokalnej infrastruktury energetycznej** ▪ Managerial Economics 2013, No. 14

Jednym z najważniejszych zadań związanych z realizacją polityki energetycznej Polski jest planowanie rozwoju gminnej infrastruktury energetycznej przez władze lokalne. Jednak wiele gmin nie ma strategicznych planów dostarczania mieszkańcom i firmom energii. Ponadto plany te, jeśli istnieją, są zazwyczaj bardzo uproszczone i nieprecyzyjne, głównie z powodu braku modeli przeznaczonych do planowania dostaw na szczeblu lokalnym. Narzędzia te, które już istnieją, mają wady ograniczające ich przydatność do planowania rozwoju lokalnych systemów energetycznych. W artykule przedstawiono matematyczny model optymalizacyjny, który wydaje się pozbawiony tych wad i ograniczeń. Przedstawiona koncepcja modelu może być dobrym

punktem wyjścia do tworzenia zaawansowanego, łatwego w obsłudze, narzędzia, które gmina może wykorzystać do optymalizacji lokalnego rozwoju infrastruktury energetycznej.

Jarosław Korpysa: **Wykorzystanie studiów przypadku w nauczaniu przedmiotów ekonomicznych** ▪ Managerial Economics 2013, No. 14

Klasyfikacja JEL: I21, J24, D01

Słowa kluczowe: *studium przypadku, nauczanie, edukacja, studenci*

Artykuł ma charakter teoretyczno-empiryczny. Podstawowym celem jest analiza wykorzystania studiów przypadku w nauczaniu przedmiotów ekonomicznych. Problem badawczy jest zweryfikowany na podstawie literatury przedmiotu oraz przeprowadzonych badań ankietowych wśród studentów kierunków ekonomicznych.

Zbigniew Kowalski: **Gościnność usługowa jako model biznesowy indywidualnego przedsiębiorstwa handlowego** ▪ Managerial Economics 2013, No. 14

Klasyfikacja JEL:031

Słowa kluczowe: *gościnność usługowa, gościnność nieusługowa, zarządzanie gościnnością usługową, model biznesowy w hotelarstwie, indywidualne przedsiębiorstwo hotelowe*

Prawidłowo wyprofilowana i wdrożona w danym przedsiębiorstwie hotelowym gościnność usługowa pozwala na skuteczne marketingowe i ekonomiczne zarządzanie obiektem oraz stanowi sposób na wzmocnienie pozycji rynkowej obiektu. Gościnność usługowa jako model biznesowy w indywidualnym przedsiębiorstwie hotelarskim stanowi ponadto nowoczesne narzędzie ekonomiczne w ręku menedżera hotelu, umożliwiając mu bardziej efektywną kontrolę nad procesem realizacji usług przez ujęcie w całość wszystkich etapów tworzenia i świadczenia usługi hotelarskiej, które mają wpływ na jej jakość. Gościnność usługowa zaczyna się bowiem na profesjonalnej umiejętności zapraszania klientów (lub gości) i kończy się na tak samo profesjonalnej umiejętności ich żegnania. Pomiędzy zapraszaniem i witaniem gości a ich pożegnaniem funkcjonuje cała sfera materialnych i niematerialnych elementów serwisowych, dzięki którym świadczona komercyjnie gościnność usługowa uzyskuje akceptowalną, satysfakcjonującą klienta wartość. Struktura gościnności usługowej opiera się na czterech podstawowych filarach: usługowej gościnności zapraszającej, witającej, serwisowej oraz żegnającej. Filary te są zintegrowane ze sobą, co oznacza, iż żaden z nich nie może funkcjonować oddzielnie, a ułomność lub słabość jednego wpływa na jakość i trwałość konstrukcji gościnności usługowej jako całości. Zagadnienie gościnności usługowej nie tylko w Polsce jest stosunkowo nowe, więc podlega stałej ocenie, analizie i konstruktywnej krytyce.

Krystian Nowakowski: **Teoria matrycy instytucjonalnej jako podstawa wyjaśniania baniek cenowych na rynku nieruchomości** ▪ Managerial Economics 2013, No. 14

Klasyfikacja JEL: R21, G21, E02

Słowa kluczowe: *bańka cenowa, bańka cenowa na rynku nieruchomości, teoria matrycy instytucjonalnej, miękkie ograniczenie finansowe*

Wzrost cen, którego nie można wyjaśnić, odnosząc się do wartości fundamentalnych, jest nadal bardzo złożonym procesem. Bańki cenowe występują na przestrzeni kilkuset lat. Złożoność rynków, ich rozproszenie geograficzne oraz różnorodność przedmiotów objętych zjawiskiem

bańki czyni je ciągle niewystarczająco zrozumianym zjawiskiem. Brak wystarczających aktualnych struktur pozwalających zrozumieć i przewidzieć zjawisko bańki cenowej był powodem wyjaśniania jej na gruncie nowej ekonomii instytucjonalnej. W artykule czynniki tworzące bańkę cenową na rynku nieruchomości zostały zbadane przy zastosowaniu teorii matrycy instytucjonalnej. Badania przeprowadzono, dokonując analizy danych i identyfikując czynniki sprzyjające tworzeniu ogromnych rozmiarów wzrostu ceny w Stanach Zjednoczonych, Hiszpanii i Polsce. Badania potwierdziły, że brak zbilansowanej kombinacji instytucji matrycy dominującej i komplementarnej prowadzi do powstawania bańki cenowej na rynku nieruchomości. W artykule potwierdzono również fakt, iż warunkiem bazowym wzrostów przekraczających wartości fundamentalne jest struktura z dominacją matrycy Y z jej bazowymi instytucjami. Zbadane instytucje zakłócające wzrost rynkowy i przekształcające go w bańkę zostały podzielone na dwie grupy. Pierwsza, niezamierzone efekty ingerencji w mechanizm rynkowy, została zbadana przez identyfikację organizacji wspierających zakup nieruchomości w Stanach Zjednoczonych i analizę efektów ich działalności, analizę społecznej polityki mieszkaniowej w Polsce i Hiszpanii oraz analizę systemu ulg podatkowych i dopłat. Druga grupa, błędnie rozumiana pełna „liberalizacja" i deregulacja wszystkich procesów rynkowych, została zbadana na dwóch poziomach: kreacji kredytu dla klientów i pozyskiwania kapitału przez same banki. Badania zostały przeprowadzone w tej grupie w obszarze standardów udzielania kredytów, procesu sekurytyzacji i wymogów kapitałowych. Działania ingerujące w mechanizm rynowy będące w sprzeczności z dominującą matrycą Y miały na celu stabilizację i stymulację rynku nieruchomości. W rzeczywistości wspierały jenak spekulację i pompowanie bańki, ponieważ instytucje matrycy komplementarnej nie zostały prawidłowo zaprojektowane. Działania dążące do błędnie rozumianej pełnej „liberalizacji" miały na celu absolutną deregulację przez eliminację instytucji komplementarnych. Badania potwierdziły, iż liberalizacja jest możliwa w zdrowo funkcjonującym systemie, ale nie oznacza na pewno, iż mechanizm rynkowy może funkcjonować bez żadnych instytucji.

Elżbieta Pohulak-Żołędowska: **Przemysłowe znaczenie akademickich badań podstawowych we współczesnych gospodarkach** ▪ Managerial Economics 2013, No. 14

Klasyfikacja JEL: O12, O31, O32, D83

Słowa kluczowe: *akademickie badania podstawowe, prawa własności intelektualnej, nauka przemysłowa*

Badania podstawowe prowadzone w publicznych środkach badawczych są niebywale istotne ze względu zarówno na nowość i aktualność prowadzonych badań, jak, co istotniejsze, także na możliwość ich rynkowego wykorzystania. Dzięki instytucjom nadającym prawa własności publicznie wytwarzanym innowacjom możliwe jest traktowanie efektów akademickich badań podstawowych jak dóbr rynkowych. Jest to kolejny krok w kierunku rozwoju nauki przemysłowej. Celem artykułu jest próba pokazania zmian w podejściu do akademickich badań podstawowych jako elementu procesu innowacyjnego.

Joanna Stefaniak-Kopoboru, Joanna Kuczewska: **Europejskie przedsiębiorstwa w czasie kryzysu** ▪ Managerial Economics 2013, No. 14

Klasyfikacja JEL: D21, F15, L21

Słowa kluczowe: *przedsiębiorstwa europejskie, kryzys, polityka przedsiębiorczości, wsparcie*

Kryzys gospodarczy oznacza szybki spadek koniunktury. Niekorzystne zjawiska gospodarcze bardzo szybko obejmują kolejne kraje, w obecnej dobie silnie powiązane handlowo i kapitałowo.

Kryzys skutkuje przede wszystkim pogarszającą się sytuacją finansową przedsiębiorstw a co za tym idzie wzrostem poziomu bezrobocia, pogorszeniem nastrojów konsumentów oraz ograniczaniem wydatków, zwłaszcza na cele konsumpcyjne. W tak niestabilnym otoczeniu makroekonomicznym przedsiębiorstwa zmuszone były do rewizji swoich strategii działania oraz efektywnego reagowania na zmiany w otoczeniu. Promowanie zaś ich konkurencyjności stało się priorytetem władz regionalnych, krajowych i ponadnarodowych. Przedsiębiorstwa działające na obszarze Unii Europejskiej znajdują się w wyjątkowej sytuacji, ponieważ mogą otrzymywać wsparcie bezpośrednie i pośrednie w celu zwalczania negatywnych skutków kryzysu oraz podnoszenia konkurencyjności zarówno na poziomie krajowym, jak i wspólnotowym. Oferta dla przedsiębiorstw obejmuje szeroki zakres wsparcia w postaci ogólnoeuropejskich sieci doradztwa biznesowego, a także programy finansowe. Takie wsparcie kreuje nowe możliwości skutecznego funkcjonowania przedsiębiorstw europejskich i poprawy ich konkurencyjności w trudnym okresie kryzysu gospodarczego oraz w kolejnych latach po jego zakończeniu.

Milena Suliga, Tomasz Wójtowicz: **Reakcja GPW w Warszawie na ogłoszenia danych o zatrudnieniu w USA** ▪ Managerial Economics 2013, No. 14

Rynki akcji reagują na różnego rodzaju napływające informacje. Najważniejsze z nich dotyczą danych makroekonomicznych, gdyż opisują one stan całej gospodarki. Ponieważ USA stanowią największą gospodarkę na świecie, to ogłoszenia amerykańskich danych makroekonomicznych szczególnie silnie wpływają na europejskie rynki akcji. W tym artykule zbadano reakcje cen akcji notowanych na Giełdzie Papierów Wartościowych w Warszawie na wartości wskaźników makroekonomicznych publikowanych przez Bureau of Labor Statistics w *Raporcie o zatrudnieniu*. Badano wpływ każdego ze wskaźników z osobna oraz wzajemne relacje pomiędzy wskaźnikami. To pozwoli na określenie, który spośród rozważanych wskaźników jest najważniejszy. W artykule badano wpływ informacji o sytuacji na amerykańskim rynku pracy w okresie od stycznia 2004 do listopada 2012. Aby określić czas reakcji GPW na napływające informacje, kierunek tej reakcji oraz jej istotność, zastosowano analizę zdarzeń dla śróddziennych stóp zwrotu indeksu WIG.

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